



TFS Safety Manual

Laboratory and Research Safety

This safety manual covers laboratory and research activities that are conducted in either a laboratory or outdoor setting which involve Texas A&M Forest Service employees. Research and laboratory activities located on a campus must also comply with that institution's published requirements.



TFS Safety Manual—Laboratory and Research Safety

TABLE OF CONTENTS

| <u>SUBJECT</u> | <u>PAGE</u> |
|--|--------------------|
| TFS Contact Information..... | 2 |
| Complaint Procedures..... | 2 |
| Responsibilities..... | 2 |
| General Laboratory Safety Guidelines: | |
| Safe Practices..... | 3 |
| Working in the Laboratory..... | 3 |
| Housekeeping..... | 4 |
| Signage and Contact Information..... | 4 |
| Physical Safety..... | 4 |
| - Aerosol Production..... | 4 |
| - Electricity..... | 5 |
| - Mechanical Equipment..... | 5 |
| - Glass and Metal Sharps..... | 5 |
| - Pressurized Systems..... | 5 |
| Equipment Safety..... | 6 |
| - Centrifuges..... | 6 |
| - Refrigerators and Freezers..... | 6 |
| Chemical Safety..... | 7 |
| - Hazcom Program..... | 7 |
| - Chemical Safety Guidelines..... | 7 |
| - Acute Toxins vs. Chronic Toxins..... | 7 |
| - Acute Toxicity..... | 7 |
| - Chronic Toxicity..... | 8 |
| - Types of Toxins..... | 8 |
| Safety Plans and Equipment..... | 8 |
| - Toxic Chemical Spills..... | 8 |
| - Chemical Exposure..... | 8 |
| - Safety Equipment..... | 8 |



TFS Safety Manual—Laboratory and Research Safety

PURPOSE

This manual is designed to give Texas A&M Forest Service (TFS) researchers, geneticists, silviculturists, entomologists and other laboratory/research workers a reference manual to use in the safe planning and execution of their research objectives and duties.

CONTACT INFORMATION

TFS Environmental Health and Safety (EHS): (979) 450-9387 or safety@tfs.tamu.edu

TAMU Radiological Safety: (979) 862-6497

SET Environmental for emergency clean-up: (877) 447-7455

COMPLAINT PROCEDURES

The chain of command is the primary venue for voicing and correcting workplace safety and health concerns. If supervisors in the chain of command do not adequately address employee concerns, contact the TFS EHS office.

RESPONSIBILITIES

Leader and Principal Investigator.

- Establish a safety climate that ensures the following:
 - ❖ Injuries and exposure incidents are reported to TFS EHS.
 - ❖ Safety and health protocols are established for each research task.
 - ❖ Research staff is informed of the potential hazards associated with the substances used.
 - ❖ Laboratory personnel are aware of spill and accident response procedures.
 - ❖ Employees are trained as required by the Texas HAZCOM Act and TFS EHS.
 - ❖ A laboratory safety officer is designated in the absence of the Principal Investigator.
 - ❖ Emergency contact numbers are posted at the facility entrance and laboratory door.
 - ❖ Deficiencies are corrected within 45 days.
 - ❖ Material Safety Data Sheets (MSDS) are available on all hazardous substances used.
 - ❖ Employees are provided with the appropriate personal protective equipment (PPE).
 - ❖ Job hazard assessments and chemical mixing protocols are conducted—where needed.
 - ❖ Labels are placed on primary and secondary containers as well as the facility—if needed.
 - ❖ Hazardous chemicals inventory is periodically updated and reported as required by TFS.

Employee and Research Staff.

- Notify supervisor and others of any unsafe conditions of which they may not be aware.
- Implement laboratory practices and controls that reduce the potential for exposure to hazards.
- Follow all safety and health protocols outlined in the MSDS.
- Complete any periodic health and safety training sessions assigned.
- Report accidents, unsafe conditions, and injuries to the Principal Investigator and TFS EHS.
- Notify personal physician if a health condition could be aggravated by laboratory work.
- Use all provided safety devices and safety equipment.
- Do not use tools and equipment without being properly trained.
- Handle all hazardous material in accordance with the Material Safety Data Sheet.

TFS Safety Manual—Laboratory and Research Safety

GENERAL LABORATORY AND RESEARCH SAFETY GUIDELINES

The type of work performed in laboratories and during research can be wide-ranging; however, TFS laboratory personnel should always consider chemical safety, physical safety, equipment safety and the principles outlined in the TFS General Hazard Safety Manual when planning any potentially hazardous activity. In this safety manual, the variety of hazards that may be encountered in a TFS laboratory and methods for mitigating the risks are discussed.

SAFE PRACTICES

Safe practices begin with knowing the hazards associated with the materials and equipment you are working with. While planning work—refer to the MSDSs, Job Hazard Analysis (JHA), and equipment operating instructions. Consider the hazards of the tasks being performed and what training, knowledge, safety equipment, etc. are required to complete the task safely. For every research objective or task performed, consider the following options:

- Develop a response plan for each emergency that may arise while performing the task.
- Review the plan periodically so that you will be ready to respond as needed.
- Use appropriate safety equipment to minimize exposure to hazardous materials.
- Verify that safety equipment is working properly prior to use.
- When using a fume hood, do not open the sash more than 18 inches and close the sash completely when the hood is unattended.
- Wear appropriate personal protective equipment (PPE) and clothing. Remove PPE and wash hands before leaving the laboratory.
- Avoid working alone in a laboratory, especially when handling toxic substances.
- Do not place anything in the mouth or eyes while in the laboratory.
- Do not store food and drinks in laboratory refrigerators or freezers.
- Do not prepare food in the laboratory or wash utensils used for food in laboratory sinks.
- Label preparation equipment “Lab Use Only” or “No Food or Drink” if in the laboratory.
- Use mechanical pipettes or pipetting devices; do not pipette with suction from your mouth.
- Clean equipment contaminated with chemical materials immediately after the task.
- Have a spill kit on hand and clean up minor spills immediately.
- Control and limit entry into laboratory or research plot during hazardous procedures.

WORKING IN THE LABORATORY

Every person who works in a laboratory is responsible for being aware of the hazards in that laboratory and for working in a safe manner. This includes the following:

- Know where emergency contact information is posted.
- Know the response procedures for spills and evacuation.
- Ensure proper training is received before working with the hazardous material.
- Ensure proper training is received in the use of their Personal Protective Equipment.
- Report unsafe conditions to the laboratory safety officer, Principal Investigator, or TFS EHS.

TFS Safety Manual—Laboratory and Research Safety

HOUSEKEEPING

Maintaining orderly and clean laboratory working areas is instrumental to minimizing accidents in the laboratory. The following steps should be taken:

- Keep aisles clear of clutter to eliminate tripping hazards and to maintain a clear exit path.
- Dispose of empty boxes and other unneeded items that take up space.
- Clean bench tops of clutter upon completion of laboratory tasks.
- Properly store chemicals and sharp instruments when not in use or at the end of the work day.
- Clean up spills, even minor ones, promptly.
- Periodically review on-hand quantities of hazardous substances for disposal.

SIGNAGE AND CONTACT INFORMATION

To warn and assist emergency responders when the laboratory is unoccupied, follow these guidelines:

- Post contact information at the entrance to every laboratory containing facility.
 - ❖ Minimum information should be the Principal Investigator (PI), the person responsible for the laboratory, and after-hours emergency contact information.
- Post universal warning signs at the facility's main entrance to communicate the greatest hazard(s) contained in the laboratory. This information is critical for emergency personnel responding to an incident in the facility.

PHYSICAL SAFETY

There is a variety of physical hazards that can be found in a laboratory environment. This section will focus on common physical hazards and how to reduce the risk associated with them.

- **Aerosol Production**
 - ❖ Liquid or solid particles suspended in air that can pose a serious health risk when inhaled and may contaminate equipment, ventilation systems, and skin. Steps should be taken to minimize using aerosol-producing processes, which include the use of blenders, shakers, and hot plates.
 - ❖ Follow these guidelines to eliminate or reduce the hazards associated with aerosols:
 - ✓ Conduct procedures that may produce aerosols under a chemical fume hood.
 - ✓ Allow aerosols to settle for ten minutes before opening a blender or shaker.
 - ✓ When combining liquids, discharge material down the side of the container to avoid splattering the material.
 - ✓ Use a mechanical pipetting device, rather than pouring chemicals from container, when feasible.
 - ✓ Apply material in the outdoors from the upwind direction.

TFS Safety Manual—Laboratory and Research Safety

➤ **Electricity**

- ❖ When using electrical equipment in a laboratory, follow these guidelines:
 - ✓ Check cords and switches for damage prior to use.
 - ✓ Use extension cords only when necessary and only on a temporary basis.
 - ✓ Use extension cords that are the correct size or rating for the equipment in use.
 - ✓ Do not run electrical cords above ceiling tiles, through walls or across thresholds.
 - ✓ Keep electrical cords away from areas where they may be pinched or cause trips.
 - ✓ Avoid plugging more than one appliance in each outlet.
 - ✓ Plug multiple appliances into a power strip with a circuit breaker.
 - ✓ Use GFCI outlets when using electrical equipment near water sources.
 - ✓ Keep access to electrical panels clear of obstructions and know where the panels are.

➤ **Mechanical Equipment**

- ❖ There are four fundamental elements of equipment safety:
 - ✓ Use the correct equipment for the job.
 - ✓ Know how to properly operate the equipment.
 - ✓ Inspect equipment for damage and for required safety features prior to use.
 - ✓ Do not use the equipment in ways it was not designed or intended to be used.

➤ **Glass and Metal Sharps**

- ❖ Accidents involving glassware are a leading cause of laboratory injuries. Follow these practices for using laboratory glassware safely:
 - ✓ Prevent damage to glassware during handling and storage.
 - ✓ Inspect glassware before and after each use. Discard broken or damaged glassware.
 - ✓ Thoroughly clean and decontaminate glassware after each use.
 - ✓ Use lubricant and hand protection when inserting glass tubing into any object.
- ❖ When possible, use plastic or metal connectors instead of glass connectors.
- ❖ Heat and cool large glass containers slowly to reduce the risk of thermal shock and breakage.
- ❖ Use Pyrex or heat-treated glass for heating operations.
- ❖ Never use laboratory glassware to serve food or drinks.
- ❖ Do not wash laboratory glassware in the same sink as food dishes or utensils.
- ❖ Use a standard laboratory detergent to clean glassware.

➤ **Pressurized Systems**

- ❖ Pressurized systems can be hazardous. Before beginning, determine the maximum allowable working pressure (MAWP) for each component in the system and never exceed the MAWP for the weakest component. When working with pressurized systems:
 - ✓ Ensure there is a relief valve set at the MAWP—if necessary.
 - ✓ Do not pressurize the system in an occupied space. Until safe operation is assured, remote operation may be necessary.

TFS Safety Manual—Laboratory and Research Safety

- ❖ Safety points to consider when working with a pressurized system:
 - ✓ Limit exposure to pressurized systems to minimize risk.
 - ✓ Identify and assess all hazards and consequences prior to beginning operations.
 - ✓ Use remote manipulations whenever possible.
 - ✓ When designing pressurized systems, use the lowest pressure that meets the need.
 - ✓ Use material with a predictably safe failure mode.
 - ✓ Ensure the components will maintain integrity at the MAWP.
 - ✓ Only use equipment designed for use under pressure.
 - ✓ Operate within the original design parameters.
 - ✓ Ensure safety mechanisms (e.g., pressure relief valves, fail-safe devices) are in place.
 - ✓ Do not leave a pressurized system unattended.

EQUIPMENT SAFETY

➤ **Centrifuges**

- ❖ Centrifuge operators must be properly trained before use.
- ❖ Ensure there is a disconnect switch that deactivates the rotor when the lid is open.
- ❖ Always keep the lid closed and locked during operation and shut down.
- ❖ Use the centrifuge in a well-ventilated area.
- ❖ If a centrifuge doesn't have an aerosol-tight chamber, use it under a fume hood.
- ❖ Follow these safe operating techniques for proper centrifuge operation:
 - ✓ Inspect the inside of each tube cavity prior to using the centrifuge.
 - ✓ Ensure the rotor and tubes are clean and dry.
 - ✓ Examine the tubes for signs of stress and replace any tubes that are damaged.
 - ✓ Ensure that centrifuge tubes are not filled more than three-fourths full.
 - ✓ To balance the rotors, tubes should be distributed evenly around the rotor.
 - ✓ Stop the rotor if the centrifuge makes an abnormal noise or vibrates excessively.

➤ **Refrigerators and Freezers**

- ❖ Do not use a household refrigerator to store flammable chemicals for these reasons:
 - ✓ Many flammables solvents are still volatile at refrigerator temperatures.
 - ✓ Refrigerator temperatures are typically higher than the flashpoint of most flammables.
 - ✓ The compartment of a household refrigerator contains numerous ignition sources.
- ❖ Use a laboratory-safe and explosion-proof refrigerator for these reasons:
 - ✓ They provide adequate protection for chemical storage in the laboratory.
 - ✓ Laboratory-safe refrigerators are specifically designed to store flammables.
 - ✓ Explosion-proof refrigerators are required in areas that may contain high levels of flammable vapors.

TFS Safety Manual—Laboratory and Research Safety

- ❖ Follow these rules for using refrigerators and freezers in the laboratory:
 - ✓ Never store flammable chemicals in a household refrigerator.
 - ✓ Do not store food or beverages in a laboratory refrigerator/freezer.
 - ✓ Ensure that all refrigerators are clearly labeled to indicate suitable usage.
 - ✓ Label household refrigerators "Not Safe for Flammable Storage".
 - ✓ Label food refrigerators "For Food and Beverages Only" and place them outside of the laboratory.

CHEMICAL SAFETY

For detailed information on chemical safety and the TFS Hazard Communications program refer to the TFS safety manual on Hazardous Materials. Chemical safety is inherently linked to other safety issues including engineering controls, laboratory procedures, personal protective equipment, electrical safety, fire safety, and hazardous waste disposal.

➤ **Hazard Communication (Hazcom) Program**

- ❖ The TFS Hazcom program is comprised of the following elements:
 - ✓ Employee training in handling hazardous substances and interpreting Material Safety Data Sheets (MSDS).
 - ✓ Work Area Specific training from supervisor, Principal Investigator, or laboratory manager.
 - ✓ Employee supervision in the laboratory.
 - ✓ Labeling of primary containers and secondary containers (optional in research labs).

➤ **Chemical Safety Guidelines**

- ❖ Assume that any unknown or unfamiliar chemical is hazardous and treat it as such.
- ❖ Know all the hazards of the chemicals with which you work.
- ❖ Never underestimate the potential hazard of any chemical or combination of chemicals.
- ❖ Never use any substance that is not properly labeled. It may not be what you think it is!
- ❖ Date all chemicals when they are received and again when they are opened.
- ❖ Follow all chemical safety instructions on container and the MSDS.
- ❖ Minimize and avoid repeat exposure to any chemical that may be considered hazardous.
- ❖ Always use appropriate personal protective equipment (PPE) when handling hazardous chemicals.
- ❖ Use the buddy system when working with hazardous chemicals.

➤ **Acute Toxins vs. Chronic Toxins**

The dose-time relationship is the basis for distinguishing between acute and chronic toxicity.

- ❖ **Acute Toxicity** of a chemical is its ability to inflict damage from a single exposure. A sudden, high-level exposure to an acute toxin can result in an emergency situation, such as a severe injury or death. Relevant examples of acute toxins include organophosphate pesticides and arsenic.

TFS Safety Manual—Laboratory and Research Safety

- ❖ **Chronic toxicity** refers to a chemical's ability to inflict damage as a result of repeated and prolonged exposures to relatively low levels of the chemical. Such prolonged exposure may cause severe injury. Relevant examples of chronic toxins include mercury and formaldehyde.

- ❖ **Types of Toxins**
 - ✓ **Carcinogens** are materials that can cause cancer in humans or animals.
 - ✓ **Reproductive toxins** are chemicals that affect a person's ability to reproduce.
 - ✓ **Teratogens** are chemicals that adversely affect a developing embryo or fetus.
 - ✓ **Sensitizers** may cause little or no reaction upon first exposure.
 - ✓ **Irritants** cause reversible inflammation or irritation to the eyes, lungs, or skin.
 - ✓ **Mutagens** can alter DNA structure.
 - ✓ **Neurotoxins** are chemicals that affect the nervous system.

SAFETY PLANS AND EQUIPMENT

Planning for safety is essential to preventing an accident or exposure. Prior to conducting any activity with a risk for exposure, there must be protocols and response plans in place.

- **Toxic Chemical Spill in the Laboratory**
 - ❖ Evacuate the facility immediately and take the following action:
 - ✓ Account for all personnel and don't let unauthorized personnel into the facility until the hazard is eliminated.
 - ✓ Contact TFS EHS and SET Environmental –if necessary.
 - ✓ Only allow personnel with appropriate PPE (IAW NIOSH guidelines) into the facility to address toxic spills.

- **Chemical Exposure**
 - ❖ Wash under the shower or eye wash station immediately and take the following action:
 - ✓ Cover any spilled material with absorbent material from spill kit.
 - ✓ Evacuate facility if necessary.
 - ✓ Review the MSDS for first aid actions—call 911 if necessary.
 - ✓ Report exposure to TFS EHS.

- **Safety Equipment**
 - ❖ Spill Kit—keep a chemical spill kit available in the laboratory (inventory yearly).
 - ❖ Eye Wash—test monthly for plumbed-in station or check saline expiration date yearly.
 - ❖ Decontamination Shower—test yearly by running water through it.
 - ❖ Fume Hoods—certify annually by a qualified technician.
 - ❖ Acid and Chemical Cabinets—visually inspect annually for corrosion and structural integrity.