TAMUCC CHEMICAL HYGIENE PLAN

PREFACE

The Environmental, Health & Safety Department is committed to providing the campus community with exemplary services that promote asset protection, environmental stewardship, a healthy and safe setting in which to conduct research, teaching and organizational activities.

Texas A&M University-Corpus Christi is required by Occupational Safety and Health Administration Standard 29 CFR 1910 section 1450 of subpart Z to develop a chemical hygiene plan for chemical laboratories. The 29 CFR 1910.1450 does not apply to all laboratories, but where it applies, it supersedes the Hazard Communication Standard 29 CFR 1910.1200. According to 29CFR 1910.1450 “laboratory” means a facility where the use of hazardous chemicals occur. Even though Texas A&M University-Corpus Christi has implemented the Hazard Communication Standard, the laboratory standard takes precedence in those areas to which it applies. There is no option of choosing between the two standards. If laboratory standard applies to an area, it must be implemented, if laboratory standard does not apply, the Hazard Communication Standard does apply.

This Chemical Hygiene Plan serves as a quick guidance for laboratory safety, and shall be available at all laboratories where hazardous chemicals are used. The Environmental, Health and Safety Department publishes a Chemical Safety Guide which is a more detail oriented plan and covers most aspects of chemical safety.

All users of chemicals must be familiar with the requirements set forth in this manual and applicable state and federal regulations and must conduct their operations in accordance with them.

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Contact for Interpretation: Director, Environmental, Health and Safety Department.
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Policy and Purpose

The Texas A&M University-Corpus Christi (TAMU-CC) will implement policies and programs to keep exposures to hazardous chemicals in laboratories at the lowest practical levels and below the Permissible Exposure Limits (29 CFR 1910.1000, Subpart Z) established by the Occupational Safety and Health Administration (OSHA). The control of laboratory exposures to hazardous chemicals will be accomplished by implementing a chemical hygiene plan containing work practices, procedures, and policies that provide a safe and healthy environment.

The OSHA Laboratory Standard (29 CFR 1910.1450) was established to protect laboratory workers from harmful exposures to hazardous chemicals. All laboratories in which chemicals are used are covered by this Standard. The Texas A&M University-Corpus Christi Environmental, Health and Safety Department have coordinated the development of the TAMU-CC OSHA Laboratory Standard Compliance Program to ensure campus compliance with this Standard. One element of the compliance program is the development of the TAMU-CC Chemical Hygiene Plan. The Chemical Hygiene Plan will be referred to as Plan or CHP.

This Plan applies to all laboratories at TAMU-CC where chemicals are used. Laboratories may develop a specific hygiene plan according to their needs; however the developed plan shall cover all topics covered in this chemical hygiene plan with additional safety features based on their needs. When developing new plans for laboratories, the lab coordinator shall inform the Environmental, Health and Safety Department of the additional changes to the plan. The new plan shall be followed only when approved in writing by the Director of E,H&S.

Responsibilities

Principal Investigators and Laboratory Supervisors:
- Maintain an up-to-date copy of the TAMU-CC Chemical Hygiene Plan or equivalent and ensure that laboratory workers comply with the Plan
- Train or arrange for training of laboratory workers, and maintain records documenting such training
- Implement and enforce the use of safety procedures including any necessary personal protective equipment
- Ensure the availability of Safety Data Sheets and relevant reference materials

Laboratory Workers (includes Teaching/Research Assistants):
- Follow all health and safety procedures
- Report all hazardous conditions to the supervisor
- Wear or use prescribed personal protective equipment
- Report any job-related injuries or illnesses to supervisor immediately
- Request information or training when unsure about how to handle a hazardous chemical

The Environmental, Health and Safety Department (E,H&S):
- Maintain a library of Safety Data Sheets and other safety resources
- Maintain TAMU-CC Chemical Safety Guide
- Maintain TAMU-CC Chemical Hygiene Plan
- Provide training and consultation upon request
- Make routine inspections, as well as special, health and risk appraisals

Deans, Directors, and Head of Academic and Administrative Units: They have the primary responsibility for the health and safety of their staff and students. Specific responsibilities regarding the implementation of the Chemical Hygiene Plan include:
- Collaborate with faculty and staff to adapt this model Chemical Hygiene Plan to include lab-specific guidelines and to develop strategies to implement the Chemical Hygiene Plan
- Make budget arrangements for health and safety improvements
Chemical Safety Principles

Introduction
The hazards of chemicals vary widely and appropriate caution must always be used. Every chemical can be hazardous in certain circumstances. An understanding of the hazards of chemicals and how they enter the body can help those working with chemicals devise procedures to work with them safely.

This chapter presents information on the physical and health hazards associated with chemicals, factors affecting toxicity, routes of exposures, and general measures that can be taken to control chemical exposures.

Physical Hazards
The following terms are frequently used when describing the physical hazards associated with chemicals:

**Combustible liquid**: Any liquid, or mixture with 1% or more of a liquid, with a flashpoint above 140° F but below 200° F.

**Compressed gas**: A gas or gas mixture with an absolute pressure exceeding 40 p.s.i. (pounds per square inch) at 70° F, or exceeding 104 p.s.i. at 130° F, or a liquid having a vapor pressure exceeding 40 p.s.i. at 100° F as determined by ASTM D-232-72, a standard of the American Society of Testing and Materials.

**Explosive**: A chemical that causes a sudden, almost instantaneous release of gas, pressure, and heat when subjected to sudden shock, high temperature or pressure.

**Flammable**:
- Aerosol: A material that can produce a flame or flashback from a valve opening.
- Gas: Any gas at ambient conditions that will cause a flammable mixture with air in concentrations of 13% or less.
- Liquid: Any liquid, or mixture with 1% or more of a liquid, with a flash point below 141° F.
- Solid: A material that is liable to cause fire through friction, contact with moisture, spontaneous reaction, or retained heat, or which can be readily ignited and burns with enough persistence or violence to cause a serious health hazard.

**Organic peroxides**: An organic compound with a bivalent O-O structure, which may be considered a peroxide derivative with one or both of the hydrogen atoms replaced with an organic molecule. They present dangerous fire and explosion risks; many are strong oxidizers.

**Oxidizer**: A chemical that initiates or supports combustion of other materials, causing fire by itself or by the release of oxygen or other gasses.

**Pyrophoric**: A material that will ignite spontaneously in air at or below 130° F.

**Unstable**: Any material, which will vigorously decompose, polymerize, condense, or will become self-reactive when exposed to conditions of shock, pressure, or temperature.

**Water-reactive**: A material which can react with water or steam to produce a gas which is either toxic or flammable.
**Health Hazards**

The following are health hazard classes as defined by the Occupational Safety and Health Administration:

**Carcinogen**: A material which causes or potentially causes cancer according to the International Research on Cancer, or is listed as such in the National Toxicology Program Annual Report on Carcinogens [http://ehis.niehs.nih.gov/roc/](http://ehis.niehs.nih.gov/roc/)

**Corrosives**: Chemicals that cause visible destruction of, or irreversible alterations in, living tissue by chemical action at the site of contact.

**Irritants**: Chemicals which are not corrosive, but which cause reversible inflammatory effects on living tissue at the site of contact.

**Mutagen**: A material that damages chromosomes.

**Sensitizer**: A chemical, which will cause an allergic reaction in a substantial number of exposed people.

**Target organ effects**:
- Cutaneous hazards: damage the skin
- Eye hazards: damage the eye
- Hematopoetic toxins: damage the blood and/or blood forming organs
- Hepatotoxic: damage the liver
- Nephrotoxic: damage the kidneys
- Neurotoxins: damage the nervous system
- Pulmonary toxins: damage the lungs
- Reproductive toxins: affect the fetus

**Teratogen**: A material that causes birth defects

**Toxic**: A chemical with an oral lethal dose of 50-500 mg/kg, a cutaneous lethal dose of 200-1000 mg/kg, or a lethal concentration in air of 200-2000 ppm (parts per million).

**Highly toxic**: A material with an oral lethal dose of <50 mg/kg, a cutaneous lethal dose of <200 mg/kg, or lethal concentration in air at <200 ppm.

**Factors Affecting Toxicity**

All chemicals are hazardous under some conditions. An understanding of the factors that affect toxicity is helpful in devising safe procedures to prevent hazardous exposures. Some of these factors are briefly discussed below:

**Dose**: Perhaps the single most significant factor of concern is the amount of exposure to the chemical. An exposure to a large amount of the chemical is usually of more concern than exposure to a small amount. For most chemicals, there is a level of exposure below which no adverse effects are likely to be observed.

**Toxicity**: Chemicals vary widely in how toxic (poisonous) they are. Exposure to small amounts of highly toxic chemicals can be a greater danger than exposure to large amounts of less toxic chemicals.
Duration and frequency: One-time exposures that are of short duration are of less concern than multiple exposures of long duration, all other factors being equal. Thus, when there has been a chemical exposure, an important piece of information concerns duration and frequency.

Synergistic effects: Many situations involve exposure to two or more chemicals at the same time. When this happens, it is possible that the combined exposures are more hazardous than what one might expect from simply adding the two effects together. While information to exposures to a single chemical is often available, good information on the possible toxic effects to chemical mixtures is often not available.

Individual characteristics: Each person is unique. While there are many similarities in response to chemical exposures, responses may vary dramatically among individuals. For examples, males can react differently than females. Special concern is often given for women who are pregnant. Some individuals are allergic or hypersensitive to certain chemicals.

Acute and chronic effects: Acute effects are those that show up immediately after a chemical exposure occurs. Chronic effects are those that occur after a significant amount (sometimes even years) of time passes and usually are the result of multiple exposures over a period of time.

Routes of Exposure
There are three major routes of entry for a chemical to enter the body: inhalation; direct contact (to skin and eyes); and ingestion. Injection is a fourth, though much less common, route of entry for chemicals. An understanding of these routes of entries enables one to develop procedures or controls to prevent hazardous exposures to chemicals.

Inhalation hazards: Inhalation of chemicals is the most common route of entry a chemical can take to enter the body. Chemicals that could be inhaled include:

• gases
• the vapors of volatile liquids
• mists and sprays of both volatile and nonvolatile liquid substances
• solid chemicals in the form of particles, fibers, and dusts

Direct (skin/eye) contact hazards: Many chemicals (e.g. acids) can injure the skin directly, while others may cause irritation or an allergic reaction. In addition to causing local toxic effects, many chemicals may be absorbed through the skin and/or eyes in sufficient quantity to cause systemic effects. The main avenues by which chemicals enter the body through the skin are hair follicles, sebaceous glands, sweat glands, and cuts or abrasions of the skin.

Direct contact effects and absorption of chemicals through the skin depend on a number of factors, including:

• chemical concentration
• chemical reactivity
• the solubility of the chemical in fat and water
• the condition of the skin
• the duration of contact

Ingestion hazards: Ingestion of chemicals is a less common route of entry into the body. However, persons using chemicals can easily ingest chemicals into the body via contaminated hands if they are not washed prior to eating, drinking, smoking, applying cosmetics, or sticking part of the hand or a writing tool that has become contaminated into the mouth.

Injection hazards: This route is the least likely for chemical exposures. Accidental injection of chemicals through needles is unlikely. However, if needles are contaminated or contaminated glassware breaks, there is
the possibility of injecting chemicals into the body. Injections can also occur through high pressure streams of liquids or gases.

Controlling Chemical Exposures

“Criteria that the employer will use to determine and implement control measures to reduce employee exposure to hazardous chemicals including engineering controls, the use of personal protective equipment and hygiene practices; particular attention shall be given to the selection of control measures for chemicals that are known to be extremely hazardous.” 29 CFR 1910.1450 (e) (ii)

Using the information presented in the earlier sections of this chapter and knowing the specific hazards of the chemicals to be used, one can design procedures to minimize hazards. At no time shall any campus employee be exposed to any chemical above the OSHA Permissible Exposure Limit (PEL) or Short Term Exposure Limit (STEL). These limits have been established by OSHA to protect the health and safety of all workers. You may request assistance from the Environmental, Health and Safety Department (825-5555) in developing or reviewing procedures to control chemical exposures.

Control techniques fall into three broad classes in order of preference: engineering controls, administrative controls, and personal protective equipment.

Engineering controls: Options for engineering controls are those that eliminate the hazard through methods such as changing the procedures or substituting less hazardous materials for more hazardous materials. Conducting work with hazardous chemicals in a fume hood and providing secondary containment in the event of spills are examples of engineering controls.

Administrative controls: Whereas engineering controls are controls that work passively once they are established, administrative controls require that workers take active steps. Some examples are posting hazard signs on laboratory doors, minimizing exposure time when working with hazardous chemicals, restricting access to areas where hazardous chemicals are used, working with highly odorous chemicals during non-office hours, and adopting standard operating procedures.

Personal protective equipment: Personal protective equipment includes items such as gloves, eye protection, suitable clothing, and respirators. Because such equipment is the last line of defense against exposure to hazardous chemicals, these are the options last employed. Note that selection of appropriate personal protective equipment is not always straightforward. In the case of gloves, there are a wide variety of types depending on the specific application. Although some types of personal protective equipment may be suitable for a wide range of applications, each operation shall be assessed individually.

Standard Operating Procedures

“Standard operating procedures relevant to safety and health considerations are to be followed when laboratory work involves the use of hazardous chemicals.” 29 CFR 1910.1450 (e) (3) (I)

This document represents a minimum set of guidelines for handling toxic chemicals. Individual administrative units, laboratories or research groups are required to develop more detailed procedures as their situations warrant. Additional or chemical specific safety procedures may be obtained by contacting Environmental, Health and Safety Department at 825-5555 or the TAMU-CC Chemical Safety Guide. A list of references is also available in the TAMU-CC Chemical Safety Guide. In all situations, supervisory personnel, faculty or staff will be responsible for enforcing adequate safety and hygiene measures in laboratories. Environmental, Health and Safety Department is available for consultative assistance to develop safe procedures for situations not covered in this guide. If you have additional question regarding safety Environmental, Health and Safety Department is available for consultation (825-5555).
General Employee Rules and Procedures:
1. Minimize all chemical exposures.
2. Skin contact with chemicals should be avoided.
3. Avoid underestimation of chemical hazards and risks.
4. Wear eye protection at all times.
5. Flammable liquids require special attention. Never use flammable materials near an open fire or source of ignition.
6. First time experiments shall be demonstrated in front of faculty, or staff members only.
7. Never store chemicals over, under, or near a sink.
8. Training shall be conducted to all laboratory workers on how to use safety devices such as fire extinguishers, eye wash, safety showers etc.
9. Evacuate the lab in case of power failure, if time permits switch off all heat sources, such as Bunsen burners before leaving the lab.
10. Do not smell or taste chemicals.
11. Use a safety shield whenever an explosion or implosion might occur. Perform such experiments under a fume hood.
12. Read all labels before using a chemical.
13. Know and understand the hazards of the chemical as stated in the SDS.
14. Know the location of the nearest fire exit, safety shower, eye station, fire extinguisher, fire alarm, emergency phone, and emergency number.
15. Do not store incompatible chemicals together.

General Laboratory Rules and Procedures
1. Understand the general employee rules and procedures thoroughly.
2. An incident report shall be filled out by a laboratory worker after an incident has occurred and be submitted to the laboratory supervisor and E,H&S as soon as possible.
3. Do not operate electrical equipment with wet hands.
4. Do not block fire exits.
5. Do not drink from lab glassware or other lab vessels.
6. Be familiar with possible hazards when using chemicals, including the appropriate personal protective equipment such as gloves, goggles, etc.
7. Never perform unauthorized laboratory experiments.

Accident response: If an injury requiring emergency medical assistance has occurred, call University Police at 361-825-4444. After any accident or incident, file an incident report and submit copies to the Environmental, Health and Safety Department.

Chemical spills: If a toxic/hazardous chemical has made contact with the skin, start flushing the area immediately. If emergency assistance is required, call University Police Ext. 4444. First Aid procedures for chemical spills are presented in SDS of the chemical.

Children and unauthorized persons: Children and other unauthorized persons shall not be in any laboratories where hazardous materials or hazardous equipment are being used.

Disposal of chemicals: Requests for collection of chemical waste shall be made to E,H&S by email or telephone at Ext. 5555. Refer Appendix 1 in this manual for further information about chemical disposal procedures. Any further questions about chemical waste management shall be directed to the E,H&S department at 825-5555.
**Electrical Safety**: Access to electrical equipment (e.g. plugs, switches and electrical panels) shall be maintained free from obstructions to allow immediate access in an emergency. All receptacle outlets in laboratory spaces shall be the polarized grounding type. Ground Fault Circuit Interrupters (GFCI's) shall be used in those locations involving wet processes or outdoor work, including electrical outlets within six feet of sinks. All electrical hand tools used inside laboratories shall be grounded or double insulated.

All electrical extension cords used shall be visible and inspected on a periodic basis for damage and/or defects. Cords shall not run in aisles or corridors where they might be damaged or create a tripping hazard. Cords shall not be run through doors, walls or partitions, under rugs, or above dropped ceilings. They shall not be wrapped around fixtures, tied in knots, or draped over pipes, lights, or ventilation ductwork. Extension cords shall not be used as substitution for fixed receptacle outlets. Cords used for 110-120 volt service shall be heavy-duty three-wire equipped with a polarized three prong plug. Two wire type extension cords shall not be used.

**Emergency eye wash/safety showers**: Be certain safety showers/emergency eye washes are properly located and maintained. These units shall be located in areas which will be immediately accessible. There shall be no obstructions that shall inhibit the use of this equipment.

Eye washes and safety showers shall be flushed on a regular basis to verify that the units are working and to clear the lines of stale water and debris. Whenever these emergency units are checked for proper functioning, written documentation showing the date and person's initial performing the check shall be maintained. Facilities Services at TAMU-CC performs the checking of eye washes and safety showers. It is the responsibility of the Principle Investigator and or the lab coordinator to ensure the routine maintenance of the safety showers and eye washes. If the safety showers and eye washes are not checked on a regular basis a work order shall be placed to Facilities Services at 825-2324.

**Equipment Safety**: Use proper equipment that is in good condition. For example, never use chipped or cracked glassware. Shield pressurized or vacuum apparatus and safeguard against bumping or overheating.

**Fire extinguishers**: Fire extinguishers must be available, charged, and hung in a location which is immediately accessible (less than 75ft). There shall be no obstructions that shall inhibit the use of this equipment. Make sure that all extinguishers are inspected annually.

Each extinguisher shall have a tag indicating the date it was last inspected. Contact E,H&S (361) 825-5555 for assistance.

**Food, drink, cosmetics**: Eating, drinking and the application of cosmetics are forbidden in areas where hazardous chemicals are used and shall be done only in well-defined, designated non-chemical areas. Food and drinks shall not be stored in the same refrigerator with chemicals, biohazards, or radioactive materials.

**Horseplay**: Practical jokes or other behavior which might confuse, startle, or distract, another worker is forbidden at all times in all TAMU-CC laboratories.

**Housekeeping**: Exits, aisles and safety equipment must NOT be obstructed in any way with equipment, furniture, or other items. Aisles within the laboratory shall be 36 inches in clear width. Work areas and floors are not to be used for excessive storage. Doors which are not in use but which are accessible from a corridor or adjacent room shall be appropriately labeled if they are blocked on the interior of the room. Hallways are not to be used as storage areas.

**Mercaptans**: To avoid false reporting of natural gas leaks, mercaptans shall not be used in such a manner (e.g. scrubbers for effluent) that persons outside of the laboratory could smell the mercaptan and suspect a natural
gas leak in the building. All persons using mercaptans shall report these uses to the E,H&S department or lab supervisor prior to actual use.

**Mouth pipetting:** Mouth pipetting is forbidden at all times.

**Perchloric acid:** If perchloric acid is heated above ambient temperature it may evaporate and condense on ductwork in the form of explosive perchlorates. Hence, when heating perchloric acid above ambient temperature, a perchloric acid fume hood with a water wash down system or a local scrubbing or trapping system must be used. Currently at TAMU-CC we do not have a perchloric acid fume hood.

**Laboratory Signs:** All laboratories shall have posted near the telephone or door entrance, the telephone numbers of persons to call in the event of an emergency. In addition to numbers for chemical spill, radiation spill, fire and medical emergency, there shall also be included name of responsible person (PI) along with office and home phone number.

The NFPA 704 diamond shall also be posted outside each laboratory for use by firefighters and safety personnel during emergency situations. Radioactivity work areas shall have the radiation hazard symbol posted, and areas where human blood or other potentially infectious materials are stored or used must bear the universal biohazard symbol.

**Smoking:** No smoking in laboratories. If you have been using chemicals, be sure to wash your hands before smoking.

**Spill preparedness:** Before working with chemicals, assess potential spill hazards. Each laboratory worker shall be familiar with general spill response procedures. Written protocols shall be developed when extremely hazardous or large quantities of chemicals are used. Have readily available all necessary personal protective equipment and spill cleanup materials. Refer Emergency Procedure Section in CHP (page 17) for more information on preventing, handling, and cleaning spills.

**Unattended experiments:** If operations involving hazardous substances are carried out with no one present, it is the responsibility of the worker to design procedures to prevent the release of hazardous substances in the event of interruptions in utility services such as electricity, cooling water, and inert gas. Lights shall be left on, and signs shall be posted identifying the nature of the operation and the hazardous substances in use. If appropriate, arrangements shall be made for other workers to periodically inspect the operation.

Similarly, if unattended experiments require the use of running water, the worker shall develop procedures to make sure the experiment is checked periodically for water leaking from the system.

**Working alone and after hour operation:** When working with hazardous materials, it is advisable to have a second person present, or at a minimum, maintain contact via telephone. It is recommended that when working alone to inform your lab coordinator and your faculty advisor about the details of the experiment. Individuals working in the lab after business hours shall inform the University Police of the same. Also provide the building and room number of your laboratory, so that a police officer may conduct a building check for your safety.

**Satellite Accumulation Areas:** All chemical laboratories have satellite accumulation areas with a label stating the same. The satellite accumulation containers shall be closed and kept under the supervision of the laboratory supervisors when not in use. Ideal way to safeguard satellite storage area is to secure the laboratory when not in use. Satellite containers shall be used only for temporary storage; they are not for permanent storage. Laboratory supervisor shall ensure that satellite containers are routinely cleared. Good housekeeping procedures shall be maintained to prevent spills from satellite accumulation containers.


**Pollution Prevention/Waste Minimization**

In general, all chemicals and their disposal shall be treated with a healthy measure of respect. Waste minimization strategies usually have the dual benefits of improving safety and reducing chemical purchase and disposal costs.

It is recommended that each lab coordinator evaluate the procedures periodically to consider the possible usage of less hazardous or smaller quantities of chemicals. This evaluation may include the following issues:

- Is there good housekeeping where chemicals are used and stored?
- Are all containers properly labeled?
- If appropriate, is there an inventory of all chemicals in the unit?
- Do the chemicals in use present significant hazards to those working with them? (e.g. highly reactive, highly toxic, carcinogenic, and/or corrosive chemicals shall be discouraged)
- If applicable, consider substitutes for all uses of mercury and chromic acid cleaning solutions

Additional technical information on ways to implement waste minimization is available from E,H&S department at (361) 825-5555.

**Personal Protective Equipment and Personal Hygiene**

Personal protective equipment and personal hygiene are basic aspects of laboratory safety. Wearing appropriate personal protective equipment and practicing good personal hygiene as described below will minimize exposures to hazardous chemicals during routine use and in the event of an accident.

**Attire:** Wear a lab coat (lab coats shall be buttoned up at all times); cover legs (no shorts or skirts) and feet (no sandals or open-toed shoes), confine loose clothing and long hair when working in the laboratory. Nylons and/or pantyhose are not recommended because they may melt upon contact with acid.

**Eye protection:** It is TAMU-CC policy that personnel including students, faculty, staff and visitors in laboratories wear safety glasses, goggles, or face shields at all times where eye hazards are a possibility. Goggles are recommended when chemical splashes are possible. Contact lenses may be worn in the laboratory; however, they do not provide any protection of the eyes. Persons who wear contacts must use the same eye protective equipment as persons who do not wear contacts.

**Face shields:** Full-face shields must be worn when conducting a procedure which may result in a violent reaction. Full-face shields with bottom caps to protect the neck are preferred because they provide the best protection. It is prudent to conduct such experiments in a fume hood.

**Glass tubing:** When inserting tubing into stoppers, use Glass-a-Matic. It is an efficient, hand held device used to insert glass rods, thermometers, and or glass tubing into rubber stopper more efficiently.

**Gloves:** Gloves are essential when working with hazardous substances. The proper gloves will prevent skin absorption, infection or burns. Glove materials vary in effectiveness in protecting against chemical hazards. Consult a chemical resistance chart or contact E,H&S (361) 825-5555 for assistance in appropriate selection.

**Personal hygiene:** It is recommend that hands be washed frequently throughout the day, after glove removal, before leaving the lab, after contact with any hazardous material, and before eating, drinking, smoking, or applying cosmetics.

**Respiratory protection:** Work in a fume hood or provide adequate ventilation when working with materials that produce hazardous vapors or fumes. If the use of a respirator is required, you must comply with TAMU-CC Respiratory Program, which includes a medical assessment, fit testing, and instructions on proper use.
**Hazard Assessments**

For each task involving hazardous materials or physical hazards, a written hazard assessment must be conducted and certified by the PI or Lab coordinator. Supervisors and Principal Investigators are responsible for conducting hazard assessments. Such assessments shall not be limited to chemical hazards, but shall also include such issues, when applicable, as radiation hazards, biological hazards, heat and cold hazards, and physical hazards.

**Safe Handling and Storage of Chemicals**

Hazards associated with various chemicals and gases vary widely. Understanding the hazards associated with a compound and minimizing the quantity used and stored in the lab will decrease chance of injury.

**Compressed gases**: Use appropriate hand carts to move compressed gas cylinders. Gas cylinders shall be capped and secured to a cart during transport. Always consider cylinders as full and handle them with corresponding care.

Gas cylinders shall be stored in well-ventilated areas with their protective caps on. Gas cylinders shall be secured (e.g., strapped or chained in place) to reduce the chance of being knocked over. Do not store cylinders near heat or high traffic areas. Do not store flammables and oxidizers together. Do not store empty and full cylinders together. Storage of large quantities of cylinders shall be in an approved gas cylinder storage area.

**Containers**: Make sure all containers are of good integrity. If deteriorated containers are found, dispose of the chemical or transfer it to a new container. Make sure that the container is appropriate for the chemical stored; for example, hydrofluoric acid must not be stored in glass and some oxidizers shall not be stored in plastic containers. Waste halogenated solvents may not be stored in metal safety cans due to the potential for corrosion. Flammable materials, if removed from their original containers, shall be stored in appropriate containers, such as safety cans or other Department of Transportation (DOT) approved containers.

**Cryogenic liquids**: These items present the potential hazards of fire or explosion, pressure buildup, embrittlement of structural materials, frostbite, and asphyxiation. Work areas must be well ventilated. Cryogenic liquids must be stored, shipped, and handled in containers that are designed specifically for this purpose. Because of the extreme cold and splash hazards, skin protection and eye protection—preferably a face shield—shall be worn when handling cryogenic liquids. First time users of cryogenic liquids shall have direct supervision and instruction from an experienced user when attempting transfers from one container to another.

**Transporting Chemicals**: Encourage the use of poly coated bottles or use bottle carriers for transporting chemicals which are in glass containers. Close caps securely. Pour chemicals carefully. Never add water to concentrated acid; rather prepare dilute solutions by adding acid to water. It is recommended that chemicals be transported in a cart instead of carrying it. When transporting chemicals in elevators it is recommended that the elevator is free of students, public or faculty, except for the person who is transporting the chemicals along with a lab coordinator, teaching assistant or supervisor. Avoid transporting chemicals in an elevator when you are alone.

**Labels**: Make sure all labels are legible. Label all containers with the chemical name and appropriate health hazard warning(s). A chemical is considered to pose a health hazard if it is in one or more of the following classes: carcinogen, corrosive, irritant, sensitizer, toxic, or highly toxic. Information on whether a chemical poses a health hazard may be found on the Safety Data Sheet.
Date all peroxidizable and other chemicals which may become unstable over time; test and/or dispose of them when appropriate. Common examples of chemicals that form peroxides upon aging are: ethyl ether, isopropyl ether, tetrahydrofuran, and dioxane.

**Storage of Chemicals**: Avoid storing chemical containers in hard to reach areas. Chemicals shall be segregated by hazard classification. Once segregated by hazard class, chemicals may be stored alphabetically. Basic segregations shall keep:
- oxidizers away from organics
- air/water reactives away from air and water
- caustics away from acids
- cyanides, sulfides away from acids
Laboratories with large numbers of hazard classifications may choose to further segregate chemicals.

**Fume hoods and Other Engineering Controls**

All users of fume hoods at the TAMU-CC campus shall comply with the Environmental, Health and Safety Department’s Chemical Safety Guide, Laboratory Fume Hood Work Practices. Fume hoods and other engineering controls, such as vented gas cabinets, shall be surveyed annually by a qualified person (from E,H&S or an outside contractor) with a written report of the results maintained by the unit in charge of the laboratory.

Fume hood velocities for all hoods on campus shall be evaluated on an annual basis. The face velocity of the hoods shall fall between 80 and 120 feet per minute (fpm) with the sash positioned at approximately half open, unless specified otherwise. (In general, fume hoods shall not be used with the sash fully open.) The fume hood will bear a sticker on the fume hood cabinet with an arrow pointing to the appropriate sash position which shall be between 80 and 102 fpm. Users shall be certain that their fume hood has a sticker on it and that the date on the sticker is less than a year old. For any further questions about fume hoods, users shall contact the E,H&S at 825-5555.

Because the status of the fume hood can change within one year, continuous air flow indicators are recommended. All fume hoods shall be equipped with air flow monitoring devices which will alert the user if there is a problem with air flow. For older hoods without air flow monitoring devices, a simple visible test to ensure flow into fume hoods and other ventilating devices is to tape a tissue to the hood and note its movement when the exhaust fan is turned on.

Protective equipment other than fume hoods shall be checked periodically by the laboratory supervisor to ensure that the equipment is functioning properly. E,H&S will assist upon request. Any questions or requests for assistance in evaluation of fume hoods and other engineering controls may be directed to E,H&S (361) 825-5555.

**Prior approval for use of certain hazardous materials**

The approval of the acquisition and use of toxic chemical agents rests with the laboratory supervisor. A statement from the Graduate School mentioning the need and use of toxic chemical must be submitted to the E,H&S Coordinator. Wastes of hazardous materials with multiple hazards (chemical, radioactive and/or bio-hazardous) often complicate disposal. The Environmental, Health and Safety Department therefore recommend that you contact us prior to conducting experiments that might generate such wastes. Questions concerning the need for approval shall be directed to E,H&S at (361)825-5555.
Select Agents Overview (USA Patriot Act)

Select Agent and Toxins, New Federal Regulation 42 CFR 73
The Environmental, Health & Safety Department provides the oversight (Responsible Official) required by federal laws & regulations. Transfers, sending or receiving of any select agent (intramural or extramural) is prohibited without E,H&S approval.

On June 12, 2002 President Bush signed the "Public Health Security and Bioterrorism Preparedness and Response Act of 2002" (Public Law 107-188). The Law's purpose is to improve the ability of the United States to prevent, prepare for, and respond to bioterrorism and other public health emergencies. The Law requires that all persons possessing select biological agents or toxins deemed a threat to public health, animal or plant health, or animal or plant products register with the appropriate federal agency.

On December 13, 2003, new rules were published in the Federal Register by the Departments of Health and Human Services (HHS) and Agriculture (USDA) governing facilities that possess, use or transfer select biological agents or toxins. These rules became effective on February 7, 2003.

A list of select agents is available in Appendix 5. If you have any questions, contact Environmental, Health and Safety Department at Extn-5555 for additional details.

Special provisions for select carcinogens, reproductive toxins and acutely toxic chemicals
In addition to the general safety guidelines mentioned above, special precautions are needed when handling carcinogens, reproductive toxins and chemicals with a high degree of acute toxicity. Before the start of any experiments or research involving the use of carcinogens, reproductive toxins, and chemicals with a high degree of acute toxicity the laboratory supervisor shall consult the Director of E,H&S Department and obtain a written permission to use the same. The laboratory supervisor should also ensure that these and other precautions designed to minimize risk of exposure to these substances are taken. The following are minimum guidelines:

• Quantities of these chemicals used and stored in the laboratory should be minimized, as should their concentrations in solution or mixtures.

• Work with carcinogens, reproductive toxins and acutely toxic chemicals should be performed within a functioning fume hood, sealed system, or other system designed to minimize exposure to these substances. (The exhaust air from the ventilation systems may require scrubbing before being released into the atmosphere.) In all cases, work with these types of chemicals should be done in such a manner that the Occupational Safety and Health Administration's (OSHA) permissible exposure limits or similar standards are not exceeded.

• Compressed gas cylinders that contain acutely toxic chemicals, such as arsine and nitrogen dioxide, should be kept in ventilated gas cabinets.

• The ventilation efficiency of the designated fume hood, or gas cabinet, and the operational effectiveness of mechanical and electrical equipment used to contain or manipulate these special substances should be evaluated periodically by the laboratory personnel at intervals determined by the laboratory supervisor. The interval of evaluating

• Systems may vary from weekly to biannually depending upon the frequency of usage, quantities employed and level of hazard.

• Each laboratory utilizing these substances must designate an area for this purpose and sign or mark this area with an appropriate hazard warning. The designated area may be an entire laboratory, an area of the laboratory, or a device such as a fume hood. The designated area should be marked with a sign stating "DANGER, specific agent, AUTHORIZED PERSONNEL ONLY" or comparable warning sign.

• All laboratory workers who work in a laboratory which has an area designated for use with carcinogens, reproductive toxins and/or acutely toxic chemicals must be trained about the deleterious effects of these substances plus signs and symptoms regarding exposure to these substances. This training is required even for those who have a potential for exposure. Training to ensure the safe handling and storage of these substances is required for those who use these materials. This training is the responsibility of the laboratory supervisor.
and must be done prior to the use of any of these materials.

- Laboratory workers using these chemicals must have access to appropriate personal protective equipment (available at no expense to the workers) and must be trained on how to properly utilize this equipment.
- Detection equipment may be required in laboratories where highly toxic chemicals (especially poisonous gases) are used.
- All wastes contaminated with these substances should be collected and disposed of promptly as outlined in the Chemical Safety Guide. Treatment of waste products to lessen or eliminate their toxicity as part of the experimental protocol is encouraged as a way of minimizing health hazards and the amount of waste, only if such treatment can be performed safely.
- The designated working area shall be thoroughly decontaminated and cleaned at regular intervals determined by the laboratory supervisor. The interval may be as short as one day or as long as six months depending upon the frequency of usage and level of hazard.
- Special precautions to avoid release and exposure to carcinogens, highly toxic chemicals and reproductive toxins must be utilized. For instance, volatile substances should be kept cool and contained. Gas cylinders should have properly functioning valves, check valves,
- Regulators, containment which can withstand pressure buildup, and appropriate piping; and dispersive solids should be kept in closed containers, used in places with minimal air currents, and appropriate contact materials should be used to avoid static charging.
- Emergency response planning for releases or spills should be prepared by the laboratory supervisor and included in the training of the laboratory workers and others who may be affected in the building. E,H&S Department should be involved in this planning.

**Chemical Hygiene Officers**

The Director of The Environmental, Health and Safety Department is the designated Chemical Hygiene Officer for Texas A&M University Corpus Christi (TAMU-CC).

Academic units that have chemistry laboratories are encouraged to have their own chemical safety officers to help implement their chemical hygiene plans. Likewise, individual research groups are encouraged to designate chemical safety liaisons to facilitate the flow of safety information throughout the campus community.

**Employee Training**

Laboratory employees including teaching assistants, faculty, and staff members shall be trained by their departments on the following:

1. Content and location of this Chemical Hygiene Plan and the Chemical Safety Guide provided by the Environmental, Health and Safety Department.
2. Potential hazards and administering first aid when chemicals are involved.
3. Signs and symptoms of overexposure to chemicals and also on how to detect potentially harmful exposures before they are harmful.
4. Location and availability of SDS, CHP, emergency telephone, exits, fire extinguishers, and emergency contact numbers including University Police, E,H&S, and supervisors.
5. Understanding permissible exposure limits in the laboratories.
6. The proper location and use of safety equipment such as safety showers, fire extinguishers, fire alarms, emergency exits, and first aid procedures.

If additional training is required in laboratory safety contact the Environmental, Health and Safety Department at Extn-5555.
**Exposure Evaluation**

It is the policy of TAMU-CC to investigate all suspected overexposures to chemicals in a prompt and timely fashion. In the event of an overexposure, after the immediate event, laboratory supervisor shall document all chemicals and circumstances involved in the overexposure. A copy of the document shall be sent to the E,H&S Department, where it shall be maintained and be accessible to the employees. The overexposure document should include:

1. Accidental breakage of hazardous material container.
2. A skin rash or irritation occurring because of contact with a chemical.
3. Caustic splash to eyes, face or body.
4. Symptoms such as nausea, dizziness, and others.

**Monitoring for Exposure**

Monitoring will be necessary for substances regulated by federal or state agencies only if there is a reason to believe that exposure levels for that substance routinely exceed the Permissible Exposure Limit (PEL) for that substance. If monitoring is performed and this initial monitoring shows no evidence of exposure, the monitoring may be discontinued.

If initial monitoring indicates an exposure above PEL, then steps shall be taken to reduce the exposure and remedial actions recommended by E,H&S shall be implemented to reduce exposure levels. A follow up by E,H&S shall be conducted to monitor the exposure levels within 60 days. All monitoring results and activities shall be available for employees upon request. Requests shall be made to the laboratory supervisor or to the E,H&S Department.

**Medical Consultation**

“Provisions for medical consultation and medical examinations in accordance with paragraph (g) of this section.” 29 CFR 1910.1450 (e) (3) (vi)

An opportunity to receive medical consultation shall be provided under the following circumstances: if an employee develops any symptoms thought to arise from chemical overexposure; after an event such as a major spill, leak or explosion which may have resulted in an overexposure; or, if an overexposure is identified as the result of an evaluation by the Chemical Hygiene Officer or designee. These suspected or actual exposures requiring medical evaluation can and shall be treated as a regular Worker’s Compensation claim. An injury report shall be filled out and signed by the supervisor. Any medical examination required by this Chemical Hygiene Plan shall be provided without cost to the employee, without loss of pay and at a reasonable time and place.

**Emergency Procedures**

**Emergency Assistance**

All accidents should be reported to the University Police at Ext. 4444. This includes accidents involving students, visitors, and employees. Employees must report accidents to their supervisors and complete the Employer’s First Report of Injury or Illness [http://hr.tamucc.edu/assets/1st%20Report%20of%20Injury.pdf](http://hr.tamucc.edu/assets/1st%20Report%20of%20Injury.pdf). A copy of the incident report form shall be available at all laboratories in TAMU-CC. Medical emergency matters will be handled by University Police. For fires or explosions call University Police immediately at Ext. 4444. Copies of incident report form shall be mailed to E,H&S Department.

If you call University Police, you shall be ready to provide the following information:

- What is the name of the chemical spilled?
- What quantity of the chemical is spilled?
- Where is the spill (building name and room number)?
• Is anyone injured or splashed with the chemical?
• Is a fire or explosion involved in the spill?
• What is your name and phone number?

Spill Preparedness
Most laboratory chemical spills and many small chemical spills outside laboratories can be safely cleaned up by those who spilled the material. Handled properly, these small spills are little more than minor nuisances. On the other hand, some spills shall be cleaned up only by specially trained emergency response personnel. Since spills can greatly disrupt your activities, and, at worst, cause bodily harm or property damage, it is prudent to make preparations before spills occur. This section provides basic emergency preparedness information and gives general guidance on how you shall respond to chemical spills. After a spill is contained, an incident report form has to be completed by the employer and submitted to E,H&S Department.

Preventing spills: Listed below are some basic spill prevention steps that apply to storage, transportation, and transfer of chemicals.

• **General precautions**
  * reduce clutter and unnecessary materials in your work areas
  * eliminate tripping hazards and other obstructions
  * have all needed equipment readily available before starting work

• **Storage precautions**
  * use sturdy shelves
  * larger containers shall be stored closer to the floor
  * containers on shelves shall be stored back from the edge to reduce the danger of falling
  * storage shelves shall have lips to further reduce the danger of falling
  * chemicals shall be stored first by compatibility, then alphabetically
  * inspect the storage area regularly for leaking or defective containers
  * use appropriate storage containers
  * do not store unprotected glass containers on the floor

• **Transportation precautions**
  * use carts, where appropriate
  * use safety containers, or secondary spill containers where appropriate
  * use bottle carriers for 2.5 and 4.0 liter bottles
  * use straps to secure containers, where appropriate
  * think about potential hazards before transporting chemicals
  * consider purchasing plastic coated "shatter resistant" bottles

• **Precautions in transferring chemicals**
  * pay careful attention to the size of container to avoid overfilling
  * use pumps or other mechanical devices rather than simple pouring
  * provide containment to capture leaks and spills

Preparing for spills: It is best to proceed in an organized manner for spill response. Evaluating potential hazards and establishing protocols in advance will be well worth the initial effort. Before working with chemicals you shall determine what could go wrong and how you might respond to a spill. As a result of this evaluation, you shall prepare written protocols for use in the event of a spill and make sure that you have all the necessary personal protective devices, safety equipment, and containment/clean up materials readily available. These protocols need to be communicated to all persons who might be affected by a spill. Each individual who may be involved in spill response or clean-up must know the purpose and limitations of all personal protective equipment, safety equipment and clean up materials.

Spill control kits: Spill control kits and or materials shall be available at all times in all chemical laboratories. You may buy prepackaged spill kits from various vendors. Because prepackaged kits tend to be expensive, many chemical users prefer to make their own kits. Shall you decide to make your own kit, include the
following at a minimum:
• Disposable (nitrile or latex) gloves (1 box)
• Neoprene gloves (1 set)
• Safety goggles (vent less preferred)
• Poly scoop
• Poly dustpan
• Plastic bags
• Absorbent material
• 3M Chemical Sorbent or similar material, or
• 1:1:1 mixture of sand, soda ash, and kitty litter
• 5-gallon poly (plastic) pail

The location of spill control kits shall be clearly marked and highly visible. Make sure all personnel know the location of the kit, are familiar with the contents of the kit, and understand the limitations of the kit.

Defining and Classifying a Spill
There are two basic types of spills: mercury spills and chemical spills.

Mercury spills generally require assistance for safe and proper collection. During normal business hours, contact your supervisor or call Environmental, Health and Safety Department at 825-5555 for assistance. During after hours, contact University Police at Ext. 4444.

Chemical spills can be broken down into two basic subtypes: simple spills, which you can clean up yourself, and complicated spills, which require outside assistance.

Complicated Spill:
If your spill meets ANY of the following conditions of a complicated spill, call University Police at 4444 immediately. Evacuate the laboratory including all students, employees, and faculty members. If anyone is injured remove them to a safe area, where no chemicals are present. Check the SDS of the chemical for first aid procedures. Follow the first aid procedures and wait for University Police.

A spill is complicated if:
• a person is injured
• identity of the chemical is unknown
• multiple chemicals are involved
• the chemical is highly toxic, flammable or reactive
• the spill occurs in a "public space" such as corridors
• the spill has the potential to spread to other parts of the building such as through the ventilation system
• the clean-up procedures are not known or appropriate materials are not readily available
• the spill may endanger the environment such as reaching waterways or soil contamination

Simple Spill:
If none of the above are met, the spill is defined as simple. You may clean up simple spills in accordance with the TAMU-CC Chemical Waste Management Guide. If you have any questions about clean up procedures contact E,H&S at (361) 825-5555.

After cleaning up a spill incident, inform your lab supervisor and please make sure to fill out the incident report and send a copy to the E,H&S Department. Our fax number is 825-5556/our mail code is 5876.
Response to Non-Compliance

If during an inspection, non-compliance to this Chemical Hygiene Plan will be addressed in the following manner.

**Step one-Verbal Notification**
If during a routine evaluation or inspection, a problem involving chemical safety procedures is observed, a verbal recommendation will be provided. If upon receipt of a verbal recommendation, the laboratory staff or the supervisory staff takes immediate steps to correct the problem, then no further response regarding the discrepancy will be requested.

**Step Two-Notice of Violation**
If no actions are taken, then a written notice of violation (NOV) of the discrepancies and recommendations including corrections during the inspection will be sent to the Principle investigator (PI) responsible for the laboratory. The PI will then be requested to take corrective action within 14 days. Verbal, email, or written response is requested.

**Step Three-NOV to Department Chair**
A list of discrepancies will be maintained by the Environmental, Health and Safety Department and a follow up will be conducted within 21 days of the inspection to determine if corrective actions have been taken. If the follow up reveals that the same discrepancy exists, notification of this situation will be sent to both the PI and Department Chair. A written response from the PI shall be sent to the E,H&S detailing specific steps taken to ensure correction of the discrepancy.

**Step Four-NOV to Dean**
If the problem continues, a notice of violation will be sent to the Dean of College. A written response explaining the corrective actions taken shall be sent by the Dean to the Director of E,H&S.

**Step Five- Health and Safety (H&S) Committee Action**
If the problem continues, the entire case history will be presented to the H&S Committee.

Any operation causing a high or unacceptable risk to students, employees or other personnel exposure, to any chemical hazard will be suspended immediately by the E,H&S without regard to the above procedures. In the event of this action, the situation will be promptly reviewed by the Director of E,H&S Department and the Health and Safety Committee.
Appendix 1  
Chemical Waste Disposal Procedures  
(If you are not sure on how to dispose your chemical waste contact your laboratory supervisor or E,H&S Department at Ext. 5555)

Waste is defined as surplus, unneeded, or unwanted material. All laboratories generate waste; it is the obligation of the laboratories to dispose of the wastes in the most eco-friendly manner and within Resource Conservation and Recovery Act (RCRA) and Superfund Amendments and Reauthorization Act (SARA Title iii) regulations. TAMU-CC follows a “cradle to grave” method on disposal of hazardous waste. Hazardous chemical can described as one which is toxic, reactive, corrosive, and or flammable. All hazardous materials shall be disposed of by the E,H&S Department.

Disposal

The following procedures have to be followed when disposing off chemicals:

* Place waste in contamination free, good, and secure containers.
* Use secondary spill containers or satellite accumulation containers when necessary.
* All waste containers bottles should have a minimum of two inches of free space on top.
* All dry waste should be bagged in appropriate containers.
* Labels should be legible, with proper chemical name.
* Hazardous material tags shall be attached to the waste container, with date when accumulation began, and also the date when container was full and ready for pick up.
* Contact the E,H&S Department for chemical waste pickup at 825-5555.

Empty Containers

Empty containers with a volume of less than five gallons can be disposed of in regular trash only if the labels are defaced, and the containers have to be rinsed a minimum of three times, making sure the washings are collected and disposed of as chemical waste.

Broken Glassware/Containers

Broken glassware and containers have to be disposed in the broken glass box only if there is no chemical residue in them. Glassware with chemical residues shall be treated as chemical waste.

Sink Disposal

Under no circumstances shall any hazardous waste be disposed of by pouring down the drain. TAMU-CC strictly follows a no drain policy on hazardous chemicals. For further information on waste disposal call E,H&S Department at 825-5555.
Appendix 2
Chemical Safety References available at the Environmental, Health and Safety Department as of June 2014:


Appendix 3
Peroxides Forming Chemicals

Class I: Unsaturated materials, especially those of low molecular weight, may polymerize violently due to peroxide initiation. Discard or test for peroxides after 6 months (liquids) or 12 months (gases).
- acrylic acid
- acrylonitrile
- butadiene
- chlorobutadiene (chloroprene)
- chlorotrifluoroethylene
- methyl methacrylate
- styrene
- tetrafluoroethylene
- vinyl acetate
- vinyl acetylene
- vinyl chloride
- vinyl pyridine
- vinylidene chloride

Class II: The following chemicals are a peroxide hazard upon concentration (distillation / evaporation). A test for peroxides should be performed if concentration is intended or suspected. Discard or test for peroxides 6 months after container is opened.
- acetal
- cumene
- cyclohexene
- cyclooctene
- cyclopentene
- diacetylene
- dicyclopentadiene
- diethylene glycol dimethyl ether (diglyme)
- diethyl ether
- dioxane (p-dioxane)
- ethylene glycol dimethyl ether (glyme)
- furan
- methyl acetylene
- methyl cyclopentane
- methyl-I-butyl ketone
- tetrahydrofuran
- tetrahydronaphthalene
- vinyl ethers

Class III: Peroxides derived from the following compounds may explode without concentration. Discard 3 months after opening container.
- Organic
  - divinyl ether
  - divinyl acetylene
  - isopropyl ether
  - vinylidene chloride
- Inorganic
  - potassium metal
  - potassium amide
  - sodium amide (sodamide)
Peroxide Detection Tests

The following test can detect most (but not all) peroxy compounds, including hydroperoxides. **NONE of these tests should be applied to materials (such as metallic potassium) that may be contaminated with inorganic peroxides.**

• Add 1-3 ml of the liquid to be tested to an equal volume of acetic acid, add a few drops of 5% aqueous potassium iodide solution, and shake. The appearance of a yellow to brown color indicates the presence of peroxides. Alternatively, additional of 1 ml of a freshly prepared 10% solution of potassium iodide to 10 ml of an organic liquid in a 25 ml glass cylinder should produce a yellow color if peroxides are present.

• Add 0.5 ml of the liquid to be tested to a mixture of 1 ml of 10% aqueous potassium iodide solution and 0.5 ml of dilute hydrochloric acid to which has been added a few drops of starch solution just prior to the test. The appearance of a blue or blue-black color within a minute indicates the presence of peroxides.

• Peroxide test strips, which turn to an indicative color in the presence of peroxides, are available commercially. Note that these strips must be air dried until the solvent evaporates and then exposed to moisture for proper operation.
a. **Scope and application.**
   1. This section shall apply to all employers engaged in the laboratory use of hazardous chemicals as defined below.
   2. Where this section applies, it shall supersede, for laboratories, the requirements of all other OSHA health standards in 29 CFR, part 1910, subpart Z, except as follows:
      i. For any OSHA health standard, only the requirement to limit employee exposure to the specific permissible exposure limit shall apply for laboratories, unless that particular standard states otherwise or unless the conditions of paragraph (a)(2)(iii) of this section apply.
      ii. Prohibition of eye and skin contact where specified by any OSHA health standard shall be observed.
      iii. Where the action level (or in the absence of an action level, the permissible exposure limit) is routinely exceeded for an OSHA regulated substance with exposure monitoring and medical surveillance requirements, paragraphs (d) and (g)(1)(ii) of this section shall apply.
   3. This section shall not apply to:
      i. Uses of hazardous chemicals which do not meet the definition of laboratory use, and in such cases, the employer shall comply with the relevant standard in 29 CFR, part 1910, subpart 2, even if such use occurs in a laboratory.
      ii. Laboratory uses of hazardous chemicals which provide no potential for employee exposure. Examples of such conditions might include:
         a. Procedures using chemically-impregnated test media such as Dip-and-Read tests where a reagent strip is dipped into the specimen to be tested and the results are interpreted by comparing the color reaction to a color chart supplied by the manufacturer of the test strip; and
         b. Commercially prepared kits such as those used in performing pregnancy tests in which all of the reagents needed to conduct the test are contained in the kit.

b. **Definitions:**

1. **Action level** means a concentration designated in 29 CFR, part 1910, for a specific substance, calculated as an eight (8)-hour time-weighted average, which initiates certain required activities such as exposure monitoring and medical surveillance.

2. **Assistant Secretary** means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

3. **Carcinogen** (see "select carcinogen").

4. **Chemical Hygiene Officer** means an employee who is designated by the employer, and who is qualified by training or experience, to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan. This definition is not intended to place limitations on the position description or job classification that the designated individual shall hold within the employer's organizational structure.

5. **Chemical Hygiene Plan** means a written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment and work practices that (i) are capable of protecting employees from the health hazards presented by hazardous chemicals used in that particular workplace and (ii) meets the requirements of paragraph (e) of this section.

6. **Combustible liquid** means any liquid having a flashpoint at or above 100°F. (37.8°C), but below 200°F. (93.3°C), except any mixture having components with flashpoints of 200°F. 93.3°C.), or higher, the total volume of which make up 99 percent or more of the total volume of the mixture.
7. Compressed gas means:
   i. A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 pounds per square inch (P.s.i) at 70°F. (21.1°C.); or
   ii. A gas or mixture of gases having, in a container, an absolute pressure exceeding 104 p.s.i at 130°F. (54.4°C.) regardless of the pressure at 70°F. (21.1°C.); or
   iii. A liquid having a vapor pressure exceeding 40 p.s.i at 100°F. (37.8°C.) as determined by ASTM D-323-72.

8. Designated area means an area which may be used for work with "select carcinogens," reproductive toxins or substances which have a high degree of acute toxicity. A designated area may be the entire laboratory, an area of a laboratory, or a device such as a laboratory hood.

9. Emergency means any occurrence such as, but not limited to, equipment failure, rupture of containers or failure of control equipment which results in an uncontrolled release of a hazardous chemical into the workplace.

10. Employee means an individual employed in a laboratory workplace who may be exposed to hazardous chemicals in the course of his or her assignments.

11. Explosive means a chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

12. Flammable means a chemical that falls into one of the following categories:
   i. Aerosol, flammable means an aerosol that, when tested by the method described in 16 CFR 1500.45, yields a flame protection exceeding 18 inches at full valve opening, or a flashback (a flame extending back to the valve) at any degree of valve opening;
   
   ii. Gas, flammable means:
      a. A gas that, at ambient temperature and pressure, forms a flammable mixture with air at a concentration of 13 percent by volume or less; or
      b. A gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air wider than 12 percent by volume, regardless of the lower limit.
   
   iii. Liquid, flammable means any liquid having a flashpoint below 100°F. (37.8°C.), except any mixture having components with flashpoints of 100°F.(37.8°C.) or higher, the total of which make up 99 percent or more of the total volume of the mixture.
   
   iv. Solid, flammable means a solid, other than a blasting agent or explosive as defined in §1910.109(a), that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious hazard. A chemical shall be considered to be flammable solid if, when tested by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a rate greater than one-tenth of an inch per second along its major axis.

13. Flashpoint means the minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite when tested as follows:
   
   i. Tagliabue Closed Tester (See American National Standard Method of Test for Flash Point by Tag Closed Tester, Z11.24-1979 [ASTM D 56-79]) - for liquids with a viscosity of less than 45 Saybold Universal Seconds (SUS) at 100°F. (37.8 °C.), that do not contain suspended solids and do not have a tendency to form a surface film under test; or
ii. Pensky-Martens Closed Tester (see American National Standard Method of Test for Flash Point by Pensky-Martens Closed Tester, Z11.7-1979 (ASTM D 93-79)) - for liquids with a viscosity equal to or greater than 45 SUS at 100°F (37.8°C.), or that contain suspended solids, or that have a tendency to form a surface film under test; or

iii. Seta flash Closed Tester (see American National Standard Method of Test for Flash Point by Seta flash Closed Tester (ASTM D 3278-78))

iv. Organic peroxides, which undergo auto accelerating thermal decomposition, are excluded from any of the flashpoint determination methods specified above.

14. Hazardous chemical means a chemical for which there is statically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. The term "health hazard" includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic systems, and agents which damage the lungs, skin, eyes, or mucous membranes. Appendices A and B of the Hazard Communication Standard (29 CFR 1910.1200) provide further guidance in defining the scope of health hazards and determining whether or not a chemical is to be considered hazardous for purposes of this standard.

15. Laboratory means a facility where the "laboratory use of hazardous chemicals" occurs. It is a workplace where relatively small quantities of hazardous chemicals are used on a non production basis.

16. Laboratory scale means work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safely manipulated by one person.

17. Laboratory scale excludes those workplaces whose function is to produce commercial quantities of materials.

18. Laboratory-type hood means a device located in a laboratory, enclosure on five sides with a moveable sash or fixed partial enclosed on the remaining side; constructed and maintained to draw air from the laboratory and to prevent or minimize the escape of air contaminants into the laboratory; and allows chemical manipulations to be conducted in the enclosure without insertion of any portion of the employee's body other than hands and arms. Walk-in hoods with adjustable sashes meet the above definition provided that the sashes are adjusted during use so that the airflow and the exhaust of air contaminants are not compromised and employees do not work inside the enclosure during the release of airborne hazardous chemicals.

19. Laboratory use of hazardous chemicals means handling or use of such chemicals in which all of the following conditions are met:
   i. Chemical manipulations are carried out on a "laboratory scale;"
   ii. Multiple chemical procedures or chemicals are used;
   iii. The procedures involved are not part of a production process, nor in any way simulate a production process; and
   iv. "Protective laboratory practices and equipment" are available and in common use to minimize the potential for employee exposure to hazardous chemicals.

20. Medical consultation means a consultation which takes place between an employee and a licensed physician for the purpose of determining what medical examinations or procedures, if any, are appropriate in cases where a significant exposure to a hazardous chemical may have taken place.
21. **Organic peroxide** means an organic compound that contains the bivalent \(-\text{o-o-}\) structure and which may be considered to be a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms has been replaced by an organic radical.

22. **Oxidizer** means a chemical other than a blasting agent or explosive as defined in §1910.109(a), that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases.

23. **Physical hazard** means a chemical for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, or an organic peroxide, an oxidizer, pyrophoric, unstable (reactive) or water-reactive.

24. **Protective laboratory practices and equipment** means those laboratory procedures, practices and equipment accepted by laboratory health and safety experts as effective, or that the employer can show to be effective, in minimizing the potential for employee exposure to hazardous chemicals.

25. **Reproductive toxins** means chemicals which affect the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogenesis).

26. **Select carcinogen** means any substance which meets one of the following criteria:
   i. It is regulated by OSHA as a carcinogen; or
   ii. It is listed under the category, "known to be carcinogens" in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (latest edition); or
   iii. It is listed under Group 1 ("carcinogenic to humans") by the International Agency for Research on Cancer Monographs (IARC) (latest editions); or
   iv. It is listed in either Group 2A or 2B by IARC or under the category "reasonably anticipated to be carcinogens" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:
      a. After inhalation exposure of 6-7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m³;
      b. After repeated skin application of less than 300 (mg/kg of body weight) per week; or
      c. After oral dosages of less than 50 mg/kg of body weight per day.

27. **Unstable (reactive)** means a chemical which is the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure or temperature.

28. **Water-reactive** means a chemical that reacts with water to release gas that is either flammable or presents a health hazard.

c. **Permissible exposure limits**
   1. For laboratory users of OSHA regulated substances, the employer shall assure that laboratory employees' exposures to such substances do not exceed the permissible exposure limits specified in 29 CFR, part 1910, subpart Z.

d. **Employee exposure determination.**
   1. Initial monitoring. The employer shall measure the employee's exposure to any substance regulated by a standard which requires monitoring if there is reason to believe that exposure levels for that substance routinely exceed the action level (or in the absence of an action level, the PEL).
   2. Periodic monitoring. If the initial monitoring prescribed by paragraph (d)(1) of this section discloses employee exposure over the action level (or in the absence of an action level, the PEL), the employer shall immediately comply with the exposure monitoring provisions of the relevant standard.
3. Termination of monitoring. Monitoring may be terminated in accordance with the relevant standard.

4. Employee notification of monitoring results. The employer shall, within 15 working days after the receipt of any monitoring results, notify the employee of these results in writing either individually or by posting results in an appropriate location that is accessible to employees.

e. Chemical Hygiene Plan - General
1. (Appendix A of this section is non-mandatory but provides guidance to assist employers in the development of the Chemical Hygiene Plan.)
2. Where hazardous chemicals as defined by this standard are used in the workplace, the employer shall develop and carry out the provisions of a written Chemical Hygiene Plan which is:
   i. Capable of protecting employees from health hazards associated with hazardous chemicals in that laboratory and
   ii. Capable of keeping exposures below the limits specified in paragraph c of this section.
3. The Chemical Hygiene Plan shall be readily available to employees, employee representatives and, upon request, to the Assistant Secretary.
4. The Chemical Hygiene Plan shall include each of the following elements and shall indicate specific measures that the employer will take to ensure laboratory employee protection:
   i. Standard operating procedures relevant to safety and health considerations to be followed when laboratory work involves the use of hazardous chemicals;
   ii. Criteria that the employer will use to determine and implement control measures to reduce employee exposure to hazardous chemicals including engineering controls, the use of personal protective equipment and hygiene practices; particular attention shall be given to the selection of control measures for chemicals that are known to be extremely hazardous;
   iii. A requirement that fume hoods and other protective equipment are functioning properly and specific measures that shall be taken to ensure proper and adequate performance of such equipment;
   iv. Provisions for employee information and training as prescribed in paragraph (f) of this section;
   v. The circumstances under which a particular laboratory operation, procedure or activity shall require prior approval from the employer or the employer's designee before implementation;
   vi. Provisions for medical consultation and medical examinations in accordance with paragraph (g) of this section:
   vii. Designation of personnel responsible for implementation of the Chemical Hygiene Plan including the assignment of a Chemical Hygiene Officer and, if appropriate, establishment of a Chemical Hygiene Committee; and
   viii. Provisions for additional employee protection for work with particularly hazardous substances. These include "select carcinogens," reproductive toxins and substances which have a high degree of acute toxicity. Specific consideration shall be given to the following provisions which shall be included where appropriate:
     a. Establishment of a designated area:
     b. Use of containment devices such as fume hoods or glove boxes;
     c. Procedures for safe removal of contaminated waste; and
     d. Decontamination procedures.
5. The employer shall review and evaluate the effectiveness of the Chemical Hygiene Plan at least annually and update it as necessary.

f. Employee information and training
1. The employer shall provide employees with information and training to ensure that they are apprised of the hazards of chemicals present in their work areas.
2. Such information shall be provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present and prior to assignments involving new exposure situations. The frequency of refresher information and training shall be determined by the employer.
3. Information. Employees shall be informed of:
   i. The contents of this standard and its appendices which shall be made available to employees;
ii. The location and availability of the employer's Chemical Hygiene Plan;
iii. The permissible exposure limits for OSHA regulated substances or recommended exposure limits for other hazardous chemicals where there is no applicable OSHA standard;
iv. Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory; and
v. The location and availability of known reference material on the hazards, safe handling, storage and disposal of hazardous chemicals found in the laboratory including, but not limited to, Material Safety Data Sheets received from the chemical supplier.

4. Training.
i. Employee training shall include:
a. Methods and observations that may be used to detect the presence or release of a hazardous chemical (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.);
b. The physical and health hazards of chemicals in the work area; and
c. The measures employees can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used.

ii. The employee shall be trained on the applicable details of the employer's written Chemical Hygiene Plan.

5. Medical consultation and medical examinations
1. The employer shall provide all employees who work with hazardous chemicals an opportunity to receive medical attention, including any follow-up examinations which the examining physician determines to be necessary, under the following circumstances:
i. Whenever an employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory, the employee shall be provided an opportunity to receive an appropriate medical examination.
ii. Where exposure monitoring reveals an exposure level routinely above the action level (or in the absence of an action level, the PEL) for an OSHA regulated substance for which there are exposure monitoring and medical surveillance requirements, medical surveillance shall be established for the affected employee as prescribed by the particular standard.
iii. Whenever an event takes place in the work area such as a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure, the affected employee shall be provided an opportunity for a medical consultation. Such consultation shall be for the purpose of determining the need for a medical examination.

2. All medical examinations and consultations shall be performed by or under the direct supervision of a licensed physician and shall be provided without cost to the employee, without loss of pay and at a reasonable time and place.

3. Information provided to the physician. The employer shall provide the following information to the physician:
i. The identity of the hazardous chemical(s) to which the employee may have been exposed;
ii. A description of the conditions under which the exposure occurred including quantitative exposure data, if available; and
iii. A description of the signs and symptoms of exposure that the employee is experiencing, if any.

4. Physician's written opinion.
i. For examination of consultation required under this standard, the employer shall obtain a written opinion from the examining physician which shall include the following:
a. Any recommendation for further medical follow-up;
b. The results of the medical examination and any associated tests;
c. Any medical condition which may be revealed in the course of the examination which may place the employee at increased risk as a result of exposure to a hazardous chemical found in the workplace;
d. A statement that the employee has been informed by the physician of the results of the consultation or medical examination and any medical condition that may require further examination or treatment.
ii. The written opinion shall not reveal specific findings of diagnoses unrelated to occupational exposure.
h. Hazard identification
1. With respect to labels and material safety data sheets:
i. Employers shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced.
ii. Employers shall maintain any material safety data sheets that are received with incoming shipments of hazardous chemicals, and ensure that they are readily accessible to laboratory employees.
2. The following provisions shall apply to chemical substances developed in the laboratory:
i. If the composition of the chemical substance which is produced exclusively for the laboratory's use is known, the employer shall determine if it is a hazardous chemical as defined in paragraph (b) of this section. If the chemical is determined to be hazardous, the employer shall provide appropriate training as required under paragraph f of this section.
ii. If the chemical produced is a byproduct whose composition is not known, the employer shall assume that the substance is hazardous and shall implement paragraph e of this section.
iii. If the chemical substance is produced for another user outside of the laboratory, the employer shall comply with the Hazard Communication Standard (29 CFR 1910.1200) including the requirements for preparation of material safety data sheets and labeling.

i. Use of respirators.
1. Where the use of respirators is necessary to maintain exposure below permissible exposure limits, the employer shall provide, at no cost to the employee, the proper respiratory equipment. Respirators shall be selected and used in accordance with the requirements of 29 CFR 1910.134.

j. Recordkeeping
1. The employer shall establish and maintain for each employee an accurate record of any measurements taken to monitor employee exposures and any medical consultation and examination including tests or written pinions required by this standard.
2. The employer shall assure that such records are kept, transferred, and added available in accordance with 29 CFR 1910.20.

k. Dates
1. Effective date. This section shall become effective May 1, 1990.
2. Start-up dates.
i. Employers shall have developed and implemented a written Chemical Hygiene Plan no later than January 31, 1991.
ii. Paragraph (a)(2) of this section shall not take effect until the employer has developed and implemented a written Chemical Hygiene Plan.

l. Appendices
The information contained in the appendices is not intended, by itself, to create any additional obligations not otherwise imposed or to detract from any existing obligation.