SOUTHERN METHODIST UNIVERSITY

CHEMICAL HYGIENE PLAN

November 2016

OFFICE OF RISK MANAGEMENT
ENVIRONMENTAL HEALTH & SAFETY

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CHEMICAL HYGIENE PLAN

TABLE OF CONTENTS

1. UNIVERSITY POLICY

1.1 POLICY

Southern Methodist University is committed to the responsibility of providing a safe work environment for its employees, students, visitors and other personnel conducting university business. It is with this commitment that the university developed and is implementing a Chemical Hygiene Plan to manage activities associated with certain recognized hazards.

In May 1990, the Occupational Safety and Health Administration (OSHA) adopted the workplace standard "Occupational Exposure to Hazardous Chemicals in Laboratories" to provide health and safety of employees working in laboratories. Southern Methodist University has responded to this regulation by providing a model plan to be used as a guide for compliance. This guide shall be used for safety and compliance concerning laboratory practices.

When properly developed and followed, this plan can serve as a comprehensive health and safety program for each laboratory. The Southern Methodist University Chemical Hygiene Guide will be reviewed, evaluated and updated at least annually to ensure it is compatible with current institutional practices and regulations and will be made readily available to employees, their representatives, and the Occupational Safety and Health Administration.

1.2 SCOPE

At Southern Methodist University (SMU) the Laboratory Standard applies to all employees and students engaged in the "laboratory use" of hazardous chemicals. It applies to all research and teaching laboratories which carry out small-scale operations using multiple chemicals and procedures, where the procedures are neither apart of, nor simulate, a production process.

1.3 RESPONSIBILITIES

Responsibility for chemical hygiene rests at all levels from President to Students of the university.

1.3.1 **President of the University** has the ultimate responsibility for the safety and health of all personnel within the University and must, with other administrators, provide continuing support for the University's environmental health and safety program including the Chemical Hygiene Plan.

1.3.2 **Deans and Department Heads** are responsible for implementing the chemical hygiene plan in their respective operating units or departments.

1.3.3 **Office of Risk Management Environmental Health and Safety** shall designate an individual who is qualified by training or experience to serve as a **Chemical Hygiene Officer (CHO).**

1.3.4 Chemical Hygiene Officer

The designated CHO shall:

a) Serve on the University's Research Safety Committee to provide technical guidance in the development and implementation of the Chemical Hygiene Plan.
b) Provide general training to all individuals working in SMU research laboratories
c) Review annually the University Chemical Hygiene Plan.

1.3.5 Research Safety Committee

The Research Safety Committee's membership shall consist of designated CHO, representations from departments of the university that are engaged in "laboratory use" of hazardous chemicals, representatives from the Office of Research and Graduate Studies (ORGS) and representatives from the University's Environmental Health & Safety (EHS) Department.

The Committee's responsibilities include:

a) To work with administrators and other employees to develop and implement appropriate laboratory safety policies and practices,
b) To maintain current knowledge of regulatory requirements for controlled or regulated substances; and evaluate ways to improve the chemical hygiene program and
c) To assist project directors to develop precautions and adequate facilities.

1.3.6 **Principal Investigator (PI) or Laboratory Supervisor** assigned to lab space has overall responsibility for the chemical hygiene plan in their respective operations, including the responsibility to:

a) Ensure that all laboratory workers know and follow the chemical hygiene rules and that protective equipment is available and in working order
b) Provide and document appropriate, lab and chemical process specific training,
c) Provide regular, formal chemical hygiene and housekeeping inspections including routine inspections of emergency equipment,
d) Know the current regulatory requirements for controlled and regulated substances,
e) Determine the required levels of protective apparel and equipment,
f) Ensure that facilities for storage and use for any materials are adequate and
g) Ensure that personnel working in the labs are properly trained and advised of lab rules and procedures.

1.3.5 **Project Director** and Other Director of Specific Operations have primary responsibility for chemical hygiene procedures for that operation.

1.3.6 **Laboratory Worker** is responsible for the following,

a) Planning and conducting each operation in accordance with the University's chemical hygiene procedures and specific rules or practices as established by the lab supervisor, and
b) Attending all appropriate training,
c) Developing good personal chemical hygiene practices.

2. CHEMICAL HAZARD INFORMATION

2.1 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.

2.2 PHYSICAL HAZARDS

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

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

2.2.2 **Compressed gas:** A gas or gas mixture with an absolute pressure exceeding 40 psi at 70°F, or exceeding 104 psi at 130°F, or a liquid having a vapor pressure exceeding 40 psi at 100°F as determined by ASTM D-232-72, a standard of the American Society of Testing and Materials.

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

2.2.4 **Flammable:** There are four kinds of flammable materials.

a) Aerosol: A material that can produce a flame or flashback from a valve opening.
b) Gas: Any gas at ambient conditions that will cause a flammable mixture with air in concentrations of 13% or less.
c) Liquid: Any liquid, or mixture with 1% or more of a liquid, with a flash point below 141°F.
d) 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.

2.2.5 **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.

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

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

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

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

2.3 HEALTH HAZARDS

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

2.3.1 **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://ntp.niehs.nih.gov/pubhealth/roc/index-1.html#toc1

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

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

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

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

2.4 TARGET ORGAN EFFECTS

TOXINS	TARGET ORGAN
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

2.5 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:

2.5.1 **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.

2.5.2 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.

2.5.3 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.

2.5.4 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.

2.5.5 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.

2.5.6 Acute and chronic effects: Acute effects are those that show up immediately after a chemical exposure occurs. A good example of an acute effect is the spillage of acid on the skin--a chemical burn will occur immediately. Chronic effects are those that occur after a significant amount of time passes and usually are the result of multiple exposures over a period of time. Cancer is a typical example of a chronic effect because cancers caused by chemical exposures often do not show up until 20 or more years after the initial exposure.

2.6 EXPOSURE ROUTES

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.

2.6.1 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:

a) Gases
b) The vapors of volatile liquids
c) Mists and sprays of both volatile and nonvolatile liquid substances
d) Solid chemicals in the form of particles, fibers, and dusts

2.6.2 **Direct contact hazards:** Many chemicals (e.g. corrosives) 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:

a) Chemical concentration
b) Chemical reactivity
c) The solubility of the chemical in fat and water
d) The condition of the skin
e) The duration of contact

2.6.3 **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. 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.

2.6.4 **Injection hazards:** Injection, or subcutaneous exposure to chemicals is not very common but may occur in a variety of ways. The most well known is accidental puncture via syringe. Other ways a subcutaneous exposure may occur is broken glass or through open wounds that are not covered while working with chemicals.

2.7 CONTROLLING CHEMICAL EXPOSURES

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 should any campus employee (or student) be exposed to any chemical above the OSHA Permissible Exposure Limit (PEL) or Short Term Exposure Limit (STEL). OSHA has established these limits as protective of virtually all workers. The National Institute of Occupational Health and Safety (NIOSH) publishes an annual guide with Recommended Exposure Limits (RELs). The American Conference of Industrial Hygienist (ACGIH) publishes a list of Threshold Limit Values (TLVs) that also dictates exposure limits for workers.

OSHA recently released documentation comparing all of the exposure limits after recognizing that many of its values may be outdated compared to the other organizations. Those comparison tables can be found here:

https://www.osha.gov/dsg/annotated-pels/

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

2.7.1 **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 or glove box, and providing secondary containment in the event of spills are examples of engineering controls.

2.7.2 Administrative controls: Whereas engineering controls are controls that work passively once they are established, administrative controls require that workers take active steps. Examples of administrative controls 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 like those listed in Chapter 3.

2.7.3 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 should be assessed individually.

2.8 PARTICULARLY HAZARDOUS SUBSTANCES

Individuals planning to use Particularly Hazardous Substances must have it approved by the Principal Investigator or supervisor and the Chemical Hygiene Officer prior to their initial use of the substance.

Responsibility for determining whether a chemical is a Particularly Hazardous Substance rests jointly with the supervisor and the individual planning to use the substance.

Particularly hazardous substances are defined to include select carcinogens, reproductive toxins and substances that have a high degree of acute toxicity (such as cyanides and dimethyl mercury).

2.8.1 Select carcinogens include any substance on the following lists of carcinogens:

a) OSHA Carcinogen List
b) *Annual Report on Carcinogens* published by the National Toxicology Program (NTP), including all of the substances listed as "known to be carcinogens" and some substances listed as "reasonably anticipated to be carcinogens"
c) International Agency for Research on Cancer (IARC), including all of Group 1 "carcinogen to humans" and some in Group 2A or 2B, "reasonably anticipated to be carcinogens"

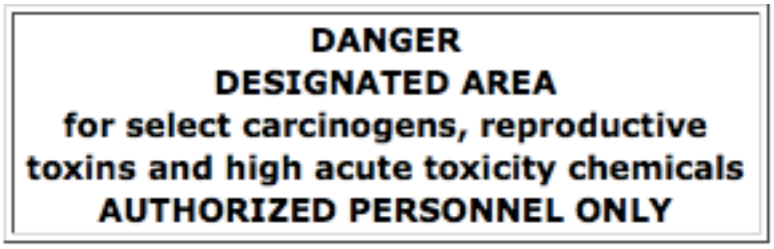
2.8.2 Reproductive toxin includes any chemical that may affect the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogenesis).

2.8.3 High acute toxicity includes any chemical that falls within any of the following categories:

a) A chemical with a median lethal dose (LD_{50}) of 50 mg or less per kg of body weight when administered orally to certain test populations
b) A chemical with an LD_{50} of 200 mg or less per kg of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) to certain test populations
c) A chemical with a median lethal concentration (LC_{50}) in air of 200 parts per million (ppm) by volume or less of gas or vapor, or 2 mg per liter or less of mist, fume, or dust, when administered to certain test populations by continuous inhalation for one hour, provided such concentration and/or condition are likely to be encountered by humans when the chemical is used in any reasonably foreseeable manner.

A list of the more commonly used particularly hazardous substances is available on the EHS website, courtesy of Duke University. This list is not exhaustive and you should consult the product SDS or contact EHS for assistance in determining whether a substance is classified as particularly hazardous.

Before using a particularly hazardous substance, an individual must:
1. Develop a laboratory-customized standard operating procedure and implement it.
2. Post the area where the substance will be used with a *Designated Area* sign.



3. Maintain and up-to-date and accurate inventor of all PHSs used in the lab.

The specific standard operating procedure for use of the substance must include the use of containment devices and personal protective equipment, decontamination procedures and procedures for safe removal of contaminated waste.

2.9 MITIGATING ELECTRICAL HAZARDS

a) Laboratory workers should know the basic procedures for removing a person from contact with a live electrical conductor.
b) Labs should be designed so that all 110-volt AC outlet receptacles accept a three prong- grounding plug.
c) It is required that Ground Fault Circuit Interrupters (GFCI) be used on outdoor receptacles and indoors near any wet operations.
d) Outlets for ventilation hoods should be located outside of the hood to prevent any possible electrical sparks inside the hood.
e) All electrical cords should be inspected annually, and any cords with cut or frayed coverings shall be destroyed and thrown away.
f) Overload protection should be provided on equipment that is likely to be left on and unattended for long periods of time.
g) Non-sparking induction motors should be used in laboratories where volatile

flammable materials may be present.

2.10 SOURCES OF INFORMATION

2.10.1. Safety Data Sheets (SDS)

SDSs should be the first source of information about the chemical hazards. SDSs will contain the following information, usually in separate sections on the sheet:

a) Section 1, Identification includes product identifier; manufacturer or distributor name, address, phone number; emergency phone number; recommended use; restrictions on use.
b) Section 2, Hazard(s) Identification
c) Section 3, Composition/Information on Ingredients
d) Section 4, First-aid Measures
e) Section 5, Fire-fighting Measures
f) Section 6, Accidental Release Measures
g) Section 7, Handling and Storage
h) Section 8, Exposure Controls/Personal Protection lists
i) Section 9, Physical and Chemical Properties
j) Section 10, Stability and Reactivity
k) Section 11, Toxicological Information
l) Section 12, Ecological Information
m) Section 13, Disposal Considerations
n) Section 14, Transport Information
o) Section 15, Regulatory Information
p) Section 16, Other Information, includes the date of preparation or last revision.

Manufacturers are required to provide a SDS for each chemical product sold. EHS maintains a subscription service for providing SDSs. Government regulations specify that SDSs be readily available to employees. "Readily available" means wither via digital copy, phone, or hard copy. It is recommended that each unit obtain hard copies of SDSs if employees do not have access to a computer, smartphone, or tablet connected to the internet.

By selecting the link below, employees have immediate access to a searchable database. For further instructions, contact EHS at 8-2083.

https://msdsmanagement.msdsonline.com/53b998b3-807a-4db0-aaf0-eb2f3be91158/msdsonline-search/

2.11 RESEARCHER TRAINING

2.11.1 Purpose of the Training Program

The purpose of Laboratory Safety Training is to explain and reinforce the information presented in the chemical hygiene plan and to give a broad overview of various laboratory safety topics.

These training sessions serve another important purpose - they provide a forum for researchers to share their health and safety concerns, and to obtain answers from EHS professionals. Researchers can also share their ideas and job experiences - they often have acquired real expertise in dealing with potentially hazardous situations that are beneficial for the whole class.

Laboratory Safety Training offered by EHS is not a substitute for specific laboratory training that must be given by Principal Investigators or Laboratory Supervisor to researchers and workers under their purview.

2.11.2 Training Topics

The general training offered by EHS covers the following topics:

a) An overview of the OSHA Laboratory Standard,
b) The content and availability of the Chemical Hygiene Plan,
c) The availability of safety data sheets and how to use them,
d) An explanation of permissible exposure limits for chemicals,
e) An overview of methods to recognize hazards, how to evaluate hazards, and common methods to prevent and control exposure,
f) The use, function and selection of personal protective equipment,
g) Common chemical and physical hazards present in the laboratory
h) Emergency procedures for fire, injury, chemical exposure, and chemical spill situations
i) Chemical waste disposal procedures at SMU.

3. PROCEDURES AND SAFETY RULES

3.1 CHEMICAL PROCUREMENT / DISTRIBUTION / STORAGE

3.1.1. Procurement

a) The decision to procure a chemical shall be a commitment to handle and use the chemical properly from the initial receipt to ultimate disposal.
b) The safety data sheet (SDS) must be reviewed for all hazardous chemicals users.
c) No container should be accepted without an adequate identifying label. The label should include as a minimum the substance name, manufacturer, distributor, appropriate warning, and precautionary measures.
d) All shipments should be dated when received and opened.

3.1.2. Inventory

a) Each department shall provide a yearly inventory of their laboratories' chemicals to EHS.
b) Annual inventories of chemicals stored in the laboratory shall ensure container integrity, label maintenance, chemical expiration dates, and proper disposal of unneeded chemicals.

3.1.3. Distribution

a) Chemicals carried by hand should be placed in secondary containment to protect against breakage or spillage.
b) When a cart or other load carrying equipment is used to transport chemicals, the cart should be stable under the load and have sidewalls.
c) Freight elevators should be used whenever possible to avoid possible exposure to persons on passenger elevators.
d) Verify that the material and known information is indicated on the label when a hazardous chemical is transported.

3.1.4. Storage

a) All chemical containers must have a legible label firmly attached
b) Determine the quantity that should be stored in the laboratory by considering the capability of the laboratory workers, the extent of the safety features available, the location of the lab, and the nature of the chemical operations.
c) All containers must be suitable for the types of materials to be stored.
d) The containers shall be dated when received and also when open
e) Every chemical in the lab should be returned to that location after each use and have a definite storage place.
f) The maximum quantity of flammable chemicals that shall be stored outside of a flammable cabinet should not exceed 10 gallons unless permission is granted by EHS and the University Fire Safety Manager.
g) Incompatible chemicals shall be kept segregated.
h) All flammable chemicals must be stored in a flammable material cabinet or refrigerator designed for that type of storage.
i) All gas cylinders must be secured and the protective valve cover in place when the cylinder is not in use. Oxidizing and flammable gases must be stored separately as dictated by regulatory requirements.

3.2 HANDLING AND USAGE

3.2.1 Flammables and Combustibles

a) A flammable liquid means any liquid with a flash point below 100 °F (37 °C). A combustible liquid means any liquid with a flash point at or above 100 ° F (37 °C) but below 200 ° F (93.3 °C).
b) Eliminate ignition sources such as open flames, smoking materials, hot surfaces, sparks from welding or cutting, operation of electrical equipment, and static electricity. Post conspicuous "No Smoking" or " No Open Flame" signs in areas where flammable materials are used.
c) Combustible and flammable liquids, in laboratories, shall be stored in approved containers and quantities.
d) When transporting approved glass containers of flammable liquids through hallways, stairways, and elevators, use a non-breakable container large enough to retain the contents of the reagent container in case breakage occurs. Approved glass and/or plastic containers used for flammable liquids shall not exceed I gallon in capacity.

e) Flammable liquids that require freezing or refrigerator storage shall have no internal sources of ignition (explosion-proof).
f) Flammable liquids should never be heated over an open flame, hot plate, or insulated resistance heaters. Use a heating mantle, steam bath, or hot water bath.
g) Drums used as a dispensing vessel shall be properly grounded and bonded
h) Any flammable liquid dispensing and receiving containers must be bonded
i) Together before pouring to prevent the accumulation of static electrical charge.
j) Store flammable liquids in approved flammable liquid containers and storage cabinets, or in a special storage room designed for that purpose
k) Work in ventilation hoods as much as possible.

3.2.2 Corrosives

a) A corrosive chemical causes visible destruction of irreversible alterations in living tissue by chemical action at the site of contact. Such chemicals commonly include strong acids or bases in concentrated form, dehydrating agents, or oxidizing agents.
b) Equipment and containers used for storage and processing of corrosive material shall be resistant to corrosion.
c) Eye protection and appropriate gloves shall always be used when handling corrosive materials.
d) When mixing concentrated acids with water, always add the acid to water very slowly.
e) Acids and bases shall be stored separately from each other.
f) If exposure to a corrosive chemical occurs, wash the affected area with copious amounts of water, immediately remove any contaminated clothing, and seek first aid or medical help.

3.2.3 Oxidizers

a) A material, which reacts vigorously at ambient temperatures when in contact with educing materials, may evolve oxygen at room temperature under slight heating. For example: chlorates, permanganates, nitrates, peroxides, etc.
b) Know the reactivity of the materials involved in an experiment or process Assure that there are no extraneous materials in the area that could become involved in a reaction.
c) If a reaction can be violent or explosive, use shields or other methods for isolating the materials or the process.
d) Use the minimum amounts necessary for the procedure. Do not keep excessive amounts of the material in the vicinity of the process.
e) Materials that are flammable shall be stored away from organic materials and/or reducers.

3.2.4 Water Reactive Material

a) Materials, which reacts violently with water. Examples include aluminum chloride, phosphorus pentachloride, and all hydrides.
b) Store water reactive compounds according to label directions. Wear proper safety equipment.
c) Use only in a hood.

3.2.5 Pyrophoric Materials

a) Pyrophoric materials ignite in air at or below room temperature in the absence of added heat, shock or friction. Examples include t-butyl lithium, silane, silicon tetrachloride, and white or yellow phosphorous.
b) Pyrophoric materials should be used and stored in an inert environment.
c) Pyrophoric operations MUST occur via a standard operating procedure(SOP) written by the laboratory where the work is occurring. Researchers must have documented training on this SOP.

3.2.6 Peroxidizable Material

a) Peroxidizable materials react with oxygen to form peroxides, which can explode with impact, heat, or friction such as removing a lid. Examples of peroxidizables include ethyl ether, tetrahydrofuran, isopropyl ether, liquid paraffin (alkenes) and olefins (alkenes).
b) Any container of chemicals that can form peroxides should be handled very carefully and not opened at all if it is of uncertain age, has formed a precipitate, its physical properties differ from those of the pure substance, or if the cap is tightly stuck.
c) Store away from heat and light. Polyethylene bottles are the best containers.
d) Always order inhibited materials when possible.
e) Peroxidizable materials MUST be dated upon receipt and opening.

3.2.7 Light Sensitive Materials

a) Light sensitive materials degrade in the presence of light forming new compounds that can be hazardous, or result in conditions such as pressure build-up inside a container that may be hazardous.

3.3 DISPOSAL

Potentially Hazardous chemicals must be disposed of in accordance with federal and state regulations and procedures established by EHS. Your department may also have procedures that you are required to follow. Contact your supervisor, instructor or EHS before discarding of any potentially hazardous chemical.

3.3.1 Guidelines For Waste Collection And Disposal

a) To determine if the chemical you want to dispose, from your laboratory or work area, is a regulated hazardous waste, contact and consult EHS.
b) All lab personnel must be familiar with the location and composition of all wastes produced and/or stored in the lab.
c) Waste containers must remain closed except when actually adding waste. Open containers violate state and federal waste regulations.
d) For disposal information, call 8-2430.
e) Request waste pickup for disposal at Hazardous Waste Disposal Form
f) Waste chemicals must not be placed or left for removal in hallways.
g) Disposal of radioactive materials require special procedures. Contact EHS before proceeding.

3.4 POLLUTION PREVENTION/WASTE MINIMIZATION

Waste minimization strategies usually have the dual benefits of improving safety and reducing chemical purchase and disposal costs. It is recommended that each unit evaluate its procedures periodically to consider the possible usage of less hazardous or smaller quantities of chemicals.

3.4.1 Introduction

Waste minimization and pollution prevention also helps ensure that the University meets the legal requirements. There are federal, states, and local laws that govern waste disposal. The best way to comply with these laws is to not generate the waste in the first place.

3.4.2 Waste Minimization Strategy

a) Substitute safer chemicals for hazardous chemicals.
b) Deal with a large inventory of mislabeled or unlabeled chemicals that were left by another teacher.
c) Communicate the importance of waste minimization to school administrators.
d) Recycle chemicals.
e) Teach students environmental responsibility as you teach them to perform experiments.

3.5 PERSONAL PROTECTIVE EQUIPMENT

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.

3.5.1 **Attire:** Wear a lab coat or apron; cover legs (no shorts or skirts) and feet (no sandals or open-toed shoes), confine loose clothing and long hair. Nylons and/or pantyhose are not recommended because they may melt upon contact with acid. Lab coats shall not be worn outside of the laboratory and should only be laundered by commercial vendors. They should not be taken home to be laundered.

3.5.2 **Eye protection:** It is state law and campus policy that personnel including students, 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.

3.5.3 **Face shields:** Full-face shields must be worn when conducting a procedure that may result in a violent reaction. Full-face shields with bottom caps to protect the neck are preferred because they provide the best protection.

3.5.4 Glass tubing: When inserting tubing into stoppers, lubricate tubing and wear leather gloves to protect hands from being cut in the event of the tubing slipping and breaking.

3.5.5 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.

3.5.6 Personal hygiene: Hands should 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.

3.5.7 Respiratory protection: Work in a fume hood or provide adequate ventilation when working with materials that produce hazardous vapors or fumes. If you feel that additional respiratory protection may be warranted, please contact EHS at 8-2430.

3.6 HOUSEKEEPING

3.6.1 Checklist

a) Exits, aisles and safety equipment must NOT be obstructed in any way with equipment, furniture, or other items.
b) Aisles within the laboratory should be 36 inches in clear width.
c) Work areas and floors are not to be used for excessive storage.
d) Doors which are not in use but which are accessible from a corridor or adjacent room should be appropriately labeled if they are blocked on the interior of the room.
e) Hallways are not to be used as storage areas.
f) Hazardous waste must not be stored for prolong period.
g) Make sure that trash is picked up regularly.
h) All the electrical cables must be organized and well insulated.

3.7 SURVEYS AND MONITORING

EHS shall conduct regular lab surveys and follow ups to maintain safety and environment friendly work place. At minimum, these will take place on an annual basis. Lab supervisors and faculty members must conduct routine self-inspections to ensure laboratory compliance. More information on the program can be found at: https://www.smu.edu/BusinessFinance/RiskManagement/Health-Safety/ResearchSafety/LabSafety/Laboratory-Survey-Program.

3.8 HAZARD IDENTIFICATION AND LABELING

a) Labels on all incoming hazardous material containers shall not be removed or defaced.
b) All departments must ensure that all laboratory containers of chemicals are labeled where required. Laboratory containers, including bottles, flasks, sample vials, etc., must be marked, labeled, or coded in all cases The labels should be dated

and should identify the generator of the material.

c) Chemicals substances developed in the laboratory shall be assumed to be hazardous in the absence of other information.

d) A review of hazard materials not previously used in the laboratory shall be completed with all lab personnel before actual handling occurs.

e) Areas of the labs that have special or unusual hazards (radiation, x-ray, laser operations, flammable materials, biological hazards, etc.) shall be posted with warning signs.

f) Exemptions for labeling requirements shall be made for chemical transfers from a labeled container into a container that is intended only for the immediate use of the employee who performed the transfer.

3.9 LABORATORY BEHAVIOR

a) Employees shall behave in a professional manner at all times in the laboratory,

b) Know the proper operation and use of the appropriate safety procedures,

c) A void practical jokes or other behavior, which may result in a distraction of another worker

d) Always obtain information on the hazards involved and the proper personal protective equipment required,

e) There should always be more than one person when working on a potentially hazardous activity,

f) All visitors to laboratories must observe all safety rules,

g) Practice laboratory safety awareness and report unsafe conditions when they are discovered and

h) Use your legs, not your back when lifting heavy objects. Make sure the load is close to your body at the start of the lift. Get help when lifting loads that are heavy, bulky or awkward.

4. SPILL CONTROL

4.1 SPILL PREVENTION GUIDELINES

Before moving a box of chemicals, examine its integrity. If a box is wet, torn, improperly sealed, or in any way defective such that movement from a stable surface would result in contents being broken, scattered, or otherwise displaced, remove contents. Place individual containers in storage or place them in another suitable box.

Boxes of chemical containers should not be stacked where there would be any danger of toppling, breakage, or spillage of contents. Chemical containers should not be left on the floor or in aisles where they could be kicked or knocked over. Always check the compatibility of the chemical with the container used (i.e., do not place acids in metal can) and with the compatibility of other chemicals in adjacent containers.

4.2 SPILL EVALUATION

Assess the severity of the spill and take the appropriate action: Does the material pose a substantial

hazard to human health or is there any immediate danger or fire or explosion? If it is a hazardous spill and/or large non- hazardous spill (approximately 1 gallon or more), contact the SMU Environmental Health and Safety Department (EHS) at 8-2430. If you are not able to contact EHS, call 911 from a landline or 214-768-3333 from a mobile phone for SMUPD.

The individual investigator should handle small, low hazard spills. In any event, persons involved in clean- up must wear appropriate personal protective equipment; i.e. safety goggles, gloves, lab coats, and if necessary, respiratory equipment.

Avoid prolonged exposure to all vapors, fumes, and smoke. Remove all ignition sources from the area. Evacuate all unnecessary personnel from the area.

4.3 SPILL RESPONSE AND CLEAN-UP PROCEDURES

In the event of a chemical spill, the individual(s) who caused the spill is responsible for prompt and proper cleanup. It is also their responsibility to have spill control and personal protective equipment appropriate for the chemicals being handled readily available. See "Developing a Spill Response Plan (4.3.2)" for more information.

4.3.1 General Guidelines

The following are general guidelines to be followed for a chemical spill. More detailed procedures may be available in your Spill Response Plan.

- Immediately alert area occupants and supervisor, and evacuate the area, if necessary.
- If there is a fire or medical attention is needed, contact SMU Police at 911 from a landline or 214-768-3333 from a mobile phone.
- Attend to any people who may be contaminated. Contaminated clothing must be removed immediately and the skin flushed with water for no less than fifteen minutes. Clothing must be laundered before reuse.
- If a volatile, flammable material is spilled, immediately warn everyone, control sources of ignition and ventilate the area.
- Don personal protective equipment, as appropriate to the hazards. Refer to the Safety Data Sheet or other references for information.
- Consider the need for respiratory protection. The use of a respirator or self-contained breathing apparatus requires specialized training and medical surveillance. Never enter a contaminated atmosphere without protection or use a respirator without training. If respiratory protection is needed and no trained personnel are available, call EHS at 8-2430 or SMUPD at 911 from a landline or 214-768-3333 from a mobile phone. If respiratory protection is used, be sure there is another person outside the spill area in communication, in case of an emergency. If no one is available, contact SMUPD.
- Using the chart below, determine the extent and type of spill. If the spill is large, if there has been a release to the environment or if there is no one knowledgeable about spill cleanup available, contact EHS at 8-2430 or SMUPD at 911 from a landline or 214-768-3333

from a mobile phone.

Category	Size	Response	Treatment Materials
Small	Up to 300mL	Chemical treatment or absorption	Neutralization or absorption spill kit
Medium	300mL to 4L	Absorption	Absorption spill kit
Large	More than 4L	Call SMUPD (911 or 214-768-3333)	Outside help

- Protect floor drains or other means for environmental release. Spill socks and absorbents may be placed around drains, as needed.
- Contain and cleanup the spill according to the table above. Loose spill control materials should be distributed over the entire spill area, working from the outside, circling to the inside. This reduces the chance of splash or spread of the spilled chemical. Bulk absorbents and many spill pillows do not work with hydrofluoric acid. POWERSORB® (by 3M) products and their equivalent will handle hydrofluoric acid. Specialized hydrofluoric acid kits also are available for purchase from lab safety suppliers. Many neutralizers for acids or bases have a color change indicator to show when the spill is neutralized.
- When spilled materials have been absorbed, use brush and scoop to place materials in an appropriate container. Polyethylene bags may be used for small spills. Five-gallon pails or 20-gallon drums with polyethylene liners may be appropriate for larger quantities.
- Complete a hazardous waste sticker, identifying the material as Spill Debris involving XYZ Chemical, and affix onto the container. Spill control materials will probably need to be disposed of as hazardous waste. Contact EHS at 8-2430 for advice on storage and packaging for disposal.
- Decontaminate the surface where the spill occurred using a mild detergent and water, when appropriate.
- Report all spills to your supervisor or the Principal Investigator.
- Universal (except for hydrofluoric acid) spill kits are available in each science and engineering building.

Building	Location
Dedman Life Science	1st floor near vending machines
Fondren Science/Heroy	2nd floor Fondren near 249
Junkins/Embry	2nd floor hallway

4.3.2 Developing a Spill Response Plan

An effective spill response procedure should consider all of the items listed below. The complexity and detail of the plan will, of course depend upon the physical characteristics and volume of materials being handled, their potential toxicity, and the potential for releases to the

environment.

- Review Safety Data Sheets (SDSs) or other references for recommended spill cleanup methods and materials, and the need for personal protective equipment (e.g., respirator*, gloves, protective clothing, etc.)
- Acquire sufficient quantities and types of appropriate spill control materials to contain any spills that can be reasonably anticipated. The need for equipment to disperse, collect and contain spill control materials (e.g., brushes, scoops, sealable containers, etc.) should also be reviewed. See Recommended Spill Control Materials Inventory for more details. EHS maintains EHS chemical spill control kits that can be used if no other materials are available. After use, please call EHS at 8-2430 to restock.
- Acquire recommended personal protective equipment and training in its proper use. **For example, if an air purifying respirator or self-contained breathing apparatus are needed, personnel must be enrolled in the Respiratory Protection Program and attend annual training and fit-testing.*
- Place spill control materials and protective equipment in a readily accessible location within or immediately adjacent to the laboratory.
- Develop a spill response plan that includes:
- Names and telephone numbers of individuals to be contacted in the event of a spill.
- Evacuation plans for the room or building, as appropriate.
- Instructions for containing the spilled material, including potential releases to the environment (e.g., protect floor drains).
- Inventory of spill control materials and personal protective equipment.
- Means for proper disposal of cleanup materials (in most cases, as hazardous waste) including contaminated tools and clothing.
- Decontamination of the area following the cleanup.

4.3.3 Recommended Spill Control Material Inventory

Your laboratory or work area should have access to sufficient quantity of absorbents or other types of materials to control any spill that can be reasonably anticipated. Vermiculite, lined 5-gallon pails and limited spill control materials are available in all of the science and engineering laboratory buildings. Additional materials may be found in certain laboratories.

Personal Protective Equipment

- 2 pairs chemical splash goggles
- 2 pairs of gloves (recommend Silver Shield® or 4H®)
- 2 pairs of shoe covers
- 2 plastic or Tyvek aprons and/or Tyvek suits

Absorption Materials

- 4 3M POWERSORB® spill pillows (or equivalent)
- 1 3M POWERSORB® spill sock (or equivalent)

- 2 DOT pails (5 gallon) with polyethylene liners
- 1 filled with loose absorbent, such as vermiculite or clay
- 1 with minimum amount of loose absorbent in the bottom

Neutralizing Materials

- Acid Neutralizer
- Caustic Neutralizer
- commercial neutralizers, such as Neutrasorb (for acids) and Neutracit-2 (for bases) have built in color change to indicate complete neutralization
- Solvent Neutralizer
- commercial solvent neutralizers, such as Solusorb, act to reduce vapors and raise the flashpoint of the mixture

Mercury Spills

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

Clean-up Tools

- Polypropylene scoop or dust pan
- Broom or brush with polypropylene bristles
- 2 polypropylene bags
- Sealing tape
- pH test papers
- Waste stickers
- Floor sign - DANGER Chemical Spill - Keep Away

5. EMERGENCY PROCEDURES

No universal emergency plan will accomplish all emergency situations. Plan in advance for an emergency. The most important component of emergency planning is prevention.

5.1 HIGH HAZARD EMERGENCIES

If the emergency consists of the following hazards treat the emergency as high hazards. Call the University Police at 911 from a landline or 214-768-3333 from a mobile phone.

- Immediately dangerous to life and Health
- Involves a large area.
- Major injury to personnel
- Is a threat to personnel and the public?
- Involves an infectious agent
- Involves a highly toxic, corrosive, or reactive material.
- If the nature of the emergency is unknown
- If it is uncertain how to handle the emergency
- If possible, isolate or evacuate the area.

When reporting the emergency give the following information:

- Name of caller and reason for calling
- Location of victim or emergency
- Name of victim
- Phone number of caller
- Facts concerning the emergency

Be available to provide emergency response personnel with information regarding the accident and hazards within the area. If possible collect safety data sheets for the chemicals involved.

5.2 LOW HAZARD EMERGENCIES

If the emergency consists of the following hazards treat the emergency as low hazard.

- A fire hazard does not exist
- Involves low to moderately toxic materials in small amounts
- Involves a readily treatable injury

Notify the immediate supervisor/instructor, DPS and the Environmental Health & Safety Department of all illnesses and injuries related to exposure of hazardous chemicals or hazards. For a small spill, use an absorbent material that will neutralize the spill, if available. Wear appropriate protective clothing when cleanup is involved. The area should be decontaminated with soap and water after clean up. Residue should be placed in an appropriate container for waste collection.

5.3 FIRE AND FIRE-RELATED EMERGENCIES

If you discover a fire or fire related emergency such as a hazardous material spill, flammable liquid spill, hazardous gas leak, smoke, or odor of burning activate the building fire alarm system. If fire alarm system is not available or operational, verbally notify persons in the building.

Use a portable fire extinguisher to extinguish the fire only if the fire is small, only at the source AND not spreading quickly. Provide the fire/police departments with the details of the problem upon their arrival. Special hazard information you may know is essential.

If fire alarms ring in your building evacuate the building and move at least 200 feet away from the building. Do not re-enter the building until directed to do so.

5.4 INJURY AND ILLNESS

Employees and students must notify their immediate supervisor or instructor of all illnesses and injuries related to exposure to hazardous chemicals.

Provide emergency and medical personnel with the following information

- Name, location and nature of the emergency
- Name of chemical involved
- Amount of chemical involved
- Area of body affected
- Symptoms

APPENDIX A

Regulations (Standards - 29 CFR)

Occupational Exposure to Hazardous Chemicals in Laboratories – 29 CFR 1910.1450

- **Part Number:** 1910
- **Part Title:** Occupational Safety and Health Standards
- **Subpart:** Z
- **Subpart Title:** Toxic and Hazardous Substances
- **Standard Number:** 1910.1450
- **Title:** Occupational exposure to hazardous chemicals in laboratories.
- **Appendix:** A , B
- **GPO Source:** e-CFR

1910.1450(a)

Scope and application.

1910.1450(a)(1)

This section shall apply to all employers engaged in the laboratory use of hazardous chemicals as defined below.

1910.1450(a)(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:

1910.1450(a)(2)(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.

1910.1450(a)(2)(ii)

Prohibition of eye and skin contact where specified by any OSHA health standard shall be observed.

1910.1450(a)(2)(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.

1910.1450(a)(3)

This section shall not apply to:

1910.1450(a)(3)(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 Z, even if such use occurs in a laboratory.

1910.1450(a)(3)(ii)

Laboratory uses of hazardous chemicals which provide no potential for employee exposure. Examples of such conditions might include:

1910.1450(a)(3)(ii)(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

1910.1450(a)(3)(ii)(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.

1910.1450(b)

Definitions —

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.

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

Carcinogen (see *select carcinogen*).

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.

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.

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.

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

Hazardous chemical means any chemical which is classified as health hazard or simple asphyxiant in accordance with the Hazard Communication Standard (§1910.1200).

Health hazard means a chemical that is classified as posing one of the following hazardous effects: Acute toxicity (any route of exposure); skin corrosion or irritation; serious eye damage or eye irritation; respiratory or skin sensitization; germ cell mutagenicity; carcinogenity; reproductive toxicity; specific target organ toxicity (single or repeated exposure); aspiration hazard. The criteria for determining whether a chemical is classified as a health hazard are detailed in appendix A of the Hazard Communication Standard (§1910.1200) and §1910.1200(c) (definition of "simple asphyxiant").

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.

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

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.

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.

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.

Mutagen means chemicals that cause permanent changes in the amount or structure of the genetic material in a cell. Chemicals classified as mutagens in accordance with the Hazard Communication Standard (§1910.1200) shall be considered mutagens for purposes of this section.

Physical hazard means a chemical that is classified as posing one of the following hazardous effects: Explosive; flammable (gases, aerosols, liquids, or solids); oxidizer (liquid, solid, or gas); self reactive; pyrophoric (gas, liquid or solid); self-heating; organic peroxide; corrosive to metal; gas under pressure; in contact with water emits flammable gas; or combustible dust. The criteria for determining whether a chemical is classified as a physical hazard are in appendix B of the Hazard Communication Standard (§1910.1200) and §1910.1200(c) (definitions of "combustible dust" and "pyrophoric gas").

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.

Reproductive toxins mean chemicals that affect the reproductive capabilities including adverse effects on sexual function and fertility in adult males and females, as well as adverse effects on the development of the offspring. Chemicals classified as reproductive toxins in accordance with the Hazard Communication Standard (§1910.1200) shall be considered reproductive toxins for purposes of this section.

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/m^3;

(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.

1910.1450(c)

Permissible exposure limits. For laboratory uses 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.

1910.1450(d)

Employee exposure determination --

1910.1450(d)(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).

1910.1450(d)(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.

1910.1450(d)(3)

Termination of monitoring. Monitoring may be terminated in accordance with the relevant standard.

1910.1450(d)(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.

1910.1450(e)

Chemical hygiene plan -- General. (Appendix A of this section is non-mandatory but provides guidance to assist employers in the development of the Chemical Hygiene Plan).

1910.1450(e)(1)

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:

1910.1450(e)(1)(i)

Capable of protecting employees from health hazards associated with hazardous chemicals in that laboratory and

1910.1450(e)(1)(ii)

Capable of keeping exposures below the limits specified in paragraph (c) of this section.

1910.1450(e)(2)

The Chemical Hygiene Plan shall be readily available to employees, employee representatives and, upon request, to the Assistant Secretary.

1910.1450(e)(3)

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;

1910.1450(e)(3)(i)

Standard operating procedures relevant to safety and health considerations to be followed when laboratory work involves the use of hazardous chemicals;

1910.1450(e)(3)(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;

1910.1450(e)(3)(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;

1910.1450(e)(3)(iv)

Provisions for employee information and training as prescribed in paragraph (f) of this section;

1910.1450(e)(3)(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;

1910.1450(e)(3)(vi)

Provisions for medical consultation and medical examinations in accordance with paragraph (g) of this section;

1910.1450(e)(3)(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

1910.1450(e)(3)(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:

1910.1450(e)(3)(viii)(A)

Establishment of a designated area;

1910.1450(e)(3)(viii)(B)

Use of containment devices such as fume hoods or glove boxes;

1910.1450(e)(3)(viii)(C)

Procedures for safe removal of contaminated waste; and

1910.1450(e)(3)(viii)(D)

Decontamination procedures.

1910.1450(e)(4)

The employer shall review and evaluate the effectiveness of the Chemical Hygiene Plan at least annually and update it as necessary.

1910.1450(f)

Employee information and training.

1910.1450(f)(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 area.

1910.1450(f)(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.

1910.1450(f)(3)

Information. Employees shall be informed of:

1910.1450(f)(3)(i)

The contents of this standard and its appendices which shall be made available to employees;

1910.1450(f)(3)(ii)

the location and availability of the employer's Chemical Hygiene Plan;

1910.1450(f)(3)(iii)

The permissible exposure limits for OSHA regulated substances or recommended exposure limits for other hazardous chemicals where there is no applicable OSHA standard;

1910.1450(f)(3)(iv)

Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory; and

1910.1450(f)(3)(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, safety data sheets received from the chemical supplier.

1910.1450(f)(4)

Training.

1910.1450(f)(4)(i)

Employee training shall include:

1910.1450(f)(4)(i)(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.);

1910.1450(f)(4)(i)(B)

The physical and health hazards of chemicals in the work area; and

1910.1450(f)(4)(i)(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.

1910.1450(f)(4)(ii)

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

1910.1450(g)

Medical consultation and medical examinations.

1910.1450(g)(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:

1910.1450(g)(1)(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.

1910.1450(g)(1)(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.

1910.1450(g)(1)(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.

1910.1450(g)(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.

1910.1450(g)(3)

Information provided to the physician. The employer shall provide the following information to the physician:

1910.1450(g)(3)(i)

The identity of the hazardous chemical(s) to which the employee may have been exposed;

1910.1450(g)(3)(ii)

A description of the conditions under which the exposure occurred including quantitative exposure data, if available; and

1910.1450(g)(3)(iii)

A description of the signs and symptoms of exposure that the employee is experiencing, if any.

1910.1450(g)(4)

Physician's written opinion.

1910.1450(g)(4)(i)

For examination or consultation required under this standard, the employer shall obtain a written opinion from the examining physician which shall include the following:

1910.1450(g)(4)(i)(A)

Any recommendation for further medical follow-up;

1910.1450(g)(4)(i)(B)

The results of the medical examination and any associated tests;

1910.1450(g)(4)(i)(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 workplace; and

1910.1450(g)(4)(i)(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.

1910.1450(g)(4)(ii)

The written opinion shall not reveal specific findings of diagnoses unrelated to occupational exposure.

1910.1450(h)

Hazard identification.

1910.1450(h)(1)

With respect to labels and safety data sheets:

1910.1450(h)(1)(i)

Employers shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced.

1910.1450(h)(1)(ii)

Employers shall maintain any safety data sheets that are received with incoming shipments of hazardous chemicals, and ensure that they are readily accessible to laboratory employees.

1910.1450(h)(2)

The following provisions shall apply to chemical substances developed in the laboratory:

1910.1450(h)(2)(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.

1910.1450(h)(2)(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.

1910.1450(h)(2)(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 safety data sheets and labeling.

1910.1450(i)

Use of respirators. 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.

1910.1450(j)

Recordkeeping.

1910.1450(j)(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 examinations including tests or written opinions required by this standard.

1910.1450(j)(2)

The employer shall assure that such records are kept, transferred, and made available in accordance with 29 CFR 1910.1020.

1910.1450(k)

[Reserved]

1910.1450(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.

[55 FR 3327, Jan. 31, 1990; 55 FR 7967, March, 6, 1990; 55 FR 12777, March 30, 1990; 61 FR 5507, Feb. 13, 1996; 71 FR 16674, April 3, 2006; 77 FR 17887, March 26, 2012]

29 CRF 1910.1450 App A: National Research Council Recommendations Concerning Chemical Hygiene in Laboratories (Non-Mandatory).