TEXAS STATE UNIVERSITY

University Chemical Hygiene Plan

Environmental, Health, Safety, Risk and Emergency Management

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INTRODUCTION AND PURPOSE

Texas State University is committed to promoting a safe environment in all University laboratories, and to protecting employees from the health and physical hazards associated with hazardous materials. University facilities must be used in a safe and appropriate manner so as not to endanger the university community or the general public. All faculty, staff, students, and other members of the Texas State community share responsibility for the safety and security of the institution and must conduct university activities and operations in compliance with applicable federal and state regulations and university policies.

The *University Chemical Hygiene Plan* (CHP) was developed to assist university labs in maintaining a safe workplace in compliance with the Occupational Safety and Health Administration (OSHA) rule 29 CFR 1910.1450, *Occupational Exposure to Hazardous Chemicals in Laboratories*, commonly referred to as the "OSHA Laboratory Standard." This document outlines roles and responsibilities for key personnel, contains policies and practices applicable to the entire university, and provides an understanding of the applicability of various regulations to operations in a laboratory.

A laboratory-specific chemical hygiene plan **(Laboratory CHP) is recommended for all laboratories that have polices, practices, and chemical hazards that the University CHP does not address**. Each Principal Investigator (PI) must be sure that their plan contains: hazard information, standard operating procedures (SOPs), personal protective equipment (PPE) requirements, engineering and administrative controls, and training requirements and documentation specific to their laboratory's operations. More information on the requirements of the Lab Specific CHP can be found on page 3 of this document.

Background on Regulatory Compliance

All Texas State University laboratories are subject to a number of regulatory requirements. The primary focus of the University CHP is to comply with the OSHA Laboratory Standard. The OSHA Laboratory Standard was developed to address workplaces where relatively small quantities of hazardous chemicals are used on a non-production basis, and it applies to all university laboratories.

The purpose of the standard is to protect laboratory employees, volunteers, and visitors from harm due to hazardous chemicals. This regulation became effective on May 1, 1990, and mandates implementation of health and safety practices and procedures in laboratories that use hazardous chemicals.

The key elements of the OSHA Laboratory Standard are:

- Protecting employees from physical and health hazards associated with hazardous chemicals in laboratories through the use of controls and Personal Protective Equipment (PPE);
- Minimizing chemical exposures;
- Training and informing workers of the hazards posed by the chemicals used in the laboratory.
- Providing for medical consultations and exams, as necessary;
- Preparing and maintaining a Chemical Hygiene Plan specific to the identified hazards in the lab;
- Designating personnel to manage chemical safety.

Other agencies, including the U.S. Environmental Protection Agency (EPA), the U.S. Department of Transportation (DOT), the Texas Commission on Environmental Quality (TCEQ), the Texas Department of Health and Human Services (TXDSHS), the City of San Marcos Water & Wastewater Department, and the City of San Marcos Fire Department, also impose obligations on users of hazardous chemicals, including:

- Specific storage and labeling requirements for hazardous chemicals;
- Limitations on the quantities of hazardous chemicals;
- Handling, storage, and disposal requirements for hazardous waste;
- Restrictions on the shipping and transportation of hazardous chemicals.

The requirements of these regulations are incorporated into the University Chemical Hygiene Plan and will be noted as so within this document.

Scope and Applicability

The University Chemical Hygiene Plan describes the necessary protection from risks posed by the laboratory use of hazardous chemicals and is limited to laboratory settings (where small amounts of hazardous chemicals are used on a laboratory-scale). Hazardous chemicals are defined as any chemical which is classified as a physical hazard or a health hazard, a simple asphyxiant, combustible dust, pyrophoric gas, or possesses hazards not otherwise classified.

All laboratories which use hazardous chemicals must comply with the requirements outlined in this document and develop a Lab-Specific Chemical Hygiene Plan when they have policies, practices, and chemical hazards the University CHP does not address. Those plans must, at a minimum, meet the elements outlined within this document and the laboratory-specific CHP template.

This plan does not specifically address protection needed against radiological, biological, or other hazards (electrical, laser, mechanical, etc.), though elements of these may be covered in lab-specific SOPs. Information on chemical, biological, and radiological safety – as well as other safety topics can also be found in the on the Environmental, Health, Safety, Risk and Emergency Management (EHSREM) website.

Implementation of the Plan

The OSHA Laboratory Standard requires the designation of personnel responsible for implementation of the Chemical Hygiene Plan. Specifically, it calls for the assignment of a Chemical Hygiene Officer (CHO). The Environmental, Health, Safety, Risk and Emergency Management (EHSREM) Office at Texas State University has primary responsibility for the University's lab safety program. The EHSREM Director (or designee) is authorized to assure compliance with the OSHA Lab Standard and to assign the role of the Chemical Hygiene Officer. This individual has the responsibility for the development and implementation of the University CHP and for ensuring overall compliance with all chemical safety regulations.

In research labs, the Principal Investigator (PI) is responsible for developing and implementing the Laboratory Specific CHP for any laboratories under their control. Ultimate responsibility for safety compliance within the lab resides with the Principal Investigator (or to an individual who has been assigned responsibility for a given laboratory).

PIs directly responsible for teaching labs and/or acting as teaching lab coordinators must incorporate the policies and practices of the University CHP with:

- Departmental safety policies.
- Existing safety practices of each individual teaching lab.
- The safety information found in published lab manuals, pamphlets, etc.

These PIs must also make those who assist them as instructors of teaching labs aware of the role that the University CHP will have in teaching lab activities.

Availability of the Plan

All elements of the Chemical Hygiene Plan (including the University CHP and any Laboratory Specific CHPs) must be made readily available to all lab personnel. Lab personnel includes all faculty, staff, and students who are assigned by their PI to work in a laboratory. Lab personnel also includes volunteers, visiting scientists and industry partners who work in a university lab space.

Review and Evaluation of Plan

The Texas State University Chemical Hygiene Officer shall review and evaluate the effectiveness of the University CHP at least annually and update it as necessary. The updated CHP will be posted on the EHSREM website.

For a Laboratory Specific CHP to be useful it must reflect the work that is currently performed within the laboratory. The Principal Investigator should review the Laboratory CHP at least annually to ensure that its contents are appropriate and adequate for current operations. If changes are necessary before the review date, the Laboratory Specific CHP must be amended, and the changes approved by the respective Principal Investigator.

ROLES AND RESPONSIBILITIES

In order to maintain an effective lab safety program, it is important for all parties to clearly understand the responsibilities inherent in their roles. Below are roles and responsibilities which are necessary to remain compliant with lab safety regulations.

For the purpose of this document, a Principal Investigator (PI) is any individual who has primary responsibility for the operations of assigned laboratory space(s). In most instances this will be a Texas State University faculty member. In some instances, a facility director or department chair may assign the responsibilities outlined in this plan to a member of the academic staff (e.g., a manager of an instrumentation laboratory can be considered a Principal Investigator for the purposes of this plan).

University President

The President advocates for a strong safety culture on the University campus and is responsible for the approval of the Texas State University safety policies at all facilities under university control.

Director of Environment, Health, Safety, Risk and Emergency Management

The Director of EHSREM will appoint the Chemical Hygiene Officer (CHO) and provide the necessary staffing and resources for maintaining an effective Laboratory Safety Program.

University Chemical Hygiene Officer

The university Chemical Hygiene Officer (CHO) is housed in the EHSREM Office and has the primary responsibility for ensuring implementation of the University CHP and overall compliance with chemical safety regulations. The CHO will:

- Review the Campus CHP annually and update when necessary;
- Maintain and update the applicable sections of EHSREM's webpage;
- Provide training to facilitate the campus community's understanding of, and compliance with chemical health and safety regulations;
- Review any Lab Specific CHPs upon request to ensure they meet the OSHA requirements;
- Maintain current knowledge concerning the requirements for storage and use of regulated substances in the laboratory;
- Conduct or oversee lab safety inspections and provide findings to the PI.
- Provide guidance for the safe handling, storage, and disposal of chemicals used at the university;
- Review lab check-in / lab registration and lab check out information submitted by PIs.

Environmental, Health, Safety, Risk and Emergency Management (EHSREM)

EHSREM has primary responsibility for developing policies and procedures to ensure that the university complies with federal, state and local requirements, as well as best-practices, related to environmental, safety, and health requirements. EHSREM personnel will:

- Develop and provide overall lab safety training to laboratory personnel;
- Inspect laboratories and identify hazards and issues of non-compliance;
- Review plans for new and renovated laboratory spaces to ensure compliance with university specifications;
- Coordinate campus emergency spill response with the local Fire Department and Emergency Response (ER) Contractors;
- Maintain website and provide accessible information, guidance, and up-to-date information regarding laboratory safety.

Deans, Chairs, and Directors

The Deans, Chairs, and Directors have primary responsibility for the health and safety of the individuals working and studying in their department's laboratories. This responsibility is filled, in part, by ensuring that all departmental faculty members (PIs) understand and take seriously their roles in implementing the University and Lab Specific Chemical Hygiene Plans.

Department Chairs are also responsible for ensuring that those responsible for labs are assigned and complete the appropriate EHSREM lab safety training.

Principal Investigator (PI)

The Principal Investigator (PI) is the faculty member or laboratory manager who has the primary responsibility for a laboratory space (as assigned by their department). The PI is responsible for providing a safe work and learning environment and for ensuring compliance with all elements of the University and Laboratory Specific CHPs within their own assigned laboratory space.

While the Principal Investigator can delegate health and safety responsibilities to a trained and knowledgeable individual (often referred to as the Laboratory Manager), the Principal Investigator must ultimately assure that the duties are performed.

The Principal Investigator must:

- Develop and implement a Laboratory Specific CHP when they have policies, practices, and chemical hazards the University CHP does not address;
- Develop and approve SOPs, ensuring that PPE, engineering controls, and administrative controls described within the SOPs provide adequate protection to lab personnel;
- Ensure that lab personnel understand the chemical hazards and follow the chemical safety policies, practices, and regulations related to their laboratory's operation

- Maintain compliance with federal, state, and local regulations related to the use storage, and disposal of hazardous chemicals in their laboratory (as outlined in this document);
- Provide access to manufacturers' Safety Data Sheets (SDSs), the University and Laboratory Specific CHPs, and other safety-related information for laboratory staff;
- Ensure that PPE and required safety equipment are available and in working order and that laboratory staff is trained in their use;
- Determine training requirements for laboratory workers based on their duties and tasks and ensure appropriate training specific to laboratory operations has been provided;
- Ensure that staff is knowledgeable on emergency plans, regarding fires, equipment failure, chemical exposures, and chemical spills;
- Maintain up-to-date chemical inventories;
- Participate in EHSREM lab safety inspections and correct unsafe conditions identified in the inspections as soon as possible.
- Maintain documentation on training, prior approvals, and other safety related issues, as outlined in this document;
- Contact EHSREM on any lab-related injury or significant exposure and submit accident reports to the EHSREM Office within 24 hours of the incident.
- Attend all safety training as required by the University, Department, and EHSREM.

Laboratory Personnel

Laboratory personnel includes all faculty, staff, and students who work in a laboratory. Lab personnel also includes interns, volunteers, visiting scientists and industry partners who work in a university lab space. The laboratory personnel working under the supervision of the Principal Investigator must:

- Follow campus and laboratory practices, policies, and SOPs as outlined in the University and Laboratory Specific CHPs;
- Attend all safety training as required by the University, Department, and PI;
- Perform only procedures and operate only equipment that they have been authorized and trained to use safely;
- Check relevant information (such as that information found in Safety Data Sheets, SDSs) on the chemical reactivity and physical and toxicological properties of hazardous materials) prior to use of the chemical substance;
- Have knowledge of emergency procedures prior to working with hazardous chemicals;
- Incorporate hazard in the planning of all experiments and procedures;
- Use the personal protective equipment and hazard control devices;
- Report any unsafe condition immediately to the PI or other safety personnel;
- Keep work areas clean and orderly;
- Avoid behavior which could lead to injury;
- Dispose of hazardous waste according to university procedures;
- Report incidents involving chemical spills, exposures, work-related injuries, and illnesses or unsafe conditions to the PI;
- Consult with the PI or with EHSREM staff on any safety concerns or questions.

Texas State University Laboratory Safety Committee

The University Laboratory Safety Committee is comprised of university faculty and staff drawn from various offices and departments. The Safety Committee will:

- Collaborate with EHSREM on campus policies on issues related to the purchase, use, storage, and disposal of chemicals;
- Review compliance with campus policies;
- Periodically review EHSREM publications and on its web site, including reviews of the University Chemical Hygiene Plan;
- Collaborate with other institutional committees to assure that chemical safety concerns are properly addressed;
- Provide a forum for the campus community to raise concerns regarding the safe use, handling, and disposal of chemicals and assist in the resolution of disputes regarding chemical safety issues;

LABORATORY SPECIFIC CHEMICAL HYGIENE PLAN

For each laboratory under their control which uses hazardous chemicals, the PI (or other lab authority as designated by the department) shall develop written documentation of the following:

- The identity and location of the laboratory;
- The Principal Investigator, and any other person responsible for implementation of the Lab Specific CHP, such as a Lab Manager as appointed by the PI;
- Contact information and emergency numbers for responsible individuals;
- Location of Safety Data Sheets (SDSs);
- Location of the lab's Chemical Inventory;
- Lab-specific strategies for controlling exposures and hazards;
- List of Standard Operating Procedures (SOPs) that are relevant for the lab;
- Documentation of prior approval for all lab personnel using PHSs or High-Risk Chemicals or procedures;
- Lab-specific information for chemical waste disposal;
- Emergency Procedures;
- Sign-off page to indicate that the CHP is accurate and has been reviewed (and updated as needed) on an annual basis;
- Documentation of laboratory-specific chemical safety training for all lab personnel;

PIs can meet the above requirements by completing the Laboratory-Specific Chemical Hygiene Plan template and by adding any additional required documentation. The template for the laboratory-specific CHP can be found Appendix A.

CHEMICAL HAZARD INFORMATION AND TRAINING

Federal, State, and University rules and regulations require all laboratory personnel receive safety training and be informed of the potential health and safety risks that may be present in their workplace.

Required Hazard Awareness Training for Lab Personnel:

General Lab Safety Training:
All lab personnel shall be required to take applicable EHSREM training (i.e., Hazard Communication, General Lab Safety, Hazardous Waste, Biosafety, etc.) before beginning work in the lab. Contact EHSREM ehs@txstate.edu for information about which trainings you need to take.

Laboratory-Specific Training:
The Principal Investigator or qualified designee shall conduct laboratory-specific hazard awareness training for all laboratory personnel before they begin working in the lab. The training can be documented using the lab orientation checklist included in the Lab CHP template. The lab-specific training must cover:

- An overview of the University CHP
- The specific chemical and physical hazards in the lab.
- Lab policies and Standard Operating Procedures, including the measures employees can take to protect themselves from the identified hazards, such as appropriate work practices, engineering controls, and personal protective equipment.
- Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory.
- The location and availability of identified reference materials listing the hazards, safe handling, storage, and disposal of hazardous chemicals found in the laboratory including, but not limited to Safety Data Sheets (SDSs) received from the chemical supplier.

This hazard awareness training shall be reviewed as necessary and any time a new hazard is introduced. The PI or qualified designee shall review laboratory personnel knowledge as often as necessary to verify that staff can perform their assigned tasks safely.

Documentation must be maintained by the PI and included in the Lab-Specific Chemical Hygiene Plan to demonstrate that such training was provided and received. Laboratory safety training must be obtained either through EHSREM classroom training, SAP (for paid employees) or CANVAS (for lab workers who are not receiving a paycheck from the University).

Required Sources of Chemical Hazard Information

Labeling Chemical Containers

Proper labeling of chemicals is a way of warning laboratory personnel of potential hazards that exist, preventing the generation of unknowns, and facilitating emergency responses such as cleaning up spills and obtaining the proper medical treatment.

- **Primary Containers** – are containers in which the chemical was received from the manufacturer or distributor. In 2015, OSHA became aligned with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS) Appendix B which is an international approach to standardizing classification of hazards and labeling. Thus, federal and state regulations require that labels on primary containers must be maintained and not defaced and have at least the following components

- Product name
- Signal word
- Pictograms
- Hazard statement(s)
- Precautionary statements
- Manufacturer name, address, and telephone number

For chemicals purchased prior to 2015 the labels on primary containers must have at least the following components:

- The name of the chemical as it appears on the Safety Data Sheet.
- Warnings about any physical and health hazards.
- The manufacturers name and address.

Aside from the Globally Harmonized System of labeling chemicals there are other labeling and/or hazard classification systems that laboratories may encounter such as NFPA fire diamonds Appendix C, HMIS color bars Appendix D, or USDOT shipping labels Appendix E.

- **Secondary Containers / Workplace Containers** - are wash bottles, squirt bottles, temporary storage containers, beakers, flasks, bottles, or any container that a chemical from an original container is transferred. Federal and state regulations require that labels on secondary containers must be maintained and not defaced and have at least the following components:
  - The name of the chemical appears on the Safety Data Sheet.
  - Warnings about any physical and health hazards, which may be expressed through words, pictures, symbols, or a combination of these.

  Use of abbreviations such as structures, formulas, or acronyms should be avoided whenever possible. However, if abbreviations are used, an abbreviation key in a visible location (preferably close to the chemicals) should be provided. The key must contain the abbreviation and the name of the chemical. It is also useful to include the hazards of the chemical on the "key." The abbreviation key must be readily available upon request by EHSREM, visitors, and emergency responder

  - **Small Containers** - For containers, which may be too small to write out a chemical name, structure, or formula, laboratories can:
    - Place containers in a Ziploc bag or other type of overpack container (beaker, plastic bottle, etc.) and label the overpack with the chemical name and its hazards.
    - For vials in a rack, label the rack with the chemical name and its hazards.
  - **Teaching Collections –** For preserved specimens in bottles, bags, or other containment units, the container must list the preservative and its hazards (ex: 70% Ethanol, Flammable and Toxic).

- **Research Samples –** Should be stored on shelves, in boxes, or racks that are labeled with the preservative and its hazards. If individual samples taken out of storage areas for processing are left unsupervised, they must have a label listing the preservative and its hazards.

- **Dating of containers** – it is best practice to date all chemical containers with the date received and the date opened. It is required to date all time sensitive chemicals, such as peroxide formers, on the date received and the date opened. More information on peroxide forming chemicals can be found in Chapter 6 - Physical and Chemical Hazards. A list of common peroxide formers and the policy for their retention can be found in Appendix F.

All Peroxide Forming Chemicals must have a receive date and date opened written on the label.

- **Reuse of Primary Containers** – Empty primary container bottles may be reused if they have been thoroughly cleaned and rinsed. If the reused bottle contains a chemical different from its original contents, the original label must be marked out/covered over and relabeled as a secondary container.

Safety Data Sheets and Other Safety Information

Safety Data Sheets (SDSs), formally known as Material Safety Data Sheets (MSDSs) are an important part of any laboratory safety program in communicating information to chemical users. SDSs are prepared by the chemical manufacturer. These documents summarize the physical and chemical characteristics, health and safety information, handling, and emergency response recommendations related to their products.

- Any chemical shipment received should be accompanied by an SDS, if not check the chemical manufacturers website or call the manufacturer for SDSs.

- SDSs must be accessible at all times. Access can mean maintaining paper copies or an electronic database.

It is the responsibility of Principal Investigators and laboratory supervisors to ensure that staff and students working in laboratories under their supervision have obtained required training and have access to SDSs (and other sources of information) for all hazardous chemicals used in laboratories under their supervision.

- If a laboratory chooses to use an electronic database, the means to access the SDSs must be posted on laboratory computers or in another conspicuous location.

- The EHSREM "rule of thumb" is that a person working in a laboratory should be able to produce an SDS for any chemical found in the lab within five minutes.

- Any accidents involving a chemical will require an SDS being provided to emergency response personnel and to the attending physician so proper treatment can be administered.

SDSs alone may not provide sufficient information on the hazards of a chemical. Laboratory personnel should review other sources of information on the chemical, such as the National Research Council's *Prudent Practices in the Laboratory*.

If you have questions on how to read SDSs, or questions about the terminology or data used in SDSs, contact EHSREM at ehs@txstate.edu for more information.

Chemical Inventory

The university is subject to federal, state, and local regulations. In order to comply with these regulations, the University requires that all PIs maintain an up-to-date inventory of all chemicals and compressed gases within their laboratory using the format designated by EHSREM. Answers to Frequently Asked Questions regarding chemical inventories can be found on the EHSREM web page. The location of chemical inventory (paper or electronic) for each lab must be made available to all lab personnel.

E-mails are sent annually to all PIs to request a review and PI approval of the current inventory in their laboratory. EHSREM uses information taken from those inventories at the beginning of each year to develop and submit reports required by regulations.

CHEMICAL INVENTORY REGULATIONS

Emergency Planning and Community Right-to Know Act (EPCRA): federal statute that requires all entities that store, use or process hazardous chemicals to report this information to their state agency responsible for emergency response planning (in Texas, the TCEQ) and to the Local Emergency Planning Committee (LEPC) in their area.

Department of Homeland Security (DHS) Chemicals of Interest - Requires facilities to determine if they have one of 300 specific chemicals above screening threshold quantities. While most of the thresholds are much higher than those quantities maintained at the University, a handful of the threshold amounts are significantly lower.

City of San Marcos Fire Codes Requires entities that use hazardous materials to maintain inventories and to provide them upon request.

Exposure Limits

Occupational Exposure Limits (OELs) are airborne concentrations that have been determined to be safe for employees for a set period of time. OSHA has published Permissible Exposure Limits (PELs) for a number of chemicals. These Permissible Exposure Limits (PELs) are listed in 29 CFR 1910.1000 TABLE Z-1. The American Conference of Governmental Industrial Hygienists (ACGIH) has published Threshold Limit Values (TLVs), which are recommended exposure limits for chemicals without PELs. It is the responsibility of the PI to ensure that laboratory policies and practices along with proper engineering controls (i.e., fume hoods, glove boxes, etc.) are adequate to minimize chemical exposures.

Chemical Information for Materials Produced in the Laboratory

Chemicals of known composition – when a chemical of known composition is produced and determined to be hazardous, the principal investigator and laboratory manager must ensure that personnel who use this chemical are provided with appropriate training and controls.

Chemicals of unknown composition – when a chemical of unknown composition is produced in the laboratory, it must be considered a "Particularly Hazardous Substance" and handled

accordingly. Each principal investigator and lab manager has the responsibility to identify and characterize these unknown chemicals as soon as possible so that it may be determined whether or not they are hazardous.

Recommended Chemical Safety Resources

Prudent Practices in the Laboratory
Published by the National Research Council, this book is an essential resource for chemical hygiene and safety. Particularly useful are the Laboratory Chemical Safety Summaries included for many common laboratory chemicals in Appendix B.

Safety in Academic Chemistry Laboratories
Published by The American Chemical Society, volume 1 (for students) and volume 2 (for faculty and administrators) provide a basic overview on preventing chemical-related accidents in the lab.

SAFE USE OF CHEMICALS

The main purpose of this CHP is to protect laboratory personnel from hazards encountered in laboratory settings. In order to protect personnel, the hazards of the chemicals, processes, and equipment used in the lab must be properly assessed, and adequate controls must be used to reduce risks of exposure.

Hazard and Risk Assessment

Hazards and risks associated with the use of hazardous chemicals should be evaluated during the planning stage of any new or modified process or project. The evaluation should review the chemical properties, reactions/byproducts, procedural hazards, equipment used, potential routes of exposure, as well as control measures to mitigate the hazards.

Once the hazard has been assessed, and the strategies for controlling the hazards have been determined, the PI will choose or develop a Standard Operating Procedure (SOP) for working with the hazard. More information about choosing and developing SOPs can be found below in the Administrative Controls section.

Resources which can be used to evaluate chemical hazards and risks include Safety Data Sheets, consulting published resources, and contacting EHSREM. Useful information about conducting hazard assessments can also be found on the American Chemical Society (ACS) website.

Particularly Hazardous Substances and High-Risk Chemicals or Procedures

Particularly Hazardous Substances are defined by OSHA as chemicals which present extreme risk potential to laboratory personnel if not handled appropriately; therefore, these substances require additional controls when used in the laboratory. More specifically, PHS chemicals are defined as acute toxins, reproductive toxins, and “select” carcinogens.

- **Acute Toxins -** substances that have a high degree of acute toxicity are interpreted by OSHA as being substances that "may be fatal or cause damage to target organs as the

result of a single exposure or exposures of short duration."

- **Reproductive Toxins** - any chemical that may affect the reproductive capabilities, including chromosomal damage (mutations) and effects on fetuses (teratogenesis).
- **Select carcinogens** - chemical agents that cause cancer. Generally, they are chronically toxic substances. OSHA defines a "select carcinogen" as a substance that meets one of the following criteria:
  1. Is regulated by OSHA as a carcinogen;
  2. Is listed under the category "known to be a carcinogen" or "reasonably anticipated to be a carcinogen" in the Annual Report on Carcinogens published by the National Toxicology Program (NTP); or
  3. Is listed under Group 1 ("carcinogenic to humans") or under Group 2A ('probably carcinogenic to humans") or 2B ("possibly carcinogenic to humans") by the International Agency for Research on Cancer (IARC).

A partial list of Particularly Hazardous Substances (PHSs) can be found in Appendix G.

As noted above, use of a PHS requires the following additional considerations which must be included in the Standard Operating Procedure for the chemical or process using the chemical:

- Establishment of a designated work area;
- Defining the procedures for safe removal of contaminated waste;
- Describing the appropriate decontamination procedures.

The room or area where work with a PHS is performed must be posted with a ***Designated Area*** sign. The "designated area" may be the workbench or fume hood where work with the PHS is performed, or in some cases, it may be the entire room.

OSHA also defines certain "**High Risk"** chemical groups as Particularly Hazardous. Chemicals considered Particularly Hazardous include the following GHS/UN classifications:

- In contact with water emits flammable gas - Category 1
- In contact with water liberates toxic gas
- In contact with acids liberates toxic gas
- Pyrophoric liquid or solid - Category 1
- Self-heating - Category 1
- Self-Reactive or Organic peroxides

The use of PHS or a High-Risk Chemical requires prior approval in the lab's Standard Operating Procedures for those chemicals, which are discussed in more detail in the Administrative Controls Section of this document.

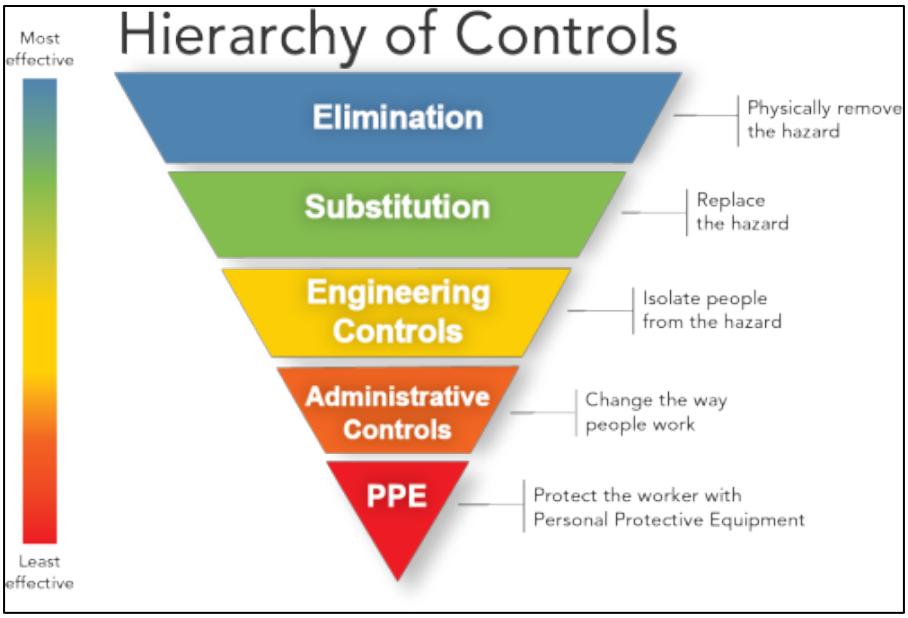
Prior Approval

If a PI determines through the hazard assessment that the use of a chemical used in a procedure is a PHS or is a high risk, then the SOP must indicate that prior approval is required before using procedure or chemical. Typically, the need for prior approval will involve work with PHSs and high-risk chemicals; however, other situations, such as changing the concentration or volume used in a procedure, or working during certain hours may also require prior approval.

The Principal Investigator will make the determination if a procedure needs prior approval and note it in the Standard Operating Procedure (SOP).

Strategies for Controlling Exposures and Hazards

The strategy for keeping employees safe during work with chemicals (or other hazards) is to use a hierarchy of controls that places emphasis on keeping hazards out of the laboratory when possible (elimination) or using less hazardous chemicals (substitution). When use of hazardous chemicals is necessary, devices should be used which remove the hazards or place a barrier between laboratory personnel and the hazards (engineering controls) the hazards are further mitigated by work practices (administrative controls) and wearing of personal protective equipment (PPE).



Source: http://www.cdc.gov/niosh/topics/hierarchy

Elimination or Substitution of Hazards

When planning research or clinical laboratory activities, consider the hazards of the chemicals that will be used. If possible, select an alternative procedure that uses less hazardous chemicals, or that substitutes a less hazardous form of the same chemical. Here are some examples:

- Phosphate assay: Some phosphate assay methods require heating perchloric acid, which can create explosive crystals in fume hood ductwork. Instead, use a method that does not call for perchloric acid, or purchase a phosphate assay kit.
- Acrylamide gels: Acrylamide is a Particularly Hazardous Substance (possible human carcinogen). Avoid potential exposure to acrylamide powder by purchasing precast polyacrylamide gels.
- Xylene: Consider using PARAclear or another environmentally safe clearing agent instead of xylene to reduce exposure and disposal concerns.

Controlling Risk of Exposures to Hazards

Engineering Controls

Engineering controls are considered the first line of defense in the laboratory for the reduction or elimination of exposure to hazardous chemicals. Examples of engineering controls are chemical fume hoods, glove boxes, ventilated storage cabinets, as well as other containment enclosures. ***In all cases, lab personnel must be trained by the PI in the proper use of such equipment.***

- **Fume hoods** - are the primary containment devices used to protect personnel and the laboratory environment from hazardous or irritating chemicals that may become airborne through volatilization or aerosolization.
    - Use a chemical fume hood when working with:
        - Particularly Hazardous Substances
        - Volatile compounds
        - Chemicals with a strong odor
        - Other materials as indicated by the chemical Standard Operating Procedure.
    - Follow these practices when working in a chemical fume hood:
        - Set the sash at the height indicated by the arrow on the inspection sticker. The only time the sash should be completely open is while setting up equipment prior to use of chemicals.
        - Place equipment and chemicals at least six inches behind the fume hood sash. This practice reduces the chance of exposure to hazardous vapors.
        - Do not allow paper or other debris to enter the exhaust duct of the hood.
        - Do not store chemicals, equipment, or supplies in fume hoods, as it can disrupt air flow.
        - Do not block the baffle area (vents at back of hood) of the fume hood.
        - Elevate any large equipment within the hood at least two inches to allow proper ventilation around and under the equipment.
        - Do not alter/modify the fume hood or associated duct work. Notify Facilities Operations if you need to have your fume hood modified.

- ***A special note for working with perchloric acid*** - using perchloric acid in a standard fume hood can lead to buildup of potentially explosive perchlorate salt residues on surfaces and in duct work. To prevent this, a fume hood with a water wash down system must be used/installed.
    - A fume hood designed for perchloric acid use should be used if any of the following is applicable:
        - Concentrated perchloric acid (60% or greater) is used;
        - Perchloric acid (at any concentration) is used at elevated temperatures;
        - Perchloric acid is used under conditions where it may become concentrated (such as with strong dehydrating agents).

- If your fume hood is not functioning properly, stop working in the hood, close the sash, and place a sign on the hood to indicate that it is not working. If hood contents could create a hazardous situation in the room (even with the sash down), leave the room and contact EHSREM at 512-245-3616. Otherwise, complete a work order for Facilities Operations to repair the hood.

- Facilities Operations (Electric Shop) performs routine maintenance on the exhaust fans tied to the fume hoods. PIs are notified of maintenance in accordance with the Fume Hood Maintenance Procedure. For the safety of the maintenance personnel, all chemical use must be stopped while this maintenance is being performed. Failure to do so could result in chemical exposure to maintenance personnel.

- **Glove Boxes -** A glove box is a sealed container that is designed to allow material to be handled in a specific atmosphere (typically inert). Glove boxes can be used to protect sensitive items inside the glove box or the user on the outside of the glove box, or both.
    - The following recommendations should be followed by all personnel using a glove box:
        - All trained personnel must understand the design features and limitations of the glove box before use. The training must include detailed instruction on elements such as the ventilation and vacuum controls that maintain a pressure differential between the glove box and outside atmosphere, atmospheric controls (e.g., controlling oxygen concentrations and moisture), etc.
        - Prior to use, a visual glove inspection must be performed. Changing of a glove must be documented (date, manufacturer, model of glove, and person performing change). Gloves should not be used to the point of failing; they should be changed according to the glove box manufacturer's recommendations or whenever it is deemed necessary.
        - Plugging ports that are never or infrequently used is recommended. A properly plugged port should have a stub glove and a glove port cap installed.
        - Chemical resistant gloves (e.g., disposable nitrile gloves) should be used under the glove box gloves to protect from contamination.
        - The glove box gloves should be cleaned on a routine basis (before each use is recommended).
        - The glove box pressure must be checked before use and immediately after gloves are changed. The pressure check should be documented.
        - Keep sharps in an approved container while in the glove box.
        - Do not work in the glove box unless the lighting is working.
        - Follow all safe work practices for using and handling compressed gas. Follow the manufacturer's recommendations.
        - All equipment and chemicals in the glove box must be organized and all chemicals must be labeled. Do not allow items to accumulate in the glove box.

- **Biological Safety Cabinets** – These cabinets are intended to protect lab personnel from biological hazards and should not be used for protection from chemical hazards.

Administrative Controls

Administrative controls are practices and procedures developed to improve the safety of laboratories, examples include Standard Operating Procedures (SOPs), good housekeeping, and chemical purchasing. While EHSREM sets broad campus policy, as outlined in this document, it does not set specific administrative controls for the use of hazardous chemicals. Such controls must be set by departments or individual PIs and kept up to date as conditions change. The following lists some essential controls:

- **Standard Operating Procedures (SOPs)** – are descriptions of how to safely perform a process or experiment using a hazardous chemical.
  SOPs are required for the use of hazardous chemicals and are part of the Lab-Specific CHP. A template for developing SOPs can be found in the Lab-Specific CHP template.
    - Labs may produce customized SOPs for certain classes of Particularly Hazardous Substances, High Risk Chemicals, or High-Risk Procedures as long as those chemicals grouped into a single SOP are handled in the same way AND as long as the SOP provides information on how to minimize the risk of exposure to all hazards associated with each chemical/procedure covered by the SOP.
    - Laboratory personnel are expected to be familiar with and to follow all SOPs relevant for their laboratory work.
    - If the SOP requires prior approval for use of a certain chemical or procedure, then the PI must ensure that all lab personnel using it are properly trained on the SOP and that prior approval for its use is documented.

- **Housekeeping** – the appearance and condition of a laboratory is directly related to safety and must be given importance of equal value to other lab practices. Lack of good housekeeping reduces work efficiency and can result in accidents.
  Laboratory personnel must adhere to the following:
    - Access to emergency equipment, showers, eyewashes, fire extinguishers, exits and circuit breakers shall never be blocked or obstructed.
    - All aisles, corridors, stairs, and stairwells shall be kept clear of chemicals, equipment, supplies, boxes, and debris.
    - Keep all areas of the lab free of clutter, trash, extraneous equipment, and unused chemical containers. Areas within the lab that should be addressed include benches, hoods, refrigerators, cabinets, chemical storage cabinets, sinks, trash cans, etc.
    - All chemicals should be placed in their proper storage areas at the end of each workday

- Collection containers for wastes must be clearly labeled including hazard identification (Contact EHSREM for empty containers and waste labels.).
- In rooms with fire sprinklers, all storage, including both combustible and non-combustible materials, must be kept at least 18" below the level of the sprinkler head deflectors to ensure that fire sprinkler coverage is not impeded.

- **Personal Hygiene -** Good laboratory work practices include the use of personal protective equipment (PPE) and good personal hygiene habits. Although PPE offers a barrier of protection against chemical hazards, good personal hygiene is also important to prevent chemical exposures.
    - Lab personnel should wear long pants and closed toed shoes when working in a laboratory.
    - Confine loose clothing, remove jewelry, and tie back long hair.
    - Do not start a siphon or pipette by mouth. Always use a pipette aid or suction bulb to start a siphon.
    - No eating, chewing gum or tobacco, drinking or applying cosmetics in areas where chemicals are stored or used.
    - Food/drinks and associated products should also not be in the laboratories, if food/drinks are part of an experiment they should be labeled as "Not for Human Consumption"
    - Do not store food in the same refrigerator with chemicals, biohazards or radioactive materials.
    - Unless moving chemicals to another location, remove PPE before leaving laboratory.
    - Wash hands and arms with soap and water before leaving the laboratory.

- **Working Alone -** Except with prior approval, laboratory personnel shall not work alone when conducting research using hazardous chemicals or processes which present physical or health hazards, such as use of toxic or explosive chemicals, use of compressed gases, or high-pressure cylinders.

  The Principle Investigator must approve, in advance, any work to be performed by individuals working alone. PIs must establish specific guidelines and standard operating procedures (SOPs) stating when working alone is not allowed and develop notification procedures when working alone takes place.
- **Leaving Experiments Unattended -** Experiments involving hazardous chemicals should not be left unattended, but if circumstances require that the experiment run when the lab is not occupied, seek the approval of the Principal Investigator or laboratory safety officer in advance.

  For unattended operations, light(s) should be left on and a warning sign should be placed on the laboratory door, or in a place that can be easily seen without putting someone in danger in the event of an emergency. The warning sign should list the following information:
    - The nature of the experiment.

- The chemicals in use.
- Hazards present (electrical, heat, etc.)
- The name of the person conducting the experiment with a contact number. A second contact name with and their number.

When setting up an experiment to be left unattended, consider potential incidents that could happen:

- Use secondary containment such as trays to contain any spills.
- Use safety shields and keep the fume hood sash down to contain chemicals and glass in the event of an explosion.
- Remove any chemicals or equipment that are not necessary
- Whenever possible, use automatic shutoff devices to prevent accidents such as loss of cooling water shutoff, over-temperature shut off, etc.
- Use emergency power outlets for equipment that could be negatively affected in the event there is a power outage or other utilities are interrupted.

- **Visitors (Visiting Scientists, Volunteers, Industry Partners)** – The University requires the same compliance with rules and attention to responsibilities for visitors as it does for university employees. All adults (18 years or older) working in laboratories who are not currently employed by the university nor currently enrolled as a student at Texas State must also fill out a liability waiver and volunteer form.
  - The PI sponsoring the lab user is responsible for ensuring that the lab user receives all appropriate safety training and training specific to the operations of the laboratory in which the visitor will participate.
  - The visitor must complete all training and documentation of the nature, scope, and date of training shall be made and retained by the faculty member.
  - If appropriate, the visitor shall be provided supervision at all times while participating in laboratory activities.

- **Minors in laboratories** – Persons under the age of ten (10) are not permitted in any laboratory. Persons under the age of sixteen (16) are not permitted to work in any laboratory unless an exemption is granted. They may tour laboratories if all hazardous activities have been suspended during that period. To allow minors to tour work in labs, PIs must comply with UPPS No. 01.04.41 Protection of Minors and Reporting Abuse Policy and EHSREM's Guidelines for Minors in Laboratories.
- **Animals in Laboratories –** Animals are not allowed in laboratories, with the following exceptions:
  - Animals used in approved teaching, research and clinical activities (including livestock kept at university owned ranches and similar facilities).
  - Service animals that meet the criteria outlined in the University's Service Animal UPPS 01.04.08 and animals in training for persons with disabilities that meet §121.003(i) of the Texas Human Resources Code.
  - On-duty Emergency Service K-9s or rescue do

- **Laboratory Security** - Laboratories should take specific action in order to provide security against theft of hazardous materials and valuable equipment. EHSREM encourages each college, department, and research group to review and develop procedures to ensure the security of all hazardous materials in their area of responsibility.

  The following are guidelines designed to minimize opportunities for theft of any hazardous materials from your laboratory:
    - Close and lock doors when no one is present in the laboratory.
    - Develop and implement lab security procedures for your lab group and train lab on security procedures.
    - Limit laboratory access to only those individuals who need to be in the lab and restrict off-hours access only to individuals authorized by the Principal Investigator.
    - Be sure to lock freezers, refrigerators, storage cabinets, and other containers where stocks of biological agents, hazardous chemicals, or radioactive materials are stored not in direct view of workers (i.e: unattended storage areas).

- **Check-in (Area Registration) and Check-out of Laboratories** - Changes in laboratory occupancies can occur due to retiring faculty, new faculty hires, new lab staff are hired, students graduate, or when facility renovations take place.

  Faculty moving into a lab (either new or pre-existing) must contact EHSREM to check-in to their lab..

  When a faculty member has made it known to their department that they are moving out of a lab the following must take place:
    - Department Chairs will notify EHSREM when a faculty member is leaving the University at least one month prior to his or her departure.
    - EHSREM will then contact faculty members with laboratories and arrange a meeting to discuss the lab closeout.
    - Faculty member must complete the Lab Check-Out Form with a representative from EHSREM.
- **Chemical Purchasing -** Prior to purchasing new chemicals, PI's and their lab personnel should review their chemical inventory and use those chemicals in stock whenever possible.
    - If it is necessary to purchase new chemicals, laboratory personnel should order the smallest quantity necessary to carry out the experiment. Avoid ordering extra quantities just because it "might be needed in the future."
    - All hazardous material purchases must be routed through EHSREM for approval by using the appropriate GL Code. If there is a questionable quantity or substance being purchased, EHSREM may contact the PI for further information. Use of the P-Card for purchases of hazardous materials is prohibited in accordance with UPPS 04.05.06.

- **Shipping of Hazardous Materials -** Mandated by the United States Department of Transportation (USDOT) shipping of hazardous materials requires specific training, labeling, and packaging. Shipping without proper training, labeling, and packaging can result in substantial monetary fines and potential criminal penalties. Any Texas State faculty, staff or students shipping hazardous materials must fill out the EHSREM Shipping Request Form and consult with trained EHSREM staff to ensure USDOT requirements are fulfilled prior to shipment of package(s).

- **Inspections/Evaluations** - The purpose of inspections is to assist faculty and staff members in identifying and correcting potential health and safety hazards that could pose a risk to laboratory personnel, students, and the campus community. Inspections fall under three types: EHSREM inspections, self-audits, and regulatory.
    - **EHSREM –** Inspections occur periodically.
    - **Self-Audits –** labs should conduct their own self-audits routinely to address any potential issues. Contact EHSREM at 512-245-3616 for assistance with conducting a self-audit.
    - **Regulatory -** Inspections by state and federal regulatory agencies can occur at any time and can result in citations and significant fines for the university. If a state or federal inspector shows up in your work area unescorted, ask them to please wait and contact EHSREM immediately at 512-245-3616.

- **Ordering New Equipment** – When new equipment is planned to be purchased and installed in laboratories, especially equipment that is required to be hooked up to building utility services such as electric, water, or gas, laboratory personnel must first consult with Facilities Operations and EHSREM to ensure the building has the necessary resources to support the new piece of equipment. Lab personnel **should not** assume they can purchase equipment first and then expect the building to be able to handle the service requirements later.

  Laboratory personnel are strongly encouraged to be proactive and to consult with the appropriate departments ahead of time, before purchasing new pieces of large equipment.

- **Laboratory Construction and Remodeling -** To provide the best service during the construction/renovation process for laboratories, it is important to take health and safety considerations into account up front during the design process. Faculty or staff members that are planning new lab construction or lab renovation should, consult with the Facilities Operations Project Manager and contact the Chemical Hygiene Officer with the following information:
    - Contact name, phone number, email
    - Department, building and room(s) the project will occur in
    - Expected start date for project
    - A list of chemicals, including storage quantities
    - Equipment planned to be installed - fume hoods, biosafety cabinet, other capture devices, chemical cabinets, eyewash and emergency shower, monitoring devices, etc.

Personal Protective Equipment (PPE)

Engineering and administrative controls are the primary means of maintaining a safe laboratory. When these methods are used in conjunction with the proper selection of PPE, risk of chemical exposure can be further minimized. Typical examples of PPE include safety goggles, safety glasses, lab coat, gloves, face shields, and respirators. Specific PPE requirements for a laboratory's chemicals and processes should be listed in the Lab Specific CHP.

It is the responsibility of the Principal Investigator and/or laboratory manager to ensure laboratory staff have received the appropriate training on the selection and use of proper PPE, that proper PPE is available and in good condition, and laboratory personnel use proper PPE when working in laboratories under their supervision.

- **Eye protection** – laboratory staff must use proper eye protection that is ANSI Z87.1 complaint for the tasks being performed in laboratories. Safety goggles are a better option than safety glasses when the following hazards are present in your lab:
    - Direct vent goggles – for high-velocity debris and blunt impacts
    - Non-venting and indirect vent goggles – for splashes and airborne droplets
    - Non-venting goggles – for airborne dust particles
    - Non-venting goggles – for chemical vapors and gases

  All laboratory personnel and visitors must wear protective eyewear while in laboratories where chemicals are being handled or stored, at all times, even when not working directly with chemicals.
- **Hand Protection** - The proper use of hand protection can help protect from potential chemical and physical hazards. Gloves must be worn when using chemicals.
    - Chemically Resistant gloves - Remember there is no universal type of glove material which will protect you from all chemical exposure. Recommended gloves types may be listed in SDSs. If they are not, review glove manufactures' web sites to help you select the proper glove for the chemical you are handling.
    - The use of latex gloves, especially thin, disposable exam gloves, for chemical handling is discouraged because latex offers little protection from commonly used chemicals. To avoid issues with allergic reactions, use hypoallergenic, non-powdered gloves. The use of latex gloves is only appropriate for:
        - Most biological materials
        - Certain clean room requirements
        - Medical or veterinary applications

- Cryogenic gloves – used when working with dry ice, liquid nitrogen and other cryogenic liquids.
- Cur Resistant gloves – used when handling broken glass.
- Heat Resistant gloves – used when handling objects from ovens, autoclaves, etc.

- **Protective Clothing** – The use of protective clothing such as lab coats, Tyvek coveralls, aprons, boots, and shoe covers can provide protection from chemical contamination or splashes. When choosing protective clothing consider:
    - the specific hazards encountered, and the degree of protection needed i.e. flame resistant, chemical resistant, etc.;
    - the comfort and ease of use; and
    - how quickly the clothing can be removed in an emergency

- **Respiratory Protection** – In situations where the laboratory fume hood or local exhaust does not adequately prevent inhalation exposure, respirators may be necessary. Use of respirators requires medical clearance, annual training, and an annual fit test. If you believe a respirator may be necessary, contact EHSREM at 512-245-3616.

- **Hearing Protection** – If occupational noise exposures exceed permissible levels (85 dB) and cannot be reduced through engineering or other controls, then hearing protective devices such as earplugs, or earmuffs must be worn.

PHYSICAL AND CHEMICAL HAZARDS

Information about general classes of chemical hazards can be found below. The information is meant to be a guide for PIs in assessing risks as well as proper handling and storage.

Chemicals can be divided into several different hazard classes. The hazard class will determine how these materials should be stored and handled and what special equipment and procedures are needed to use them safely. Each chemical container, whether supplied by a vendor or produced in the laboratory, must include labels that clearly identify the hazards associated with that chemical. See Chapter 4, Chemical Hazard Information and Training, for more information on chemical labeling. In addition to specific chemical labels, hazard information for specific chemicals can be found by referencing the Safety Data Sheet (SDS) for that chemical.

It is essential that all laboratory personnel understand the types of hazards, recognize the routes of exposure, and are familiar with the major hazard classes of chemicals. In many cases, the specific hazards associated with new compounds and mixtures produced in labs will not be known. It is recommended that all new chemical compounds be treated as if they were potentially harmful and to use appropriate PPE along with engineering and administrative controls.

Flammability Hazards

Flammable and combustible liquids are one of the most common types of chemicals used at Texas State University and are an important component in a number of laboratory processes. While common, it is important to remember that these materials can constitute a significant immediate threat and should be treated with particular care.

Flammable liquids include those chemicals that have a flashpoint of less than 100 degrees Fahrenheit.

- Minimize the amount of flammable liquids stored in the lab. As a general rule, do not store more than 10 gal/100sqft outside of flammable storage cabinets.

Given the complexities of local, state, and federal regulations regarding the amounts of flammables that may be stored in a lab contact EHSREM at 512-245-3616 for a consultation.

- Flammable liquids that are not in active use should be stored inside fire resistant flammable storage cabinets or safety cans.
- Flame-resistant laboratory coats should be worn when working with flammable materials and/or with procedures where a significant fire risk is present (e.g., when working with open flame, etc.).
- Always keep flammable liquids stored away from oxidizers and away from heat or ignition sources such as vacuum pumps, radiators, electric power panels, etc.
- When using flammable liquids, keep containers away from open flames; it is best to use heating sources such as steam baths, water baths, oil baths, and heating mantels. Never use a heat gun to heat a flammable liquid.
- Any areas using flammables should have a fire extinguisher present. If a fire extinguisher is not present, contact EHSREM at 512-245-3616.
- When pouring flammable liquids, it is possible to generate enough static electricity to cause the flammable liquid to ignite. If possible, make sure both containers are electrically interconnected to each other by bonding the containers, and connecting them to a ground.
- Always clean up any spills of flammable liquids promptly. Be aware that flammable vapors are usually heavier than air (vapor density > 1). For those chemicals with vapor densities heavier than air (applies to most chemicals), it is possible for the vapors to travel along floors and, if an ignition source is present, result in a flashback fire.

Oxidizer Hazards

The OSHA Laboratory Standard defines an oxidizer as "a chemical other than a blasting agent or explosive that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases." Oxidizers are a concern for laboratory safety due to their ability to promote and enhance the potential for fires in labs. Common examples of oxidizers are bromine, hypochlorites, permanganates, nitric acid, and peroxides.

- As with any chemicals, but particularly with oxidizers, quantities stored on hand should be kept to a minimum.
- Whenever planning an experiment, be sure to read the SDS and other reference documents to understand the hazards and special handling precautions that may be required, including use of a safety shield.
- Be aware of the melting and auto-ignition temperatures for these compounds and ensure any device used to heat oxidizers has an over-temperature safety switch to prevent the compounds from overheating.
- Laboratory staff should be particularly careful when handling oxidizers (especially high surface area oxidizers such as finely divided powders) around organic materials.
- Store oxidizers away from flammables, organic compounds, and combustible materials.
- Avoid using metal objects when stirring or removing oxidizers from chemical containers. Plastic or ceramic implements should be used instead.
- Laboratory personnel should avoid friction, grinding, and impact with solid oxidizers.
- Reaction vessels containing oxidizing material should be heated in a mantle or sand bath. Oil baths should not be used.
- Glass stoppers and screw cap lids should always be avoided, and plastic or polyethylene lined bottles and caps should be used instead.

Reactivity Hazards

Reactive and explosive substances are materials that decompose under conditions of mechanical shock, elevated temperature, or chemical action, and release of large volumes of gases and heat.

- <u>Water Reactive Materials</u> –
  When water reactive materials come in contact with water, one or more of the following can occur: liberation of heat which may cause ignition of the chemical itself if it is flammable, or ignition of flammables that are stored nearby; release of a flammable, toxic, or strong oxidizing gas; release of metal oxide fumes; and formation of corrosive acids. Common examples include sodium metal and potassium metal.

  Water reactive chemicals can be particularly hazardous because water is the most commonly used fire extinguishing medium. Attempting to put out a fire involving water-reactive materials with water will only make the situation worse. Special "Class D" fire extinguishers are required for use with water-reactive compounds. To obtain a Class D fire extinguisher, contact the EHSREM office at 512-245-3616.

- Pyrophorics -
  Pyrophoric materials can ignite spontaneously in the presence of air. Examples of pyrophoric materials: Tert-butyllithium, White Phosphorus, Diethylzinc, Triethylaluminum, and several organometallic compounds

  In the event of an accident, such as a bottle being knocked off a shelf, the chemical can spontaneously ignite, and a fire can occur. Extra care must be taken when handling spontaneously combustible chemicals. When transporting these chemicals, it is best to use a bottle carrier and carts. Flame-resistant laboratory coats must always be worn when working with pyrophoric chemicals.

- Peroxide-Forming Chemicals -
  Peroxides are very unstable and some chemicals that can form them are commonly used in laboratories. This makes peroxide-forming materials some of the most hazardous substances found in a lab. Peroxide-forming materials are chemicals that react with air, moisture, or impurities to form peroxides. The tendency to form peroxides by most of these materials is greatly increased by evaporation or distillation.

  Organic peroxides are extremely sensitive to shock, sparks, heat, friction, impact, and light. Many peroxides formed from materials used in laboratories are more shock sensitive than TNT. Just the friction from unscrewing the cap of a container of ether that has peroxides in it can provide enough energy to cause an explosion.

  Below is a list of the most common examples of peroxide-forming materials (the italicized group is the more hazardous). A more complete list may be found in Apprendix F:

Diisopropyl Ether	Divinylacetylene
Sodium Amide	Potassium Amide
Dioxane	Diethyl Ether
Tetrahydrofuran	Vinyl Ethers
Butadiene	Vinylpyridine
Acrylonitrile	Styrene

  - Peroxide-forming materials must be dated with the date received and date opened.
  - Certain peroxide-forming chemicals such as diisopropyl ether, divinyl acetylene, sodium amide, and vinylidene chloride must be properly disposed of if they are older than three months. Contact EHSREM for further instruction if you need to dispose of these substances.
  - Chemicals such as dioxane, diethyl ether, and tetrahydrofuran must be properly disposed of after one year if opened or expired. Contact EHSREM for further instruction if you need to dispose of these substances.
  - Store all peroxide-forming materials away from heat, light, and sources of ignition. Light accelerates the formation of peroxides

- Do not open the chemical container if peroxide formation is suspected. The act of opening the container could be sufficient to cause an explosion. Visually inspect liquid peroxide-forming materials for crystals or unusual viscosity before opening. Pay special attention to the area around the cap. Peroxides usually form upon evaporation, so they will most likely be formed on the threads under the cap.
- If you suspect that peroxides may be present, contact EHSREM. If you notice crystal formation in the container or around the cap, do not attempt to open or move the container. Call EHSREM for proper disposal.
- Never distill ether unless it is known to be free of peroxides.

Health Hazards

OSHA defines "health hazards" as chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic systems, and agents which damage the lungs, skin, eyes, or mucous membranes.

The major classes of "hazardous" and "particularly hazardous substances" and their related health and safety risks are detailed below.

Corrosive Substances
As a health hazard, corrosive substances cause destruction of, or alterations in, living tissue by chemical action at the site of contact. Major classes of corrosive substances include:

- Strong acids – e.g., sulfuric, nitric, hydrochloric, and hydrofluoric acids
- Strong bases – e.g., sodium hydroxide, potassium hydroxide and ammonium hydroxide
- Dehydrating agents – e.g., sulfuric acid, sodium hydroxide, phosphorus pentoxide and calcium oxide
- Oxidizing agents – e.g., hydrogen peroxide, chlorine, and bromine.

Symptoms of exposure for inhalation include a burning sensation, coughing, wheezing, laryngitis, shortness of breath, nausea, and vomiting. For eyes, symptoms include pain, blood shot eyes, tearing, and blurring of vision. For skin, symptoms may include reddening, pain, inflammation, bleeding, blistering and burns. As a physical hazard, corrosive substances may corrode materials they come in contact with and may be highly reactive with other substances. It is important to review information regarding the materials they may corrode, and their reactivity with other substances, as well as information on health effects. In most cases, these materials should be segregated from other chemicals and require secondary containment when in storage.

Irritants
Irritants are defined as non-corrosive chemicals that cause reversible inflammatory effects on living tissue by chemical action at the site of contact. A wide variety of organic and inorganic compounds, including many chemicals that are in a powder or crystalline form, are irritants.

The most common example of an irritant may be ordinary smoke which can irritate the nasal passages and respiratory system. Consequently, eye and skin contact with all laboratory chemicals should always be avoided. Symptoms of exposure can include reddening or discomfort of the skin and irritation to respiratory systems.

Sensitizers
A sensitizer (allergen) is a substance that causes exposed people to develop an allergic reaction in normal tissue after repeated exposure to the substance. Examples of sensitizers include diazomethane, chromium, nickel, formaldehyde, isocyanates, arylhydrazines, benzylic and allylic halides, and many phenol derivatives. Sensitizer exposure can lead to all of the symptoms associated with allergic reactions or can increase an individual's existing allergies.

Hazardous Substances with Toxic Effects on Specific Organs
Substances included in this category include:

- Hepatotoxins – i.e., substances that produce liver damage, such as nitrosamines and carbon tetrachloride.
- Nephrotoxins – i.e., agents causing damage to the kidneys, such as certain halogenated hydrocarbons.
- Neurotoxins – i.e., substances which produce their primary toxic effects on the nervous system, such as mercury, acrylamide, and carbon disulfide.
- Agents which act on the hematopoietic system – e.g., carbon monoxide and cyanides which decrease hemoglobin function and deprive the body tissues of oxygen.
- Agents which damage lung tissue – e.g., asbestos and silica.

Symptoms of exposure to these materials vary. Staff working with these materials should review the SDS for the specific material being used and should take special note of the associated symptoms of exposure.

Particularly Hazardous Substances (PHSs)
OSHA regulations require that provisions for additional employee protection be made for work with particularly hazardous substances (PHSs). These include carcinogens, reproductive toxins, and substances that have a high degree of acute toxicity.

- **Acute Toxins -** Substances that have a high degree of acute toxicity are interpreted by OSHA as being substances that "may be fatal or cause damage to target organs as the result of a single exposure or exposures of short duration." Acute toxins, associated chemical waste, and storage containers must be handled with care to prevent cross contamination of work areas and unexpected contact. Empty containers of these substances must be packaged and disposed of as hazardous waste.
- **Reproductive Toxins -** These include any chemical that may affect the reproductive capabilities, including chromosomal damage (mutations) and effects on fetuses (teratogenesis).

- Reproductive toxins can affect the reproductive health of both men and women if proper procedures and controls are not used. For women, exposure to reproductive toxins during pregnancy can cause adverse effects on the fetus; these effects include embryolethality (death of the fertilized egg, embryo, or fetus), malformations (teratogenic effects), and postnatal functional defects. For men, exposure can lead to sterility.
- Examples of embryotoxins include thalidomide and certain antibiotics such as tetracycline. Women of childbearing potential should note that embryotoxins have the greatest impact during the first trimester of pregnancy. Special caution is advised when working with all chemicals, especially those rapidly absorbed through the skin (e.g., formamide). Pregnant women and women intending to become pregnant should consult with their laboratory supervisor and EHSREM before working with substances that are suspected to be reproductive toxins.
- **Select carcinogens** - The Occupational Safety and Health Administration (OSHA) defines a "select carcinogen" as a substance that meets one of the following criteria:
    - Regulated by OSHA as a carcinogen;
    - Is listed under the category "known to be a carcinogen" or "reasonably anticipated to be a carcinogen" in the Annual Report on Carcinogens published by the National Toxicology Program (NTP); or
    - Is listed under Group 1 ("carcinogenic to humans") or under Group 2A ('probably carcinogenic to humans") or 2B ("possibly carcinogenic to humans") by the International Agency for Research on Cancer (IARC).

A list of Particularly Hazardous Substances (PHSs) can be found in Appendix G.

Nanomaterials

The increasing use of nanomaterials in research labs warrants consideration of the hazards they may pose. As is the case with many new technologies, the health effects of nanomaterials have not been thoroughly investigated. Consequently, the uncertainty surrounding the toxicity of nanomaterials merits a cautious approach when working with them.

Nanomaterials include any materials or particles that have an external dimension in the nanoscale (~1 – 100 nm). Nanomaterials are both naturally occurring in the environment and intentionally produced. Intentionally produced nanomaterials are referred to as Engineered Nanomaterials (ENMs). Materials whose properties do not differ significantly between their nanoscale and larger forms are generally excluded from ENMs.

The most common types of ENMs are carbon-based materials such as nanotubes, metals and metal oxides such as silver and zinc oxide, and quantum dots made of compounds such as zinc selenide.

Nanomaterials can be categorized by the potential risk of exposure they pose to personnel based on the physical state of the materials and the conditions in which they are used. In general, the risk of exposure is lowest when nanomaterials are bound in a solid matrix with little potential to create airborne dust or when in a non-volatile liquid suspension. The risk of exposure increases when nanomaterials are used as fine powders or are suspended in volatile solvents or gases. The parent compound of the nanomaterial should also be taken into consideration when evaluating the potential hazards associated with exposure (e.g., a highly toxic compound such as cadmium should be anticipated to be at least as toxic and possibly more toxic when used as a nanomaterial).

- Whenever possible, select less hazardous forms, such as engineering nanomaterials bound in a substrate or matrix or in a water-based liquid suspension gel.
- Always minimize airborne releases of nanomaterials by utilizing appropriate engineering controls such as glove boxes or other fully enclosed systems.
- Whenever possible, nanomaterials should be worked with in solutions or attached to substrates so that dry material is not released.
- Line work area with absorbent pad. When working with powders, use antistatic paper and floor sticky mats. Wet wipe and/or HEPA-vacuum work surfaces potentially contaminated with nanoparticles at the end of each operation. Dispose of contaminated wipes and HEPA filters in a sealed container for hazardous waste disposal.

Compressed Gases

The presence of compressed gases creates physical and/or health hazards in the laboratory and therefore require safety control measures to ensure safe use. The large amount of pressure contained makes gas cylinders a potential rocket or bomb if the cylinder or valve fails. Users should refer to the appropriate Safety Data Sheet (SDS) for specific chemical hazard information of the gases in their lab and develop SOPs as appropriate.

In general, the following safety measures should be taken when working with compressed gas cylinders:

- Secure all cylinders in racks, holders, or clamping devices. Fasten cylinders individually (not ganged) in a well-ventilated area.
- Do not rely on color to identify container contents. Check the label.
- Close valves, and release pressure on the regulators when cylinders are not in use.
- Minimize the number of hazardous gas cylinders in a laboratory.
- Store separately:
    - Full cylinders away from empty cylinders. (Label as full or empty.)
    - Oxidizing gases (such as oxygen) away from flammable gases.
- Keep heat, sparks, flames, and electrical circuits away from gas cylinders.
- Post storage area for flammable gases or oxygen with "No Smoking" and "No Open Flames" signs.
- Do not store gas cylinders in hallways or public areas.
- Never move a gas cylinder unless the cylinder cap is in place and the cylinder is chained or otherwise secured to a cart. When possible, have an assistant to help.

- Only use regulators approved for the type of gas in the cylinder.
- Do not use adapters to interchange regulators.
- When opening a cylinder valve, direct the cylinder opening away from people, and open the valve slowly.
- For flammable gases, use a flashback arrestor between regulator and hose. (Prevents flame from entering cylinder.)
- Consider a ventilated gas cabinet or chemical fume hood for flammable or irritating gases, depending on quantities used.
- Return cylinders and unused gas to vendor. If the vendor cannot be determined, contact EHSREM at 512-245-3616.

Drug Enforcement Agency (DEA) Scheduled Drugs

Due to their abuse potential, items identified by Drug Enforcement Administration (DEA) as controlled substances are subject to licensing, registration, storage, security, use, and disposal requirements.

Controlled substances are materials containing any quantity of a substance with a stimulant, depressant, or hallucinogenic effect on the higher functions of the central nervous system and having the tendency to promote abuse or physiological or psychological dependence, as designated in state and federal controlled substance schedules.

Contact EHSREM for a list of DEA controlled substances. Principal Investigators (PIs) using controlled substances in their laboratory research (including animal research) are subject to federal regulatory requirements. The University cannot, by law, maintain a campus-wide registration for controlled substances. It is therefore the responsibility of each PI to obtain appropriate licenses and registration and to adhere to applicable regulatory requirements when working with controlled substances. PI's must register their controlled substances with the DEA. Penalties for using such drugs in research without proper registration can be severe.

Copies of all registration and licensing related correspondence must be kept by the PI and be made available upon request by EHSREM.

To dispose of unwanted or expired controlled substances, contact EHSREM at 512-245-3616 for further direction. Sewer disposal is not an acceptable method of disposal.

Thefts, suspected thefts, unauthorized uses, or other losses of any controlled substance must be reported to the University Police Department (UPD) and EHSREM upon discovery. Registrants must also document the incident to the DEA

EMERGENCY AND SPILL RESPONSE PROCEDURES

Safety Showers, and Eyewashes

All laboratories using hazardous chemicals, particularly corrosive chemicals, must have access to an eyewash and/or an emergency shower as per the OSHA standard 29 CFR 1910.151 – Medical Services and First Aid. The ANSI Standard Z358.1-2009 - Emergency Eyewash and Shower Equipment provides additional guidance by stating that emergency eyewash and/or emergency showers be:

- Installed on same level as chemical hazards (i.e. access to units should not require going up or down stairs or ramps).
- Within 10 seconds walking time from chemical hazards (approximately 55ft).
- Path to the units should not be obstructed.

The ANSI Standard states that plumbed emergency eyewash and safety showers should be operated **weekly** for 3-5 minutes to verify proper operation and inspected semi-annually. Weekly flushing ensures the units are operating properly, helps to keep the units free of clutter, and helps prevent the growth of bacteria within the plumbing lines, which can cause eye infections. It is recommended to allow the water to run for at least 3 minutes. EHSREM strongly encourages laboratories to post an "Eyewash Testing Sheet" near the eyewash to document that weekly flushing is occurring. The testing sheet can be found in Appendix I

Laboratories are responsible for regularly activating/flushing eyewashes in their spaces and ensuring that access to emergency eyewashes and showers are kept free of clutter and ensuring the eyewash nozzle dust covers are kept in place.

Contact EHSREM at 512-245-3616 if you any questions concerning the requirements for emergency eyewashes and showers and how best to maintain (flush) these units

Report any malfunctioning eyewashes and emergency showers to EHSREM to have the unit assessed and repaired. If either the emergency shower or eyewash is not working properly, post a "Do Not Use" sign on the unit to alert others.

Those working in laboratories must be instructed in the location and proper use of eyewashes and safety showers. Other equipment such as drench hoses may support ***but not*** replace approved eyewashes and showers.

Use of Eyewashes

- If you get a chemical in your eyes, call for help from other workers in the lab.
- A coworker should lead you to the nearest eyewash and push the activation handle all the way on.
- Put your eyes in the stream of water and begin flushing.
- Hold open your eyelids with your fingers and roll your eyes around to obtain maximum irrigation of the eye

- Keep flushing for at least 15 minutes or until help arrives.

- Seek medical attention / call 911.

- Report the incident to the PI and have PI complete a "Supervisor's Report of Incident, Injury, or Illness" and submit it to EHSREM within 24 hours of the incident.

If a coworker gets a chemical in their eyes, assist them to the eyewash and activate the eyewash. Help them get started flushing their eyes using the procedures listed above and seek medical help / call 911. After calling for medical help, continue to assist the person using the eyewash and continue flushing for 15 minutes.

Use of Emergency Showers

- If you splash a chemical on your body, call for help from other workers in the lab.

- A coworker should lead you to the nearest emergency shower and pull the activation handle.

- Once under the stream of water, begin removing your clothing to wash off all chemicals.

- Keep flushing for at least 15 minutes or until help arrives.

- Seek medical attention / call 911.
- PI complete a "Supervisor's Report of Incident, Injury, or Illness" and submit it to EHSREM within 24 hours of the incident.

If a coworker in the lab needs to use an emergency shower, assist them to the emergency shower, activate the shower for them, and help them get started flushing using the procedures listed above and then call **911**. After calling 911, continue to assist the person and continue flushing for 15 minutes or until help arrives.

NOTE: Although an emergency is no time for modesty, if a person is too modest and reluctant to use the emergency shower, you can assist them by using a lab coat or other piece of clothing as a screen while they undress under the shower. As you are assisting someone, you should wear gloves to avoid contaminating yourself. When using an emergency shower or eyewash, do not be concerned about the damage from flooding. The important thing to remember is to keep flushing for 15 minutes. If there is a large quantity of chemical spilled or washed off, contact EHSREM at 512-245-3616 (after hours 512-738-6650) to see if the rinsate needs to be collected as hazardous waste.

Fire Hazards

Laboratory personnel should not attempt to extinguish large fires (anything larger than a small trash can). The following steps should be taken:

- Confine the fire by closing the vent hood sash or laboratory doors and fire doors as appropriate.
- Immediately evacuate the fire area, pull building alarms, and dial 911 once outside the building.

Beginning stage fires may be extinguished by designated laboratory personnel trained in the use of portable fire extinguishers. Ideally, at least two people should be available when the fire is extinguished. The following steps should be taken:

- Alert other personnel and have them dial 911.
- Extinguish the fire by using the P.A.S.S. system.
    - **P**: **Pull the pin** that is located on the top of the fire extinguisher. Pulling the pin releases the fire extinguisher's locking mechanism.
    - **A**: **Aim** the fire extinguisher at the base of the fire.
    - **S**: **Squeeze the lever** to release the extinguishing agent in a controlled manner. To stop the discharge, let go of the lever. Remember that the extinguisher only holds a limited amount of extinguishing agent.
    - **S**: **Sweep** the fire extinguisher back and forth across the base of the fire until it has been completely extinguished.
- If the fire cannot be controlled, evacuate the area.

Chemical Spills

With proper training and preparation laboratory personnel can safely and effectively handle the majority of chemical spills that occur in the laboratory.

Due to the hazardous properties of certain chemicals, the size of the spill or the likelihood that a spill might become an emergency, assistance from EHSREM may be necessary. Proper training and planning includes:

- Be sure that EHSREM's emergency contact sign (Appendix J) is posted in the lab. Also post numbers of laboratory PI and laboratory workers.
- Make sure lab personnel understand the chemical spill response procedures.
- Keep a spill kit fully stocked and easily accessible.
- Train personnel how to use the spill kit and when it is safe to clean up a spill.
- Make sure everyone working in the lab knows:
    - Locations of fire alarm pull stations, safety eye washes and showers, and telephones.

When a chemical spill occurs, it is necessary to take prompt and appropriate action. The first action to take is to determine if the spill is a incidental or significant spill:

- **Incidental Spill** – Small quantity spill (< 5 gallons) of a known chemical which does not spread rapidly; it poses a minor health and safety hazard to people; it does not endanger property or the environment.

- **Significant Spill –** Large quantity spill (>5 gallons) of a known chemical which spreads rapidly; it poses a serious health and safety hazards to people and it endangers property or environment (such as fire, explosion, or is toxic, corrosive, oxidizer) or is an unidentified chemical**.**

When considering cleaning up a **incidental spill**:

- Alert people in the lab that a spill has occurred.
- Evaluate the spill and decide if it can be handled by lab personnel.
- Put on the Proper Personal Protective Equipment (PPE) such as goggles, gloves, etc. before beginning cleanup.
- Confine the spill to a small area. Use absorbent material from your spill kit to absorb spilled materials.
- Place the saturated absorbent in a chemical waste bag.
- Place all cleaning materials into the chemical waste bag in the spill kit and seal it.
- Label the bag with a hazardous waste label and include it in the next hazardous waste collection by EHSREM staff.
- Clean the spill area with water.
- Replenish your spill kit supplies, if kit is maintained by EHSREM call 245-3616 to have kit resupplied.
- Report the spill to the laboratory PI.

When a **significant spill** has occurred:

- Alert people in the area and evacuate, closing all doors. If the building needs to be evacuated, pull the fire alarm.
- Identify the spilled material if you can do so safely.
- If the spill involves a flammable liquid, turn off all ignition sources if you can do so safely.
- Once evacuated isolate any contaminated persons and protect yourself and others from chemical exposure.
- Call UPD (university police) at 911 and EHSREM at 245-3616 (512-738-6650 after hours) and be prepared to provide the following information:
    - Where the spill occurred (building and room number).
    - If there are any injuries and if medical attention is needed.
    - The identity of the spilled material(s) - be prepared to spell out the chemical names.
    - The approximate amount of material spilled.
    - How the spill occurred (if you know).
    - Any immediate actions taken.
    - Who first observed the spill and the approximate time it occurred.
    - Where you will meet emergency responders or provide a call back number (if available).
- Keep people away from the spill area until qualified spill responders arrive.
- Have someone available who is knowledgeable about the spilled material to provide information to the spill responders.

Following notification to 911, all significant spills, or spills involving chemical exposure should be reported to the EHSREM. This is important to ensure that you have not been exposed or injured and that the spill is reported to the appropriate regulatory agencies. The spill reports are also used to develop practices to reduce the likelihood of future spills.

Incidental spills are considered near miss accidents and may be an indication of potential for more significant incidents. You are encouraged to report these spills to EHSREM. doing so will provide information regarding where remedial actions should be taken. Such actions include modification of work practices, additional training on chemical handling and storage, and spill response.

CHEMICAL STORAGE, TRANSPORT, AND DISPOSAL

There are established regulations as well as recommended practices for proper storage of chemicals. Proper storage of chemicals results in safer and healthier working conditions, extends the usefulness of chemicals, and can help prevent contamination. Chemical storage areas include, but are not limited to, central stockrooms, laboratory work areas, storage cabinets, refrigerators, and freezers.

Chemical Compatibility and Safe Storage

Laboratories should adhere to the following storage guidelines for the proper and safe storage of chemicals. By implementing these guidelines, laboratories can ensure safer storage of chemicals and enhance the general housekeeping and organization of the lab. Proper storage of chemicals also helps utilize limited laboratory space in a more efficient manner.

- Always segregate and store chemicals according to compatibility and hazard classes. See Appendix H for recommendations.
- Flammable liquids in excess of quantities for specific flammability classes must be stored in approved flammable liquid storage cabinets.
- Do not store acids in flammable liquid storage cabinets. The exceptions are organic acids, such as Acetic acid, Lactic acid, and Formic acid, which are considered flammable/combustible and corrosive and can be stored in flammable or corrosive storage cabinets.
- Do not store flammable liquids in standard refrigerators or freezers. Due to the potential explosion hazard, only store flammables in units approved by the manufacturer for storage of flammables.
- All chemical containers must be labeled. Labels should include the name of the chemical and the hazards the chemical presents to the user.
- Be sure to check chemical containers regularly and replace any labels that are deteriorating or falling off and/or relabel with another label before the chemical becomes an unknown.
- Keep all containers of chemicals closed when not in use.
- Every chemical should have an identifiable storage place and should be returned to that location after use.
- The storage of chemicals on benchtops should be kept to a minimum to prevent clutter and possible spills.
- Chemical storage in fume hoods must be kept to a minimum. Excess storage in hoods can interfere with airflow, reduce working space, and increase the risk of a spill, fire, or explosion.
- Chemicals should not be stored on the floor due to the potential for spills. If it is necessary to store bottles on the floor, then the bottles should be placed in secondary containment away from lab walkways.

- For multiples bottles of the same chemical, older containers should be stored in front of newer containers and containers with the least amount of chemical should be stored in front of full containers. This allows for older chemicals to get used up first and helps to minimize the number of chemical containers in the storage area.
- Do not store chemicals in direct sunlight or next to heat sources.
- Laboratories should keep only the minimum quantity of chemicals necessary.
- Liquid chemical containers should be stored in secondary containment, such as trays, to minimize the potential for bottle breakage and minimize the potential for spills.
- Chemical containers should be dated when they arrive and should be checked regularly and disposed of when they pass their expiration date. **Please Note:** Due to the potential explosion hazard, peroxide forming chemicals are required to have a received and opened date.
- No chemicals should be stored above eye level unless an appropriate step stool or ladder is present in the lab.

Chemical Retention

Prudent chemical retention and storage practices are vital to maintain a safe laboratory working environment and to minimize the financial costs and environmental impact associated with the handling and disposal of unwanted chemicals. Because chemical purity can be affected by factors such as temperature, light, exposure to air, and other substances, lab personnel and PIs should follow the general guidelines set by chemical suppliers. Chemicals with an expiration date that has been exceeded should be properly disposed of through the EHSREM Hazardous Materials and Hazardous Waste Management Program.
Some chemicals retained past the expiration date can become unstable or may form explosive compounds (peroxides) over time. **EHSREM requires that certain chemicals which are known to degrade or form peroxides must be used or properly disposed of by their expiration date**. See Physical and Chemical Hazards, and Appendix F for more detailed information on handling and disposing of peroxide forming materials. Contact EHSREM if you have peroxide-forming chemicals which have exceeded the expiration date or designated shelf-life. **Do not attempt to handle or open suspect containers**.

Although not recommended, should you decide to retain chemicals with an "indefinite shelf life", you should ask yourself:

• Do I trust the purity of the chemical(s) to not skew my research results?

• Do I really need that chemical(s)?

• How much space am I giving up storing that chemical(s).

Transporting Chemicals

When moving chemicals from room to room in your building:
- Take precautions to avoid dropping or spilling chemicals.
- Make sure that chemical containers are sealed during transport and that incompatible chemicals are placed in secondary containment away from one another.
- Carry breakable containers in specially designed bottle carriers or leak-resistant, unbreakable secondary containers.

- When transporting chemicals on a cart, use a cart that is suitable for the load and one that has high edges to contain leaks or spills. The cart should be capable of negotiating uneven surfaces without tipping the chemical container or the cart.
- Transport chemicals by traveling least-trafficked routes. When possible, use freight elevators.
- Gas cylinders must be strapped to a hand truck specifically designed for that purpose. Cylinder cover caps must be in place.

If transporting large amounts of chemicals for a laboratory move, (or any amount of chemicals on a public road), contact the EHSREM Office at 512-245-3616 for consultation on safe packaging and compliance with federal, state, and local laws.

Hazardous Waste Disposal

Hazardous waste can pose a threat to students, employees, visitors, and the environment if managed improperly. To minimize the possibility of such threats, appropriate practices and procedures are required. EHSREM has primary responsibility for the overall management of the university's hazardous waste program; however, each PI or Lab Manager is responsible for proper management of hazardous waste within their labs. All lab personnel must comply with the Hazardous Materials and Hazardous Waste Management Program requirements found in UPPS 04.05.06 and all applicable state and federal regulations.

Texas State University is registered with the TCEQ and the EPA as a Large Quantity Generator of hazardous waste and therefore, strict regulations apply. Compliance with these regulations requires partnership and cooperation from all departments involved in the generation and storage of waste on campus.

The Resource Conservation and Recovery Act (RCRA) requires "cradle-to-grave" tracking and management of hazardous waste, meaning waste must be properly tracked and managed from the point of generation, through transportation, storage, treatment, and final disposal.

Anyone or any facility that generates, treats, stores or disposes of hazardous waste must comply with RCRA and the corresponding state regulations [30 TAC Chapter 335] .

Waste Determination

Laboratories that generate chemical waste or chemically contaminated lab debris must accurately identify the contents of the waste container on the hazardous waste label. This information is crucial and is required for EHSREM to properly classify the waste stream for proper disposal.

Additional information and resources to assist in identifying hazardous waste and proper disposal of chemical wastes in the lab can be found on the Hazardous Waste Management Program on the EHSREM website

Storing Hazardous Waste

All chemical wastes that are generated as a result of lab processes or unwanted chemicals are considered hazardous wastes by the University and must be stored in the Satellite Accumulation Area (SAA) within the laboratory

PIs or their designee must ensure that the SAA is properly managed in accordance with federal and state regulations. All lab personnel who work in labs where hazardous wastes are generated must take "Hazardous Waste" training. The PI or Lab Manager must ensure that all SAAs are maintained in compliance with the following requirements:

- All **containers must be closed** except when waste is actively being added. Caps must be screwed on. If you are concerned about vapor build-up in your container, please contact EHSREM to discuss options.
- Waste **containers must be compatible** with the contents. EHSREM provides 5-gallon carboys and 30-gallon bung top drums for liquid wastes and DOT approved 5-gallon buckets and open-top drums for solid wastes. Chemical-contaminated sharps boxes are also available.
- All **wastes must be labeled** with the Texas State Hazardous Waste label. The contents of the container must be filled out as soon as a waste is added to the container.
- **Do not accumulate more than 55-gallons** of waste in your SAA. Contact EHSREM for pick up well before this volume is reached.
- Liquid wastes must be **stored in secondary containment** and incompatible wastes should be stored in separate secondary containment devices.
- Always ensure that you leave at least 3 – 4 inches of head space in the waste container.

PIs are responsible for requesting a waste pick up when their waste containers are approaching the fill line. Please contact EHSREM at 512-245-3616 to request a pickup.

Drain Disposal

Texas State University does not permit drain disposal of chemical wastes, unless a specific dilution and/or neutralization method for a consistent waste stream has been reviewed and approved by EHSREM. This applies to weak acid and base solutions with no other contaminates. Contact EHSREM for specific questions about drain disposal variances.

Waste Minimization Principles

The Waste Reduction Policy Act (WRPA) requires large quantity generators to prepare and submit a Pollution Prevention Plan (P2 Plan) every 5 years. The purpose of the P2 Plan is to develop goals and projects to reduce the amount of hazardous waste generated each year.

At Texas State, one major component of our P2 Plan is abiding by waste minimization principles by stopping waste before it can be generated. For laboratories, this can be accomplished by purchasing only the chemicals you need. The same practice should also be applied to solutions that are created in the lab. Refrain from accepting chemicals from other laboratories simply because they are offered.

All Texas State University laboratories should follow the American Chemical Society's guidance document Less is Better, which outlines strategies for waste reduction and the benefits of a waste minimization program.

EXPOSURE MONITORING AND MEDICAL CONSULTATIONS

Lab personnel are eligible for medical surveillance and consultation if they perform work-related tasks that might be reasonably anticipated to cause occupational exposure to a potential hazard. The program does not include pre- employment medical examinations.

Medical examinations and consultation shall be performed by or under the direct supervision of a licensed physician, at a reasonable time and place without cost or loss of pay to the employee. It is the responsibility of the affected department or PI to contact the EHSREM Office to arrange for such care.

An opportunity to receive medical attention, including any follow-up examinations which the examining physician determines to be necessary, shall be provided to employees under the following circumstances:

- When an employee develops signs or symptoms associated with occupational exposure to a hazardous chemical;
- When air sampling reveals exposure levels routinely above the action level, or in its absence the PEL for an OSHA regulated substance. Medical surveillance shall comply with the requirements of that particular standard;
- Medical consultation shall be provided whenever an abnormal event such as a spill, leak or explosion takes place in the laboratory. Its purpose shall be to determine whether a subsequent medical examination is necessary.

Incident/Accident Notification Investigation

PIs must ensure that a Supervisors Report of Incident/Injury/Illness is completed within 24 hours for all work-related injuries or illnesses involving activities for which their employees are paid. These reports should be completed and e-mailed or delivered to the EHSREM Workers Compensation Specialist regardless of where or whether the person received medical follow-up.

Texas State University employees are covered through the State Office of Risk Management's Workers' Compensation Program who serves as the state's insurance carrier. The Workers' Compensation Act covers on-the-job injuries that occur in the course and scope of employment and that result in damage or harm to the body. It also covers occupational diseases directly caused by exposure in the workplace. The Worker's Compensation Program pays for medical treatment and lost wages for employees who are injured or become ill as a result of their work.

Laboratory Specific Chemical Hygiene Plan

For

[*Insert name of research group for which the plan is applicable*]

Certification and Annual Review and Updates

By signing and dating here, the Principal Investigator (PI) certifies that this Laboratory-Specific Chemical Hygiene Plan is accurate and that it effectively provides for the chemical safety of employees and students in this laboratory.

Principal Investigator:

_____

Signature Printed Name Date

Laboratory Safety Officer (if other than PI):

_____

Signature Printed Name Date

By signing and dating here, the Laboratory Principal Investigator certifies that the required annual review (and update, if needed) of the Laboratory-Specific Chemical Hygiene Documentation has been completed, and that this document continues to be accurate and to effectively provide for the chemical safety of employees in this laboratory.

Reviewed by:		Review Date:	
Reviewed by:		Review Date:	
Reviewed by:		Review Date:	

Table of Contents

Section 1: Personnel

Safety Personnel

List the names of key safety personnel. In addition to indicating the individual in charge of the laboratory (i.e., the P.I. or lab manager) and the Laboratory Safety Officer, the names of key staff such as the building manager or other important individuals should be included.

Name	Position	Phone
	Principal Investigator	
	Lab Manager	
UPD Dispatch	Emergency	911
UPD Dispatch	Non-Emergency	512-245-2805
EHSREM	Safety Office	512-245-3616
EHSREM	Safety Office After-Hours/Weekends	512-738-6650

Laboratory Staff/Students

List all individuals who work with hazardous chemicals in the labs and are therefore subject to this plan.

Name	Name	Name

Section 2: Laboratory Room Locations

List all rooms in which use of hazardous chemicals will occur:

Building	Rooms	Room Assigned to the PI (Y/N)	Shared Facility (Y/N)

Section 3: Laboratory-Specific Policies

Include below all laboratory-specific policies instituted by the Principal Investigator (e.g., lab coats must be worn in the lab at all time, no working alone, etc.). This space provides the opportunity to place in one location and document the lab's safety policies related to the use of hazardous chemicals.

Section 4: Orientation Checklist:

An orientation checklist for all laboratory personnel listed in Section 1 must be filled out.

As part of my orientation with the laboratory operation I have read and am familiar with the contents (and location) of:

- ☐ The OSHA Laboratory Standard
- ☐ The Laboratory Specific CHP
- ☐ The Texas State University CHP
- ☐ SDSs for lab chemicals

I have been instructed on:

- ☐ The chemical hazards in the lab
- ☐ Laboratory-specific policies
- ☐ The relevant exposure limits [PELs (OSHA), TLVs (ACGIH), etc.]
- ☐ The signs and symptoms associated with exposures to hazardous chemicals used in the lab
- ☐ The physical hazards of the laboratory (heat, electrical, mechanical, etc.)

I have reviewed the laboratories emergency procedures, including:

- ☐ Emergency phone numbers
- ☐ Evacuation routes
- ☐ Location and use of chemical spill kits
- ☐ Laboratory fume hood failure procedure
- ☐ Procedures for uncontrolled chemical releases
- ☐ How to respond to injuries in the laboratory

I have been shown the location of emergency equipment:

- ☐ Fire extinguishers
- ☐ Safety showers
- ☐ Eye wash stations
- ☐ First-aid supplies

I have been made familiar with routine operations of the laboratory, including:

- ☐ Lab cleaning and maintenance rules
- ☐ Proper use of PPE
- ☐ Chemical storage policies for the lab
- ☐ Waste disposal procedures
- ☐ Chemical procurement practices
- ☐ The proper use of chemical fume hoods

In addition, I have been made familiar with the following lab-specific health and safety features and safety resources:

I have completed orientation of all the above items

Name: _____ Date: _____

Signature: _____

PI Signature: _____

Section 5: Laboratory Safety Training
Master List of Required Training

List the training required in order to work with hazardous chemicals in your laboratory. This list should include training provided by the university, outside sources, and hands-on training of tasks and procedures provided in-lab. It is understood that the training below does not apply to all students or staff but will be based on each individual's work assignments.

Training Title	Description/Purpose

Section 5 (Continued): Laboratory Safety Training

Documentation of Training

Track required training using the table below. A separate sheet should be used for each training course and/or training session.

Title of Training:

Training Performed by:

Description of Training:

Name (print)	Signature	Date

Section 6: Prior Approvals

This section of the lab-specific CHP allows the PI to document approval for individuals to perform specific Standard Operating Procedures (as indicated in the SOP description).

Standard Operating Procedure Title:

Name of Approved Individual	PI Authorization Signature	Date of Authorization

Section 7: SDSs and Inventory of Hazardous Chemicals

A number of regulations require that Safety Data Sheets (SDSs) be maintained and readily accessible for all hazardous chemicals. The Campus Chemical Hygiene Plan also requires that inventories be maintained for certain categories of hazardous chemicals above specified amounts. Provide a description of where the SDSs are stored and how inventory records are maintained.

Safety Data Sheets

Location of SDSs:

Format of SDS (electronic, hard copy, etc):

Chemical Inventory

Method of Maintaining Inventory:

Location of Inventory Records:

Section 8: Exposure Monitoring Records

In rare instances it may be necessary to perform personnel exposure monitoring when working with a hazardous chemical. This can occur when chemical exposure levels approach or exceed the Permissible Exposure Limit (PEL) of OSHA and the Threshold Limit Value(TLV) of ACGIH (see Section 12 and Appendix A of the Campus CHP for details). Initial monitoring is required if there is reason to believe that the action level (or PEL if there is no applicable action level) for a substance is routinely exceeded. If the initial monitoring discloses employee exposure over the action level or PEL an exposure monitoring program may be initiated. Employees must be notified of the results within 15 working day after the receipt of the results by posting in an accessible location.

Describe any exposure monitoring requirements for laboratory operations:

Location of Exposure Monitoring Records:

Section 9: References

This section can be used to include chemical or laboratory safety information relevant to the operations of the laboratory. The references can either be appended to the end of this section or references can be cited below.

References:

Section 10: Laboratory SOPs – Task Table

Prepared By: | **Revision Date:**

*For many procedures a simple description of the tasks, the associated hazards, and the PPE required to mitigate risks is acceptable. This table is **not appropriate** for work involving Particularly Hazardous Substances or for use of chemicals that pose a high risk due to reactivity or other properties. This table is appropriate for describing safety requirements for miscellaneous tasks performed in a laboratory.*

Task	Hazard Description	Required PPE and Engineering Controls

Section 10 (continued): Standard Operating Procedure (SOP)

If there is an existing written procedure that incorporates safety information from the sections below, that procedure can be used in lieu of completing this SOP template.

TITLE:	

PURPOSE: *Give the purpose of the procedure being performed (e.g. This process determines acid detergent fiber in animal feeds).*

1. **PRINCIPAL INVESTIGATOR (PI) INFORMATION:**

Principal Investigator:	**Building:**
PI Signature:	**Lab Room Number:**
Date:	**SOP Revision Date:**

2. **EMERGENCY CONTACTS:** *Primary contact should be one (preferably the PI) who can be reached in the event of an emergency during and* ***after*** *business hours (8:00AM – 5:00PM Monday – Friday).*

Primary Contact:	**Phone #:**
Secondary Contact:	**Phone #:**
Police/Fire/Ambulance: 911*	**Student Health Center: 1-512-245-2161**
ESHREM: 1-512-245-3616	**EHSREM (after hours): 1- 512-738-6650**

**When dialing 911 for Police/Fire/Ambulance give the dispatcher the following information:*
- *Calling from Texas State University*
- *Building name*
- *Building street address*
- *Nature of emergency: e.g., fire, injury, chemical spill*

3. **Location of Safety Data Sheet (SDSs):** *Give location where in the lab SDSs may be found and if SDSs are in an electronic database how they can be accessed by those working in the lab.*

4. **HAZARD IDENTIFICATION:**

a. Check *ALL* hazards that apply to the chemical(s) used: *Refer to Safety Data Sheet*s (SDSs).

☐ Sensitizer	☐ Corrosive	☐ Toxic	☐ Irritant
☐ Reproductive Toxin*	☐ Air Reactive/Pyrophoric*	☐ Water Reactive*	☐ Carcinogen*
☐ Acutely Toxic*	☐ Explosive/Unstable*	☐ Oxidizer	☐ **F**lammable
☐ Target Organ Hazard (specify organ)		☐ Peroxide Former	

*If the chemical(s) you are using falls into a hazard group that is followed by an asterisk (*) that chemical is a **Particularly Hazardous Substance (PHS)** and requires prior approval by the PI and establishing a designated work area with posted signs before being used in the lab.*

b. Location of designated work area within lab:

c. Check *ALL* additional hazards that are present when the procedure is performed.

☐ Fire Hazards	☐ Elevated Temperatures	☐ Heat Gun	☐ Radiation
☐ Cryogen/Low Temp	☐ Pressure or Vacuum	☐ Compressed Gases	☐ Laser or UV Light
☐ Sharps	☐ Moving Parts	☐ Electrical	☐ Biological

Other Hazards (List below):

5. **HAZARD CONTROL:**

a. Selection and Purchasing: *Give the total quantity to be purchased, physical state, and from who the chemical(s) will be purchased from (e.g., Sigma-Aldrich, Thermo-Fisher Scientific, etc.). When possible purchase small quantities or dilute solutions to reduce risk of exposure and minimize waste. Consider safer container options such as shatterproof glass, septum- top containers, etc.*

b. Engineering Controls: *Check the box for each of the controls to be used.*

☐ Fume Hood ☐ Biosafety Cabinet ☐ Glove Box ☐ Vented Gas Cabinet

☐ Other (List below: include controls such as pressure relief valves, intrinsically safe hot plates, auto shut offs, etc.).

c. Function Check: *Are the engineering controls to be used functioning properly?*

Fume Hood	Biosafety Cabinet	Glove Box	Vented Gas Cabinet
☐ Yes	☐ Yes	☐ Yes	☐ Yes
☐ No	☐ No	☐ No	☐ No
☐ N/A	☐ N/A	☐ N/A	☐ N/A

d. Certification: *Are the engineering controls to be used have a current certification?*

Fume Hood	Biosafety Cabinet	Glove Box	Vented Gas Cabinet
☐ Yes	☐ Yes	☐ Yes	☐ Yes
☐ No	☐ No	☐ No	☐ No
☐ N/A	☐ N/A	☐ N/A	☐ N/A

5. HAZARD CONTROL(continued):

c. Administrative and Work Practice Controls: *List any specific work practices and training needed to safely perform the procedure (e.g., review Safety Data Sheets before using chemicals, do not work alone, must notify other staff members before using chemical, work away from heat sources, etc.).*

5. HAZARD CONTROL: (continued)

d. Required Personal Protective Equipment (PPE): *Check the boxes below for the PPE to be used. For lab coats, gloves, and respirators list the exact types to be used (e.g. flame-resistant coat, Nitrile gloves, non-venting goggles, etc.).* ***Note: If respirators are to be used contact EHSREM at ehs@txstate.edu prior to purchasing and using.***

☐ Lab Coat (type):	☐ Respirator	☐ Chemical Apron
☐ Gloves (type):	☐ Safety Glasses	☐ Other: List Below
☐ Goggles (type):	☐ Face Shield	

e. Storage and Transportation

Describe how the chemical will be stored away from incompatible materials (i.e., flammables storage cabinet, refrigerator, glovebox, etc.). Describe how the chemical will be transported inside and outside of the laboratory (e.g. on cart in containment tray). ***Note: If the chemical is to be transferred to a secondary container, the container must be labeled with the chemical name and hazard warnings. Contact EHSREM at ehs@txstate.edu for blank labels.***

6. EMERGENCY PROCCEDURES: SPILLS, EXPOSURES, FIRES:

a. Emergency Equipment: *Check the box next to the emergency equipment that is present in the lab and give the location where it may be found.*

- ☐ Fire Extinguisher, Location: _____
- ☐ Safety Shower, Location: _____
- ☐ Safety Eyewash, Location: _____
- ☐ First Aid Kit, Location: _____
- ☐ Chemical Spill Kit, Location: _____
- ☐ Emergency Contact List, Location: _____

b. Spills: *Describe the procedures to be followed in the event of a chemical spill, include any contact information that is not found in* ***Section 3. Emergency Contacts****.*

6. EMERGENCY PROCCEDURES: SPILLS, EXPOSURES, FIRES: (continued)

c. Fire: *Describe the procedures to be followed in the event of a fire, include any contact information that is not found in* ***Section 3. Emergency Contacts****.*

d. Eye Contact: *Describe procedure to be to be followed in the event of an exposire to the eyes, include any contact information that is not found in* ***Section 3. Emergency Contacts****.*

e. Skin Contact: *Describe the procedure to be followed in the event of an exposure to the skin, include any contact information that is not found in* ***Section 3. Emergency Contacts****.*

6. EMERGENCY PROCCEDURES: SPILLS, EXPOSURES, FIRES: (continued)

f. Ingestion: *Describe the procedure to be followed in the event of chemical ingestion, include any contact information that is not found in* ***Section 3. Emergency Contacts****.*

g. Inhalation: *Describe the procedure to be followed in the event of an inhalation exposure, include any contact information that is not found in* ***Section 3. Emergency Contacts****.*

7. PROCEDURE: *Describe each step of how the procedure is performed, be sure to include in the "Hazard and Hazard Controls and PPE" column list the hazard(s) associated with each step and the engineering controls and PPE that must be used. Enter decontamination procedures and how to store and dispose hazardous waste in part 8, "Waste Disposal and Decontamination Procedure".*

STEPS OF PROCEDURE	HAZARD and HAZARD CONTROLS and PPE
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

7. <u>PROCEDURE: (continued):</u> *Describe each step of how the procedure is to be performed. In the "Hazard and Hazard Controls and PPE" column list the hazard(s) associated with each step and the engineering controls and PPE that must be used. Enter decontamination procedures and how to store and dispose hazardous waste in part 8, "Waste Disposal and Decontamination Procedure".*

STEPS OF PROCEDURE	HAZARDS and HAZARD CONTROLS and PPE
10.	
11.	
12.	
13.	
14.	
15.	
16.	
17.	
18.	

7. PROCEDURE (continued): *Describe each step of how the procedure to be performed. In the "Hazard and Hazard Controls and PPE" column list the hazard(s) associated with each step and the engineering controls and PPE that must be used. Enter decontamination procedures and how to store and dispose hazardous waste in part 8, "Waste Disposal and Decontamination Procedure".*

STEPS OF PROCEDURE	HAZARDS and HAZARD CONTROLS and PPE
19.	
20.	
21.	
22.	
23.	
24.	
25.	
26.	
27.	

8. Waste Disposal and Decontamination Procedure:

Describe how hazardous waste is stored and disposed. Any chemical waste must be disposed of as hazardous waste in accordance with the Texas State Hazardous Waste Management Program. Also, if any of the chemical(s) used are considered a Particularly Hazardous Substance (PHS) describe how work surfaces and other items will be decontaminated after use. If you have specific questions about disposal, please contact EHSREM at ehs@txstate.edu .

9. Documentation of SOP review:

The PI and lab worker must sign to verify that the worker has read and understands this SOP prior to performing work with the chemical listed in this SOP. These signatures will also serve as giving worker prior approval to use a chemical classed as a Particularly Hazardous Substances (PHS).

Worker Name (print)	Worker Signature	PI Signature	Date

Appendix B: Globally Harmonized System for Chemical Labeling and Hazard Classification (GHS)

The **Globally Harmonized System for Chemical Labeling** adopted by OSHA is a revision to the Hazard Communication Standard (HCS) which provides a consistent and understandable approach to classifying chemicals and communicating chemical hazard information on labels and Safety Data Sheets (SDSs). GHS safety labels have six elements:

1. **Product Identifier (chemical name)** – Should match the name on the Safety Data Sheet (SDS).

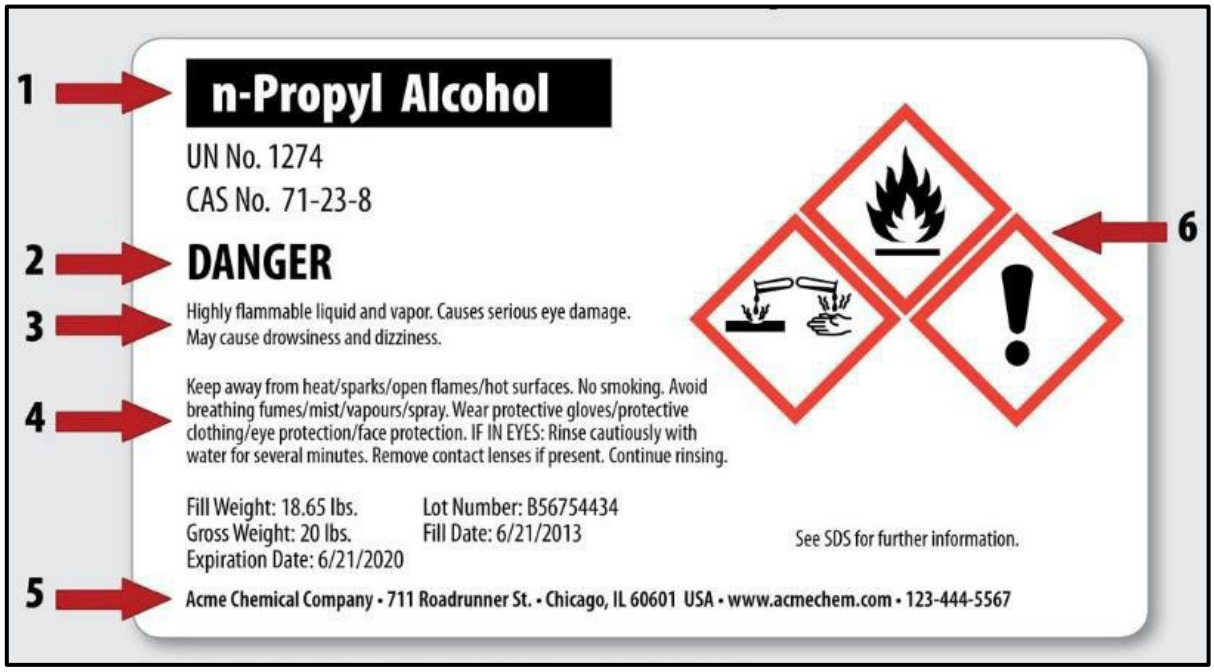
2. Signal Word – Can be either "Danger" (severe) or "Warning" (less severe).

3. Hazard Statements – A phrase(s) assigned to a hazard class that describes the product's hazards.

4. Precautionary Statements – Describes recommended measures to minimize or prevent adverse effects resulting from exposure.

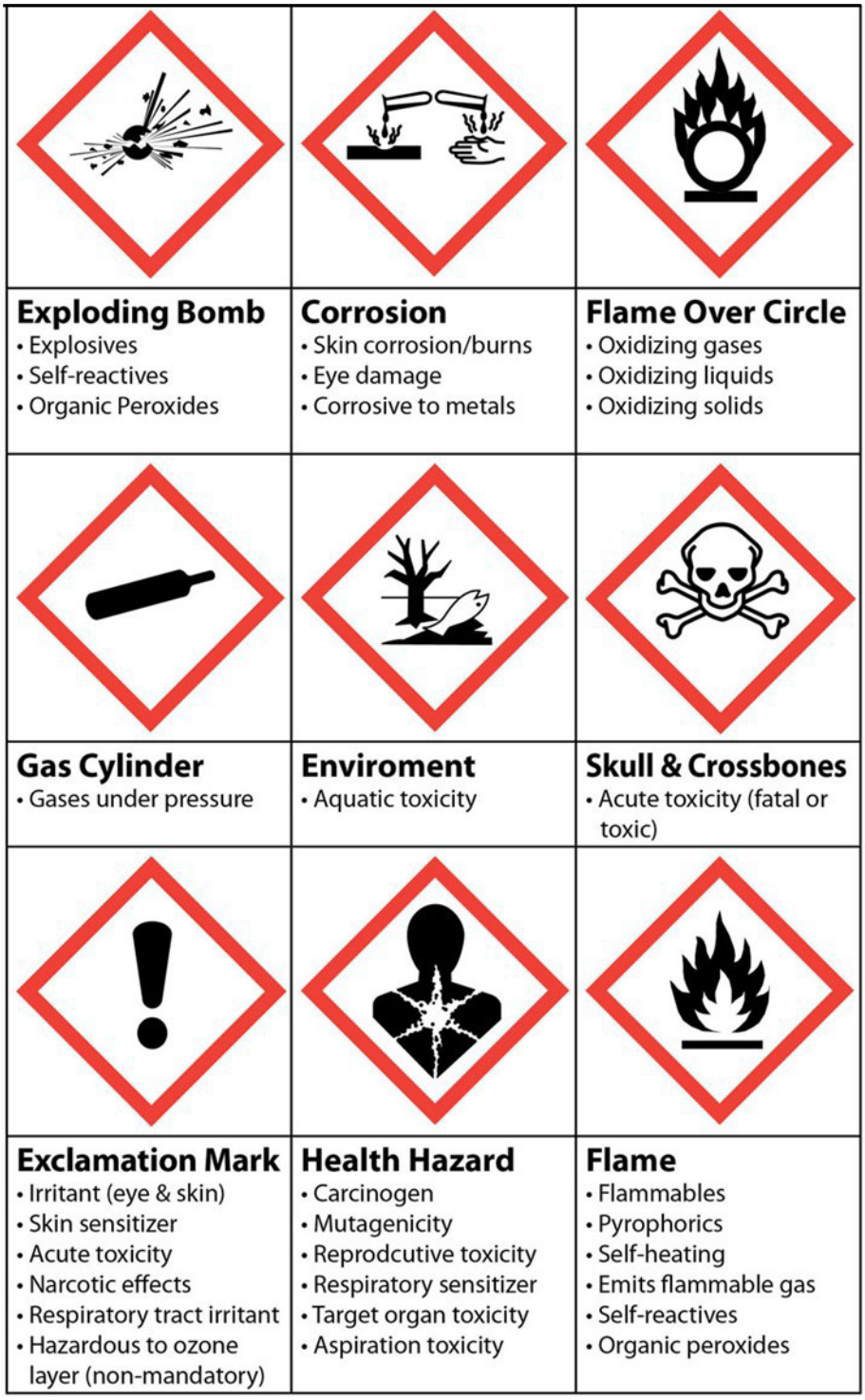
5. Supplier Information – the name, address, and telephone number of the manufacturer or supplier.

6. Pictograms – Symbols to convey specific hazard information.



To convey health, physical, and environmental hazard information, GHS uses nine pictograms which are composed of a red diamond border, a symbol in black, and a white background.

GHS Pictograms



Exploding Bomb	Corrosion	Flame Over Circle
• Explosives • Self-reactives • Organic Peroxides	• Skin corrosion/burns • Eye damage • Corrosive to metals	• Oxidizing gases • Oxidizing liquids • Oxidizing solids
Gas Cylinder	**Enviroment**	**Skull & Crossbones**
• Gases under pressure	• Aquatic toxicity	• Acute toxicity (fatal or toxic)
Exclamation Mark	**Health Hazard**	**Flame**
• Irritant (eye & skin) • Skin sensitizer • Acute toxicity • Narcotic effects • Respiratory tract irritant • Hazardous to ozone layer (non-mandatory)	• Carcinogen • Mutagenicity • Reprodcutive toxicity • Respiratory sensitizer • Target organ toxicity • Aspiration toxicity	• Flammables • Pyrophorics • Self-heating • Emits flammable gas • Self-reactives • Organic peroxides

GHS is similar to the National Fire Protection Association (NFPA) Fire Diamond fire diamond and the Hazardous Material Information System (HMIS) color bar in that numbers are used to categorize the severity of the hazard. **However**, unlike NFPA or HMIS, with GHS the lower the number the greater the severity of the hazard.

GHS Hazard Ranking	NFPA/HMIS Hazard Ranking
Category 1 = Extreme Hazard	0 = Minimal hazard
Category 2 = Serious Hazard	1 = Slight Hazard
Category 3 = Moderate Hazard	2 = Moderate Hazard
Category 4 = Slight Hazard	3 = Serious Hazard
Category 5 = Minimal Hazard	4 = Extreme Hazard

GHS has dropped the word "Material" from Material Safety Data Sheets (MSDS). They are now called Safety Data Sheets (SDS). SDSs contain 16 sections:

1. Identification
2. Hazard(s) identification
3. Composition/information on ingredients
4. First-aid measures
5. Fire-fighting measures
6. Accidental release measures
7. Handling and storage
8. Exposure control/personal protection
9. Physical and chemical properties
10. Stability and reactivity
11. Toxicological information
12. Ecological information
13. Disposal considerations
14. Transport information
15. Regulatory information
16. Other information

Appendix C: National Fire Protection Association (NFPA) Fire Diamond

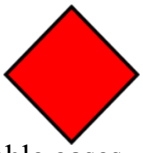
The **National Fire Protection Association (NFPA) Fire Diamond** is a hazard rating system that incorporates the use numbers, colors, and symbols as a compliance aid for OSHA's Hazard Communication Standard.

The NFPA fire diamond is designed for emergency responders to quickly and easily identify the risks posed by hazardous materials. This helps determine what, if any, special equipment should be used, procedures followed, or precautions taken during the initial stages of an emergency response.

The four diamonds are color-coded: blue for health hazards, red for flammability, yellow for reactivity / instability, and white for special hazards. The number ratings range from 0-4. (0 = low hazard to 4 = extreme hazard)

Health 

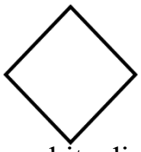
- **4.** Life-threatening, major or permanent damage may result from single or repeated overexposures.
- **3.** Major injury likely.
- **2.** Temporary or minor injury may occur.
- **1.** Irritation or minor reversible injury.
- **0.** No significant risk to health.

Flammability 

- **4.** Flammable gases, or very volatile flammable liquids with flash points below 73° F (23° C), and boiling points below 100° F (38° C). Materials may ignite spontaneously with air.
- **3.** Materials capable of ignition under almost all normal temperature conditions. Includes flammable liquids with flash points below 73° F (23° C) and boiling points above 100° F (38° C), as well as liquids with flash points between 73° F and 100° F.
- **2.** Materials which must be moderately heated or exposed to high ambient temperatures before ignition will occur. Includes liquids having a flash point at or above 100° F (38° C) but below 200° F (93° C).
- **1.** Materials that must be preheated before ignition will occur. Includes liquids, solids and semi solids having a flash point above 200° F (93° C).
- **0.** Materials that will not burn.

Reactivity / Instability Hazard 

- **4.** Materials that are readily capable of explosive water reaction, detonation or explosive decomposition, polymerization, or self-reaction at normal temperature and pressure.
- **3.** Capable of detonation or explosive decomposition but requires a strong initiating source, must be heated under confinement before initiation, reacts explosively with water, or will detonate if severely shocked.
- **2.** Undergoes violent chemical change at elevated temperatures and pressures, reacts violently with water, or may form explosive mixtures with water.
- **1.** Normally stable, but can become unstable at elevated temperatures and pressures.
- **0.** Normally stable, even under fire exposure conditions, and is not reactive with water.

Special Hazards 

Any symbol within the white diamond indicates any special hazards associated with a material. The following hazard codes are defined by the NFPA 704 standard:

- **OX** - Oxidizer, allows chemicals to burn without an air supply.
- **~~W~~** - Reacts with water in an unusual or dangerous manner.
- **SA** - Simple asphyxiant gas. Specifically limited to the following gases: nitrogen, helium, neon, argon, krypton, and xenon.

The following five hazard codes are not part of the NFPA 704 standard, but may be encountered:

- **COR** Corrosive (can burn through things). Example: sulfuric acid.
- **BIO** or  - Biological hazard

- **POI** - Poisonous.
- **RA, RAD** or  - Radioactive.
- **CRY or CRYO** – Cryogenic.

Appendix D: Hazardous Materials Identification System (HMIS)

The **Hazardous Materials Identification System** (**HMIS**) is a hazard rating system that incorporates the use of labels, numbers, colors, and letter codes as a compliance aid for OSHA's Hazard Communication Standard.

The HMIS color bar is similar to the fire diamond created by the National Fire Protection Association (NFPA). While the NFPA fire diamond is designed for emergency responders to quickly and easily identify the risks posed by hazardous materials. The HMIS color bar is intended to be used by employers and workers on a daily basis and provides information on acute and chronic health hazards, flammability, physical hazards, and personal protective equipment.

Health

The Health section conveys the health hazards of the material. The Health bar has two spaces, one for an asterisk and one for a numeric hazard rating. If present, the asterisk signifies a chronic health hazard (i.e., long-term exposure may cause a health problem).

- **4.** Life-threatening, major or permanent damage may result from single or repeated overexposures.
- **3.** Major injury likely.
- **2.** Temporary or minor injury may occur.
- **1.** Irritation or minor reversible injury possible.
- **0.** No significant risk to health.

Flammability 

Before 2002 the criteria used to assign numeric values to flammability were identical to those used by NFPA. After 2002 the flammability criteria are defined according to OSHA standards.

- **4.** Flammable gases, or very volatile flammable liquids with flash points below 73° F (23° C), and boiling points below 100° F (38° C). Materials may ignite spontaneously with air.
- **3.** Materials capable of ignition under almost all normal temperature conditions. Includes flammable liquids with flash points below 73° F (23° C) and boiling points above 100° F (38° C), as well as liquids with flash points between 73° F and 100° F.
- **2.** Materials which must be moderately heated or exposed to high ambient temperatures before ignition will occur. Includes liquids having a flash point at or above 100° F (38° C) but below 200° F (93° C).
- **1.** Materials that must be preheated before ignition will occur. Includes liquids, solids and semi solids having a flash point above 200° F (93° C).
- **0.** Materials that will not burn.

Physical Hazard 

After 2002, the yellow color bar (which represented chemical reactivity) was replaced by an orange bar, which represents physical hazards. Seven hazard classes are recognized: Water Reactive, Organic Peroxides, Explosives, Compressed gases, Pyrophoric materials, Oxidizers, and Unstable Reactive.

- **4.** Materials that are readily capable of explosive water reaction, detonation or explosive decomposition, polymerization, or self-reaction at normal temperature and pressure.
- **3.** Materials that may form explosive mixtures with water and are capable of detonation or explosive reaction in the presence of a strong initiating source. Materials may polymerize, decompose, self-react, or undergo other chemical change at normal temperature and pressure with moderate risk of explosion.
- **2.** Materials that are unstable and may undergo violent chemical changes at normal temperature and pressure with low risk for explosion. Materials may react violently with water or form peroxides upon exposure to air.
- **1.** Materials that are normally stable but can become unstable (self-react) at high temperatures and pressures. Materials may react non-violently with water or undergo hazardous polymerization in the absence of inhibitors.
- **0.** Materials that are normally stable, even under fire conditions, and will not react with water, polymerize, decompose, condense, or self-react. Non-explosives.

Personal Protection

HMIS uses the white section and a letter code to indicate what personal protective equipment (PPE) should be used when working with a chemical. The codes for personal protective equipment are listed below, this list is not all inclusive.

Letter Code	Protective Equipment	Protective Equipment Symbol
A	Safety Glasses	
B	Safety Glasses, Gloves	
C	Safety Glasses, Gloves, Apron	
D	Face Shield, Gloves, Apron	
E	Safety Glasses, Gloves, Dust Respirator	
F	Safety Glasses, Gloves, Apron, Dust Respirator	
G	Safety Glasses, Gloves, Vapor Respirator	
H	Splash Goggles, Gloves, Apron, Vapor Respirator	
I	Safety Glasses, Gloves, Dust and Vapor Respirator	
J	Splash Goggles, Gloves, Apron, Dust & Vapor Respirator	

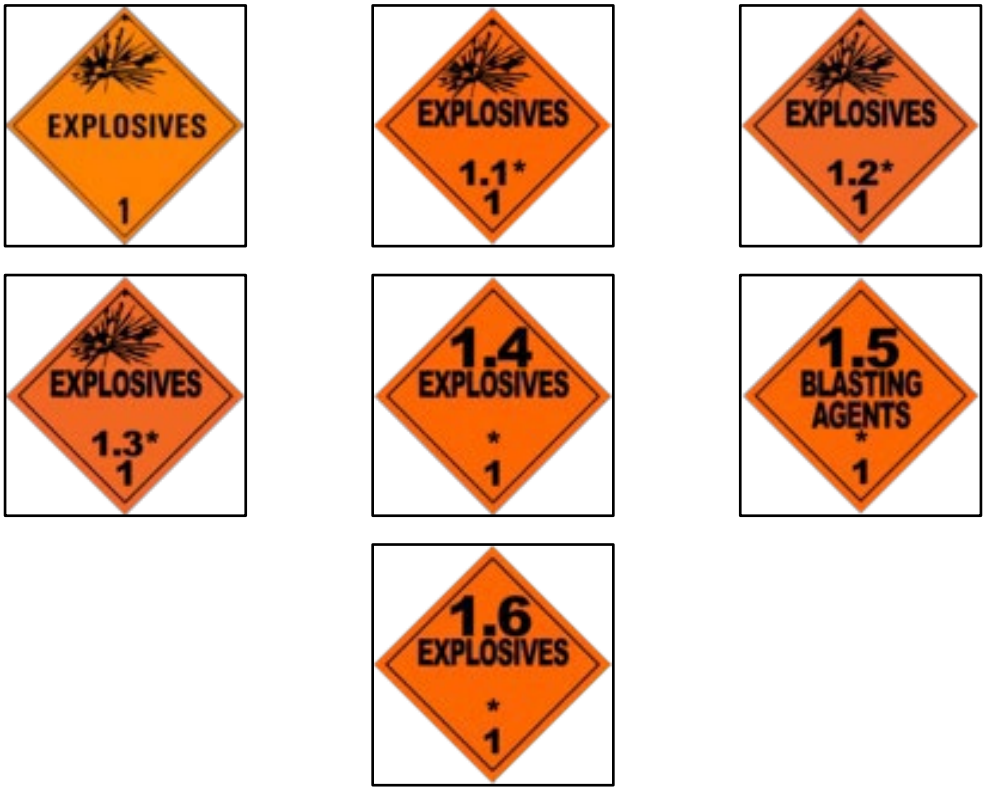
Appendix E: United States Department of Transportation (DOT) Placards

Title 49 of the United States Code of Federal Regulations (49CFR) requires the use of US DOT (US Department of Transportation) hazardous materials placards when shipping hazardous materials cargo and dangerous goods in the United States. These placards can be found on vehicles, crates, boxes, containers, and entrances to areas with hazardous materials.

Hazardous materials are divided into nine classes (in addition to subcategories) based on the specific chemical characteristics producing the hazard.

Class 1: Explosives

1.1 — Explosives with a mass explosion hazard. (nitroglycerin/dynamite)
1.2 — Explosives with a blast/projection hazard.
1.3 — Explosives with a minor blast hazard. (rocket propellant, display fireworks)
1.4 — Explosives with a major fire hazard. (consumer fireworks, ammunition)
1.5 — Blasting agents.
1.6 — Extremely insensitive explosives.



Class 2: Gases

2.1 Flammable Gas: Gases which ignite on contact with an ignition source, such as acetylene, hydrogen, and propane.
2.2 Non-Flammable Gases: Gases which are neither flammable nor poisonous. Includes the cryogenic gases/liquids used for cryopreservation and rocket fuels, such as nitrogen, neon, and carbon dioxide.
2.3 Poisonous Gases: Gases liable to cause death or serious injury to human health if inhaled; examples are fluorine, chlorine, and hydrogen cyanide.

Class 3: Flammable and Combustible Liquids

Flammable liquid: liquid having a flashpoint of not more than 60° Celsius (140° Fahrenheit)..

Combustible Liquid: liquid having flashpoint above 60° Celsius (140° Fahrenheit).and below 93° Celsius (200° Fahrenheit).

Class 4: Flammable Solids

4.1 Flammable Solids: Solid substances that are easily ignited and readily combustible (nitrocellulose, magnesium, safety or strike-anywhere matches).

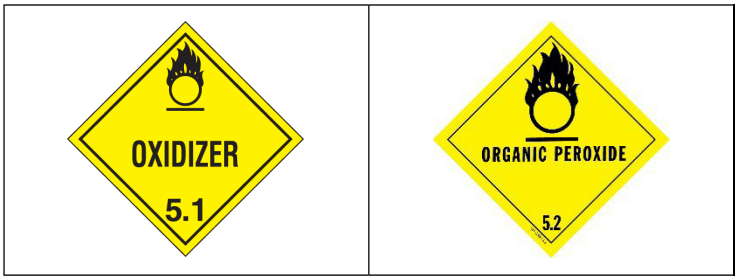
4.2 Spontaneously Combustible: Solid substances that ignite spontaneously (aluminum alkyls, white phosphorus).

4.3 Dangerous when Wet: Solid substances that emit a flammable gas when wet or react violently with water (sodium, calcium, potassium, calcium carbide).

Class 5: Oxidizing Agents and Organic Peroxides

5.1 Oxidizing Agents: may, by yielding oxygen, cause or enhance combustion of other materials (calcium hypochlorite, ammonium nitrate, hydrogen peroxide, potassium permanganate).

5.2 Organic Peroxides: may, by yielding oxygen, cause or enhance combustion of other materials (benzoyl peroxides, cumene hydroperoxide).



Class 6: Toxic and Infectious Substances

6.1 a Toxic Substances: liable to cause death or serious injury to human health if inhaled, swallowed or by skin absorption (potassium cyanide, mercuric chloride).

6.1 b Toxic Substances: harmful to human health (pesticides, methylene chloride).

6.2 Biohazardous Substances: material known to contain a pathogen which may be harmful to human health.

Class 7: Radioactive Substances

Radioactive substances comprise substances or a combination of substances which emit ionizing radiation (uranium, plutonium).

Class 8: Corrosive Substances

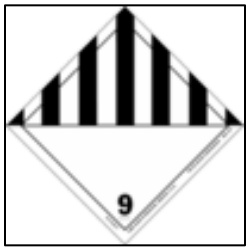
Corrosive Substances: are substances that can dissolve organic tissue or severely corrode certain metals:

8.1 Acids: such as sulfuric acid, hydrochloric acid.

8.2 Alkalis / Bases: such as potassium hydroxide, sodium hydroxide.

Class 9: Miscellaneous

Hazardous substances that do not fall into the other categories (asbestos, air-bag inflators, dry ice).



Appendix F: Common Peroxide Forming Chemicals

(NOTE: The lists below cover many commonly known peroxide formers, but is not all-inclusive)

List A: Chemicals known to form explosive levels of peroxides without concentration

Suggested safe storage period: If unopened from manufacturer, up to 18 months or stamped expiration date, whichever comes first. After opening, materials should be discarded or evaluated for peroxides within 3 months. Store under nitrogen if possible.

Divinyl acetylene	Potassium amide
Divinyl ether	Sodium amide (sodamide)
Isopropyl ether	Butadiene[a]
Vinylidene chloride	Chloroprene[a]
Potassium metal	Tetrafluoroethylene[a]

[a] When stored as a liquid monomer

List B: Chemicals that may auto-polymerize as a result of peroxide accumulation

Suggested safe storage period: If unopened from manufacturer, up to 18 months or stamped expiration date, whichever comes first.

- **After opening, materials without inhibitors should not be stored for longer than 24 hours.**
- After opening, materials with inhibitors should be discarded or evaluated for peroxides within 12 months.

Acrylic acid[a]	Tetrafluoroethylene[b]
Acrylonitrile[a]	Vinyl acetate
Butadiene[b]	Vinylacetylene
Chloroprene[b]	Vinyl chloride
Chlorotrifluoroethylene	Vinylpyridine
Methyl methacrylate[a]	
Styrene	

[a] Although these chemicals form peroxides, no explosions involving these monomers have been reported.

[b] When stored in liquid form, these chemicals form explosive levels of peroxides without concentration. They may also be stored as a gas in gas cylinders. When stored as a gas, these chemicals may auto-polymerize as a result of peroxide accumulation.

List C: Chemicals known to present peroxide hazards upon concentration (distillation/ evaporation)

Suggested safe storage period: If unopened from manufacturer, up to 18 months or stamped expiration date, whichever comes first. After opening, materials should be discarded or evaluated for peroxides within 12 months.	
Acetal (1,1-diethoxyethane)	2-Hexanol
Acetaldehyde	Methylacetylene
Benzyl alcohol	3-Methyl-1-butanol
2-Butanol	Methylcyclopentane
Cumene	Methyl isobutyl ketone
Cyclohexanol	4-Methyl-2-pentanol
2-Cyclohexen-1-ol	2-Pentanol
Cyclohexene	4-Penten-1-ol
Decahydronaphthalene	1-Phenylethanol
Diacetylene	2-Phenylethanol
Dicyclopentadiene	2-Propanol
Diethyl ether	Tetrahydrofuran
Diethylene glycol dimethyl ether (diglyme)	Tetrahydronaphthalene
Dioxanes	Vinyl ethers
Ethylene glycol dimethyl ether (glyme)	Other secondary alcohols
4-Heptanol	

Appendix G:
OSHA Particularly Hazardous Substances

1910.1450(e)(3) Chemical Hygiene plan … shall include: (viii) Provisions for additional employee protection for work with **particularly hazardous substances**. These include "select carcinogens," reproductive toxins and substances which have a high degree of acute toxicity. **CAS#** - Chemical Abstracts Service Number. **Select Carcin** - Select carcinogen as defined by OSHA in 1910.1450. **Repro Toxin** - Reproductive toxins means chemicals which affect the reproductive chemicals which affect the reproductive capabilities including mutations and effects on fetuses (teratogenesis). **Acute Toxic** - Acutely toxic chemicals are capable of causing serious harm upon a single, brief exposure. **Skin Haz.** - Skin hazards are chemicals capable of causing harm through direct skin (contact) absorption.

CHEMICAL NAME	CAS #	Select Carcin	Repro Toxin	Acute Toxic	Skin Haz.
2,4,5-T	000093-76-5		X		
ACETALDEHYDE	000075-07-0	X			
ACETAMIDE	000060-35-5	X			
ACETYLAMINOFLUORENE,2-	000053-96-3	X			
ACROLEIN	000107-02-8			X	
ACRYLAMIDE	000079-06-1	X			X
ACRYLONITRILE	000107-13-1	X		X	X
ADIPONITRILE	000111-69-3			X	
ADRIAMYCIN	023214-92-8	X			
AFLATOXIN M1	006795-23-9	X			
AFLATOXINS	001402-68-2	X			
AF-2[2-(2-FURYL)-3-(5-NITRO-2- FURYL)ACRYLAMIDE]	003688-53-7	X			
AMINOANTHRAQUINONE, 2-	000117-79-3	X			
AMINOAZOBENZENE,para-	000060-09-3	X			
AMINOAZOTOULENE,ortho-	000097-56-3	X			
AMINODIPHENYL,4-, "s"	000092-67-1	X			X
AMINOPTERIDINE	000054-62-6		X		
AMINO-2-METHYLANTHRAQUINONE, 1-	000082-28-0	X			
AMINO-3,4-DIMETHYL-3h-IMIDAZO(4,5f)QUINOLINE,2-	077094-11-2	X			
AMINO-3,8-DIMETHYL-3H-IMIDAZO(4,5-f) QUINOXALINE, 2-	077500-04-0	X			
AMINO-5-(5-NITRO-2-FURYL)-1,3,4-THIADIAZOLE, 2-	000712-68-5	X			
AMITROLE	000061-82-5	X			
AMMONIA (GAS)	007664-41-7			X	
AMMONIUM DICHROMATE (VI)	007789-09-5	X			
ANDROGENIC (ANABOLIC) STEROIDS	000000-00-0	X	X		
ANILINE AND COMPOUNDS	000062-53-3			X	X
ANISIDINE, ORTHO-	000090-04-0	X			X
ANISIDINE HYDROCHLORIDE, o-	000134-29-2	X			
ANTHRACENEDIONE,9,10-, 1,4,5,8-TETRAAMINO	002475-45-8	X			
ANTHRAQUINONE, 1,8-DIHYDROXY	000117-10-2	X			
ANTIMONY OXIDE	001309-64-4	X			
ANTINEOPLASTIC AGENTS	000000-00-0		X		
ANTITHYROID DRUGS	000000-00-0		X		
ARAMITE	000140-57-8	X			
ARSENEOUS ACID, CALCIUM SALT (2:1)	015194-98-6	X			
ARSENEOUS ACID, POTASSIUM SALT	013464-35-2	X			
ARSENIC ACID	007778-39-4	X	X	X	

CHEMICAL NAME	CAS #	Select Carcin	Repro Toxin	Acute Toxic	Skin Haz.
ARSENIC ACID, CALCIUM SALT	010103-62-5	X			
ARSENIC ACID, CALCIUM SALT (2:3)	007778-44-1	X			
ARSENIC ACID, DISODIUM SALT, HEPTAHYDRATE	010048-95-0	X			
ARSENIC ACID, LEAD(2+) SALT (1:1)	007784-40-9	X			
ARSENIC ACID, MONOPOTASSIUM SALT	007784-41-0	X			
ARSENIC ACID, SODIUM SALT	007631-89-2	X			
ARSENIC AND COMPOUNDS	007440-38-2	X	X		
ARSENIC COMPOUNDS	000000-00-0	X	X		
ARSENIC PENTAFLUORIDE	007784-36-3	X	X	X	
ARSENIC PENTOXIDE	001303-28-2	X			
ARSENIC TRIOXIDE	001327-53-3	X	X	X	
ARSENIUOS ACID, CALCIUM SALT	027152-57-4	X			
ARSENIUOS ACID, MONOSODIUM SALT	007784-46-5	X			
ARSINE	007784-42-1			X	
ARSONIC ACID, CALCIUM SALT (1:1)	052740-16-6	X			
ASBESTOS	001332-21-4	X			
ASBESTOS, ACTINOLITE	077536-66-4	X			
ASBESTOS, AMOSITE	012172-73-5	X			
ASBESTOS, ANTHOPHYLLITE	077536-67-5	X			
ASBESTOS, CHRYSOTILE	012001-29-5	X			
ASBESTOS, CROCIDOLITE	012001-28-4	X			
ASBESTOS, TREMOLITE	077536-68-6	X			
ATRAZINE	001912-24-9	X			
AURAMINE, TECHNICAL-GRADE	000492-80-8	X			
AZACITIDINE	000320-67-2	X			
AZASERINE	000115-02-6	X			
AZATHIOPRINE	000446-86-6	X			
AZBLLEN ASBESTOS	017068-78-9	X			
A-a-C(2-AMINO-9H-PYRIDO[2,3-b]INDOLE)	000000-00-0	X			
BARIUM CHROMATE(VI)	010294-40-3	X			
BENZENE	000071-43-2	X	X		
BENZIDINE	000092-87-5	X			
BENZIDINE, 2,3'-DIMETHOXY-,DIHYDROCHLORIDE	020325-40-0	X			
BENZIDINE, 3,3'-DICHLORO-, DIHYDROCHLORIDE	000612-83-9	X			
BENZIDINE-BASED DYES	000000-00-0	X			
BENZOFURAN	000271-89-6	X			
BENZOTRICHLORIDE	000098-07-7	X			
BENZO[a]PYRENE	000050-32-8	X			
BENZO[b]FLUORANTHENE	000205-99-2	X			
BENZO[f]FLUORANTHENE	000205-82-3	X			
BENZO[k]FLUORANTHENE	000207-08-9	X			
BENZYL VIOLET 4B	001694-09-3	X			
BENZ[a]ANTHRACENE	000056-55-3	X			
BERYLLIUM ALUMINUM ALLOY	012770-50-2	X			
BERYLLIUM ALUMINUM SILICATE	001302-52-9	X			
BERYLLIUM AMD COMPOUNDS	007440-41-7	X			
BERYLLIUM CHLORIDE	007787-47-5	X			
BERYLLIUM COMPOUNDS	000000-00-0	X			
BERYLLIUM FLUORIDE	007787-49-7	X			
BERYLLIUM HYDROGEN PHOSPHATE (1:1)	013598-15-7	X			
BERYLLIUM HYDROXIDE	013327-32-7	X			

CHEMICAL NAME	CAS #	Select Carcin	Repro Toxin	Acute Toxic	Skin Haz.
BERYLLIUM OXIDE	001304-56-9	X			
BERYLLIUM OXIDE CARBONATE	066104-24-3	X			
BERYLLIUM SULFATE, TETRAHYDRATE (1:1:4)	007787-56-6	X			
BERYLLIUM SULFATE (1:1)	013510-49-1	X			
BERYLLIUM ZINC SILICATE	039413-47-1	X			
BETEL QUID WITH TOBACCO	000000-00-0	X			
BISCHLOROETHYL NITROSOUREA (BCNU)	000154-93-8	X			
BITUMENS,EXTRACTS OF STEAM-&AIR- REFINED	008052-42-4	X			
BLEOMYCIN, HYDROCHLORIDE	067763-87-5	X			
BLEOMYCIN SULFATE	009041-93-4	X			
BLEOMYCINS	000000-00-0	X			
BLEOMYCINS	011056-06-7	X			
BORON TRIBROMIDE	010294-33-4			X	
BORON TRIFLUORIDE	007637-07-2			X	
BRACKEN FERN	000000-00-0	X			
BROMINE	007726-95-6			X	
BROMINE PENTAFLUORIDE	007789-30-2			X	
BROMOACETONE	000598-31-2			X	
BROMODICHLOROMETHANE	000075-27-4	X		X	
BUSULFAN	000055-98-1		X		
BUTADIENE,1,3-	000106-99-0	X			
BUTANE, (+-)-1,2:3,4-DIEPOXY-	000298-18-0	X			
BUTANEDIOL DIMETHANESULPHONATE,1,4- (MYLERAN)	000055-98-1	X			
BUTYLATED HYDROXYANISOLE (BHA)	025013-16-5	X			
BUTYLATED HYDROXYANISOLE (BHA)	030031-64-2	X			
BUTYRIC ACID, 4-(N-BUTYL-N-NITROSAMINO)-	038252-74-3	X			
BUTYROLACTONE,BETA-	003068-88-0	X			
CADMIUM AND COMPOUNDS	007440-43-9	X	X		
CADMIUM CARBONATE	000513-78-0	X			
CADMIUM CHLORIDE	010108-64-2	X			
CADMIUM COMPOUNDS	000000-00-0	X			
CADMIUM FLUOBORATE	014486-19-2	X			
CADMIUM NITRATE	010325-94-7	X			
CADMIUM OXIDE	001306-19-0	X			
CADMIUM SULFATE (1:1)	010124-36-4	X			
CADMIUM SULFIDE	001306-23-6	X			
CAFFEIC ACID	000331-39-5	X			
CALCIUM CHROMATE (VI)	013765-19-0	X			
CAPTAFOL	002425-06-1	X			
CARBAMIC ACID, N-METHYL-N-NITROSO,ETHYL_ESTER	000615-53-2	X			
CARBON DISULFIDE	000075-15-0		X		X
CARBON MONOXIDE	000630-08-0		X		
CARBON TETRACHLORIDE	000056-23-5	X			X
CARBON-BLACK EXTRACTS	000000-00-0	X			
CARRAGEENAN, DEGRADED	009000-07-1	X			
CERAMIC FIBERS (RESPIRABLE SIZE)	000000-00-0	X			
CHLORAMBUCIL	000305-03-3	X	X		
CHLORAMPHENICOL	000056-75-7	X			
CHLORDANE	000057-74-9	X			
CHLORDANE	012789-03-6	X			
CHLORDANE, ALPHA	005103-71-9	X			

CHEMICAL NAME	CAS #	Select Carcin	Repro Toxin	Acute Toxic	Skin Haz.
CHLORDANE, BETA	005103-74-2	X			
CHLORDANE, GAMMA	005566-34-7	X			
CHLORENDIC ACID	000115-28-6	X			
CHLORINATED PARAFFINS (CARBON-12, 60% CHLORINE)	108171-26-2	X			
CHLORINATED PARAFFINS (CARBON-23, 43%CHLORINE)	108171-27-3	X			
CHLORINATED TOULENES, ALPHA-	000000-00-0	X			
CHLORINE TRIFLUORIDE	007790-91-2			X	
CHLOROETHYL(2)-3-CYCLOHEXYL-1-NITROSOUREA,1-	013010-47-4	X			
CHLOROETHYL(2)-3-(4-METHYLCYCLOHEXYL)-1-NITROSOUREA,1-	013909-09-6	X			
CHLOROFORM	000067-66-3	X			
CHLOROMETHYL ETHER,BIS-	000542-88-1	X			
CHLOROMETHYL METHYL ETHER	000107-30-2	X			
CHLOROPHENOL, meta-	000108-43-0	X			
CHLOROPHENOLS	000000-00-0	X			
CHLOROPHENOXY HERBICIDES	000000-00-0	X			
CHLOROPICRIN	000076-06-2			X	
CHLOROPRENE	000126-99-8		X		X
CHLOROZOTOCIN	054749-90-5	X			
CHLORO-2-METHYLPROPENE, 3-	000563-47-3	X			
CHLORO-ortho-PHENYLENEDIAMINE,4-	000095-83-0	X			
CHLORO-ortho-TOLUIDINE, para-	000095-69-2	X			
CHLORO-O-TOLUIDINE HYDROCHLORIDE, 4-	003165-93-3	X			
CHROMATE(1-),HYDROXYOCTAOXODIZINCATEDI-POTASSIUM	011103-86-9	X			
CHROMIC ACID, DISODIUM SALT	007775-11-3	X			
CHROMIC ACID, LEAD(2+) SALT (1:1)	007758-97-6	X			
CHROMITE (MINERAL)	001308-31-2	X			
CHROMIUM, DICHLORODIOXO-	014977-61-8	X			
CHROMIUM, HEXAVALENT AND COMPOUNDS	007440-47-3	X			
CHROMIUM CARBONATE	029689-14-3	X			
CHROMIUM COUMPOUNDS,HEXAVALENT	000000-00-0	X			
CHROMIUM PHOSPHATE	007789-04-0	X			
CHROMIUM TRIACETATE	001066-30-4	X			
CHROMIUM (III) OXIDE (2:3)	001308-38-9	X			
CHROMIUM (VI) OXIDE (1:3)	001333-82-0	X			
CHROMIUM (VI)CHLORIDE,	014986-48-2	X			
CI ACID RED 114	006485-34-3	X			
CI DIRECT BLUE 15	002429-74-5	X			
CISPLATIN	015663-27-1	X			
CITRUS RED NO. 2	006358-53-8	X			
COAL TAR	065996-89-6	X			
COAL TAR DISTILLATE	065996-92-1	X			
COAL TAR DYE	000000-00-0	X			
COAL-TAR	008007-45-2	X			
COAL-TAR PITCHES	065996-93-2	X			
COBALT	007440-48-4	X			
COBALT, BIS(CARBONATA(2-))HEXAHYDROXYPENTA-MONOHYDRATE	051839-24-8	X			
COBALT, TRI-MU-CARBONYLNONACARBONYLTETRA-,TETRAHYDRO	010210-68-1	X			

CHEMICAL NAME	CAS #	Select Carcin	Repro Toxin	Acute Toxic	Skin Haz.
COBALT, (MU(CARBONATO(2-)-O:O'))DIHYDROXYDI	012069-68-0	X			
COBALT ACETATE	000071-48-7	X			
COBALT ALLOY, CO, CR	011114-92-4	X			
COBALT CARBONATE	000513-79-1	X			
COBALT CARBONATE, COBALT DIHYDROXIDE (2:3)	012602-23-2	X			
COBALT CARBONYL	017786-31-1	X			
COBALT DINITRATE HEXAHYDRATE	010026-22-9	X			
COBALT HYDROXIDE	001307-64-4	X			
COBALT HYDROXIDE OXIDE	012016-80-7	X			
COBALT NAPHTHATE	061789-51-3	X			
COBALT OXIDE	001308-05-1	X			
COBALT TRIACETATE	000917-69-1	X			
COBALT (2+) SULFIDE	001317-42-6	X			
COBALT (III) OXIDE	001308-04-9	X			
COBALT (II) ACETATE	006147-53-1	X			
COBALT(2+) OXIDE	001307-96-6	X			
COBALT(II) CHLORIDE	007646-79-9	X			
COBALT(II) CHLORIDE, HEXAHYDRATE	007791-13-1	X			
COBALT(II) HYDROXIDE	021041-93-0	X			
COBALT(II) NITRATE (1:2)	010141-05-6	X			
COBALT(II) SULFATE (1:1)	010124-43-3	X			
COBALT-CHROMIUM-MOLYBDENUM ALLOY	012629-02-6	X			
COBALT-CHROMIUM-NICKEL-TUNGSTEN ALLOY	012638-07-2	X			
COBLAT MOLYBDATE(VI)	013762-14-6	X			
CONESTORAL	000438-67-5	X			
COUMARIN ANTICOAGULANTS	000000-00-0		X		
CREOSOTES	008001-58-9	X			
CRESIDINE, para-	000120-71-8	X			
CRESOATE, WOOD	008021-39-4	X			
CUPFERRON	000135-20-6	X			
CYANAMIDE	000420-04-2			X	
CYANIDES	000057-12-5			X	X
CYANOGEN	000460-19-5			X	
CYCASIN	014901-08-7	X			
CYCLOPENTA(C)FURO(3',3':4,5)FOURO(2,3-H)(1)BENZOPYRAN	001162-65-8	X			
CYCLOPHOSPHAMIDE	000050-18-0	X	X		
CYCLOPHOSPHAMIDE	006055-19-2	X			
CYCLOSPORIN	079217-60-0	X			
CYCLOSPORIN A	059865-13-3	X			
C.I. BASIC RED 9 MONOHYDROCHLORIDE	000569-61-9	X			
DACARBAZINE	004342-03-4	X			
DAUNOMYCIN	020830-81-3	X			
DDT	000050-29-3	X	X		X
DECABORANE	017702-41-9			X	X
DIACETYLBENZIDINE,N,N'-	000613-35-4	X			
DIAMINOANISOLE, 2,4-	000615-05-4	X			
DIAMINOANISOLE SULPHATE, 2,4-	039156-41-7	X			
DIAMINODIPHENYL ETHER, 4,4'-	000101-80-4	X			
DIAMINOTOLUENE, 2,4-	000095-80-7	X			
DIAZEPAM	000439-14-5		X		

CHEMICAL NAME	CAS #	Select Carcin	Repro Toxin	Acute Toxic	Skin Haz.
DIBENZO[a, e]PYRENE	000192-65-4	X			
DIBENZO[a, h]PYRENE	000189-64-0	X			
DIBENZO[a, i]PYRENE	000189-55-9	X			
DIBENZO[a, l]PYRENE	000191-30-0	X			
DIBENZO[c, g]CARBAZOLE, 7H-	000194-59-2	X			
DIBENZ[a, h]ACRIDINE	000226-36-8	X			
DIBENZ[a, h]ANTHRACENE	000053-70-3	X			
DIBENZ[a, j]ACRIDINE	000224-42-0	X			
DIBORANE	019287-45-7			X	
DIBROMOPROPYL(2,3)PHOSPHATE, TRIS	000126-72-7	X			
DIBROMO-3-CHLOROPROPANE,1,2-	000096-12-8	X	X		
DICHLOROACETYLENE	007572-29-4			X	
DICHLOROBENZENE, para-	000106-46-7	X			
DICHLOROBENZIDINE,3,3'-	000091-94-1	X			X
DICHLOROETHANE, 1,2-	000107-06-2	X			
DICHLOROETHANE,1,1-,2-(O-CHLOROPHENYL)-2(P-CHLOROPHENYL)	000053-19-0	X			
DICHLOROMETHANE	000075-09-2	X			
DICHLOROPROPENE, 1,3- (TECHNICAL-GRADE)	000542-75-6	X			X
DICHLORO-2,2-BIS(P-CHLOROPHENYL)ETHANE, 1,1- (DDD)	000072-54-8	X			
DICHLORO-2,2-BIS)P-CHLOROPHENYL)ETHYLENE, 1,1- (DDE)	000072-55-9	X			
DICHLORO-4,4'-DIAMINODIPHENYL ETHER, 3,3'-	028434-86-8	X			
DICHLORVOS	000062-73-7	X			
DIEPOXYBUTANE	001464-53-5	X			
DIESEL ENGINE EXHAUST	000000-00-0	X			
DIESEL FUEL MARINE	000000-00-0	X			
DIETHYL SULPHATE	000064-67-5	X			
DIETHYLHYDRAZINE, 1,2-	001615-80-1	X			
DIETHYLSTILBOESTROL	000056-53-1	X	X		
DIGLYCIDYL RESORCINOL ETHER	000101-90-6	X			
DIHYDROSAFROLE	000094-58-6	X			
DIISOPROPYL SULFATE	002973-10-6	X			
DIMETHOXYBENZIDINE, 3,3'- (o-DIANISIDINE)	000119-90-4	X			
DIMETHYL SULFATE	000077-78-1	X		X	X
DIMETHYL SULFOXIDE	000067-68-5		X		X
DIMETHYLAMINOAZOBENZENE, para-	000060-11-7	X			
DIMETHYLBENZIDINE, 3,3'- (o-TOLIDINE)	000119-93-7	X			
DIMETHYLCARBAMOYL CHLORIDE	000079-44-7	X			
DIMETHYLFORMAMIDE,N,N-	000068-12-2	X			
DIMETHYLHYDRAZINE, 1,1-	000057-14-7	X			X
DIMETHYLHYDRAZINE, 1,2-	000540-73-8	X			
DIMETHYLVINYL CHLORIDE	000513-37-1	X			
DINITROPYRENE, 1,6-	042397-64-8	X			
DINITROPYRENE, 1,8-	042397-65-9	X			
DIOXANE, 1,4-	000123-91-1	X			X
DIRECT BLACK 38	001937-37-7	X			
DIRECT BLUE 6	002602-46-2	X			
DISPERSE BLUE 1	002475-45-8	X			
DI(2-ETHYLHEXYL)PHTHALATE	000117-81-7	X			
ENDOSULFAN	000115-29-7			X	X

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ENDRIN	000072-20-8			X	X
EPICHLOROHYDRIN	000106-89-8	X			X
ERIONITE	012510-42-8	X			
ERIONITE	066733-21-9	X			
ESTRADIOL-17	000050-28-2	X			
ESTRA-1,2,5(10),7-TETRAEN-17-ONE,3-(SULFOOXY)-, SODIUM SALT	016680-47-0	X			
ESTRONE	000053-16-7	X			
ETHINYLESTRADIOL	000057-63-6	X			
ETHYL ACRYLATE	000140-88-5	X			X
ETHYL ALCOHOL CONSUMPTION	000064-17-5		X		
ETHYL METHANESULPHONATE	000062-45-7	X			
ETHYLENE CHLOROHYDRIN	000107-07-3			X	X
ETHYLENE DIBROMIDE	000106-93-4	X	X		X
ETHYLENE GLYCOL ETHERS	000000-00-0		X		
ETHYLENE OXIDE	000075-21-8	X	X		
ETHYLENE THIOUREA	000096-45-7	X			
ETHYLENEIMINE	000151-56-4	X			
ETHYL-N-NITROSOUREA,N-	000759-73-9	X			
FLUORINE	007782-41-4			X	
FORMALDEHYDE	000050-00-0	X			
FOWLER'S SOLUTION	001332-10-1	X			
FUEL OIL, RESIDUAL	068476-33-5	X			
FURAN	000110-00-9	X			
GASOLINE	008006-61-9	X			
GASOLINE, ENGINE EXHAUST FUMES	000000-00-0	X			
GERMANE	007782-65-2			X	
GLASSWOOL (RESPIRABLE SIZE)	000000-00-0	X			
GLU-P-1 (2-AMINO-6-METHYLDIPYRIDO[1,2-a:3',2'-d] IMIDAZOLE)	067730-11-4	X			
GLU-P-2(2-AMINODIPYRIDO[1,2-A:3',2' D]IMIDAZOLE)	067730-10-3	X			
GLYCIDALDEHYDE	000765-34-4	X			
GLYCIDOL	000556-52-5	X			
GOSSYPOL	000303-45-7		X		
GRISEOFULVIN	000126-07-8	X			
HALOTHANE	000151-67-7		X		
HC BLUE 1	002784-94-3	X			
HEPTACHLOR	000076-44-8	X			
HEPTACHLOR EPOXIDE	001024-57-3	X			
HEXACHLOROBENZENE	000118-74-1	X	X		
HEXACHLOROETHANE	000067-72-1	X			
HEXACHLOROHEXANES	000608-73-1	X			
HEXAMETHYLPHOSPHORAMIDE	000680-31-9	X			
HYDRAZINE	000302-01-2	X			X
HYDRAZINE, SULFATE (1:1)	010034-93-2	X			
HYDRAZOBENZENE	000122-66-7	X			
HYDROGEN CYANIDE	000074-90-8			X	X
HYDROGEN FLUORIDE (HYDROFLURIC ACID)	007664-39-3			X	X
HYDROGEN SELENIDE	007783-07-5			X	
HYDROGEN SULFIDE	007783-06-4			X	
INDENO[1,2,3-cd]PYRENE	000193-39-5	X			

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IQ(2-AMINO-3-METHYLIMIDAZO[4,5-f]QUINOLINE)	076180-96-6	X			
IRON-DEXTRAN COMPLEX	009004-66-4	X			
ISOPRENE	000078-79-5	X			
KEPONE (CHLORDECONE)	000143-50-0	X			
LASIOCARPINE	000303-34-4	X			
LEAD ACETATE	000301-04-2	X			
LEAD ACETATE (II) TRIHYDRATE	006085-56-4	X			
LEAD AND COMPOUNDS	007439-92-1	X	X		
LEAD CHROMATE (VI) OXIDE	018454-12-1		X		
LEAD COMPOUNDS, INORGANIC	000000-00-0	X	X		
LEAD (II) PHOSPHATE (3:2)	007446-27-7	X			
LINDANE, ALPHA	000319-84-6	X			
LINDANE, BETA	000319-85-7	X			
LINDANE AND OTHER HEXACHLOROCYCLOHEXANE ISOMERS	000058-89-9	X			X
LITHIUM	007439-93-2		X		
LITHIUM CARBONATE	000554-13-2		X		
LITHIUM CITRATE	000846-59-1		X		
MAGENTA (CONTAINING CI BASIC RED 9)	000632-99-5	X			
MeA-ALPHA-C(2-AMINO-3-METHYL-9H-PYRIDO[2,3- b] INDOLE)	068006-83-7	X			
MECOPROP	000093-65-2	X			
MEDROXYPROGESTERONE	000071-58-9	X			
MELPHALAN	000148-82-3	X			
MERCHALAN	000531-76-0	X			
MERCURY	007439-97-6		X		X
MERCURY, INORGANIC COMPOUNDS	000000-00-0		X		X
MESTRANOL	000072-33-3	X			
METHANE,TERANITRO-	000509-14-8	X			
METHIMAZOLE	000060-56-0		X		
METHOXSALEN AND UV RADIATION	000298-81-7	X			
METHOXYPSORALEN,5-	000484-20-8	X			
METHYL BROMIDE	000074-83-9			X	X
METHYL CYCLOPENTADIENYL MANGANESE TRICARBONYL	012108-13-3			X	X
METHYL HYDRAZINE	000060-34-4			X	
METHYL ISOCYANATE	000624-83-9			X	X
METHYL MERCURY	022967-92-6		X		
METHYL METHANESULPHONATE	000066-27-3	X			
METHYLAMINOPTERIN	000059-05-2		X		
METHYLANILINE, 2,6-	000087-62-7	X			
METHYLAZIRIDINE, 2- (PROPYLENEIMINE)	000075-55-8	X			
METHYLAZOXYMETHANOL	000590-96-5	X			
METHYLAZOXYMETHANOL ACETATE	000592-62-1	X			
METHYLCHRYSENE, 5-	003697-24-3	X			
METHYLDICHLOROARSINE	000593-89-5			X	
METHYLENE BIS(2-CHLOROANILINE), 4,4- (MBOAC)	000101-14-4	X			X
METHYLENE BIS(2-METHYLANILINE), 4,4'-	000838-88-0	X			
METHYLENEBIS(N,N-DIMETHYL)BENZENAMINE, 4,4'	000101-61-1	X			
METHYLENEDIANILINE, 4,4'- AND ITS DIHYDORCHLORIDE	000101-77-9	X			
METHYLENEDIANILINE,4,4'-DIHYDROCHLORIDE	013552-44-8	X			

CHEMICAL NAME	CAS #	Select Carcin	Repro Toxin	Acute Toxic	Skin Haz.
METHYLTHIOURACIL	000056-04-2	X			
METHYL-1-NITROANTHRAQUINONE, 2- (UNCERTAIN PURITY)	000129-15-7	X			
METHYL-N-NITROSOURETHANE, N-	000000-00-0	X			
METHYL-N-NITRO-N'-NITROSOGUANIDINE,N-(MNNG)	000070-25-7	X			
METRONIDAZOLE	000443-48-1	X			
MICHLER'S KETONE	000090-94-8	X			
MINERAL OILS,UNTREATED AND MILDLY TREATED	000000-00-0	X			
MIREX	002385-85-5	X	X		
MITOMYCIN C	000050-07-7	X			
MOLYBDATE ORANGE	012656-85-8	X			
MONOCROTALINE	000315-22-0	X			
MORPHOLINOMETHYL-3-[(5- NITROFURFURYLIDENE) AMINO], 5-	003031-51-4	X			
MUSTARD GAS (SULPHUR MUSTARD)	000505-60-2	X			
NAFENOPIN	003771-19-5	X			
NAPHTHYL METHYLCARBAMATE	000063-25-2		X		
NAPHTHYLAMINE, 2-	000091-59-8	X			X
NAPHTHYLAMINE, ALPHA-	000134-32-7	X			X
NAPHTHYLAMINE,N,N-BIS(2CHLOROETHYL)-2-	000494-03-1	X			
NICKEL, METALLIC	007440-02-0	X			
NICKEL ALLOY AISI 687	011068-91-0	X			
NICKEL BISCYCLOPENDADIENE	001271-28-9	X			
NICKEL CARBONYL	013463-39-3	X		X	
NICKEL CARBONYL	013464-39-3	X			
NICKEL COMPOUNDS	000000-00-0	X			
NICKEL SULFIDE (3:20	012035-72-2	X			
NICKEL (III) HYDROXIDE	012125-56-3	X			
NICKEL (II) ACETATE (1:2)	000373-02-4	X			
NICKEL (II) CARBONATE (1:1)	003333-67-3	X			
NICKEL (II) HYDROXIDE	012054-48-7	X			
NICKEL (II) OXIDE (1:1)	001313-99-1	X			
NICOTINE	000054-11-5		X	X	X
NIRIDAZOLE	000061-57-4	X			
NITRIC ACID (FUMING)	007697-37-2			X	X
NITRIC OXIDE	010102-43-9			X	
NITRILOTRIACETIC ACID	005064-31-3	X			
NITRILOTRIACETIC ACID, DISODIUM SALT	015467-20-6	X			
NITRILOTRIACETIC ACID, DISODIUM SALT, MONOHYDRATE	023255-03-0	X			
NITRILOTRIACETIC ACID, MONOSODIUM SALT	018994-66-6	X			
NITRILOTRIACETIC ACID, SODIUM SALT	010042-84-9	X			
NITRILOTRIACETIC ACID, TRISODIUM SALT,MONOHYDRATE	018662-53-8	X			
NITRILOTRIACETIC ACID AND SALTS	000139-13-9	X			
NITROACENAPHTHENE, 5-	000602-87-9	X			
NITROBIPHENYL,4-	000092-93-3	X			
NITROCHRYSENE, 6-	007496-02-8	X			
NITROFEN (TECHNICAL-GRADE)	001836-75-5	X			
NITROFLUORENE	000607-57-8	X			

CHEMICAL NAME	CAS #	Select Carcin	Repro Toxin	Acute Toxic	Skin Haz.
NITROFURFURYLIDIENE(5)-AMINO-2- IMIDAZOLIDINONE, 1-	000555-84-0	X			
NITROGEN DIOXIDE	010102-44-0			X	
NITROGEN MUSTARD	000051-75-2	X			
NITROGEN MUSTARD HYDROCHLORIDE	000055-86-7	X			
NITROGEN MUSTARD N-OXIDE	000126-85-2	X			
NITROGEN MUSTARD N-OXIDE HYDROCHLORIDE	000302-70-5	X			
NITROGEN TETROXIDE	010544-72-6			X	
NITROPROPANE, 2-	000079-46-9	X			
NITROPYRENE, 1-	005522-43-0	X			
NITROPYRENE, 4-	055738-54-0	X			
NITROPYRENE, 4-	057835-92-4	X			
NITROSOBUTYLBUTANOLAMINE, N-	003817-11-6	X			
NITROSODIETHANOLAMINE, N-	001116-54-7	X			
NITROSODIETHYLAMINE,N-	000055-18-5	X			
NITROSODIMETHYLAMINE,N-	000062-75-9	X			
NITROSODI-n-BUTYLAMINE, N-	000924-16-3	X			
NITROSODI-n-PROPYLAMINE, N-	000621-64-7	X			
NITROSOMETHYLETHYLAMINE, N-	010595-95-6	X			
NITROSOMETHYLVINYLAMINE, N-	004549-40-0	X			
NITROSOMORPHOLINE, N-	000059-89-2	X			
NITROSONORNICOTINE, N'-	016543-55-8	X			
NITROSONORNICOTINE, N-	084237-38-7	X			
NITROSOPIPERIDINE, N-	000100-75-4	X			
NITROSOPYRROLIDINE, N-	000930-55-2	X			
NITROSOSACOSINE, N-	013256-22-9	X			
NITROSO-N-METHYLUREA,N-	000684-93-5	X			
NORETHISTERONE	000068-22-4	X			
N-NITROSOMETHYLAMINO-1-(30PYRIDYL)-1-BUTANONE, 4-(NNK)	064091-91-4	X			
N-NITROSOMETHYLAMINO-PROPIONITRILE, 3-	060153-49-3	X			
N-[4-(5-NITR-2-FURYL)-2-THIAZOYL]ACETAMIDE	000531-82-8	x			
OCHRATOXIN A	000303-47-9	X			
OIL ORANGE SS	002646-17-5	X			
OXAZOLIDININE,2,5-(MORPHOLINOMETHYL)-3-[(5-NITROFURYLIDENE)	003795-88-8	X			
OXYMETHOLONE	000434-07-1	X			
PANFURAN S (CONTAININGDIHYDROXMETHYLFURATRIZINE)	000794-93-4	X			
PARAMETHADIONE	000115-76-3		X		
PARATHION	000056-38-2			X	X
PCB (AROCLOR 1254)	011097-69-1	X			
PCB (AROCLOR 1260)	011096-82-5	X			
PENICILLAMINE	002219-30-9		X		
PENTABORANE	019624-22-7			X	
PENTACHLOROBIPHENYL	025429-29-2	X			
PENTACHLOROPHENOL	000087-86-5	X			
PENTACHLOROPHENOL	000087-86-5			X	X
PHENACETIN	000062-44-2	X			
PHENAZOPYRIDINE HYDROCHLORIDE	000136-40-3	X			
PHENOBARBITAL	000050-06-6	X			

CHEMICAL NAME	CAS #	Select Carcin	Repro Toxin	Acute Toxic	Skin Haz.
PHENOXYBENZAMINE HYDROCHLORIDE	000062-92-3	X			
PHENYL GLYCIDYL ETHER	000122-60-1	X			
PHENYTOIN	000057-41-0	X	X		
PHLP(2-AMINO-1-METHYL-6-PHENYLIMIDAZO[4,5-B] PYRIDINE)	105650-23-5	X			
PHOSGENE	000075-44-5			X	
PHOSPHINE	007803-51-2			X	
PHOSPHORUS (YELLOW)	007723-14-0			X	
POLYBROMINATED BIPHENYL (FF-1)	067774-32-7	X			
POLYBROMINATED BIPHENYLS	000000-00-0	X	X		
POLYCHLORINATED BIPHENYLS	000000-00-0	X	X		
POLYCHLORINATED BIPHENYLS	001336-36-3	X			
PONCEAU 3R	003564-09-8	X			
PONCEAU MX	003761-53-3	X			
POTASSIUM BROMATE	007758-01-2	X			
POTASSIUM CHROMATE (VI)	007789-00-6	X			
POTASSIUM DICHROMATE (VI)	007778-50-9	X			
PROCARBAZINE HYDROCHLORIDE	000366-70-1	X			
PROGESTERONE	000057-83-0	X			
PROGESTINS	000057-83-0	X			
PROPANE SULTONE, 1,3-	001120-71-4	X			
PROPARGYL BROMIDE	000106-96-7			X	
PROPIOLACATONE, BETA	000057-57-8	X			
PROPIONIC NITRILE	000107-12-0			X	
PROPRIONIC ACID,2-(2,4-DICHLOROPHENOXY)	000120-36-5	X			
PROPYLENE OXIDE	000075-56-9	X		X	
PROPYLTHIOURACIL	000051-52-5	X			
RADON AND ITS DECAY PRODUCTS	010043-92-9	X			
RESERPINE	000050-55-5	X			
RETINOIC ACID, 1,3-CIS-	004759-48-2		X		
SACCHARIN	000081-07-2	X			
SACCHARIN, CALCIUM SALT	006485-34-3	X			
SACCHARIN, SODIUM SALT	000128-44-9	X			
SAFROLE	000094-59-7	X			
SELENIUM HEXAFLUORIDE	007783-79-1			X	
SELENIUM SULFIDE	007446-34-6	X			
SENARMONITE	012412-52-1	x			
SHALE-OILS	068308-34-9	X			
SILICA, CRYSTALLINE CRISTOBALITE	014464-46-1	X			
SILICA, CRYSTALLINE TRIDYMITE	015468-32-3	X			
SILICA, CRYSTALLINE TRIPOLI	001317-95-9	X			
SILICIC ACID BERYLLIUM SALT	015191-85-2	X			
SODIUM DICHROMATE (VI)	010588-01-9	X			
SODIUM FLUOROACETATE	000062-74-8			X	X
SODIUM ortho-PHENYLPHENATE	000132-27-4	X			
SOOTS	000000-00-0	X			
STERIGMATOCYSTIN	010048-13-2	X			
STIBINE	007803-52-3			X	
STREPTOZOTOCIN	018883-66-4	X			
STRONTIUM CHROMATE (VI)	007789-06-2	X			
STRYCHNINE	000057-24-9			X	

CHEMICAL NAME	CAS #	Select Carcin	Repro Toxin	Acute Toxic	Skin Haz.
STYRENE	000100-42-5	X			
STYRENE-7,8-OXIDE	000096-09-3	X			
SULFALLATE	000095-06-7	X			
SULFUR TRIOXIDE	007446-11-9	X			
SULFURIC ACID	007664-93-9	X			
SULFURIC ACID, FUMING	008014-95-7	X			
TALC CONTAINING ASBESTIFORM FIBRES	014807-96-6	X			
TETRACHLORODIBENZO-para-DIOXIN, 2,3,7,8- (TCCD)	001746-01-6	X	X		
TETRACHLOROETHYLENE	000127-18-4	X	X		X
TETRACYCLINES	000060-54-8		X		
TETRAETHYL LEAD	000078-00-2		X	X	X
TETRAETHYL PYROPHOSPHATE	000107-49-3			X	
TETRAMETHYL SUCCINONITRILE	003333-52-6			X	X
THALIDOMIDE	000050-35-1		X		
THIAZOLE,2(2-FORMYLHYDROZINE)-4-(5-NITRO-2- FURYL)	003570-75-0	X			
THIOACETAMIDE	000062-55-5	X			
THIODIANILINE, 4,4'-	000139-65-1	X			
THIOPHENOL	000108-98-5			X	
THIOTEPA	000052-24-4	X			
THIOUREA	000062-56-6	X			
THORIUM DIOXIDE	001314-20-1	X			
TOBACCO PRODUCTS, SMOKELESS	000000-00-0	X			
TOBACCO SMOKE	000000-00-0	X	X		
TOLUENE	000108-88-3		X		X
TOLUENE DIISOCYANATE, 2,6-	000091-08-7	X			
TOLUENE DIISOCYANATES	000584-84-9	X			
TOLUENE DIISOCYANTE	026471-62-5	X			
TOLUENESULFONAMIDE, O-	000088-19-7	X			
TOLUIDINE, ORTHO-	000095-53-4	X		X	X
TOLUIDINE, ORTHO-	000108-49-0			X	X
TOLUIDINE HYDROCHLORIDE, O-	000630-21-5	X			
TOXAPHENE (POLYCHLORINATED CAMPHENES)	008001-35-2	X			
TREOSULPHAN	000299-75-2	X			
TRICHLOROETHANE,1,1,1-,2-(O-CHLOROPHENYL)- 2-(P-CHLOROPHENYL	000789-02-6	X			
TRICHLOROETHYLENE	000079-01-6	X			
TRICHLOROMETHINE	000817-09-4	X			
TRICHLOROPHENOL, 2,4,6-	000088-06-2	X			
TRICHLOROPROPANE, 1,2,3-	000096-18-4	X			
TRIMETHADIONE	000127-48-0		X		
TRP-P-1(3-AMINO-1,4-DIMETHYL-5H-PYRIDO[4,3-b] INDOLE)	062450-07-1	X			
TRP-P-2(3-AMINO-1-METHYL-5H-PYRIDO[4,3- b]INDOLE)	062450-06-0	X			
TRYPAN BLUE	000072-57-1	X			
URACIL MUSTARD	000066-75-1	X			
URETHANE	000051-79-6	X			
VALENTINITE	001317-98-2	X			
VALPROIC ACID	000099-66-1		X		
VANADIUM PENTOXIDE	001314-62-1			X	
VENOM, SNAKE- CROTALUS ADAMANTEUS	000000-00-0			X	
VENOM, SNAKE- CROTALUS ATROX	000000-00-0			X	
VINYL ACETATE	000108-05-4	X			

CHEMICAL NAME	CAS #	Select Carcin	Repro Toxin	Acute Toxic	Skin Haz.
VINYL BROMIDE	000593-60-2	X			
VINYL CHLORIDE	000075-01-4	X	X		
VINYL FLUORIDE	000075-02-5	X			
VINYLCYCLOHEXENE, 4-	000100-40-3	X			
VINYLCYCLOHEXENE DIEPOXIDE	000107-87-6	X			
VINYL-1-CYCLOHEXENE DIEPOXIDE, 4-	000106-87-6	X			
VITAMIN A CONSUMPTION	000068-26-8		X		
WARAFIN	000081-81-2		X		
WELDING FUMES	000000-00-0	X			
XYLIDINE	001330-73-8			X	X
ZINC CHROMATE HYDROXIDE	013530-65-9	X			
ZINC CHROMATE (VI) HYDROXIDE HYDRATE	015930-94-6	X			

Appendix H: General Chemical Segregation

When certain hazardous chemicals are stored or mixed together, violent reactions may occur because the chemicals are unsuitable for mixing or are incompatible. Classes of incompatible chemicals should be segregated from each other when in storage. Use the following general guidelines.

HAZARD CLASS	RECOMMENDED STORAGE METHOD	EXAMPLES	INCOMPATIBILITIES CHECK SDS/MSDS
Oxidizers	Store inside a noncombustible cabinet, separate from flammable and combustible materials. Store inorganic oxidizers, organic peroxides, separate from each other via secondary containment.	Inorganic oxidizers - Sodium hypochlorite, ammonium nitrate Organic peroxides – methyl ethyl ketone peroxide, allyl compounds, haloalkenes, dienes, monomeric vinyl compounds,	Separate from reducing agents, flammables, and combustibles
Flammable Liquids	Store in grounded flammable storage cabinet.	Acetone, benzene, methanol, ethanol, toluene	Separate from acids, bases, oxidizers, and poisons.
Flammable Solids	Store in grounded flammable storage cabinet. Flammable solids must be segregated from flammable liquids using secondary containment.	Phosphorus, lithium, sodium, potassium	Separate from acids and oxidizers.
Corrosives Acids	Store in separate acid storage cabinet. Within the acid cabinet store each of the following groups separately via secondary containment: oxidizing acids, flammable (organic) acids, and mineral acids.	Oxidizing acids - nitric acid, perchloric acid, chromic acid, picric acid Flammable and organic acids – glacial acetic acid, trifluoracetic acid, trichloroacetic acid Mineral acids - Hydrochloric acid, sulfuric acid, phosphoric acid	Separate from flammable liquids, flammable solids, bases, oxidizers.

CLASS OF CHEMICALS	RECOMMENDED STORAGE METHOD	EXAMPLES	INCOMPATIBILITIES CHECK SDS/MSDS
Corrosives - Bases	Store in separate storage cabinet. Store inorganic bases separate from reducing agents via secondary containment.	Inorganic bases – sodium hydroxide, potassium hydroxide, ammonium hydroxide Reducing agents – Lithium aluminum hydride, sodium borohydride, lithium borohydride	Separate from oxidizers and acids.
General Chemicals Non-reactive	Store on general laboratory benches or shelving preferably below eye level.	Agar, sodium chloride, sodium bicarbonate, and most non-reactive salts	See SDS/MSDS
Water Reactive Chemicals	Store in dry, cool, location, protect from water fire sprinkler. Note: Many water reactive chemicals are flammable solids. If flammable solid, store as such. If not, store separately from all other chemicals.	Sodium metal, potassium metal, lithium metal, lithium aluminum hydride	Separate from all aqueous solutions, and oxidizers.
Poisons (Toxicological Hazard)	If poisons can be categorized as oxidizer, acid, or flammable, store as such. If non-reactive but highly toxic store separately from all other chemicals.	Cyanides, heavy metals compounds (e.g., cadmium, mercury, osmium) methyl iodide, dimethyl sulfate, mercury	Flammable liquids, acids, bases, and oxidizers.

EYEWASH TESTING LOG

Per ANSI Z358.1-2009
"Eyewashes shall be activated weekly for a period long enough to verify operation and ensure that flushing fluid is available."

If eyewash is not working properly contact EHSREM at ehs@txstate.edu

Date Tested	Initials of Tester		Date Tested	Initials of Tester

TO BE POSTED NEAR EYEWASH STATION

TEXAS STATE

EMERGENCY

Police * Fire * Medical

DIAL 911

NON - EMERGENCY

University Police http://www.police.txstate.edu/	512-245-2805
Student Health Center http://www.healthcenter.txstate.edu/	512-245-2161
Poison Control Center http://www.poisoncontrol.org/	1-800-222-1222
Parking Services http://www.parking.txstate.edu/	512-245-2887

Environmental, Health, Safety, Risk and Emergency Management

http://www.fss.txstate.edu/EHSRM/

8 – 5 pm: 512-245-3616

After Hours: 512-738-6650