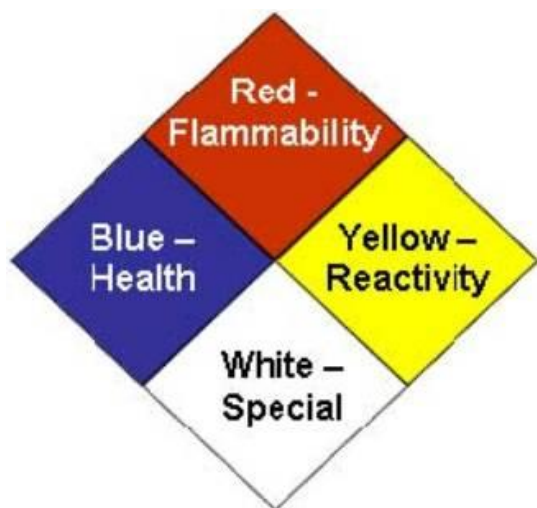


LAB SAFETY GUIDELINES



DEPARTMENT OF RISK MANAGEMENT AND SAFETY

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Introduction

The following lab safety guidelines are established to assist faculty, staff, students, and visitors in remaining safe and accident free while at Texas A&M University-Commerce (TAMUC). These lab safety guidelines have been established through portions of existing TAMUC programs, including:

- Texas A&M University-Commerce Hazardous Waste Management Program
- Texas A&M University-Commerce Bloodborne Pathogen Control Plan
- Texas A&M University-Commerce Hazardous Communication Program

A detailed copy of any of the above can be made available upon request through the Department of Risk Management and Safety.

A copy of these guidelines will be kept in each laboratory and chemical stock room on campus. Additionally, a copy will be located at the appropriate Department Head and Deans Office.

Chemical Safety Guidelines

It is the policy of TAMUC to provide a safe and healthy work environment for all students, employees, and visitors. As one part of the safety program, training will be provided to students and employees in techniques necessary for proper use of, and to minimize exposure to potentially hazardous chemicals. The objective of this program is to reduce or eliminate the risk of illness or injury from an exposure to chemicals in accordance with all applicable Federal, State, Local, technical, and related TAMUC policies and regulations, including:

- Texas Administrative Code - Title 25 - Part 1 – Texas Department of State Health Services - Chapter 96 - Bloodborne Pathogen Control
- Texas Health & Safety Code - Title 6 - Chapter 502 – Tx Hazardous Communication Act
- Resource Conservation and Recovery Act (RCRA)
- 40CFR – Protection of the Environment – Environmental Protection Agency (EPA)
- Texas Administrative Code – Title 30 – Part 1 – Texas Commission on Environmental Quality - Chapter 335 - Industrial Solid Waste And Municipal Hazardous Waste
- NFPA Life Safety Code

Always follow these guidelines when working with chemicals:

- Assume that any unfamiliar chemical is hazardous.
- Know all the hazards of the chemicals with which you work.
- Consider any mixture to be at least as hazardous as its most hazardous component.
- Never use any substance that is not properly labeled.
- Follow all chemical safety instructions precisely.
- Minimize your exposure to any chemical, regardless of its hazard rating.

- Use personal protective equipment, as appropriate.
- Use common sense at all times.

The five prudent practices of chemical safety sum up these safety guidelines:

- Treat all chemicals as if they were hazardous.
- Minimize your exposure to any chemical.
- Avoid repeated exposure to any chemical.
- Never underestimate the potential hazard of any chemical or combination of chemicals.
- Assume that a mixture or reaction product is more hazardous than any component or reactant.

Safe Handling Guidelines

Students and employees should treat all chemicals and equipment with caution and respect.

When working with chemicals, remember to do the following:

- Remove and use only the amount of chemicals needed for the immediate job at hand.
- Properly seal, label, and store chemicals in appropriate containers.
- Keep the containers clearly marked and in a well-ventilated area.
- Check stored chemicals for deterioration and broken containers.
- Learn how to dispose of chemicals safely and legally.
- Clean up spills and leaks immediately.
- Know what to do in an emergency.

Likewise, when working with chemicals, remember the following:

- Do not store chemicals near heat or sunlight or near substances which might initiate a dangerous reaction.
- Do not transport unprotected chemicals between the work area and other areas. Use a tray, rack, cart or rubber carrier. Always use a secondary container when transporting hazardous or highly odorous chemicals on an elevator.
- Do not pour hazardous chemicals down the sink.
- Do not put fellow workers or yourself in danger.

Hygiene and Chemical Safety

Good personal hygiene will help minimize exposure to hazardous chemicals. When working with chemicals, follow these guidelines:

- Wash hands frequently and before leaving the laboratory. Also, wash hands before eating, drinking, smoking, or applying makeup.

- Remove contaminated clothing immediately. Do not use the clothing again until it has been properly decontaminated.
- Follow any special precautions for the chemicals in use.
- Do not eat, drink, smoke, or apply makeup around chemicals.
- Do not wear contact lenses near chemicals, especially corrosives or volatile solvents.
- Do not keep food or food containers anywhere near chemicals.
- Do not use laboratory equipment to serve or store food or drinks.
- Do not sniff or taste chemicals.

Hazard Communication Program

TAMUC has a written Hazard Communication Program that complies with OSHA standards and the Texas Hazard Communication Act for hazardous chemicals. This program is available from the Department of Risk Management and Safety. It requires the following:

- Employee training (including recognition of signs of exposure)
- Labeling procedures
- MSDSs for chemicals at each workplace
- Instructions on how to read and interpret MSDSs
- Chemical inventory reporting procedures
- Recordkeeping requirements
- Emergency response procedures

An integral part of hazard communication is hazard identification. Everyone who works with hazardous chemicals should know how to read and interpret hazard information. Signs, like the NFPA diamond in the illustration below, alert employees to the known hazards in a particular location.

The following is a detailed explanation of the NFPA hazard classification codes:

- **Health (Blue):**
 - 4 Can cause death or major injury despite medical treatment
 - 3 Can cause serious injury despite medical treatment
 - 2 Can cause injury. Requires prompt medical treatment
 - 1 Can cause irritation if not treated 0 No hazard
- **Flammability (Red):**
 - 4 Very flammable gases or liquids
 - 3 Can ignite at normal temperatures
 - 2 Ignites with moderate heat
 - 1 Ignites with considerable preheating 0 Will not burn

- **Reactivity (Yellow):**
 - 4 Readily detonates or explodes
 - 3 May detonate or explode with strong initiating force or heat under confinement
 - 2 Normally unstable, but will not detonate
 - 1 Normally stable. Unstable at high temperature and pressure.
 - 0 Normally stable and not reactive with water.

- **Specific Hazard (White):**
 - Oxidizer - OX
 - Acid - ACID
 - Alkali - ALK
 - Corrosive - COR
 - Use No Water - ~~W~~
 - Radioactive -

Bloodborne Pathogens

TAMUC has a written Bloodborne Pathogen program that complies with Health and Safety Code, Chapter 81, Subchapter H, and analogous to OSHA Bloodborne Pathogens Standard, this program is available from the Department of Risk Management and Safety.

The following are basic principles of the program:

- Universal precautions are observed to prevent contact with blood or other potentially infectious materials. All blood or other potentially infectious materials are considered infectious regardless of the perceived status of the source individual.
- Engineering and work practice controls are used to eliminate or minimize exposure to employees. Where occupational exposure remains after institution of these controls, personal protective equipment is used. Examples include safety design devices, sharps containers, needleless systems, sharps with engineered sharps injury protection for employees, passing instruments in a neutral zone, etc.
- Supervisors and workers examine and maintain engineering and work practice controls within the work center on a regular schedule.
- Hand washing facilities are also available to the employees who incur exposure to blood or other potentially infectious materials. The University's plan requires that these facilities be readily accessible after incurring exposure.
- If hand washing facilities are not feasible, the employer is required to provide either an antiseptic cleanser in conjunction with a clean cloth/paper towels, antiseptic towelettes

or waterless disinfectant. If these alternatives are used, then the hands are to be washed with soap and running water as soon as feasible.

- After removal of personal protective gloves, employees wash hands and any other potentially contaminated skin area immediately or as soon as feasible with soap and water. If employees incur exposure to their skin or mucous membranes, then those areas are washed with soap and water or flushed with water as appropriate as soon as feasible following contact.

Needles

Contaminated needles and other contaminated sharps are not bent, recapped, removed, sheared, or purposely broken. The University's plan allows an exception to this if no alternative is feasible and the action is required by a specific medical procedure. If such action is required, then the recapping or removal of the needle must be done by the use of a device or a one-handed technique.

Contaminated Sharps Discarding and Containment

Contaminated sharps are discarded immediately or as soon as feasible in containers that are closable, puncture resistant, leak proof on sides and bottom, and biohazard labeled or color-coded. During use, containers for contaminated sharps are easily accessible to personnel; located as close as is feasible to the immediate area where sharps are being used or can be reasonably anticipated to be found (e.g., laundries); maintained upright throughout use; are not allowed to overflow; and replaced routinely.

Contaminated Equipment

Equipment which may become contaminated with blood or other potentially infectious materials is examined prior to servicing or shipping and decontaminated as necessary unless the decontamination of the equipment is not feasible. Employers place a biohazard label on all portions of contaminated equipment that remain to inform employees, service representatives, and/or the manufacturer, as appropriate.

Personal Protective Equipment

All personal protective equipment used is provided without cost to employees. Personal protective equipment is chosen based on the anticipated exposure to blood or other potentially infectious materials. The protective equipment is considered appropriate only if it does not permit blood or other potentially infectious materials to pass through or reach the employee's clothing, skin, eyes, mouth, or other mucous membranes under normal conditions of use and for the duration of the time which the protective equipment is used. Examples of personal

protective equipment include gloves, eyewear with side shields, gowns, lab coats, aprons, shoe covers, face shields, and masks. All personal protective equipment is fluid resistant.

All personal protective equipment is cleaned, laundered, and disposed of by the employer at no cost to employees. All repairs and replacements are made by the employer at no cost to employees.

All garments which are penetrated by blood are removed immediately or as soon as feasible and placed in the appropriate container. All personal protective equipment is removed prior to leaving the work area and placed in the designated receptacle.

Gloves are worn where it is reasonably anticipated that employees will have hand contact with blood, other potentially infectious materials, non-intact skin, and mucous membranes. Latex sensitive employees are provided with suitable alternative personal protective equipment.

Disposable gloves are not to be washed or decontaminated for re-use and are to be replaced as soon as practical when they become contaminated or as soon as feasible if they are torn, punctured, or when their ability to function as a barrier is compromised.

Utility gloves may be decontaminated for re-use provided that the integrity of the glove is not compromised. Utility gloves are discarded if they are cracked, peeling, torn, punctured, exhibit other signs of deterioration, or when their ability to function as a barrier is compromised.

Masks in combination with eye protection devices, such as goggles, glasses with solid side shield, or chin length face shields, are required to be worn whenever splashes, spray, splatter, or droplets of blood or other potentially infectious materials may be generated and eye, nose, or mouth contamination can reasonably be anticipated.

Surgical caps or hoods and/or fluid resistant shoe covers or boots are worn in instances when gross contamination can reasonably be anticipated.

Material Safety Data Sheets

Before using any chemical, read the container label and the appropriate Material Safety Data Sheets (MSDSs). Container labels and MSDSs are good sources of information for chemical safety. They provide the following information:

- Hazardous ingredients
- Exposure limits

- Physical and chemical characteristics, including the following:
 - Boiling point
 - Vapor pressure
- Physical hazards, including the following:
 - Flammability
 - Explosiveness
 - Reactivity
- Health hazards, including chemicals that are:
 - Toxic
 - Carcinogens
 - Irritants
- First-aid procedures
- Proper leak, spill, and disposal techniques
- Proper storage and handling procedures
- Other special provisions

Glassware

Accidents involving glassware are the leading cause of laboratory injuries. To reduce the chance of cuts or punctures, use common sense when working with glassware. In addition, follow special safety precautions for tasks that involve unusual risks.

Follow these practices for using laboratory glassware safely:

- Prevent damage to glassware during handling and storage.
- Inspect glassware before and after each use. Discard or repair any cracked, broken, or damaged glassware.
- Thoroughly clean and decontaminate glassware after each use.
- When inserting glass tubing into rubber stoppers, corks, or tubing, follow these guidelines:
 - Use adequate hand protection.
 - Lubricate the tubing.
 - Hold hands close together to minimize movement if the glass breaks
- When possible, substitute plastic or metal connectors for glass connectors.
- Large glass containers are highly susceptible to thermal shock. Heat and cool large glass containers slowly.
- Use Pyrex or heat-treated glass for heating operations.
- Leave at least 10 percent air space in containers with positive closures.
- Never use laboratory glassware to serve food or drinks.

- Use thick-walled glassware for vacuum operation.
- Use round-bottomed glassware for vacuum operations. Flat-bottomed glassware is not as strong as round-bottomed glassware.

Follow these safety guidelines for handling glassware:

- When handling cool flasks, grasp the neck with one hand and support the bottom with the other hand.
- Lift cool beakers by grasping the sides just below the rim. For large beakers, use two hands: one on the side and one supporting the bottom.
- Never carry bottles by their necks.
- Use a cart to transport large bottles of dense liquid.

Follow these guidelines for handling and disposing of broken glass:

- Do not pick up broken glass with bare or unprotected hands. Use a brush and dust pan to clean up broken glass. Remove broken glass in sinks by using tongs for large pieces and cotton held by tongs for small pieces and slivers.
- Glass contaminated with biological, chemical, or radioactive materials must be decontaminated before disposal or be disposed of as hazardous waste.
- Before disposing of broken glass in a trash can, place the glass in a rigid container such as cardboard and mark it "Broken Glass."

Refrigerators/Freezers

Using a household refrigerator to store laboratory chemicals is extremely hazardous for several reasons. Many flammable solvents are still volatile at refrigerator temperatures. Refrigerator temperatures are typically higher than the flashpoint of most flammable liquids. In addition, the storage compartment of a household refrigerator contains numerous ignition sources including thermostats, light switches, and heater strips. Furthermore, the compressor and electrical circuits, located at the bottom of the unit where chemical vapors are likely to accumulate, are not sealed. Laboratory-safe and explosion-proof refrigerators typically provide adequate protection for chemical storage in the laboratory.

Laboratory-safe refrigerators, for example, are specifically designed for use with flammables since the sparking components are located on the exterior of the refrigerator. Explosion-proof refrigerators are required in areas that may contain high levels of flammable vapors (e.g., chemical storage rooms with large quantities of flammables).

Follow these rules for using refrigerators in the laboratory:

- Never store flammable chemicals in a household refrigerator.

- Do not store food or drink in a laboratory refrigerator/freezer.
- Ensure that all refrigerators are clearly labeled to indicate suitable usage.
- Laboratory-safe and explosion-proof refrigerators should be identified by a manufacturer label.
- "Not Safe for Flammable Storage" labels are available from the Environmental Health & Safety Department.
- Refrigerators used to hold food should be labeled "For Food Only".

Fume Hoods

Fume hoods provide primary confinement in a chemical laboratory. They exhaust toxic, flammable, noxious, or hazardous fumes and vapors by capturing, diluting, and removing these materials. Fume hoods also provide physical protection against fire, spills, and explosion. Fume hoods provide the best protection when the fume hood sash is in the closed position. All chemical fume hoods must be ducted to the outside of the building.

Fume Hood Safety Considerations

The potential for glass breakage, spills, fires, and explosions is great within a fume hood. Due to the chance for fires or explosions, fume hoods should be located towards the back of a laboratory, away from primary and secondary exits. Practice safe work habits when working with fume hoods, including the following:

Air Flow and Ventilation: Employee traffic in front of a fume hoods or opening/closing laboratory doors can interfere with hood performance. Ensure that there is sufficient aisle space in front of fume hoods.

Fume Hood Type: All fume hoods are not appropriate for all types of work. Ensure that hazardous chemicals are used in the proper type or class of hood. For example, use perchloric acid only in fume hoods specifically designed for perchloric acid.

Fume Hood Use and Care

To ensure safety and proper fume hood performance, follow these guidelines:

- Use a fume hood when working with chemicals or procedures that may produce hazardous fumes or vapors.
- Know how to properly operate a fume hood before beginning work. Inspect the fume hood before starting each operation.
- Place equipment and chemicals at least six inches behind the fume hood sash. This practice reduces the chance of exposure to hazardous vapors.
- Do not allow paper or other debris to enter the exhaust duct of the hood.

- Do not store excess chemicals or equipment in fume hoods.
- Do not block the baffle area of the fume hood.
- Elevate any large equipment within the hood at least three inches to allow proper ventilation around the equipment.
- When working in a fume hood, set the sash at the height indicated by the arrow on the inspection sticker. The only time the sash should be completely open is while setting up equipment.
- Wear personal protective equipment, as appropriate.
- Do not alter/modify the fume hood or associated duct work.
- Clean up spills in the hood immediately.

Spill Response

Spills are likely whenever chemicals are used. Personnel should be trained and equipped to handle most of the spills in their work area. Contact the Department of Risk Management and Safety for assistance or advice about a chemical spill.

Spill Prevention and Planning

Prevention is the best safety strategy for any environment. Use safe handling procedures and be aware of the potential hazards associated with chemicals. For example, before working with any chemicals, review the appropriate MSDSs. Be prepared to respond to a chemical spill. To prepare for a potential spill, follow these guidelines:

- Develop and periodically review written procedures for an emergency response plan.
- Keep a fully stocked chemical spill response kit available.
- Know the location and proper use of cleanup materials.
- Know how to turn off equipment, heat sources, electrical panels, etc.
- Review appropriate MSDSs.

Response Kit

Work areas that contain potentially hazardous chemicals should have a chemical spill response kit. This kit should include the following:

- Disposable laboratory/surgical gloves
- Disposable vinyl gloves
- Safety goggles
- Absorbent (e.g., spill pillows, vermiculite, litter box filler, etc.)
- Plastic scoop
- Plastic trash bags

Responding to Chemical Spills

The following sequence provides a brief overview of proper chemical response procedures:

- Notify others in the immediate area that a spill has occurred. Evacuate the area if necessary.
- Attend to injured and exposed people.
- Identify the spilled chemical(s).
- Based on the hazards and the personal protective equipment needed (e.g., respiratory protection), determine if you can safely clean the spill or if assistance is necessary. (Most spills can be cleaned safely by the people who were using the chemical.)

If you determine that you can safely clean the spill without emergency assistance, follow these guidelines:

- Wear appropriate protective clothing and equipment.
- Have another person stand by during the cleanup.
- Clean up the spill and collect all wastes for proper disposal.
- Ventilate the area, as necessary, before it is reoccupied.
- Decontaminate reusable cleanup supplies such as scoops, rubber boots, etc.
- Restock the chemical spill kit and return it to the normal storage location.

Do not take unnecessary risks with chemical spills. Call the Department of Risk Management and Safety whenever a spill involves the following:

- Large volume of spilled material
- Very hazardous material
- Very hazardous conditions (e.g., fire, explosion, toxicity, etc.)
- Strong odor
- Personnel injury or exposure

Chemical Storage

Proper chemical storage is as important to safety as proper chemical handling. Often, seemingly logical storage ideas, such as placing chemicals in alphabetical order, may cause incompatible chemicals to be stored together.

General Guidelines

Follow these guidelines for safe chemical storage:

- Read chemical labels and MSDSs for specific storage instructions.
- Store chemicals in a well-ventilated area; however, do not store chemicals in a fume hood.

- Maintain an inventory of all chemicals in storage.
- Return chemical containers to their proper storage location after use.
- Store glass chemical containers so that they are unlikely to be broken.
- Store all hazardous chemicals below eye level.
- Never store hazardous chemicals in a public area or corridor.

Separating Hazardous Chemicals

In addition to the guidelines above, there are storage requirements for separating hazardous chemicals. Because an alphabetical storage system may place incompatible chemicals next to each other, group chemicals according to their hazard category (i.e., acids, bases, flammables, etc.).

Follow these guidelines to ensure that hazardous chemicals are stored safely:

- Separate acids from bases. Store these chemicals near floor level.
- Isolate perchloric acid from organic materials. Do not store perchloric acid on a wooden shelf.
- Separate highly toxic chemicals and carcinogens from all other chemicals. This storage location should have a warning label and should be locked.
- Separate acids from flammables.
- Do not keep peroxide-forming chemicals longer than twelve months.
- Do not allow picric acid to dry out.
- If flammables need to be chilled, store them in a laboratory-safe refrigerator, not in a standard refrigerator.
- Flammables should be stored in a flammable storage cabinet.

Shipping/Receiving Chemicals

The U.S. Department of Transportation regulates the shipment of hazardous materials. Anyone who packages, receives, unpacks, signs for, or transports hazardous chemicals must be trained and certified in Hazardous Materials Transportation. Warehouse personnel, shipping and receiving clerks, truck drivers, and other employees who pack or unpack hazardous materials must receive this training. Contact the Environmental Health & Safety Department for more information on shipping or receiving hazardous chemicals.

Hazardous Waste and Texas A&M University - Commerce

Hazardous waste disposal is governed by the EPA and the TNRCC through State and Federal regulations. The purpose of environmentally sound disposal methods is to prevent harm to the water, land, and air. TAMUC complies with hazardous waste disposal regulations by means of

the Hazardous Waste Management Program. This program is available from the Department of Risk Management and Safety.

Penalties of Noncompliance

Noncompliance with any hazardous waste regulation may result in substantial fines and penalties for the University. In addition, individual generators may be personally liable. Generators may be cited or fined for numerous types of violations. Violations range from improperly labeling a waste container to intentionally disposing of hazardous waste incorrectly.

Types of Hazardous Waste

An item is considered waste when the owner determines that the material is no longer useful and needs to be discarded. An item is considered to be hazardous waste if it meets one or more of the following characteristics:

- A chemical component is listed on one of the Chemical Tables of the Hazardous Waste Management Program.
- Mixture contains a listed hazardous waste and a nonhazardous waste.
- Material meets the definition of one of the following:
 - Ignitability (flashpoint < 60o C or supports combustion)
 - Reactivity (e.g., water reactives, cyanides, explosives, unstable chemicals)
 - Corrosivity (ph < 4 or > 10)
 - EP toxicity (e.g., pesticides, heavy metals, poisons)
 - Material is not excluded from regulations.

Individual departments are responsible for properly identifying the hazardous waste they generate and for following University disposal procedures.

Containers, Tags, and Collection

Proper containment, tagging, collection and disposal are essential to the success of the Hazardous Waste Program. The following sections discuss these areas.

Filling Containers

Hazardous waste collection containers must be in good condition, must not leak, and must be compatible with their hazardous contents (e.g., do not use metal containers for corrosive waste or plastic containers for organic solvents). All containers must have suitable screw caps or other secure means of closure. When large waste containers (greater than 10 gallons total volume) are warranted, contact the Department of Risk Management and Safety for assistance. If you are reusing a container to accumulate waste, destroy the original product label. EPA regulations

require that waste containers be labeled with the accumulation start date, the identity of the contents, and the words "Hazardous Waste". Use a new label to identify the hazardous waste; don't use the disposal tag.

IMPORTANT: *Never overfill hazardous waste containers. Expansion and excess weight can lead to spills, explosion, and extensive environmental exposure.*

Hazardous waste containers for liquids are generally rated by volume capacity. Allow extra room in liquid containers to allow for contents expansion.

- Do not fill jugs and bottles past the shoulder of the container. The shoulder of the container is the place where the container slopes in towards the neck.
- Fill closed head cans (5 gallons or less) to leave approximately two inches of space between the liquid level and the top of the container.
- Fill closed head drums (larger than 5 gallons) to leave approximately four inches of space.

Hazardous waste containers for solids are generally rated by their weight capacity and volume capacity. Take care not to exceed the weight capacity of a solid container. Weight is generally not a problem for jars and open head cans (5 gallons or less), but it can be a problem for open head drums (larger than 5 gallons). Depending on weight requirements, you may fill containers for solids within two inches of the closure.

IMPORTANT: *Keep all waste collection containers closed except when adding or removing material.*

Completing Tags

When a container is ready for disposal, complete a waste tag (available from the Dept. of Risk Management and Safety) and attach it to the container. A waste disposal tag must be attached to each waste container before disposal.

Follow these guidelines for completing hazardous waste tags:

- Completely fill out both the upper and lower sections of the tag. (This information is essential for record keeping.)
- The "REQUESTOR" is the person in charge of the lab.
- Use full chemical names or common names. Chemical formulas or abbreviations are not acceptable.

- List all chemical components in the waste container, including water. Long lists may be continued on the back of the tag.
- Indicate the percent concentration of potentially explosive materials such as picric acid and nitro compounds.
- Place additional hazard information in REMARKS.
- Attach the tag to a string which encircles the container. Rubber bands, tape, and wire are not acceptable.

Collection and Disposal

After receiving a properly completed waste disposal tag, the Dept. of Risk Management and Safety will collect the waste. Containers with improper caps, leaks, outside contamination, or improper labeling will not be picked up until these problems have been corrected.

Improper disposal methods for hazardous chemical waste include the following:

- Disposal down the drain.
- Intentional evaporation in a fume hood.
- Disposal in the regular trash.

Disposing of Empty Containers

What do I do with empty chemical containers? How do I get rid of them? Can they be placed in the trash dumpster? These are questions frequently asked by TAMUC personnel. The answer is fairly simple but very important.

EPA regulations stipulate that empty containers must meet the following requirements:

- *Containers must not contain free liquid or solid residue.*
- *Containers must be triple rinsed.*
- *Product labels must be defaced or removed.*
- *Container lids or caps must be removed.*

Punch holes in the bottom of metal containers and plastic jugs before disposing of them in the regular trash. It is not necessary to break empty glass containers.

IMPORTANT: *Containers that do meet the requirements mentioned here must be treated as hazardous waste.*

Minimization and Substitution

The cost of commercial waste disposal continues to rise and the amount of waste generated continues to increase. TAMUC cannot control disposal costs, but it can reduce the amount of

waste generated. The following sections discuss how to minimize waste sources and waste products.

Waste Source Reduction Techniques

Use the following techniques to reduce waste sources:

Purchasing and Inventory Control

- Use computerized tracking systems to manage purchasing and control inventory.
- Maintain current inventory records to prevent overstocking and to monitor the shelf life of remaining chemicals.
- Develop a campus-wide chemical exchange network to promote chemical sharing and avoid redundant purchases.
- Negotiate with suppliers to gain volume discounts, flexible delivery schedules, and delivery of fewer small-sized containers without cost penalties.
- **PURCHASE QUANTITIES FOR IMMEDIATE USE ONLY.** Do not order quantities to obtain a special unit cost savings.
- Obtain compressed gases from vendors who accept return of empty or partially full cylinders.
- Include waste generation as a criteria in equipment selection.
- Rotate chemical stocks to use chemicals before their shelf-life expires.

Chemical Usage

- Use lab procedures that assure the integrity of chemical quality.
- Reduce spills and waste by pre-weighing chemicals for undergraduate use.
- Require proper labeling of all secondary containers. Replace all deteriorating labels on primary and secondary containers.
- Substitute less hazardous chemicals whenever possible (e.g., biodegradable scintillation cocktails instead of xylene or toluene-based cocktails).
- Minimize the use of heavy metals (e.g., silver, chromium, mercury, barium, cadmium, and lead).
- Substitute alcohol or electronic thermal monitors for mercury thermometers.
- Use "No-Chromix", detergents, or enzymatic cleaners to clean laboratory glassware.
- Minimize solvent waste by recycling or substitution.

Waste Minimization Techniques

Follow these techniques to reduce hazardous waste:

- Establish a Faculty Task Force to review waste streams and recommend waste minimization procedures.
- Do not mix different types of waste.
 - Do not put non-hazardous waste, such as a mixture of water, sodium bicarbonate, and acetic acid, into a waste container of hazardous waste.
 - Do not combine inorganic heavy metal waste with organic solvents waste. - Segregate halogenated waste solvents from non-halogenated waste solvents
 -
- Segregate waste streams by storing them in separate waste containers. Store waste containers separate from reagent containers being used to avoid accidental contamination.
- Decontaminate empty containers to make them non-hazardous.
- Neutralize dilute acids and bases to make them non-hazardous and suitable for drain disposal.
- If possible, redesign experimental protocols so harmful byproducts are detoxified or reduced.
- Recycle chemicals via purification.
- Make lab employees accountable for waste when labs are decommissioned.

Special Concerns Employees who generate hazardous waste must maintain and control their hazardous waste accumulation areas. Special concerns for hazardous waste include the following:

- Unneeded chemicals that are to be discarded must be handled and managed as hazardous waste.
- **Unknown chemical waste will be picked up by the Dept. of Risk Management and Safety. Departments will be charged for the chemical analysis to determine proper disposal method.**
- Gas cylinders are extremely difficult to discard. They should be returned to the manufacturer or distributor whenever possible. Cylinders that cannot be returned should be tagged as hazardous waste as soon as possible.
- Photographic chemicals containing silver may not be placed in the sanitary sewer. They must be disposed of as hazardous waste.

NOTE: Some developing equipment has a filter to capture silver before the photographic effluent enters the drain. Please notify the Department of Risk Management and Safety if you have this type of equipment.

Lab Inspection Form

The Department of Risk Management and Safety will periodically conduct laboratory inspections throughout the semester/year. The following list what is typically inspected.

Electrical Safety (NFPA Code)

- Do not provide power to laboratory equipment with extension cords:
- Repair electrical cords/outlet/plugs not in good condition
- Discontinue use of three way plugs. *Use an electric strip with a fuse.*
- Remove extension cord(s) above ceiling tiles. *Hidden fire hazard*
- Electrical panel is not: accessible labeled. *Must be both.*

Fire/Life Safety (NFPA Code)

- Keep lab door closed. *Reduces spread of fire / smoke.*
- Remove obstruction blocking fire extinguisher.
- Keep evacuation/exit routes cleared.
- EHSD will __replace__mount__service fire extinguisher.
- Replace brittle Bunsen burner tubing.
- Remove items within 18 inches of ceiling.
- Replace missing ceiling tiles. *They are part of the fire break system*

Warning Signs/Labels (TDH HazCom Act)

- Properly label secondary containers to indicate contents.
- Replace missing or deteriorating labels.
- Post emergency contacts on outer door.
- Post specific warning signs (bio-hazard, radioactive, etc.) on lab door.
- Label microwave "Lab Use Only" or "Food Only".
- Label refrigerator "Not Safe for Flammable Storage" or "Food Only".

Physical Hazards

- Relocate or tape down electrical cords, hoses and/or computer cables that present tripping hazards.
- Secure compressed gas cylinders.
- Apply safety cap to cylinders when not in use.
- Vacuum pumps:
 - Belt guard (Is it missing?)
 - Exhaust (Is it vented?)
 - Oil leaks
 - Running unattended

- Do not store glass items on floor

Chemical Storage (NFPA Code, TDH HazCom Act)

- Minimize amounts of flammables.
- Do not store hazardous liquid chemicals above eye level.
- Do not store food and chemicals in same refrigerator.
- Remove flammables stored in household refrigerator.
- Do not store chemicals on floor.
- Alphabetical storage should only be used within same hazard class.
Segregate according to hazard class
- Segregate chemicals by hazard class.
- Repackage or dispose of chemicals in deteriorated containers.
- Date chemicals when received and again when opened.
- Do not store chemicals on work bench.
- Store flammable liquids in flammable storage cabinet.
- Do not store misc. items in flammable storage cabinets.

Fume Hood

- Remove clutter from
 - fume hood
 - biological safety cabinet.
Presents a spill/ splash hazard and can interfere with the airflow.

Pull down sash on fume hood. *Must be at or below marked level to operate correctly*
- Remove electrical strips in fume hood. *Fire hazard.*
- Remove chemicals stored in fume hood.
Storing chemicals in a hood present spill/ splash hazards as well as interfering with the operation of the air system.
- Clean dirty fume hood. *Personal safety hazard and can damage hood.*
- Remove items stored in back part of fume hood blocking the airflow.
- Remove loose paper items from
 - fume hood
 - biological safety cabinet.
- Remove lab coat from fume hood controls. *To prevent accidental operation of valves.*

Waste Disposal (EPA/ TNRCC Regulations)

- Autoclave biohazard waste before disposal.
- Seal open waste container. *State regulations prohibit evaporation as a means of disposal.*

- Dispose of old chemicals/samples/waste.
- Encapsulate sharps before disposal. *All sharp metal implements (razors, needles, surgical blades, etc.) must be discarded by placing them in a hard-sided container and encasing them in a hard substance, e.g., concrete, plaster, paraffin, polymerized resin, etc.*
- Dispose broken glass properly. Glass should be placed in a cardboard box, which can be securely sealed with tape before disposal
- Dispose of old lecture bottles.
- Label waste container: "Hazardous Waste" and list chemical contents.

Autoclave (TNRCC Regulations)

- Remove bags of waste waiting to/that have been autoclaved.
- Put tape that produces the word "AUTOCLAVED" across all Biohazard symbols on bags.
- Do not throw away a Biohazard bag without covering all Biohazard symbols.
- Keep a log of each autoclave load of biohazardous waste. *Required by State law.*
- Replace chart paper or printer paper to record operating parameters of each autoclave load.
- Use a secondary container of sufficient size to hold Biohazard bags to be autoclaved

Personal Protective Equipment/Eyewash/Showers (ANSI Standards, TDH HazCom Act)

- Remove obstruction blocking shower/eyewash.
- Flush eyewash on a regular basis. *This insures cleanliness and proper operation.*
- A squeeze bottle eyewash is not acceptable. *This should be removed unless the sterile solution is replaced frequently.*
- EHS will test the shower/eyewash.
- Provide Personal Protective Equipment. *Gloves, lab coats, eye protection, etc.*
- Lab personnel should wear Personal Protective Equipment.

Safe Lab Practices

- Prohibit smoking.
- Limit eating or drinking to areas away from lab work areas.
- Provide adequate facilities for hand washing (e.g. soap, towels)
- Do not recap used needles. Carefully place uncapped needles into sharps container. Recapping needles exposes personnel to more opportunities for injury.
- Deface all empty bottles before reuse or disposal to prevent confusion over contents
- No open toed shoes
- Lab surfaces free of clutter: back packs, books, etc