Laboratory Safety Manual

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1. Purpose

A variety of hazards may exist in the laboratories at Stephen F. Austin State University (SFASU). The risks associated with these hazards are greatly reduced or eliminated if proper precautions and practices are observed in the laboratory. To manage these risks and promote safety in the workplace, the Environmental Health, Safety, & Risk Management Department (EHSRM) at SFA has developed this Laboratory Safety Manual. This manual is designed to aid faculty, staff, students, and visitors in maintaining a safe laboratory work environment in which to teach, conduct research, and learn. This Laboratory Safety Manual applies to all laboratories at SFA, on or off the main campus, and is intended to highlight those laboratory practices that are necessary for protecting students, staff, faculty, and visitors from exposure to hazardous chemicals and potential dangers. Additionally, it is the job of the Laboratory Supervisor or Principal Investigator to develop site specific standard operating procedures for all hazardous substances and potentially dangerous situations. EHSRM will assist the Laboratory Supervisor or Principal Investigator to develop site specific procedures upon request.

All laboratories using hazardous chemicals are required to comply with the Occupational Safety and Health Administration's (OSHA) 29 CFR 1910.1450, Occupational exposure to hazardous chemicals in laboratories. This standard requires the employer to develop a written chemical hygiene plan, which is capable of protecting employees from the health hazards associated with hazardous chemicals in the laboratory. This Laboratory Safety Manual meets the OSHA requirements and serves as the SFA Chemical Hygiene Plan.

2. Responsibilities

It is imperative that Stephen F. Austin State University employees comply with federal, state, and local environmental health, safety, and risk management legislation, and relevant environmental compliance and protection codes. In addition, it is essential that employees observe industry best practices and comply with SFA safety policies, programs, and procedures. All faculty, staff, students, and visitors performing laboratory procedures are required to have training on the physical and health hazards present in the laboratory, the known risks, and what to do if an accident occurs. More information on training requirements can be found on page 36. Every individual is responsible for conducting activities in a manner that will not endanger themselves or others and must comply with the applicable requirements of State and Federal laws, as well as, with university policies and procedures described in this manual. The Laboratory Supervisor, instructor, or Principal Investigator is ultimately responsible for the safety of any personnel in their laboratory. The following sections describe specific responsibilities for each level of supervision related to laboratory safety:

2.1 The Department of Environmental Health, Safety, & Risk Management (EHSRM)

- Provide general laboratory safety training to laboratory supervisory personnel.
- Conduct periodic and unannounced laboratory inspections to ensure compliance with federal, state, and local regulations, as well as the SFA policies, procedures, and information contained in this manual or in response to specific activities or concerns.
- Undertake necessary enforcement actions to ensure full compliance with all federal, state, local regulations and all institutional safety policies, up to and including independent authority to shut down laboratories for violation of SFA policies or the law.
- Provide technical assistance to Laboratory Supervisors and workers concerning appropriate storage, handling, and disposal of hazardous waste and chemicals.
- Provide assistance in hazardous material spill response.
- Conduct fume hood testing and inspections.

- Provide technical assistance in laboratory construction, modification, and renovation plans for safety design.
- Provide technical assistance concerning personal protective equipment and laboratory safety equipment.
- Maintain copies of laboratory safety training records, inspections, chemical inventory, and Safety Data Sheets (SDS).
- Provide guidance for maintaining compliance with federal, state, and local regulations as well as the procedures stated in this manual.
- Report the loss of controlled substances or glassware to the Department of Public Safety (DPS) as required by the DPS Memorandum of Understanding (MOU). See *Appendix A* on page 40.
- Review and update this laboratory safety manual as needed, or as required by changes in regulations and/or safety standards.

2.2 College Dean

- Ensure the safe operations of all laboratories and other sites in the respective college where chemicals are used or laboratory procedures are conducted.
- Ensure compliance with the SFA policies and procedures contained in this manual and those contained in any supplementary SFA safety program manuals.
- Has independent enforcement authority to close a laboratory for safety violations.
- Has the primary responsibility for the environmental health and safety of their staff and students.

2.3 Department Chairs and Directors

- Oversee chemical and biological safety within departmental laboratories by ensuring that all faculty and staff adhere to applicable regulations, policies, and procedures described in this manual.
- Ensure completion and updates to annual inventories of hazardous chemicals and controlled substances and glassware (see page 40) as required by the Texas Hazard Communication Act, the university's Hazard Communication Program, and the Department of Public Safety.
- Arrange for payment of fees associated with proper waste disposal.
- Provide all necessary laboratory safety equipment and person protective equipment (PPE) for their employees.

2.4 Principal Investigators and Laboratory Supervisors

- Assume direct responsibility for their laboratory's compliance with this Laboratory Safety Manual and all applicable federal and state regulations.
- Monitor the procurement, safe use, and proper disposal of chemicals.
- Write standard operating procedures and other information relevant to lab processes in their specific areas as needed to supplement those contained in this manual.
- Instruct employees on the contents of this manual and any supplemental materials.
- Train laboratory employees on how to find and use Safety Data Sheets.
- Take all reasonable precautions to protect the safety and health of laboratory workers and the environment.
- Coordinate with EHSRM for hazardous waste disposal and oversee the handling of hazardous waste pending proper disposal.
- Conduct regular laboratory safety evaluations.
- Take corrective action in response to unsafe laboratory practices or conditions identified as a non-compliance with the procedures outlined in this manual.

- Complete and update annual laboratory chemical and controlled substances and glassware inventories (see page 40 for list of controlled substances and glassware).
- Report losses in controlled substances or glassware to EHSRM immediately at: 468-6034 or safety@sfasu.edu.
- Provide site specific training on laboratory hazards.
- Have readily available a current copy of a Safety Data Sheet for all hazardous chemicals in the laboratory. Hard copies are not required (although recommended) as long as easy access to electronic copies is provided.
- Complete Waste Stream Determination Forms (see *Appendix B* on page 45) for all waste generated within their laboratory and forward copies to EHRSM at: safety@sfasu.edu (email) or 936-468-7312 (fax).
- Post Laboratory Chemical Waste Guidelines poster (provided in *Appendix C* on page 48), Right to Know poster (provide in *Appendix D* on page 50), and any other posters supplied by EHSRM in all laboratories or common areas.
- Forward documentation of training, inventories, waste stream determination, corrective actions, and lab accidents to EHSRM via email: safety@sfasu.edu.

2.5 Laboratory Employees and Students

- Maintain a thorough understanding and follow the laboratory safety procedures in this manual and those contained in any supplementary information developed by the university in response to specific activities or areas of research for all purposes using chemical materials.
- Properly use and maintain personal protective equipment.
- Properly use and maintain flammable liquid storage cabinets, acid storage cabinets, biological safety cabinets, fume hoods and other laboratory safety equipment provided.
- Inform supervisor immediately of any laboratory safety equipment that is needed but not available or that is not in good working condition.
- Report all accidents, possible chemical or biological exposures, or unsafe conditions to their supervisor.
- Attend Hazard Communication, Laboratory Safety, Fire Safety, and all other applicable training sessions.

3. General Laboratory Safety

The following section addresses basic laboratory safety procedures designed to be universal for all laboratories at SFA. These procedures should be followed in all labs on or off the SFA campus.

3.1 Standard Operating Procedures

The Standard Operating Procedures (SOPs) regarding various lab components provided in this manual offer general lab safety guidelines. This document contains only a minimum set of guidelines and recommendations required to maintain a safe working environment, and do not provide specific standard operating procedures necessary to work in their respective laboratories. It is the responsibility of the Lab Supervisor or Principal Investigator to develop specific standard operating procedures for their laboratory.

Standard operating procedures (SOPs) are detailed work practices, which are developed to provide guidance for the safe execution of specific lab work practices and procedures. Site-specific SOPs should be written for each potentially hazardous work practice performed in the laboratory. SOPs include but are not limited to procurement, distribution, storage, labeling, equipment usage, general lab practices, waste

disposal, and emergency procedure practices for the particular chemical, work practice, or hazard group. Safety information about each chemical can be found in the chemical's SDS provided by the manufacturer or by searching online for the chemical name followed by "SDS". Contact your supervisor or EHSRM if you need assistance locating a SDS.

3.1.1 General Lab Safety Guidelines

The following guidelines have been established to minimize or eliminate hazards in the laboratory and aid in maintaining a safe laboratory environment. It is the responsibility of the Lab Supervisor or Principal Investigator to inform each person that enters into the laboratory to understand the safety and health hazards associated with hazardous materials and equipment in the laboratory. It is also the individual's responsibility to practice the following general lab safety guidelines at all times while working in the laboratories at SFA.

- Always wear proper eye protection, close toed shoes, and long pants in SFA laboratories. Lab coats, gloves, and other PPE may also be required depending on the hazards associated with the lab.
- Always know the hazards associated with the materials that are being used in the lab.
- Know the location of safety equipment such as eyewash stations, emergency showers, and fire extinguishers. Keep safety equipment clear of obstructions at all times.
- Eyewashes should be flushed weekly by lab personnel and documented on the eyewash tags provided by EHSRM.
- Properly label hazardous chemical waste with the words "Hazardous Waste" and the specific contents. Keep the label attached to the container at all times. Always replace old and deteriorated labels as needed.
- Keep chemical containers closed when not in use.
- All primary and secondary chemical containers must be labeled with contents and known hazards.
- Never remove chemicals, biological agents, or any other laboratory related item from the laboratory without proper authorization.
- Never perform unauthorized work, preparations, or experiments.
- Never engage in horseplay or other unsafe behavior in chemical or biological work areas.
- Chemical fume hood sashes should be kept closed whenever possible. Maintain the minimum possible opening when working. **Do not store chemicals in fume hoods.**
- Do not store or consume food and drinks in labs or in any place where hazardous materials are stored or used, including lab refrigerators or freezers.
- Always wash hands and arms with soap and water before leaving the work area. This applies even if you are wearing gloves.
- Remove clutter and practice good housekeeping.
- Tie back long hair and loose clothing.
- Do not use cell phones or audio devices while working in the lab. Distractions can lead to accidents.
- Never leave an open flame unattended and remember the location of the nearest fire extinguisher.
- Never leave an experiment unattended while it is being heated or is rapidly reacting.
- Do not store or work with flammable substances near an open flame or other heat source.
- Secure gas cylinders properly and keep safety caps on cylinders when not in use.
- Have appropriate spill supplies available and follow response procedures.
- Eliminate extension cords and power strips in series. These can pose fire and/or trip hazards. Extension cords may be used for temporary use only (a few hours) and must be put away before leaving the lab.
- Keep exits and aisles clear of obstructions.

- Glass chemical bottles should not be stored on the floor.
- Do not store any lab equipment or chemicals in walkways or corridors.
- Keep equipment back from the edge of the lab bench to prevent accidental spillage.
- Never store chemicals or heavy equipment above eye level.
- Report any accident immediately, however minor or irrelevant you might think it might be.

3.2 Hazardous Chemicals and Hazard Communication Program

Hazardous chemicals pose the greatest risk in laboratories at SFA. The following sections will help you identify the hazards associated with the chemicals found in your laboratory, determine the best practices for proper labeling, signage, transport, and user safety of those chemicals.

3.2.1 What are Hazardous Chemicals

A hazardous chemical is defined as: any element, chemical compound, or mixture of elements or compounds whose use could present a physical or health hazard. A physical hazard arises when use of a chemical is potentially dangerous due to the possibility of explosion, fire or violent reaction with other chemicals. The following information will help you identify and classify chemical hazards:

Physical Hazards include:

- Flammable or Combustible liquid
- Compressed Gas
- Explosive
- Oxidizer
- Pyrophoric
- Unstable or Reactive
- Water Reactive

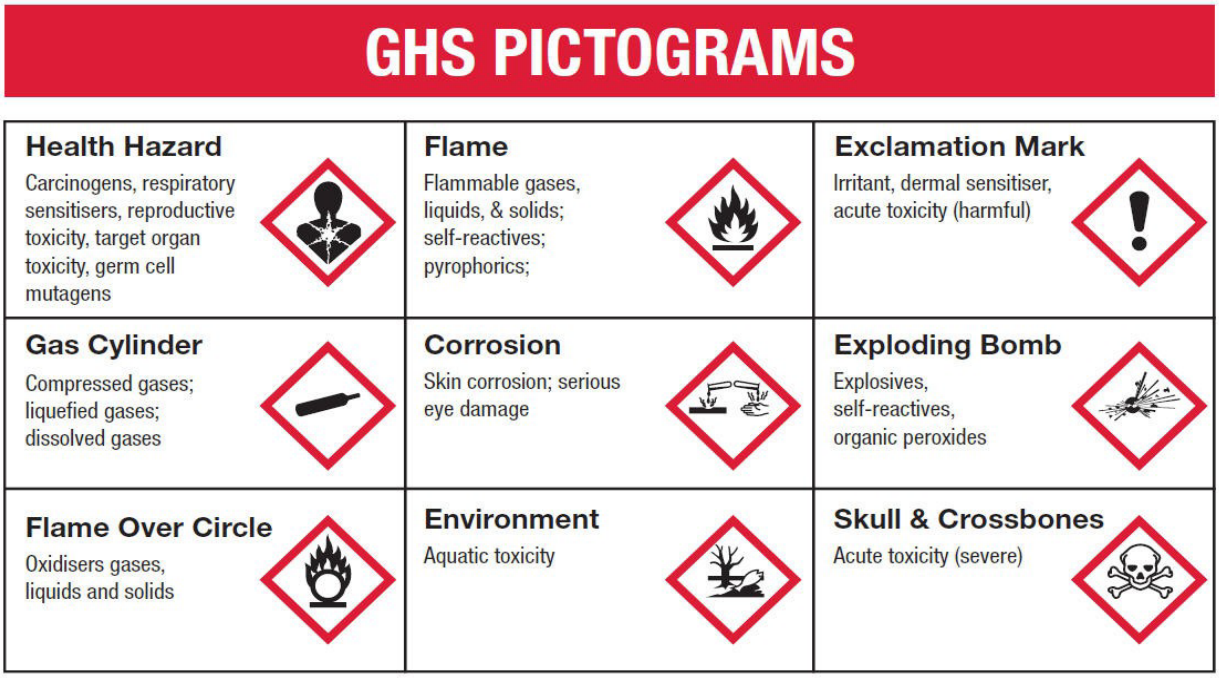

Table 3.1: Physical and health hazards are indicated on Safety Data Sheets and chemical labels with the applicable GHS pictograms.

Health Hazards include:

- Carcinogen
- Toxic or highly toxic agent
- Reproductive toxin
- Irritant
- Corrosive
- Sensitizer
- Hepatotoxin
- Nephrotoxin
- Neurotoxin
- Hemototoxin
- Agent which damages the lungs, skin, eyes and mucous membranes.

The health effects caused by the above categories of chemicals may be **acute** or **chronic**. An acute effect is an adverse health effect that is the result of a short-term exposure to a high concentration of a toxic material. An acute effect is usually felt immediately or with reactions occurring within two to three hours of overexposure. In the case of highly toxic materials, death may result even with prompt medical care. The most common type of exposure in laboratories is acute as a result of accidents and spills.

3.2.2 Hazard Communication Program

OSHA and the Texas Hazard Communication Act require that a written Hazard Communication Program (Hazcom) be developed, implemented and maintained at each work place. The EHSRM Department has developed a Hazard Communication Program for SFA which can be accessed on the EHSRM website at https://www.sfasu.edu/safety/documents/SFASU_Hazard_Communication_Manual_2020(1).pdf

According to the Texas Hazard Communication Act, the written Hazcom program must address at minimum the following requirements:

- Information about workplace chemicals and hazards.
- Labels and other forms of warnings for containers of hazardous chemicals.
- Safety Data Sheets (SDS).
- Employee information and training.
- Reporting Fatalities and Injuries.
- Employee Rights.

3.2.3 Safety Data Sheets (SDS)

Safety Data Sheets (SDS) became standardized into a 16-section format under the Globally Harmonized System (GHS) when fully implemented in 2016. Prior to the GHS changes, these were commonly known as Material Safety Data Sheets or MSDS. The SDS are more uniform and applicable to those who have adopted the GHS. These documents provide valuable information on hazardous chemicals and must be readily available for all chemicals in the laboratory either in hard copy or electronic format. The SDS information is useful for establishing parameters for a safe workplace and is invaluable if emergencies involving the chemical occur. It is the responsibility of the Laboratory Supervisor to maintain the SDS and have appropriate instructions to find them in the need of emergency or special situations like spills or accidental exposure. For every new chemical purchased, the SDS list must be updated within the lab and employees trained on the new chemical's hazards.

The SDS contains information on the potential hazards (health, fire, reactivity, and environmental) and how to work safely with the chemical product. The SDS contains information on the use, storage,

handling, and emergency procedures all related to the hazards of the material. The SDS contains much more information about the material than the chemical label. SDSs are prepared and provided by the supplier or manufacturer of the material.

If you do not have the SDS for any chemical:

- Search for it online by typing in the specific chemical name followed by "SDS" or "Safety Data Sheet"
- Call the manufacturer
- For further assistance call EHSRM at 468-6034, or email safety@sfasu.edu.

A SDS will have the following 16 section format:

Section 1, Identification includes product identifier; manufacturer or distributor name, address, phone number; emergency phone number; recommended use; restrictions on use.

Section 2, Hazard(s) identification includes all hazards regarding the chemical; required label elements.

Section 3, Composition/information on ingredients includes information on chemical ingredients; trade secret claims.

Section 4, First-aid measures includes important symptoms/effects, acute, delayed; required treatment.

Section 5, Fire-fighting measures lists suitable extinguishing techniques, equipment; chemical hazards from fire.

Section 6, Accidental release measures lists emergency procedures; protective equipment; proper methods of containment and cleanup.

Section 7, Handling and storage lists precautions for safe handling and storage, including incompatibilities.

Section 8, Exposure controls/personal protection lists OSHA's Permissible Exposure Limits (PELs); Threshold Limit Values (TLVs); and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the SDS where available as well as appropriate engineering controls; personal protective equipment (PPE).

Section 9, Physical and chemical properties list the chemical's characteristics.

Section 10, Stability and reactivity lists chemical stability and possibility of hazardous reactions.

Section 11, Toxicological information includes routes of exposure; related symptoms, acute and chronic effects; numerical measures of toxicity.

Section 12, Ecological information may include information on ecotoxicity, degradability, bio accumulative potential, soil mobility, and other environmental hazards.

Section 13, Disposal considerations gives information on safe handling for disposal and methods of disposal.

Section 14, Transport information includes the UN number, proper shipping name, transport hazard classes, packing group, and special transport precautions.

Section 15, Regulatory information includes the safety, health, and environmental regulations specific to the product.

Section 16, Other information includes the date of preparation or last revision.

3.2.4. Labels

Container labeling can be a very effective method to communicate the physical and health hazards of chemicals used in laboratories. Chemical containers must contain the following basic information:

- Identity of the Chemical,
- Appropriate Hazard Warnings and
- Name and Address of the manufacturer, distributor or responsible party.

The containers that you receive directly from the manufacturer or distributor are called primary containers. The following chemical label guidelines apply to all chemical containers on the SFA campus:

- All chemical containers must be labeled.
- All labels must be legible in English and include chemical/product name. Chemical formulas are not acceptable.
- Whenever required they should include information related to relevant hazards.
- Labels on incoming containers must not be removed or defaced.
- Date all chemical containers which may become unstable over time with the appropriate expiration date.
- Waste chemical containers must be clearly marked "Hazardous Waste" indicating specific name of waste chemical and date when full.
- All secondary containers should be labeled and include all the basic label information mentioned above just like primary containers.

3.2.5 Signs

Every laboratory should visibly post the following signs and posters:

- Emergency Procedures and Contact Information
- Employee Right to Know poster
- Special hazards/emergency instructions when appropriate
- No food or drink signs on laboratory refrigerators and freezers
- Warning signs at areas or equipment where special or unusual hazards exist like excessive flammables or fragile equipment.

3.3 Chemical Handling Practices

Specific requirements for purchasing, storage, labeling, and communicating chemical hazards in the lab must be followed. The following sections describe in more detail these requirements related to chemical safety.

3.3.1 Purchasing Chemicals

When purchasing chemicals for the laboratory, less hazardous alternatives to chemicals used in various protocols should be considered. Always know the appropriate waste handling procedures for the chemicals purchased provided in the SDS. Contact EHSRM for assistance with waste handling procedures at 468-6034 or safety@sfasu.edu. The department who orders or uses the chemical is

ultimately responsible for appropriate disposal of the chemical, including payment of disposal fees. Therefore, waste management costs for the chemicals should be included in the respective budgets.

Another consideration when purchasing chemicals for the laboratory is duplication. If a lab with multiple researchers or users does not control ordering and maintain an accurate inventory, duplication of inventory items will result. This practice consumes lab storage space and also increases the amount of hazardous chemicals in the lab as well as increased waste management costs.

3.3.2 Transportation and Distribution of Chemicals

Occasionally chemicals will need to be moved from one location to another. Chemicals carried by hand should be placed in a closable secondary container such as a bucket or plastic box. These secondary containers provide protection to the bottle and help keep it from breaking. They also help to minimize spillage if the bottle does break or leak. 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. It is always recommended that you have hazardous chemical purchases delivered directly to the laboratory. If transporting large amounts of chemicals for a laboratory move, contact EHSRM at 468-6034 for consultation on safe packing and transport.

3.4 Laboratory Chemical Storage

Proper storage of chemicals in laboratories is always a major concern. Chemicals that have been stored improperly could react, forming hazardous products, or be released to the environment. Each department is responsible for safely storing and managing their chemicals. The following guidelines will assist in proper chemical storage:

- Chemicals should be segregated based on their physical and chemical hazards and stored with compatible chemicals (e.g. corrosives, flammables, toxic, or reactive).
- If a chemical exhibits more than one hazard, segregate by using the characteristic that exhibits the primary hazard. Refer to the Chemical Compatibility Guide on page 13 for more details.
- Always read the label and SDS carefully before storing a chemical. The SDS for most materials lists incompatibilities for that chemical.
- Do not store chemicals near heat sources or in direct sunlight.
- Date chemicals when received and first opened. Always use the old chemicals first which will reduce the amount of chemicals for disposal.
- Keep in mind the expiration dates for chemicals.
- Never use lab benches as permanent storage areas for chemicals.
- Inspect chemicals regularly for any signs of deterioration and for the integrity of the label.
- Never use unlabeled chemicals.
- Never store chemical containers on the floor or on the edge of shelves. All shelves used for chemical storage should have lips (raised edges) to prevent any spillage or overturns.
- Do not use fume hoods as a permanent storage location for chemicals, with the exception of particularly odorous chemicals that may require ventilation.
- Never store chemicals above the eye level. If there is a leak or breakage, the contents will fall onto your face and upper body.
- Chemicals that need refrigeration must be sealed with tight fitting caps and kept in laboratory safe refrigerators. Do not clutter the refrigerators with stored chemicals.
- Never store flammable liquids in a standard or domestic refrigerator or freezer. They have numerous ignition sources that could ignite vapors.

- Do not store excessive amounts of chemicals in the lab. Unnecessary storage of chemicals is a fire hazard and limits work place. It also increases the waste generated and thus waste disposal costs.
- Contact EHSRM at 468-6034 for any disposal of old, outdated or unused chemicals.

3.4.1 Chemical Compatibility Guide

As mentioned in the previous section, proper chemical storage is imperative. Storing incompatible chemicals together could result in injury or damage to property due to fire, explosion, or the generation of toxic gases. The following information will assist you in determining which chemicals may be stored together and those that require segregation.

Hazardous chemical reactions can occur from improper storage when incompatible materials mix because of:

- Accidental breakage
- Container failure
- Fires and earthquakes
- Mixing of gases or vapors from poorly closed containers
- Mistakenly storing incompatibles together because of improperly labeled containers

3.4.1.1 Incompatible Chemicals

The list below is an example of incompatible chemicals. Substances in the left-hand column should be stored and handled so that they cannot accidentally contact corresponding substances in the right-hand column. This is a partial list of some common laboratory chemicals and is not intended to cover every chemical that may be stored in your lab.

Chemical Name:	Incompatible With:
Acetic Acid	Chromic acid, nitric acid, peroxides, permanganates
Acetic anhydride	Hydroxyl-containing compounds such as ethylene glycol, Perchloric acid
Acetone	Concentrated nitric and sulfuric acid mixtures, hydrogen peroxide
Acetonitrile	Strong acids and bases
Acetylene	Chlorine, bromine, copper, silver, fluorine, mercury
Alkali and alkaline earth metals, such as sodium, potassium, lithium, magnesium, calcium, powdered aluminum	Carbon dioxide, carbon tetrachloride, other chlorinated hydrocarbons (also prohibit the use of water, foam, and dry chemical extinguishers on fires involving these metals—dry sand should be employed)
Ammonia (anhydrous)	Mercury, chlorine, calcium hypochlorite, iodine, bromine, hydrogen fluoride
Ammonium hydroxide	Strong acids, hydrogen peroxide, acidic metals
Aniline	Nitric acid, hydrogen peroxide
Chromic acid and chromium trioxide	Acetic acid, naphthalene, camphor, lycerol, turpentine, alcohol, other flammable liquids

Chlorine	Ammonia, acetylene, butadiene, butane, other petroleum gases, hydrogen, sodium carbide, turpentine benzene, finely divided metals
Chloroform	Alkali metals (e.g. sodium, potassium), acetone, strong bases
Copper	Acetylene, hydrogen peroxide
Fluorine	Isolate from everything
Formaldehyde	Nitric acid, sulfuric acid, hydrochloric acid, Perchloric acid, anhydrides, inorganic acids
Hydrazine	Hydrogen peroxide, nitric acid, any other oxidant
Hydrocarbons (benzene, butane, propane, gasoline, turpentine, etc.)	Fluorine, chlorine, bromine, chromic acid, peroxides
Hydrochloric acid	Strong bases, permanganates, chlorates, chlorites
Hydrocyanic acid	Nitric acid, alkalis
Methanol	Perchloric acid, sulfuric acid, nitric acid, highly reactive metals (e.g., potassium, sodium, magnesium)
Nitric Acid	Acetic anhydride, acetone, Acetonitrile, alcohols, thiols, amines, dichloromethane, DMSO, benzene, bases
Phenol	Nitric acid, Perchloric acid, sulfuric acid
Pyridine	dinitrogen tetroxide, acid chlorides, anhydrides, Perchloric acid

3.4.1.2 Classes of Incompatible Chemicals

The following list of incompatible chemicals is arranged by chemical class and covers a broader range of the types of chemicals found in laboratories. Mixing incompatible chemicals could result in serious injury, property damage, or even death!

Chemical Class:	**Incompatible With:**
Alkali and alkaline earth • Carbides • Hydrides • Hydroxides • Metals • Peroxides	Water Acids Halogenated organic compounds Halogenating agents Oxidizing agents
Azides, inorganic	Acids Heavy metals and their salts Oxidizing agents
Cyanides, inorganic	Acids Strong bases
Nitrates, inorganic	Acids Reducing agents
Organic compounds	Oxidizing agents

• Organic acyl halides	Bases Organic hydroxy and amino compounds
• Organic anhydrides	Bases Organic hydroxy and amino compounds
Organic halogen compounds	Group IA and IIA metals Aluminum
Organic nitro compounds	Strong bases
Oxidizing agents	Reducing agents
Chlorates	Ammonia, anhydrous and aqueous
Chromates	Carbon
Chromium trioxide	Metals
Dichromates	Metal hydrides
Halogens	Nitrites
Halogenating agents	Organic compounds
Hydrogen peroxide	Phosphorus
Nitric acid	Silicon
Nitrates	Sulfur
Reducing agents	Oxidizing agents Arsenates Arsenites Phosphorus Selenites Selenates Tellurium salts and oxides
Sulfides, inorganic	Acids

There are a variety of chemical hazards found in campus laboratories. The following sections describe some of the more common chemical hazards which may be present and tips designed to help maintain a safe working environment:

3.4.2 Flammables

Flammable materials can be found in any physical state including: aerosols, gases, liquids, and solids. In most laboratory situations, gases, liquids, and solids will be the main concern. Flammable gases are defined by OSHA to be "(A) a gas that has a flammable range with air at 20 °C and standard pressure at 101.3 kPa; or (B) forms a flammable mixture with air at a concentration of 13% by volume or less at ambient air; or (C) a gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air wider than 12% by volume, regardless of the lower limit." Flammable liquids mean any liquid having a flashpoint below 100°F. Flammable solid means "a solid which is a readily combustible solid, or which may cause or contribute to fire through friction." The Safety Data Sheet is a good source for determining if a chemical is flammable. In addition, most flammable substances are labeled as such.

For the purpose of this manual, we will define a flammable liquid as any liquid with a flash point below 100°F. The flash point of a liquid is the lowest temperature at which a liquid gives off vapor at such a rate to form an air & vapor mixture that will ignite, but will not sustain ignition. Flammable liquids are indeed the most common chemicals found in a laboratory. It is the vapor of a flammable liquid, not the liquid itself that often ignites and causes a fire.

Examples of flammable liquids with flashpoint less than 100°F: All alcohols, acetone, acetaldehyde, acetonitrile, amyl acetate, benzene, cyclohexane, dimethyldichlorosilane, dioxane, diethyl ether, ethyl acetate, histoclad, hexane, hydrazine, methyl butane, picolene, piperidine, pyridine, some scintillation liquids, all silanes, tetrahydrofuran, toluene, triethylamine, and xylene.

Follow these safety tips when working with flammable materials:

- Any solvent not in a flammable liquid storage cabinet is considered to be unprotected.
- A flammable cabinet is a metal cabinet meeting the design and construction requirements of NFPA 30 and have been tested and listed by third parties like Factory Mutual Laboratories.
- Flammable liquid storage cabinets shall not be located near exit doorways, stairways, or in a location that would impede egress.
- Laboratory design must ensure that flammable liquid storage cabinets are not located near an open flame or other ignition source.
- Glass containers storing flammables should be limited to 1 pint in size whenever practical. When not in use, they should be stored in a flammable liquid storage cabinet.
- Transferring of flammable liquids from one container to another should always be done in a laboratory fume hood or an approved bulk chemical storage room.
- When flammable or combustible liquids present multiple hazards, the Laboratory Supervisor shall address the storage requirements for each hazard.
- Incompatible flammable materials should not be stored within the same cabinet.
- Minimize the amount of flammables stored in the lab.
- Never store flammable chemicals in a standard household refrigerator.
- Flammable liquid storage cabinets shall be conspicuously labeled with the words "FLAMMABLE – KEEP FIRE AWAY" or similar wording.

3.4.3 Corrosives

Corrosive materials are those that cause visible destruction of, or irreversible alterations by chemical action at the site of contact. Corrosives are most commonly acids and bases, but many other materials can also be severely damaging. Strong oxidizing materials can also cause burns and damage to the eyes and skin. Certain substances considered non corrosive in their natural dry state are corrosive when wet such as when in contact with moist skin or mucus membranes. Examples of these materials are lithium chloride, halogen fluorides, and allyl iodide. Sulfuric acid is a very strong dehydrating agent and nitric acid is a strong oxidizing agent. Dehydrating agents can cause severe burns to the eyes due to their affinity to water. The SDS will indicate if a chemical is corrosive.

Follow these safety tips when storing or handling corrosives:

- Always store acids separately from bases.
- Store acids in acid storage cabinets away from flammables since many acids are strong oxidizers.
- Corrosives stored in an ordinary metal cabinet will quickly damage it. Store corrosives in a wooden, plastic, or other type of cabinet that is corrosion resistant.
- Nitric acid should be stored in a separate cabinet or compartment.

3.4.3.1 Mineral Acids

Oxidizing: Examples: Sulfuric acid, Nitric acid, Chromic acid, Perchloric acid etc.

- Store separately from organic acids.
- Highly reactive with most substances.
- Perchloric acid presents special hazards. Take precautions to isolate it from acetic anhydride, bismuth and its alloys, alcohol, paper, wood, oil, ether, grease, and sulfuric acid. Never keep it near acetic acid. Only use in an approved perchloric fume hood!

Non Oxidizing: Examples: Hydrochloric, hydrofluoric, phosphoric, hydroiodic.

- Hydrofluoric is extremely hazardous and requires special attention. It can cause severe burns and inhalation of anhydrous hydrogen fluoride can be fatal.
- Always use hydrofluoric acid in a properly functioning fume hood and always wear personal protective clothing.
- Never store it in a glass container as it is incompatible with glass. Store it separately in an acid storage cabinet and keep only the required amount in lab.
- If you come in contact with hydrofluoric acid, promptly seek medical attention.

3.4.3.2 Organic Acids

Examples: Acetic acid, Butyric acid, Formic acid, Propionic acid.

- Store separately from oxidizing mineral acids.
- Corrosive to metal surfaces.
- Store in a ventilated corrosive storage cabinet if possible.
- Can be stored with organic solvents unless otherwise stated on the SDS.
- Keep Perchloric acid away from acetic acid.

3.4.4 Oxidizers

Oxidizers are agents that initiate or promote combustion in other materials, thereby causing fire to burn more rapidly through the release of oxygen or other gases. Depending on the class of the chemical, an oxidizing material may increase the burning rate of combustibles with which it comes in contact or causes the spontaneous ignition of combustibles with which it comes in contact. Some oxidizers can cause an explosive reaction when exposed to heat, shock, or friction.

Note: Oxidizers are generally corrosive.

Examples: Peroxides, Nitrates, Nitrites, Perchlorates, Chlorates, Chlorites, Hypochlorites, Dichromates etc.

<u>Follow these safety tips when handling or storing oxidizers in the lab:</u>

- Oxidizers form explosive combinations with flammable or combustible material. For this reason, they should be stored away from solvents, organic compounds, and combustible materials and in a cool, dry location.
- Never store them under the sink.
- Strong oxidizing agents like chromic acid should be stored in glass or some other inert container, preferably unbreakable. Corks and rubber stoppers should not be used.
- Perchloric acid is an oxidizing agent of particular concern. Whenever possible, substitute a less hazardous chemical for Perchloric acid.

- Do not allow Perchloric acid to come in contact with any strong dehydrating agents such as sulfuric acid. The dehydration of Perchloric acid is a severe fire and explosion hazard.
- **Only use Perchloric acid in an approved perchloric fume hood!**

3.4.5 Water Reactive Materials

Water reactive materials are chemicals, which react violently with water to produce heat and flammable or toxic gas. They can be particularly hazardous to firefighting personnel responding to a fire in a lab because water is the most commonly used fire extinguishing medium.

Examples: Alkali metals like lithium, sodium, potassium, Alkali metal hydrides, Alkali metal amides, Metal alkyls such as lithium alkyls and aluminum alkyls, Grignard reagents, Magnesium, Silanes, Zinc, Aluminum, Anhydrous metal halides like AlCl3, TiCl4, ZrCl4, SnCl4, Halides of non-metals like POCL3, SOCl2, SO2 Cl2, Halides of non-metals like BCl3, BF3, PCl3, PCl5, Phosphorous pentoxide, Calcium Carbide, Organic acid halides and anhydrides of low molecular weight.

3.4.6 Pyrophoric Materials

Pyrophoric means a chemical that will ignite spontaneously in air at a temperature of 130°F (54°C) or below.

Classes of Pyrophoric Chemicals:
Grignard reagents, RMgX
Metal alkyls and aryls, such as RLi, RNa, R 3 Al, R 2 Zn
Metal carbonyls, such as Ni(CO)4 , Fe(CO)5 , Co 2 (CO)8
Alkali metals such as Na, K
Metal powders, such as Al, Co, Fe, Mg, Mn, Pd, Pt, Ti, Sn, Zn, Zr
Metal Hydrides, such as NaH, LiAlH 4
Nonmetal hydrides, such as B 2 H 6 and other boranes, PH 3 , AsH 3
Nonmetal alkyls, such as R 3 B, R 3 P, R 3 As
Phosphorus (white)

3.4.7 Peroxide Forming Materials

Peroxide forming materials are chemicals that react with air, moisture, or impurities for form peroxides. The tendency to form peroxides is greatly increased by evaporation or distillation. Peroxide forming materials can form shock sensitive peroxide crystals over time or upon exposure to air. Organic peroxides are extremely sensitive to shock, sparks, heat, friction, impact, and light. They are very unstable and some chemicals that can form them are commonly used in laboratories. The most common peroxide forming chemicals in use are diethyl ether and tetrahydrofuran (THF). Peroxide formation cannot be prevented once the chemical has been opened unless the chemical is maintained under an inert atmosphere. *For this reason, it is recommended that all peroxide formers be dated when received, and periodically evaluated using test strips to indicate peroxide formation. It is prudent practice to maintain only the inventory necessary to complete ongoing work. DO NOT STOCKPILE! The Safety Data Sheet is a good source for determining if a material is capable of forming peroxides.*

<u>Follow these safety tips when handling or storing chemicals with the potential for form peroxides:</u>

- Do not open the chemical container if peroxide formation is suspected. 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.
- Date all peroxide forming materials with the date received, and the expected shelf life. Chemicals such as diisopropyl ether, divinyl acetylene, sodium amide, and vinylidene chloride should be discarded after three months. Chemicals shuch as dioxane, diethyl ether, and tetrahydrofuran should be disposed after one year.
- Store all peroxide forming materials away from heat, sunlight, and sources of ignition. Sunlight accelerates the formation of peroxides.
- Secure the lids and caps on these containers to discourage the evaporation and concentration of these chemicals.
- Never store these chemicals in glass containers with screw cap lids or glass stoppers. Friction and grinding must be avoided. Also, never store them in a clear glass bottle allowing exposure to light.

Classes of Chemicals That Can Form Peroxides Upon Aging

Class I: Unsaturated materials, especially those of low molecular weight, may polymerize violently and hazardously due to peroxide initiation.

Acrylic acid	Tetrafluoroethylene
Acrylonitrile	Vinyl acetate
Butadiene	Vinyl acetylene
Chlorobutadiene (chloroprene)	Vinyl chloride
Chlorotrifluoroethylene	Vinyl pyridine
Methyl methacrylate	Vinylidene chloride
Styrene	

Class II: The following chemicals are a peroxide hazard upon concentration (distillation/ evaporation). A test for peroxide should be performed if concentration is intended or suspected.

Acetal	Dioxane (r-dioxane)
Cumene	Ethylene glycol dimethyl ether (glyme)
Cyclohexene	Furan
Cyclooctene	Methyl acetylene
Cyclopentene	Methyl cyclopentane
Diacetylene	Methyl-i-butyl ketone
Dicyclopentadiene	Tetrahydrofuran
Diethylene glycol dimethyl ether (diglyme)	Tetrahydronaphthalene
Diethyl ether (ether)	Vinyl ethers

Class III: Peroxides derived from the following compounds may explode without concentration.

Organic	Inorganic
Divinyl ether	Potassium metal
Divinyl acetylene	Potassium amide
	Sodium amide (sodamide)

Isopropyl ether
Vinylidene chloride

NOTE: Lists are illustrative but not exhaustive.

3.4.8 Compressed Gas Cylinders

Compressed gas cylinders in the laboratory pose both chemical and physical hazards. These cylinders are safe under normal use; however, serious accidents have resulted from the misuse, abuse, or improper handling of compressed gases. If a valve is damaged as the result of the tank being knocked over, the cylinder can become a projectile causing severe injury. Some gases also present a fire hazard due to their high degree of flammability.

Follow these safety tips when handling or storing compressed gas cylinders in the lab:

- Secure cylinders in an upright position with proper chain, stand, or strap at all times. Stored cylinders must have the valves closed and the valve covers must be in place.
- The valve protection cap should be left in place until the cylinder is secured and ready for use. Never struggle with a cylinder cap or use a screw driver to remove a cylinder cap. Do not drop cylinders or allow them to be struck with violent force. Use cylinders in an upright position, unless equipment manufacturer provides specific instructions otherwise.
- Turn all valves off when not in use.
- Do not modify relief valves.
- Know the contents, properties, and health hazards associated with the contents. Contents must be clearly labeled.
- Notify distributor immediately of any problems in the operation or condition of the cylinder (e.g. dents).
- Ensure all hardware connecting the cylinder to receiver is compatible with the pressure and contents to which it is exposed always use the correct gauge for the pressure and chemical to which it is exposed.
- Select the smallest reusable cylinder compatible with the need.
- Always release pressure from regulator before disconnecting.
- Emergencies: in the event of a cylinder emergency such as a significant leak, evacuate the area, shut the door, and call 911.
- Always return compressed gas cylinders to the supplier when finished. If cylinders cannot be returned to supplier, contact EHSRM at 468-6034 for proper disposal.
- Never store cylinders of flammable gases (empty or full) near cylinders of oxygen or other oxidizers. A minimum separation of 20 feet or specially designed separation wall must be maintained. When practical, store cylinders a minimum of 20 feet from flammable liquids and away from sources of heat. If this is not practical, consult EHSRM at 468-6034 for assistance.
- Never store cylinders in a path of egress.
- Clearly mark "empty" cylinders with tag or sign. Separate "empty" and "full" cylinders to avoid confusion.
- Cylinders must be hydrostatically tested every 10 years. Note the last test date on top of the cylinder. Notify the supplier immediately if outdated cylinders are identified.
- Keep amount of flammable gases to a minimum. The number of flammable gas cylinders (10"x50") must not exceed 3 cylinders per 500 square feet in a non- sprinkled building or 6 cylinders per 500 square feet in a sprinkled building.

- Never rely on color-coding as a way to identify the compressed gas cylinder. Color codes are for the owner's convenience.
- Transport cylinders in an upright position.
- Never roll or drag full or empty cylinders. Preferred transport method is to secure cylinders (with valve covers in place) to a hand truck or similar mode of transport.
- Do not move a cylinder that has a regulator on it even if main tank valve is off.
- Treat "empty" cylinders with the same respect as "full" cylinders.
- Transport of cylinders via stairs is discouraged unless other means of upper floor access is not available. When transporting cylinders via stairs, the cylinders must be capped and secured in an upright position to a hand truck suitable for use on stairs.

3.5 Exposure Control Measures

Exposure controls are the first line of defense in minimizing and preventing chemical exposures in the lab. The following sections describe common exposure controls found in laboratories at SFA. Following these safety guidelines and reporting problems with equipment will greatly minimize the risks associated with chemical exposures.

3.5.1 Chemical Fume Hoods

Chemical fume hoods are the most reliable and primary engineering control used in the laboratory to protect against the inhalation of hazardous vapors and gases. A fume hood is a partially enclosed workspace that is exhausted, in most cases, to the outside of the building. An efficiently working fume hood minimizes a person's exposure to airborne contaminants and prevents them from reaching the breathing zone. It also provides protection from unanticipated fires, explosions, and chemical splashes.

Optimum airflow, or face velocity, of a chemical fume hood is 80-120 feet per minute. This range allows the hood to properly contain and exhaust contaminants, reduces the chance for escape of fumes via turbulence and outside air movement. Face velocities below 80 fpm are likely to allow contaminants to escape from the hood and face velocities above 120 fpm can cause excessive turbulence and can also allow contaminants to escape.

3.5.1.1 Types of fume hoods and their function

There are several types of fume hoods that are located within different types of laboratories. Each type of fume hood provides a unique function by design.

- Constant Air Volume (CAV)/ Conventional Hood –The volume of airflow within this type of hood remains constant. All air enters through the sash opening. As one lowers or raises the sash the velocity of the airflow increases and decreases respectively. It is very important to properly position the sash in order to maintain the optimum face velocity (80-120 feet per minute).
- Bypass Hoods – This type of hood is essentially the same as a conventional/CAV hood. The only difference is that it has an air bypass above the sash that provides an additional source of room air when the sash is closed. The bypass area becomes exposed as the sash is lowered, which reduces the rate of increase in the face velocity and reduces the chance for turbulence and loss of containment. As with the conventional/CAV hoods, it is important to properly position the sash in order to maintain a face velocity of 80-120fpm.
- Auxiliary Air Hood – This type of hood is similar to the bypass hood. The difference being that the source of the bypass air does not come from inside the lab but from a dedicated duct that brings in air from outside of the building. While this type of hood saves energy by reducing the

amount of air-conditioned or heated room air exhausted through the hood, it can cause discomfort for those working in or around the hood. It is important to remember to close the sash when the hood is not in use. This will allow the unconditioned air to bypass through the hood and reduce the effect on the temperature and humidity in the lab

- Variable Air Volume (VAV) – These hoods are very sophisticated and have the ability to maintain a constant face velocity as the height of the sash is lowered and raised. The exhaust volume is adjusted when the sash is moved so that the average face velocity is maintained within set parameters. The sash of a VAV hood should be closed when not in use in order to conserve energy.

(Most hoods on campus are standard VAV hoods)

- Radioactive Hood – Any of the above listed hoods can also be used for radioactive materials. The only stipulation is that the interior work surface must be impervious (usually stainless steel). In some cases, the hood is also required to have a filter at the hood outlet that Radiation Safety is able to monitor.

(The SFA Radiation Safety Officer will mark hoods with the above sticker if they are approved for radioactive materials use)

Note: SFA does not currently have an active Radioactive Materials License for the use of regulated radioactive materials on campus. Contact EHSRM at 468-6034 for more information regarding the use of radioactive materials.

- Perchloric Acid Hood – Perchloric acid will vaporize when heated above ambient temperatures. Once vaporized, it may condense in the hood, ducting, and fan components. These condensed vapors are corrosive and can react with other collected materials to form explosive perchloric salts and esters. To minimize the corrosive and reactive effects of these compounds, perchloric acid hoods are built with welded stainless steel hood surfaces, ductwork, and fans and are equipped with a wash down system. This system should be used after each use of heated perchloric acid. Any materials that are deposited within the system are washed away which prevents the buildup of percholrates. Perchloric hoods must be used if perchloric acid is to be used above ambient temperature or at concentrations above 72%.
- Ductless/Recirculating hood – These hoods filter air through HEPA or charcoal filters and then discharge the filtered air back into the laboratory. These hoods are not common and must be approved by EHSRM prior to installation. Contact EHSRM at 468-6034 or safety@sfasu.edu for more information.

3.5.1.2 Fume Hood Safety and Guidelines

While the chemical fume hood is a very effective engineering control, it does not provide absolute containment or protection. However, adequate protection can be provided by an efficiently working hood in a properly ventilated room. Certain work practices are required for the hood to have this efficiency. The following work practices are required at a minimum. More stringent practices may be necessary in some circumstances when deemed necessary by the Laboratory Supervisor or Principal Investigator.

- Wear appropriate personal protective equipment when working with chemicals, even when work is conducted in a fume hood. At a minimum wear eye protection, gloves, and lab coat.
- The recommended working heights are most commonly between 12 and 18 inches depending on the procedure. Contact your Lab Supervisor or Principal Investigator for the recommended working height of the particular hood. Hoods should be marked with an arrow or other indicator showing the proper sash height for optimal performance.
- It is suggested that the hood sash be lowered or closed when not in use. As a general rule, the hood should not be used with the sash fully open.

- Any and all operations & experiments that generate air contaminants above the exposure limit must be conducted inside a hood


GOOD

(This person is using the fume hood at the certified or marked working height. They are also wearing gloves, safety glasses and their lab coat as additional protection against spills, splatters and explosions)


BAD

(This person is not using the fume hood at the certified or marked working height. They are not wearing any personal protective equipment which is even more important when someone is not using the fume hood correctly.)

- Do not position air vents or fans so as to direct airflow across the face of the hood.
- All apparatus should be a minimum of 6 inches back from the face of the hood.
- Do not put your head in the hood when contaminants are being generated.
- Fume hoods are not to be used as a waste disposal mechanism. Evaporating a hazardous waste is a violation of federal hazardous waste regulations and could result in serious fines.
- Do not store chemicals or apparatus in the hood. This can greatly impair its performance. Exceptions may be made for ongoing experiments that require the use of a fume hood.

Fume hoods cannot be used for storage

- Be sure that the hood is on when in use. (A simple way to make sure that the hood is pulling in air is to tape a wipe or paper to the bottom of the sash. If it is not pulled back towards the inside of the hood, it may not be on or may be broken and need to be checked by EHSRM. Some fume hoods are equipped with a digital meter or other mechanical device indicating the air flow velocity.

- Fume hoods may not adequately contain hazardous solids in powder form.
- The slots of the baffles along the back of the hood should be kept free of obstruction. No more than 25% of the bottom slot should be blocked.
- Foot traffic past the hood should be kept to a minimum when in use.
- Laboratory doors and windows should be kept closed.
- Do not remove the hoods sash or panels except when it is necessary to set-up apparatus. They must be replaced before any operations begin.
- Do not place any spark source (i.e. electrical receptacles) inside the hood when flammable gases or liquids are present.
- If there is a chance of explosion or eruption, use an appropriate barricade or shield.
- It is suggested that all large equipment be elevated 1-2 inches above the working surface of the hood. This reduces the amount of baffle blockage and maintains the hoods performance.

3.5.1.3 Certification of Fume Hoods

EHSRM measures the face velocity of every chemical fume hood at SFA and certifies them annually. The Physical Plant Department is notified when repairs are needed to restore any marginal or failing hood to a passing range or to fix any monitor or general issues associated with the hood. Once repairs have been made, EHSRM is notified by Physical Plant and the hood is rechecked and recertified if passing. If you work in a lab with a chemical fume hood and notice a problem with the air flow, monitor, or general function of the hood, please contact EHSRM at 468-6034.

3.5.2 Personal Protective Equipment

The next exposure control method in minimizing and preventing chemical exposure is personal protective equipment (PPE). The most important thing to remember about PPE is that it only protects you if you wear it. Safety Data Sheets or other references should be consulted for information on the type of PPE required for the particular work you are performing. The Laboratory Supervisor or Principal Investigator are primarily responsible for providing and ensuring that all workers and personnel are using the appropriate PPE.

3.5.2.1 Protective Clothing

- Lab coats are designed to protect clothing and skin from chemicals that may be spilled or splashed. Lab coats should be properly fitted to the wearer and is best when knee length. There are several types of lab coats for different types of protection:

    - Cotton protects against flying objects, sharp or rough edges and is usually treated with a fire retardant. Since many synthetic fabrics can adhere to skin when burning, and thereby increase the severity of a burn, cotton is the most preferred laboratory clothing fabric.
    - Wool protects against splashes of molten materials, small quantities of acid and small flames.
    - Synthetic fibers protect against sparks and infrared or ultraviolet radiation. However, synthetic fiber lab coats can increase the severity of some laboratory hazards. For instance, some solvents may dissolve particular classes of synthetic fibers, thereby diminishing the protective ability of the coat. In addition, on contact with flames, some synthetic fibers will melt. The molten material can cause painful skin burns and release irritating fumes.
    - Aluminized and reflective clothing protect against radiant heat.

- An apron provides an alternative to the lab coat. It is usually made of plastic or rubber to protect the wearer against corrosive or irritating chemicals. An apron should be worn over garments that cover the arms and body, such as a lab coat.
- Loose or torn clothing can fall into chemicals or become caught in equipment and moving machinery. Aprons, lab coats, and other protective clothing should be readily available and utilized in a laboratory environment.
- If necessary, long hair should also be tied back. Loose hair can catch fire, dip into chemical solutions, or get caught in machinery.

3.5.2.2 Foot Protection

Foot protection is essential to prevent injury from corrosive chemicals, heavy objects, electrical shock, and gives traction on wet floors. For this reason, shoes that completely cover and protect the foot are required in labs.

Though it is practically impossible to provide foot safety gear to everyone working in the laboratories, the following shoe types should never be worn in the laboratory:

- Sandals
- Clogs
- High Heels
- Shoes that expose the foot in any way

3.5.2.3 Protective Gloves

- Any glove can be permeated by chemicals. The rate at which this occurs depends on the composition of the glove, the chemicals present and their concentration, and the exposure time to the glove. Glove manufacturers and the Safety Data Sheets accompanying products in use are good sources of specific glove selection information, or contact EHSRM for assistance in selection. Below is some helpful information regarding glove suitability.
  The following information is helpful in proper glove selection:

  - Latex "surgeons" or "exam" gloves are a general use laboratory glove and provide minimal chemical resistance and light protection against irritants and limited protection against infectious agents.
  - PVC protects against mild corrosive and irritants.
  - Natural rubber gloves protect against mild corrosive material and electric shock.
  - Neoprene gloves are suitable for working with solvents, oils, or mild corrosive material.
  - Butyl, Neoprene and nitrile gloves are resistant to most chemicals, e.g., alcohols, aldehydes, ketones, most inorganic acids, and most caustics.
  - Cotton gloves absorb perspiration, keep objects clean and provide some limited fire retardant properties.
  - Zetex gloves resist abrasion, most acids (except hydrofluoric acid), alkalis and solvents.

- If direct chemical contact occurs, replace gloves regularly throughout the day. Wash hands regularly and remove gloves before answering the telephone or opening doors to prevent spread of contamination.
- Check gloves for cracks, tears, and holes before use.
- Care should be taken when removing gloves. Peel the glove off the hand, starting at the wrist and working toward the fingers. Keep the working surface of the glove from contacting skin during removal. Disposable gloves should be discarded after each use. Never reuse disposable gloves.
- Always wash hands as soon as possible after removing protective gloves.

3.5.2.4 Eye and Face Protection

Laboratory work may require eye and face protection to reduce the possibility of chemical exposures due to splashes. Eye protection is required for everyone who enters a chemical work area. The type of eye protection needed depends on the circumstances. Typically, safety goggles that protect the top, bottom, front and sides of the eyes are recommended and may be required. If contact lenses are worn the Laboratory Supervisor or Principal Investigator and co-workers should all be aware of this, in case an accidental splash renders the wearer of such lenses incapable of washing or rinsing his or her eyes. Contact lenses must be removed when washing the eyes in order to adequately wash the chemical from the eyes.

Face shields are necessary when working with severely corrosive liquids, with glassware under reduced or elevated pressure, with glass apparatus used in combustion or other high-temperature operations, and when there is a possibility of an explosion or implosion.

3.5.2.4 Respirators

Respirators may sometimes be relied on if the engineering controls and laboratory design do not adequately limit the potential exposure to hazardous air contaminants. The proper selection and type of respirator used should be based on a thorough analysis of the specific activity planned. Individuals planning to use respiratory protection should contact EHSRM for fit testing and training. See the SFA Respiratory Protection Plan on the EHSRM website at: https://www.sfasu.edu/safety/documents/protective_clothing(1).pdf for more details.

3.5.3 Safety Showers and Eye Wash Stations

Each laboratory area should be equipped with a safety shower and eye wash station. The ANSI standard, Z358.1-2014, emergency eyewash and shower equipment, requires that emergency showers and eyewash stations be located no more than 10 seconds in time or 100 feet from the hazard. This safety equipment must be readily accessible, be kept clear of obstructions, and clearly labeled. EHSRM will inspect all campus safety showers and eyewashes at least annually. Additionally, lab staff should test eyewash stations weekly to maintain a clean flow of water. All employees and students must be familiar with the location and use of safety showers and eye wash even if their job does not involve working directly with hazardous chemicals.

3.5.3.1 Safety Showers

- Shower valves must open readily and remain open until intentionally closed.
- Although an associated floor drain is desirable, its absence should not prohibit installation of a safety shower.
- Water delivered must be a minimum of 20 gallons per minute.

3.5.3.2 Eye/Face Wash Stations

- Eye wash stations are designed to provide a gentle and continuous, low-pressure flow of aerated potable water at 0.4 gallons per minute for a period of at least 15 minutes.
- The path to the eye wash cannot involve opening a door unless:
    - There is always another employee present that can open the door.
    - The exposed employee can exit the room without having to manually manipulate a door knob (i.e. push bar)
- Eyewash stations should be tested once a week by lab personnel to flush lines.

Follow the procedures below when using an eyewash:

- Hold eyelids open using the thumb and index finger to help ensure that effective rinsing has occurred behind the eyelid. It is normal to close the eyes tightly when splashed, but this will prevent water from rinsing and washing the chemical out. Eyelids must be held open.
- Necessary training or practice of this procedure to respective personnel is encouraged to help familiarize potential users with the feel of rinsing. It will also make it easier for the user to react both promptly and properly to an emergency situation.
- Flush eyes and eyelids with water or eye solution for a minimum of 15 minutes. “Roll” eyes around to ensure full rinsing.

- Contact lenses must be removed as soon as possible to ensure that chemicals are not trapped behind the lenses and then the eyes can be completely rinsed of any harmful chemicals.
- Medical attention should be sought immediately. Ideally another person in the lab should make contact with responders or dial 911. The sooner medical attention can be given, the chances of not sustaining permanent damage or blindness is greatly improved.

3.6 Basic Laboratory Safety Practices

Basic laboratory safety practices and procedures will greatly reduce the risk of accidents and injuries in the lab. The following basic laboratory safety practices will help promote a safe work environment for all laboratory occupants. All Lab Supervisors, Principal Investigators, staff, students, and visitors should be familiar with these safety practices and follow them at all times.

3.6.1 Housekeeping

Maintaining a lab in a clean and orderly manner is critical to the safety of the work environment. Clutter leads to accidents and can make it easier for fires to start and spread. Follow these general housekeeping rules in all campus laboratories:

- Keep drawers and cabinet doors closed and clutter off the floor to avoid tripping hazards.
- Keep aisles clear of obstacles such as boxes, chemical containers, and other storage items.
- Avoid slipping hazards by cleaning up spilled liquids promptly and by keeping the floor free of loose equipment such as stirring rods, glass beads, stoppers, and other such hazards.
- Never block or even partially block the path to an exit or to safety equipment, such as a safety shower or fire extinguishers.
- Supplies and laboratory equipment on shelves should have sufficient clearance so that, in case of a fire, the fire sprinkler heads are able to carry out their function.
- Always store hazardous materials and equipment properly when not in use.
- Clean the work area upon completion of a task and at the end of the day. The custodial staff is only expected to perform routine duties such as cleaning the floor and emptying the general trash.
- In preparation for any maintenance service such as, fume hood repair, plumbing, electrical etc. the laboratory staff must prepare the laboratory before the maintenance personnel arrive. Whenever possible remove hazards that maintenance personnel may encounter during their work activities. For example, infectious agents or chemicals must be moved to a secure area prior to initiation of maintenance work. Additionally, the Laboratory Supervisor or Principal Investigator should escort maintenance personnel into the laboratory and inform them of the presence of any hazardous materials prior to the work being done.

3.6.2 No Food or Drinks in Laboratories

Eating, drinking, smoking, vaping, gum chewing, applying cosmetics, and taking medicine in laboratories is strictly prohibited.

- Food, beverages, cups, and other drinking and eating utensils should not be stored in areas where hazardous materials are handled or stored.
- Glassware used for laboratory operations should never be used to prepare or consume food or beverages.
- Laboratory refrigerators, ice chests, cold rooms, ovens, and so forth should not be used for food storage or preparation. Signs should be posted on this type of equipment stating: “No Food or Drink”.

- Refrigerators used for the provision of food storage must be marked "For Food Storage Only."
- Laboratory water sources, ice makers, and deionized water should not be used for human consumption.
- Laboratory materials should never be consumed or tasted.

3.6.3 Electrical Safety

- Examine all electrical cords periodically for signs of wear and damage. If damaged electrical cords are discovered, unplug the equipment and contact a licensed electrician for repair.
- Properly ground all electrical equipment.
- If sparks are noticed while plugging or unplugging equipment or if the cord feels hot, do not use the equipment until it can be serviced by an electrician.
- Do not run electrical cords along the floor where they will be a tripping hazard and be subject to wear. If a cord must be run along the floor, protect it with a cord cover.
- Do not run electrical cords above the ceiling.
- Do not plug too many items into a single outlet. Cords that enable you to plug more than one item in at a time should not be used. Multi-plug strips can be used if they are protected with a circuit breaker and if they are not overused.
- Do not use extension cords for permanent wiring. If you must use extension cords throughout the laboratory, then it is time to have additional outlets installed.

3.7 Fire Safety

Each laboratory on the SFA campus is equipped with some or all of the fire safety equipment described in the following sections. Every lab meets or exceeds the minimum requirements of the State Fire Marshal. Familiarize yourself with the equipment in your laboratory and how to use it, so you're ready in the event of a fire emergency.

3.7.1 Fire Extinguishers

Fire extinguishers are very important components of laboratory safety. Fire extinguishers are selected and located as required by NFPA 101, Life Safety Code and NFPA 1, Fire Code. EHSRM performs monthly inspections maintenance on all fire extinguishers at SFA.

- Only use a fire extinguisher if the fire is very small and you know how to use the extinguisher safely. If you can't put out the fire, leave immediately. Make sure you call 911 and pull the red fire alarm switch when exiting the building.
- If you do choose to use a fire extinguisher, remember the acronym **PASS**.
  - **P**ull the silver metal pin completely out. This pin is held in place by a plastic band that will break.
  - **A**im at the base of the fire. Remember that your goal is to coat the material that's burning not try to treat the flames.
  - **S**queeze the handle to discharge the fire extinguisher.
  - **S**weep back and forth until the fire is completely out.
- In laboratories, fire extinguishers should be securely located on the wall near an exit. The lab occupant should be aware of the condition of the fire extinguishers by observing them for broken seals, damages, low gauge pressure, or improper mounting.
- For fire extinguisher service, requests, training, or any questions call EHSRM at 468-4442.

3.7.2 Fire Alarms

Fire alarms are designed so that all endangered laboratory personnel and building occupants are alerted by an audible or visual warning.

- All employees/students should become familiar with the exact location of the fire alarm pull stations nearest to their laboratory. These are typically located near building exits.
- Sprinkler systems, smoke detectors, and heat detectors may automatically activate the fire alarm. (This should not be considered a substitute for manual fire alarm activation.)
- Smoke detectors should never be tampered with or obstructed by stacking boxes or other equipment near them.
- Treat every alarm activation as an actual fire event and evacuate according to your building's emergency plan.
- In case of a fire, immediately exit the building and call 911 or Campus Police at 468-2608.

3.7.3 Sprinklers

Sprinklers are designed to enhance life safety by controlling a fire until the fire department arrives or, in many cases, completely extinguish the fire.

- Sprinklers are automatically activated, and laboratory workers should not attempt to shut off or tamper with the system.
- Items in the laboratory must be stored at least 18 inches below the sprinklers.
- Sprinklers must not be painted or otherwise obstructed.
- Intense heat should not be used near sprinklers.
- Items (e.g., wiring or tubing etc.) must not hang from the sprinklers or sprinkler pipes. Doing so could activate the sprinklers causing damage to property and interrupt business.

3.7.4 Fire Blankets

Some of the labs at SFA have fire blankets mounted on the wall and clearly labeled. Fire blankets can provide you with extra support when you're faced with a fire situation. When you smother the flames with a fire blanket, you are extinguishing the fire by taking away the oxygen. Take notice of the location of the fire blanket in your lab if available.

Follow the steps below when using a fire blanket:

- If your clothes are on fire, stand next to the wall mounted blanket and pull the blanket out while turning around in circles to completely wrap the blanket around you to smother the flame.
- If another person's clothes are on fire, pull the blanket completely out and cover or wrap around the other person to smother the flame.
- Fire blankets may also be used to smother small fires in other locations within the lab, but a fire extinguisher is the preferred method.

3.7.5 Gas Shut Off Valves

Laboratories equipped with natural gas for burners and other lab devices are equipped with emergency shut off valves near the lab exit door(s). In the event of a fire involving natural gas, immediately activate the emergency gas shut off valve to stop the flow of gas to the source of the fire and follow the procedures above to use a fire extinguisher and/or exit the building activating the fire alarm pull station on your way out.

4. Emergency Procedures

In the event of an emergency such as an injury or chemical spill, prompt action will greatly reduce the severity and risk of affecting others. If you or other personnel are able to react, the following procedures will provide some guidance until help arrives. Never put yourself or others in danger in order to provide emergency response. Always call for help and use your best judgment when responding to emergencies.

4.1 First Aid

Aside from minor cuts and scrapes, first call 911 and/or University Police at 468-2608. Tell them your precise location and the nature of the injury. If assisting another injured person, remain on-site until help arrives and provide as much information relating to the injury as possible. For all injuries, report to EHSRM by using the "Accident/Injury – 24 Hour Report Quick Link" on the EHSRM website at: www.sfasu.edu/safety, or report to supervisor to contact EHSRM. Medical treatment will be covered by Worker's Compensation insurance for SFA employees. SFA students may also seek treatment at the SFA Health Services between the hours of 8 am – 5 pm, Mon. – Fri.

4.1.1 First Aid Kits

First aid kits are recommended as standard equipment in the laboratory. A typical first aid kit for laboratories includes a variety of items specially selected to carry out emergency treatment of cuts, burns, eye injuries, or sudden illness. The first aid kit should contain individually sealed packages for each type of item. Contents of the kit should be checked regularly to ensure that expended items are replaced. Laboratory Supervisors are responsible for maintaining the contents of the first aid kit.

4.1.2 Cuts and Other Wounds

Small cuts and scratches

- Direct pressure - place sterile pad over wound and apply pressure evenly with the opposite hand.
- Elevation - if direct pressure does not control bleeding, raise the area above the level of the heart.
- Cleanse area with soap and water.
- For large cuts or bleeding that cannot be controlled, follow the first two steps above and call 911.

4.1.3 Thermal Burns

Minor burns may be treated on-site while more serious burns require immediate medical attention.

For minor burns:

- Apply cold water applications and/or immerse in cold water for at least 10 minutes.
- Seek further medical treatment as needed.

Second and third degree burns are characterized by red or mottled skin with blisters (second degree), white or charred skin (third degree).

- For second and third degree burns, call 911.

4.1.4 Chemical Burns

If hazardous chemicals should come into contact with skin or eyes, follow the first aid procedures below.

- Skin:
    - Remove clothing - don't let modesty stand in the way.
    - Remove shoes - chemicals may also collect here.
    - Rinse the area with large quantities of water for at least 15 minutes (sink, shower, or hose).
    - Do Not apply burn ointments/spray to affected areas.
    - Call 911

- Eyes: (acid/alkali, e.g., HCl, NaOH)
    - Flush eyes thoroughly (15 minutes) using the eyewash station. Seek medical attention as needed. More detailed eyewash procedures are found on pages 28 of this manual.

4.1.5 Ingestion of Chemicals

- Call 911 Immediately.
- Call the Poison Control Center at 1-800-222-1222 for advice on appropriate actions to be taken while awaiting emergency medical assistance.
- If the victim is unconscious, turn their head or entire body onto their left side. Be prepared to start CPR if you are properly trained, but be cautious about exposing yourself to chemical poisoning via mouth-to-mouth resuscitation. If available, use a CPR rescue mask.

4.1.6 Inhalation of Chemicals

- Evacuate the area and move the victim into fresh air.
- Call 911.
- If the victim is not breathing and you are properly trained, perform CPR until the first responders arrive. Be careful to avoid exposure to chemical poisoning via mouth-to-mouth resuscitation. Use a CPR rescue mask if available.
- Treat for chemical burns of the eyes and skin as noted above.

4.2 Chemical Spills

While every effort should be made to avoid chemical spills, they do occasionally occur in laboratories. Chemical spill cleanup supplies should be located in or near each lab at SFA. Check with the Lab Supervisor or Principal Investigator for the location of these supplies and know where to find them in case of a spill. Small spills should be cleaned up by the individual who caused the spill unless it is too large or dangerous to do so. For large spills or spills of acutely hazardous chemicals, call EHSRM at 468-6034 during the hours of 7:30 am – 4 pm, Mon. –Fri. For spills requiring assistance outside of these hours, call the University Police at 468-2608.

The following information will assist you in determining the proper course of action should a spill occur:

4.2.1 Spill Response and Clean-up Procedures

The following are general guidelines to be followed for a chemical spill. More detailed procedures may be available with your laboratory spill response plan or Lab Supervisor or Principal Investigator.

- Immediately alert area occupants and supervisor, and evacuate the area, if necessary.
- If there is a fire or medical attention is needed, immediately contact 911 or University Police at 468-2608.
- Attend to any people who may be contaminated. Contaminated clothing must be removed immediately and the skin flushed with water for no less than fifteen minutes. Clothing must be washed before reuse. See first aid for more information.
- If a volatile, flammable material is spilled, immediately warn others, control sources of ignition, and ventilate the area.
- Wear personal protective equipment, as appropriate to the hazards. Refer to the Safety Data Sheet for appropriate PPE.
- Consider the need for respiratory protection. The use of a respirator or self-contained breathing apparatus requires specialized training and medical surveillance. Never enter a contaminated atmosphere without protection or use a respirator without training. If respiratory protection is needed and no trained personnel are available, call EHSRM at 468-6034. If respiratory protection is used, be sure there is another person outside the spill area in communication, in case of an emergency. If no one is available, contact 911 or EHSRM.
- Using the chart below, determine the extent and type of spill. If the spill is large, there has been a release to the environment, or if there is no one knowledgeable about spill clean-up available, contact EHSRM at 468-6034.

Category	Size	Response	Treatment Materials
Small	up to 300mL	chemical treatment or absorption	Neutralization or absorption spill kit
Medium	300mL - 5 liters	absorption	Absorption spill kit
Large	more than 5 liters	call EHSRM	outside help

- Notify the Laboratory Supervisor/Principal Investigator and EHSRM at 468-6034 for all spills regardless of the size.
- Protect floor drains or other means for environmental release. Spill socks and absorbent pads may be placed around drains, as needed.
- Contain and clean up the spill. Loose spill absorbent material should be distributed over the entire spill area, working from the outside, circling to the inside. This reduces the chance of splash or spread of the spilled chemical. Many neutralizers for acids or bases have a color change indicator to show when neutralization is complete.
- When spilled materials have been absorbed, use brush and scoop to place materials in an appropriate container. Polyethylene bags may be used for small spills. Five-gallon pails or 20-gallon drums with polyethylene liners may be appropriate for larger quantities.
- Complete a hazardous waste sticker, identifying the material as Spill Debris with the specific chemical name, and affix onto the container. Spill control materials will probably need to be disposed of as hazardous waste. Contact EHSRM at 468-6034 for advice on storage and packaging for disposal.

- Decontaminate the surface where the spill occurred using a mild detergent and water, when appropriate.

4.2.2 Spill Kit Supplies

Your laboratory or work area should have access to sufficient quantity of absorbents or other types of materials to control and respond to small to moderate size spills in the lab. EHSRM can assist with selecting the proper spill cleanup supplies appropriate for your laboratory.

The following supplies should be kept on-hand to make up the spill kit:

Personal Protective Equipment
- 2 pairs chemical splash goggles
- 2 pairs of disposable gloves
- 2 pairs of shoe cover
- 2 plastic or Tyvek aprons and/or Tyvek suits

Absorption Materials
- 4 spill pillows (absorbent pillows)
- 1 spill sock
- 2 DOT buckets (5 gallon)
  - 1 filled with loose absorbent, such as vermiculite or kitty litter

Neutralizing Materials
- Acid Neutralizer
- Caustic Neutralizer
  - commercial neutralizers, these have built in color change to indicate complete neutralization
- Solvent Neutralizer
  - commercial solvent neutralizers, such as Solusorb, act to reduce vapors and raise the flashpoint of the mixture

Mercury Spills
- Small disposable pipette to pick up large drops (optional)
- Hg Absorb Sponges - amalgamate mercury residue
- Hg Absorb Powder - amalgamates mercury
- Hg Vapor Absorbent - reduces concentration of vapor in hard-to-reach areas
- Mercury Indicator - powder identifies presence of mercury

Clean-up Tools
- Polypropylene scoop or dust pan
- Broom or brush with polypropylene bristles
- 2 waste bags
- “Hazardous Waste” stickers

NOTE: Do not put chemical spill cleanup materials in the regular trash. Contact EHSRM for proper disposal.

5. Training

All individuals working in a laboratory (faculty, staff, students, and visitors) should be adequately trained on hazards present in the laboratory, the known risks, and what to do if an accident occurs. Every laboratory worker should be trained to know the location and proper use of available PPE, safety equipment, and spill cleanup supplies. The Laboratory Supervisor/Principal Investigator is responsible for providing information to his or her personnel about any hazards present in the lab and available safety equipment. This information must be provided at the time of the employee's initial assignment and prior to any assignments involving new potential chemical hazards. The following lists the information that should be provided by the Lab Supervisor/Principal Investigator:

- The location and availability of this manual.
- The location and availability of all safety equipment.
- The site-specific chemical hazards and ways to protect yourself from those hazards. Refer to hazard communication program on the EHSRM website at: www.sfasu.edu/safety.
- The location and availability of known reference material on the hazards, Safety Data Sheets (SDS), and the safe handling, storage, and disposal of hazardous chemicals found in the laboratory.
- The physical and health hazards of chemicals in the work area. The measures lab personnel can take to protect themselves from these hazards, including specific procedures the Lab Supervisor has implemented to protect personnel from exposures to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used.
- The applicable details of this manual.

Employees must be trained when new chemical hazards are introduced into their workplace, or when new hazards are shown on updated Safety Data Sheets (SDS), as well as upon reassignment to different workplaces that involve new chemical hazards or protective measures. Site specific training must be conducted by the Lab Supervisor/Principal Investigator.

In addition to the site-specific training, Hazardous Communication training, laboratory safety training, hazardous waste management training, and fire safety training are offered by EHSRM and are required for faculty, staff, and graduate students that engage in laboratory activities. Contact EHSRM at 468-6034 or safety@sfasu.edu for more information or to schedule a training.

6. Inspections

EHSRM inspects all laboratories at SFA on a regular basis. Inspection reports will be forwarded to the appropriate Lab Supervisor or Principal Investigator. Any safety concerns or violations identified during the inspection should be addressed in a timely manner and a corrective action report provided to EHSRM. Concerns that are not able to be addressed immediately and require additional time will be evaluated by EHSRM on a case-by-case basis. Lab Supervisors and Principal Investigators are also expected to perform laboratory safety self-inspections periodically to ensure continued compliance. A copy of the self-inspection checklist is provided in *Appendix E* on page 52. If a lab is not in compliance with the safe operating procedures as outlined in this manual, EHSRM has the authority to close the lab until violations are corrected.

7. Laboratory Security

The security of SFA laboratories and controlled access to sensitive materials, equipment, and information is vital. The following sections outline steps that should be followed to ensure proper security and control over laboratories on the SFA campus.

7.1 Controlled Access

- Laboratories should be locked at all times when not in use.
- Card-keys or traditional keys should be used to permit entry.
- All entries (including entries by visitors, maintenance workers, repairmen and others needing one-time or occasional entry) should be under the direct supervision of the Lab Supervisor or Principal Investigator.
- Only workers required to perform a job should be allowed in laboratory areas, and workers should be allowed only in areas and at hours required to perform their particular job.
- Access for students, visiting scientists, etc., should be limited to hours when regular employees are present.
- Access for routine cleaning, maintenance, and repairs should be limited to hours when regular employees are present.
- Freezers, refrigerators, cabinets, and other containers where stocks of biological agents or hazardous chemicals are stored should be locked when they are not in direct view of workers.
- EHSRM maintains unlimited access to all laboratories and work areas in order to conduct inspections and respond to concerns or emergencies.

7.2 Export Control

Export control refers to federal laws and regulations governing the export of certain information and technology to foreign entities and foreign nationals, whether abroad or in the United States. Its purpose is to regulate distribution of strategically important technology and information to foreign nationals and foreign countries and entities for reasons of foreign policy, national security, and the prevention of terrorism.

The export control regulations may affect your ability to:

- Ship/take/transfer items out of the U.S.
- Travel internationally with equipment/laptops
- Collaborate with foreign colleagues/institutions
- Allow the participation of foreign students or foreign researchers in research activities
- Provide services (including training) to foreign persons, both in the U.S. and abroad
- Conduct research freely without having to apply for an export license and/or implement security access controls.

For more information on export control regulations and assistance with determining how they may affect your laboratory functions, visit the SFA Export Control website at: http://www.sfasu.edu/compliance/287.asp.

7.3 Inventory Control

Laboratory Supervisors and Principal Investigators are ultimately responsible for monitoring their inventory for losses. Some lab chemicals and glassware are controlled by the Department of Public

Safety, should be closely monitored, and significant losses reported immediately to EHSRM. Additionally, the following inventory control methods should be followed:

- All packages should be inspected before being brought into the laboratory area.
- Packages containing specimens, bacterial or virus isolates, or toxins should be opened in a safety cabinet or other appropriate containment device.
- Know what materials are being removed from the laboratory area.
- Biological materials/toxins for shipment to other laboratories should be packaged and labeled in conformance with all applicable local, federal, and international shipping regulations.
- Required permits (e.g., PHS, DOT, DOC, USDA) should be in hand before materials are prepared for shipment. Contact EHSRM at 468-6034 for assistance with shipping hazardous or biological materials.
- Certain chemicals and laboratory glassware are controlled by the Texas Department of Public Safety (DPS). Report unexplained losses of these materials and equipment immediately to EHSRM at 468-6034 or safety@sfasu.edu as required by the DPS Memorandum of Understanding (MOU). See the DPS MOU in *Appendix A* on page 40 for a complete list of controlled items and more details. EHSRM will report the loss to DPS within 5 days of the occurrence as required.

8. Miscellaneous

8.1 Surplus

- Chemicals stored in excess or quantities more than required by the user can be distributed among other laboratories that are in need of the same chemical. Contact EHSRM at 468-6034 for assistance.
- Lab or medical equipment must not be disposed of in a dumpster but rather via Surplus Property. Consult with EHSRM prior to sending any equipment that contained or could contain hazardous materials to surplus. Keep in mind that many items not immediately suspect for hazardous materials may still contain metals (mercury columns, tin or lead solder, insulators, springs, etc.) or other hazardous materials.
- Equipment must be visually examined by the user or other knowledgeable individuals for evidence of spills, leaks, damage, or other conditions of concern. All equipment must be cleaned by the user prior to pick up for surplus. Disconnect the equipment from power supplies prior to cleaning and be careful not to combine incompatible substances during cleaning.
- Equipment must be free of bio-hazardous, hazardous, or radioactive materials or residues. If these materials were stored or used in the equipment, contact EHSRM for assistance with cleaning guidelines and after cleaning so the item in question may be examined prior to delivery to surplus.
- Oils must be removed from pumps, capacitors, power supplies, or other oil-filled equipment.
- Laboratory refrigerators and freezers may not be sent to surplus unless completely decontaminated or transferred directly to another lab on campus strictly for laboratory use. Once a refrigerator or freezer has been used in a lab, it may never be used to store food and beverages. Lab refrigerators or freezers may never be offered up for public sale.
- Prior to disposing of a lab refrigerator or freezer, the refrigerant must be removed by a Physical Plant Technician. Contact the Physical Plant Department at 468-3206 to submit a work order to have the refrigerant removed.

8.2 Defrosting Research Freezer

- Plan for 2 days of freezer downtime during this process.
- Never move a freezer to a non-research space (e.g., balcony, corridor, office, etc.) for defrosting.
- Before thawing, identify hazardous materials stored in the freezer.
  - Wipe down the unit if hazardous chemical contamination is suspected or visible contamination is present.
  - If the freezer has been used to store bio-hazardous material, collect the ice and add 1 part bleach to 9 parts melted ice. Allow 20 minutes of contact time before pouring the melted ice down the drain (preferably in a fume hood).
- Remove the contents of the freezer.
- Unplug the freezer in the morning. This allows you to monitor runoff throughout the day.
- Never use sharp objects to chip at the ice. Freezer walls are easily punctured by sharp objects, allowing coolant to escape and resulting in expensive repairs or replacement costs.
- Never allow liquid to run directly onto floors creating a slip hazard, or down any outside drain (a potential regulatory violation).
- Establish a wick and reservoir system to manage the melting ice: Place a piece of bench paper (paper side down, plastic side up) or towel inside the freezer, on the lower level and lead it into a bucket or large pan. Surround the freezer and collection pan with paper towels or bench paper. Manage contaminated ice and liquid according to instructions in step 3.
- Clean the freezer inside and out with a 10% bleach solution. Clean dirt and dust off the exterior coils, if you can access them, to extend the life of the freezer and save energy.
- Plug in the freezer and wait for the desired temperature to be reached.

8.3 Broken Glassware Disposal

- Broken laboratory glassware must never be placed in the regular trash can in the lab. Broken glass can easily puncture through trash bags posing a risk to custodial staff taking out the trash.
- Place broken glass in a designated “Broken Glass” box or other sturdy cardboard box conspicuously labeled with the words “Broken Glass”.
- Broken glass contaminated with biological hazards must be autoclaved of decontaminated with a disinfectant prior to placing it in the broken glass box.
- Once the box is full, tape it shut and take directly to the dumpster outside the building. It is the responsibility of the Lab Supervisor/Principal Investigator to ensure proper disposal of broken glass. Custodial staff have been instructed not to handle broken glass and will not take these containers to the dumpster.

8.4 Safe Handling of Laboratory Animals

The EHSRM Department has developed a Biosafety Manual for SFA which can be accessed on the EHSRM website at https://www.sfasu.edu/safety/documents/Biosafety_Manual_2020_update.pdf

- The SFA Biosafety manual provides safety guidelines to minimize exposure of infectious agents for those working with biohazards (biological agents and biological toxins).
- The universally accepted biological hazard warning symbol shall be used in laboratories and work areas to notify others about the presence of infectious agents.
- The most important element of containment is strict adherence to standard microbiological practices and techniques. Persons working with infectious agents or infected materials must be aware of potential hazards and trained to be proficient in the practices and techniques required for handling such materials safely.

APPENDIX A
DPS Memorandum of Understanding
Controlled Substances & Glassware

Memorandum of Understanding between the Texas Department of Public Safety and the Texas Higher Education Coordinating Board

Pursuant to Texas Health and Safety Code, Section 481.0621 (b), the Texas Department of Public Safety (DPS) and the Texas Higher Education Coordinating Board (THECB) enter into this memorandum of understanding in order to establish the responsibilities of the DPS, the THECB, and the public or private institutions of higher education for implementing and maintaining a program for reporting information concerning controlled substances, controlled substance analogues, chemical precursors, and chemical laboratory apparatus used in education or research activities of institutions of higher education.

1 - DEFINITIONS

(a) Agent – any peace officer or other person who is authorized by law to enforce or administer state or federal drug laws.

(b) Central Location – location within an institution of higher education where records are maintained.

(c) 21 CFR, Part 1301 – 21 Code of Federal Regulations, Part 1301 to End, providing for the Registration of Manufacturers, Distributors, and Dispensers of Controlled Substances and any amendments to these regulations hereafter adopted.

(d) Client – any person or entity to which DPS has issued a permit authorizing the purchase, sale, transfer or furnishing of a controlled item.

(e) Controlled Glassware – condensers; distilling apparatus; vacuum dryers; single, two-and three-necked flasks; distilling flasks; Florence flasks; filter funnels; Buchner funnels; separatory funnels; Erlenmeyer flasks; round-bottom flasks; thermometer flasks; filtering flasks; Soxhlet extractors; and adapter tubes made of glass.

(f) Controlled Item – precursor chemicals and laboratory apparatus listed in Texas Health and Safety Code Section 481.002 (51) and 481.002 (53) and as named by rule by the Director of the Department of Public Safety pursuant to the Texas Health and Safety Code Section 481.077(b) and 481.080(c).

The table below lists the controlled items as of September 1, 2005.

Precursor Chemicals	Laboratory Apparatus
1. Methylamine	A. Condensers
2. Ethylamine	B. Distilling apparatus
3. D-lysergic acid	C. Vacuum dryers
4. Ergotamine tartrate	D. Three-necked flasks
5. Diethyl malonate	E. Distilling flasks
6. Malonic acid	F. Tableting machines
7. Ethyl malonate	G. Encapsulating machines
8. Barbituric acid	H. Filter funnels, buchner funnels, and separatory funnels
9. Piperidine	I. Erlenmyer flasks, two-necked flasks, single neck flasks, round-bottom flasks, Florence flasks, thermometer flasks, and filtering flasks
10. N-acetylanthranilic acid	J. Soxhlet extractors
11. Pyrrolidine	K. Transformers
12. Phenylacetic acid	L. Flask heaters
13. Anthranilic acid	M. Heating mantles
14. Hypophosphorus acid	N. Adapter tubes
15. Ephedrine	
16. Pseudoephedrine	
17. Norpseudoephedrine	
18. Phenylpropanolamine	
19. Red phosphorus	

(g) Controlled Substance – a substance, including a drug, an adulterant and a dilutant as defined by the Health and Safety Code, Chapter 481, the Texas Controlled Substances Act.

(h) Controlled Substance Analogue – (1) a substance with a chemical structure substantially similar to the chemical structure of a controlled substance in Schedule I or II or Penalty Group 1, 1-A, or 2 of the Texas Health and Safety Code, Chapter 481, Texas Controlled Substances Act; and (2) a substance specifically designed to produce an effect substantially similar to, or greater than, the effect of a controlled substance in Schedule I or II or Penalty Group 1, 1-A, or 2 of the Texas Health and Safety Code, Chapter 481, Texas Controlled Substances Act.

(i) DPS – Department of Public Safety Narcotics Service Regulatory Program that is charged with the regulation of controlled substances and items listed in this MOU.

(j) Institution of Higher Education or Institution – this term includes an institution of higher education, as defined in Texas Education Code, Section 61.003(8), a private or independent institution of higher education, as defined in Texas Education Code, Section 61.003(15), and a private postsecondary educational institution, as defined in Texas Education Code, Section 61.302(2).

(k) MOU – memorandum of understanding as required by the Texas Health and Safety Code, Section 481.0621(b).

(l) Nar-22 – form prepared and issued by DPS Narcotics Service to clients to report sale, transfer, or furnishing of a controlled substance or item.

(m) Site – a specific location at an institution where controlled items are utilized and/or stored.

(n) THECB – Texas Higher Education Coordinating Board.

(o) Unacceptable Discrepancy – any difference in the amount on hand and the amount documented that cannot reasonably be explained by accidental or normal loss.

2 - PROCEDURES

Institutions of higher education in Texas shall adopt procedures in compliance with this MOU. When requested, the DPS shall provide technical advice to the institution or site, and educational materials or presentations if funds and personnel are available.

3 - RECORDS AND REPORTS

a. The site shall maintain all purchase order records, in accordance with the minimum retention requirements established by the Texas State Library and Archives Commission, of the incoming controlled substances, controlled substance analogues, precursor chemicals and laboratory apparatus (including controlled glassware) covered in this MOU that have been purchased or received by the site or central location.

b. An institution or site that discovers a readily unacceptable discrepancy, loss, pilferage or theft of a controlled substance, controlled substance analogue, precursor chemical or laboratory apparatus (including controlled glassware) shall submit a written report of the incident to the appropriate law enforcement agency no later than 5 business days after the date of discovery of the discrepancy, loss, pilferage or theft. The institution shall forward the report to DPS within 5 additional business days after the report is submitted to the appropriate law enforcement agency.

c. Upon request, the DPS shall assist the law enforcement agency conducting an investigation regarding the pilferage or theft of the controlled substance, precursor chemical, or laboratory apparatus named in this MOU.

d. The DPS may request that an institution or site provide a duplicate of any record(s) covered by this MOU and the institution or site shall provide such record(s) within 10 business days of the request. The record(s) may be provided in electronic or hard copy form.

4 - SALE, TRANSFER OR FURNISHING OF CONTROLLED ITEMS

a. The institution or site shall prohibit the sale, furnishings, or transfer of controlled items, including glassware, covered by this MOU to any person or entity not holding a DPS permit, unless the recipient is specifically exempted by law or rule.

b. The institution shall report to the DPS on a Nar-22 form or any form mutually agreed upon by all parties, every sale, furnishing or transfer of a controlled item leaving the institution. The site shall submit these reports to the DPS within 30 days of the furnishing or transfer of the controlled items. This report shall include the name, address, telephone number, permit number (if applicable), driver license number, and date of birth of the client receiving the controlled items.

5 - CONTROLLED SUBSTANCES AND CONTROLLED SUBSTANCE ANALOGUES

a. The institution or site is responsible for complying with the established procedures as required in 21 CFR, Part 1301 to End and as required by any amendments to 21 CFR Part 1301.

b. Upon request, the DPS shall provide technical advice to the institution or site regarding the inventories required in 21 CFR, Part 1301 to End.

c. Upon request, the DPS shall assist the law enforcement agency conducting any investigation regarding any significant loss, pilferage or theft of the controlled substances or controlled items contained in this MOU.

6 - AUDITS AND INSPECTIONS

The institution or site shall permit any DPS agent to conduct audits and inspections of all records made in accordance with the MOU at any reasonable time and shall not interfere with the discharge of the agent's duties.

7 - SECURITY AND STORAGE

The institution or site shall ensure the security of the controlled items by cost-effective means that afford a reasonable sense of safety and accountability, such as electronic records keeping and physical security. In addition, the institution or site shall require that the controlled substances and precursor chemicals are stored in accordance with recommendations of the manufacturer, the Texas Commission on Environmental Quality and the Federal Environmental Protection Agency.

8 - CONTACT PERSON(S)

Each institution or site shall appoint one or more individuals, as needed, to be responsible for implementing the security measures established by the institution or site. The institution shall annually provide a list of these individuals to the DPS and shall ensure that these individuals serve as the contact between the institution and the DPS. The initial list of contact persons shall be provided within ninety (90) days after the effective date of this Memorandum of Understanding.

Greg Moore 936-468-6034, gregory.moore@sfasu.edu

The general provisions of this Memorandum of Understanding shall be effective on the date of signature by representatives of both parties. This agreement, upon review of both parties, may be amended by written agreement whenever such action is necessary.

Date: 6-13-06

[redacted]

Thomas A. Davis, Jr.
Director
Texas Department of Public Safety

Date: 5/24/06

[redacted]

Teri Flack
Deputy Commissioner
Texas Higher Education Coordinating Board

Suggestions for Implementing MOU Procedures

1. Notify all personnel involved with environmental and safety issues about the MOU.

2. Notify all science and health laboratory personnel about the MOU.

3. Provide information to appropriate personnel regarding the potential problem of diversion of laboratory chemicals and apparatus to illegal drug operations.

4. Notify the Department of Public Safety (DPS) of the person designated to act as the liaison between the institution and the DPS.

5. Notify all personnel involved in the sale or transfer of surplus equipment that none of the precursor chemicals or laboratory apparatus, including glassware, listed as controlled items in the MOU should be sold or otherwise transferred to anyone who does not have the proper permit or the specific authority to purchase or accept the controlled items. Personnel involved in the transfer or sale of these items should be provided with copies of the Nar-22 form, which should be used to report the sale, transfer, or furnishing of the listed precursor chemicals or laboratory apparatus. Any party involved in an auction of surplus equipment should be informed of the MOU.

6. Establish procedures to assure an appropriate level of security for controlled items in educational and research laboratories and storerooms. Designate an individual to be responsible for establishing security measures.

7. Encourage all personnel to be alert and attentive to the disappearance of any of the controlled items and to report losses to the institution's contact person for controlled substances.

APPENDIX B

Waste Stream Determination Form

Waste Stream Determination

Laboratories and work areas at Stephen F. Austin State University who generate waste are required to determine if any of their waste is hazardous. Only household waste is exempt from this requirement. This technical guidance document explains the steps involved in making a waste determination and the associated documentation requirements.

Making Waste Determinations

Hazardous waste determinations must be done for every waste stream generated within a lab or work area. Breaking the waste determination into steps can make it easier to complete the process.

Step 1

Make a list of all waste streams being generated. List what process generates each waste stream, and document how many pounds of each waste stream are generated on the form attached.

Step 2

Check to see if each waste meets the definition of "solid waste" as found in the Code of Federal Regulations, 40 CFR 261.2. Waste is considered solid waste if it:

- Is a solid or a liquid (or in some cases a gas) that is discarded, abandoned, recycled, or considered inherently waste-like; and
- Is not otherwise exempt from the definition of solid waste under 40 CFR 261.4(a).

One common way materials become exempt from the definition of solid waste is when they are discharged to a sewer or drain that is regulated under the Clean Water Act, or, for example an NPDES discharge point, a pre-treatment system, or a Wastewater Treatment Facility.

Step 3

Record how the analysis of the waste was made. Record any methods used and attach any outside documentation for the analysis, such as analytical results or SDS. If user knowledge was used to make the determination, indicated that here and explain the reason for the determination.

Step 4

Indicate here whether or not the waste is hazardous. If it is hazardous, list the hazardous characteristics (eg. Corrosive, toxic, flammable, reactive). Applicable waste codes can be found on the EHSRM website under the "Listed Hazardous Waste" pdf.
http://www.sfasu.edu/safety

Documenting Waste Determinations

Maintain documentation of Steps 1 through 4 and forward copies to the EHSRM Department at SFA PO Box 6113, Fax: 468-7312, or email to gregory.moore@sfasu.edu.

Adequate documentation will include a statement about whether or not the waste is hazardous as well as copies of all documents used in Steps 1 through 3. Documentation is required for all wastes, both non-hazardous and hazardous. Some examples of documentation that may be included are:

- Safety Data Sheets (SDSs);
- Process flow diagrams;
- Analytical results from a laboratory; and
- Chemical reaction diagrams.

Summary

Conducting an adequate determination for each waste stream and properly documenting that determination will help facilities stay in compliance and avoid costly mistakes. Adequate determinations are the foundation of any good hazardous waste management program and will help reduce management and disposal costs.

For additional information regarding proper management of solid or hazardous waste at SFA or help completing the required documentation you may contact Greg Moore at (936)-468-6034 or gregory.moore@sfasu.edu

Waste Stream Determination Form

Building Name and Room Number:_____

STEP 1:

Waste Name:_____

Description of Process:_____

_____

_____

_____

Amount of waste generated each month:_____

STEP 2: Does this waste meet the definition of a solid waste? YES NO

STEP 3:

Was laboratory analysis used to make this determination? YES NO

If yes, record the name and method for the laboratory analysis:_____

Attach a copy of the analytical results to this sheet.

Was knowledge of the process used to make this determination? YES NO

If yes, explain the reason for this determination and attach any applicable Safety Data Sheets

_____

_____

_____

_____

STEP 4:

Is this waste non-hazardous? YES NO

Is this waste a listed hazardous waste? YES NO

If yes, list hazardous waste characteristics:_____

_____

Name and title of the person making the determination:_____

Contact Phone:_____Email:_____

Date:_____

APPENDIX C

Laboratory Chemical Waste Guidelines (Poster)

Stephen F. Austin State University
Laboratory Chemical Waste Guidelines

Hazard Awareness

Knowing GHS Pictograms

Oxidizer **Toxic** **Explosive**

Flammable **Carcinogen** **Corrosive**

Gas Cylinder **Environment** **Irritant**

NEVER dispose of hazardous chemical waste by pouring it down the sink drain or evaporating in a fume hood!

Accident Response

Emergency Response for Accidents Involving Hazardous Materials

If the accident is a fire, explosion, or life-threatening:

- Call 911 for emergency assistance,
- Follow your department emergency procedures
- Evacuate the area or building
- Activate the fire alarm pull station located at the buildings exit as needed.
- Contact the Emergency Coordinator Jeremy Pickett at (936) 468-1667

If the accident is not life-threatening:

- Please contact UPD at (936) 468-2608
- Contact the Environmental Health, Safety, and Risk Management Department (EHSRM) to report all injuries at (936) 468-4514

Fire alarm pull stations are located at all building exits.

Spill Response

Call the Chemical Hygiene Officer at (936) 468-6034 for cleanup assistance of spills if:

- You are not knowledgeable of the material and its hazard, or
- The spill is not contained in a hood or on a lab bench, or
- You cannot complete the cleanup with your materials on hand.

Minor spill cleanup:

- Alert people in the immediate area of the spill.
- Put on appropriate Personnel Protective Equipment (PPE), (gloves, protective eyewear, and lab coat).
- Contain the spill with absorbent spill material.
- Place the absorbed spill material in secondary containment, such as the spill bucket. Label the container and notify EHSRM for pick-up.
- Dispose of contaminated PPE properly.

The fire extinguisher for this room is located:

_____

Handling Laboratory Wastes

A laboratory chemical becomes a waste when you decide that you no longer intend to use or re-use it.

Laboratory wastes may be accumulated for up to a maximum of 12 months in the lab.

- Confirm all waste containers are properly closed and labeled.
- Submit pick up request through Chematix or by calling the Safety Officer at (936) 468-6034

APPENDIX D

Hazard Communication Notice to Employees

(Right-to-Know Poster)

NOTICE TO EMPLOYEES

The Texas Hazard Communication Act, codified as Chapter 502 of the Texas Health and Safety Code, requires public employers to provide employees with specific information on the hazards of chemicals to which employees may be exposed in the workplace. As required by law, your employer must provide you with certain information and training. A brief summary of the law follows.

HAZARDOUS CHEMICALS

Hazardous chemicals are any products or materials that present any physical or health hazards when used, unless they are exempted under the law. Some examples of more commonly used hazardous chemicals are fuels, cleaning products, solvents, many types of oils, compressed gases, many types of paints, pesticides, herbicides, refrigerants, laboratory chemicals, cement, welding rods, etc.

WORKPLACE CHEMICAL LIST

Employers must develop a list of hazardous chemicals used or stored in the workplace in excess of 55 gallons or 500 pounds. This list shall be updated by the employer as necessary, but at least annually, and be made readily available for employees and their representatives on request.

EMPLOYEE EDUCATION PROGRAM

Employers shall provide training to newly assigned employees before the employees work in a work area containing a hazardous chemical. Covered employees shall receive training from the employer on the hazards of the chemicals and on the measures they can take to protect themselves from those hazards. This training shall be repeated as needed, but at least whenever new hazards are introduced into the workplace or new information is received on the chemicals which are already present.

SAFETY DATA SHEETS

Employees who may be exposed to hazardous chemicals shall be informed of the exposure by the employer and shall have ready access to the most current Safety Data Sheets (SDSs) or Material Safety Data Sheets (MSDSs) if an SDS is not available yet, which detail physical and health hazards and other pertinent information on those chemicals.

LABELS

Employees shall not be required to work with hazardous chemicals from unlabeled containers except portable containers for immediate use, the contents of which are known to the user.

EMPLOYEE RIGHTS

Employees have rights to:

- access copies of SDSs (or an MSDS if an SDS is not available yet)
- information on their chemical exposures
- receive training on chemical hazards
- receive appropriate protective equipment
- file complaints, assist inspectors, or testify against their employer

Employees may not be discharged or discriminated against in any manner for the exercise of any rights provided by this Act. A waiver of employee rights is void; an employer's request for such a waiver is a violation of the Act. Employees may file complaints with the Texas Department of State Health Services at the telephone numbers provided below.

EMPLOYERS MAY BE SUBJECT TO ADMINISTRATIVE PENALTIES AND CIVIL OR CRIMINAL FINES RANGING FROM $50 TO $100,000 FOR EACH VIOLATION OF THIS ACT

Further information may be obtained from:

Texas Department of State Health Services
Consumer Protection Division
Policy, Standards, & Quality Assurance Section
Environmental Hazards Unit
PO Box 149347, MC 1987
Austin, TX 78714-9347

(512) 834-6787
(800) 293-0753 (toll-free)
Fax: (512) 834-6726
E-mail: TXHazComHelp@dshs.texas.gov
Website: www.dshs.texas.gov/hazcom

TEXAS Health and Human Services | Texas Department of State Health Services

Worker Right-To-Know Program
Publication # E23-14173
Revised 05/2018

APPENDIX E

Laboratory Safety Inspection Checklist

Environmental Health, Safety & Risk Management, SFASU

Building: **Room**: **Date:**

Inspector: **Lab Personnel:** **Lab Contact:**

	General Safety and Hygiene	Yes	No	N/A	
1	Work areas are clean and free of spilled materials				
2	Is the lab free of food and drinks?				
3	Lab is free from slip, trip or fall hazards				
4	Hazard warning signs available and properly used				
5	SDS available and employees are trained				
6	Lab refrigerators are clean and labeled “No Food or Drink”				
7	Is the lab free of mold?				
8	Is the lab free of penetrations in walls, floor, or ceiling?				
9	All ceiling tiles in place				
10	Lab is free from inappropriate or permanent use of extension cords				
11	Noise below safety levels (85 dBA TWA MAX recommended)				
Compressed gas cylinders					
12	Gas cylinders properly secured in an upright position				
13	Cylinder capped when not in use				
14	Fuel gases segregated from oxygen (>20ft)				
15	Pressure relieved from valves on cylinders not in use				
16	Gas cylinders are at least 20 feet away from all flammable,				
	combustible or incompatible substances				
Fume Hoods					
17	Inspection current and status posted				Vel?
18	Fume Hoods functioning properly				
19	Are Fume Hoods free of permanent storage/clutter?				
20	Fume hood sash closed when unattended/ at or below 18 inches when attended				
Training					
21	Lab personnel know how to get SDS from EHS, Lab and internet				
22	Lab personnel have PPE available				
Emergency Equipment and Procedures					
24	Emergency contact list posted in the lab (near phone/door)				
25	Eyewash and Emergency shower available				
26	Emergency shower and eyewash are working properly and not blocked				

27	Fire extinguisher is available, mounted and clearly marked			
28	Exits, aisles, and fire extinguishers clear of obstruction			
29	First aid kit readily available and adequately stocked (optional)			
30	Spill cleanup materials are present.			
Chemical Storage & Chemical Inventory & Hazardous Material/Atmosphere				
31	Chemical Inventory is complete			
32	Incompatible chemicals stored properly			
33	Containers are properly used and labeled			
34	Flammables are stored in flammables cabinets			
35	Are all chemicals stored by hazard class, eg: Flammables, oxidizers			
	Acids, bases, reactives and toxins?			
36	Chemical waste containers closed and properly labeled			
37	Hazardous Chemicals are stored below eye level			
38	Is the lab free of bad odors?			
39	Ventilation where chemicals used is available			
40	Lab free of containers stored on the floor			
41	Bench tops and sink areas clean and tidy			

Comments: