Chemical Hygiene Plan

Updated November, 2021

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INTRODUCTION

CCR Title 8, Section 5191(e)(1) Chemical Hygiene Plan.
(1) Where hazardous chemicals as defined by this regulation are used in the workplace, an employer shall develop and carry out the provisions of a written Chemical Hygiene Plan that provides for both of the following:
(a) Protecting employees from health hazards that are associated with hazardous chemicals in that laboratory.
(b) Keeping exposures below the limits specified in Subsection 5191(c)

Tri-County Technical College has developed this Chemical Hygiene Plan to promote the safe operation of the College laboratories and facilities for students, faculty and staff, and to promote a culture of safety within the College.

This Plan is intended to satisfy the requirements of the US Department of Labor, Occupational Safety and Health Administration 29 CFR 1910.1450 Occupational Exposures to Hazardous Chemicals in Laboratories, and the South Carolina Occupational Safety and Health Act (SCOSHA) to develop a Chemical Hygiene Plan (CHP) for the protection of our students and employees. The two broad performance goals for the TCTC Chemical Hygiene Plan are: (1) to ensure adequate protection of faculty, staff, and students from any hazards associated with the laboratory use of chemicals within campus laboratories; and, (2) to keep employee and student exposure to chemicals below the OSHA specified permissible exposure limits (PELs).

In addition, the Plan provides guidance for a safe experience in our laboratories. This document is managed by the Tri-County Technical College Safety Committee. Comments or corrections to this document should be forwarded to the VP of Business Affairs**. The Chemical Hygiene Officer is the overall hazardous communications coordinator, but the maintenance and compliance of the labs is the responsibility of the lab manager, Department Heads, and Deans. The lab manager, Department Heads, and Deans are responsible for the communication, education, and compliance of this Plan on all campuses.**

The TCTC Chemical Hygiene Plan is available to all employees, students, representatives, and if necessary, representatives of OSHA. Compliance is mandatory for employees and students. Employment involving laboratory use of hazardous chemicals is *contingent* upon following the described safety and environmental guidelines in this plan.

All laboratory users must be made aware of this plan. New employees should review the plan and receive safety training before beginning work with hazardous chemicals. A copy of this plan must immediately be available to all laboratory workers at all times.

The TCTC Chemical Hygiene Plan has been reviewed and approved by the Chemical Hygiene Officer, College Safety Committee, the Senior VP Vice President of Academic Affairs, and the President of the College. The effectiveness of the Chemical Hygiene Plan will be reviewed and evaluated at least annually and updated as necessary. Discussion of the plan is encouraged; and improvements, proposed changes, or questions relating to policy should be directed to the Chemical Hygiene Officer. The Chemical Hygiene Officer will reevaluate, revise, and update the plan periodically to reflect new safety information, better safety practices, and greater ease of implementation in accordance with the Laboratory Standard.

The Chemical Hygiene Plan contains distinct elements and safety measures specified by the OSHA standard which are designed to ensure employee protection in each of the following areas:

- Standard Operating Procedures to be used when working with hazardous chemicals;
- Criteria to be used to determine and implement control measures to reduce exposure to hazardous chemicals;
- Measures to be taken to ensure that fume hoods and other protective equipment are functioning properly;
- Employee information and training program;
- Certain hazardous operations or procedures that require prior approval before employees carry them out;
- Designation of personnel responsible for implementation of the Chemical Hygiene Plan;
- Additional provisions for work with select carcinogens, reproductive toxins, and substances with high acute toxicity.
- A medical examination and consultation policy.

Each of these elements is discussed in this Chemical Hygiene Plan. Each chapter begins with an excerpt from the OSHA standard describing the required content.

COLLEGE SAFETY COMMITTEE

The College Safety Committee is made up of individuals holding the following positions and/or performing the following job functions:

- Vice President for Business Affairs
- Dean of Arts and Sciences Division
- Dean of Health Education Division
- Dean of Engineering and Industrial Technology Division
- Dean of Student Development
- Assistant Dean, School of Science and Math
- Chemical Hygiene Officer
- Health Education Division representative
- EIT Division Representative
- Physical Plant representative
- Campus Police Representative

I. Standard Operating Procedures

CCR Title 8, Section 5191(e)(1) Chemical Hygiene Plan.
(1) Where hazardous chemicals as defined by this regulation are used in the workplace, an employer shall develop and carry out the provisions of a written Chemical Hygiene Plan that provides for both of the following:
(a) Protecting employees from health hazards that are associated with hazardous chemicals in that laboratory.
(b) Keeping exposures below the limits specified in Subsection 5191(c)

A. General

Standard operating procedures are work practices and policies deemed necessary to protect users from chemical hazards in the laboratory. These policies cannot anticipate every possible hazard or situation; they do, however, describe those practices fundamental to good chemical hygiene under most circumstances.

1. This document applies to all Tri-County Technical College Labs in which chemicals are used at any time. "Chemicals" are defined as non-edible substances that are not on the FDA Generally Recognized As Safe (GRAS) List.

2. Students, faculty, and staff shall follow the Chemical Hygiene Plan to promote their health and safety.

3. The design of the laboratory facilities will provide sufficient space for safe work by the number of persons to be in the laboratory. Exit doors will be clearly marked and free of obstructions to permit quick, safe escape in an emergency.

4. Only students enrolled at Tri-County Technical College in the specific course may participate in laboratory exercises.

5. Laboratory facilities will be used only by persons with proper qualifications and training. The number of persons assigned to the laboratory shall not exceed the number of laboratory stations available.

6. Users will follow general precautions for handling laboratory chemicals to minimize all chemical exposures. Specific guidelines found in the appropriate Safety Data Sheets (SDS), will also be followed.

7. Laboratory users shall not underestimate the risk of exposure, and exposure to hazardous substances shall be minimized. The decision to use a particular substance will be based on the best available knowledge of each chemical's particular hazard and the availability of proper handling facilities and equipment. Substitutions, either of chemicals or experiments, will be made where appropriate to reduce hazards without sacrificing instructional objectives. When the risk outweighs the benefit and no substitute is available, then the experiment, procedure, or chemical shall be eliminated.

8. Chemicals shall not be accepted from a supplier unless it is accompanied by the corresponding SDS, or an SDS from that supplier for that chemical is already on file. All SDS shall be accessible to employees at all times on computer desktops, on the SDS Repository, in binders located in specified

areas. Employees shall attend annual training sessions to read and use the information found on Safety Data Sheets.

9. Generally, textbooks, laboratory manuals, and other instructional materials designate the safety precautions needed for a particular laboratory activity. However, total reliance on such publications to provide complete and accurate information is not advisable.

B. Laboratory Procedures

General guidelines for working with laboratory chemicals are found throughout the Chemical Hygiene Plan. Specific guidelines and procedures are also described in later sections of the Chemical Hygiene Plan Identifying potential laboratory hazards, anticipating the consequences, and reducing or eliminating the risks by using appropriate safety precautions is the best approach to working with laboratory chemicals. Specific principles follow.

1. Individuals in laboratories:

    a. Food and drink, gum chewing, application of cosmetics, or manipulation of contact lenses are not permitted in any TCTC laboratory where chemicals are used or stored.

    b. The use of cell phones, headphones, or other devices that will distract students from the educational process or inhibit a safe environment are prohibited in the laboratory.

    c. All persons will conduct themselves in a responsible manner at all times in the laboratory (horseplay, throwing items, and pranks are prohibited). Use or retention of laboratory supplies or equipment is prohibited unless specifically authorized by a supervisor or instructor.

    d. Employees shall not work alone in the lab or chemical storage area unless other employees are in the vicinity and are aware that someone is in the laboratory.

    e. Touching, smelling, tasting, or other close contact with chemicals is strictly forbidden.

    f. Pipetting should never be done by mouth. A bulb or other device for suction should be used instead.

    g. Students should not insert glass tubing into rubber stoppers. Instructors shall use the appropriate lubricant and hand protection when inserting tubing.

    h. Students and employees should ensure glassware is cool before touching it. Hot glass looks the same as cool glass.

    i. Heating of glass for purposes of softening or melting should only be done with the authorization of a supervisor or instructor. Appropriate eye and hand protection shall be worn. Students may not heat glass for bending or melting.

    j. Glassware should not be dried by inserting a towel wrapped around a glass rod.

    k. Proper procedures for Bunsen burners or other sources of flame shall be followed. A flame should never be left unattended.

l. Personal protective equipment (PPE) and clothing must be worn while in the lab. OSHA Standard 1910 Subpart I (1910.132) requires the use of Personal Protective Equipment in all labs where users are exposed to blood, chemical hazards, or mechanical irritants. Therefore, all students enrolled in science labs where exposure to blood or chemical hazards exists will be required to wear lab coats and other protective equipment as deemed necessary in each lab. All students enrolled in labs where exposure to mechanical irritants exists will be required to purchase goggles and wear this protective equipment in each lab. Goggles must be certified to meet ANSI Z87.1 standards. All Personal Protective Equipment is provided or sold at the TCTC Campus Store.

1) Approved safety goggles that meet ANSI Z87.1 standard must be worn in the laboratory when any experimental work is underway. Approved safety goggles must be worn over regular eyeglasses that may be prescribed.

2) **CLOSED** shoes (no sandals, flip flops, slippers, etc.) must be worn at all times in the laboratory so that feet are **completely** covered. Individual courses may have other specific requirements.

3) Clothing that covers the legs must be worn for personal protection (no shorts, mini-skirts, etc.). Personal protective equipment, as described in Part II.A., must be worn at all times in the laboratory.

4) Loose clothing and hair that is longer than shoulder length must be confined when working in the laboratory.

5) The use of contact lenses in the laboratory is strongly discouraged. Permission to wear contact lenses in the laboratory may be obtained; however, for personal safety goggles with shielded vents must be worn. Students may be required to sign a statement saying that they will accept responsibility for any injury caused by the wearing of contact lenses. These documents are available from the course instructor.

m. Should a fire alarm or any other evacuation occur during a lab activity, all Bunsen burners and electrical equipment should be turned off, as appropriate. The room and building must be evacuated as directed.

n. Careful storage and handling procedures shall be used to avoid glassware breakage. In the event of breakage of glass not containing chemicals or biological materials, protection for the hands shall be worn when picking up the broken pieces. Small pieces shall be swept up with a brush and pan. Broken glass shall be separated from other waste by placing it in a special container marked Broken Glass. Broken glass contaminated with chemicals must be treated as hazardous waste. See Section I.M. for proper procedures.

o. The quantities of flammable liquids used in the laboratory shall not exceed the amount that can be consumed in the current fiscal year.

p. Chemical and biological materials shall be stored only in the chemical preparation and storage areas. Quantities sufficient for the current experiment cycle are permitted in laboratories when properly labeled. See section II.B.2 for proper labeling procedures.

2. Students in the laboratory:

    a. Must read lab directions and Safety Data Sheets prior to their assigned lab and follow all verbal and written instructions.

    b. Shall perform only assigned experiments.

    c. Shall report all accidents, injuries, chemical spills, glass breakage, faulty equipment, or equipment malfunctions to the instructor immediately. The instructor or their designee must contact Campus Police immediately by calling extension 1800.

    d. Shall only carry out laboratory work under the direct supervision of an instructor or designated staff member.

C. Housekeeping Practices

1. All laboratory areas must be kept clean and orderly.

2. All chemical and biological wastes shall be placed in appropriate, segregated receptacles that are properly labeled. See Section I.K. for labeling and disposal procedures.

3. Sinks are to be used only for disposal of water and those solutions designated in section I.H.4. Other solutions must be placed in the appropriately labeled waste container.

4. Tabletops are to be swept clean and washed at the end of any lab activity that utilizes chemical or biological materials.

5. All chemical spills shall be cleaned up according to Section I.I., as soon as they occur. Chemicals and cleanup materials shall be disposed of according to Section H.

6. Access to emergency equipment, showers, eyewashes, or exits must never not be blocked.

7. Chemicals and equipment must be properly stored according to Section I.F. Chemicals shall not be stored in aisles, on the floor, in stairwells, on desks, or laboratory tables.

8. Operating hotplates, running water and open flames shall not be left unattended.

9. All cabinets and drawers shall be kept closed when not in use to avoid catching and bumping hazards.

D. Chemical Procurement

1. Efforts should be made to order chemicals in quantities that are likely to be consumed in one year, and shall be purchased only in the quantity sufficient for the declared use.

2. A chemical shall not be accepted without an adequate identifying label.

3. The container shall be marked with the full level and date(s) it is received and opened.

4. Laboratory chemicals not in the inventory listing (see II.B.1.) may not be stored or brought into the laboratory or other areas of the College.

5. Donated chemicals shall only be accepted with the approval of the Program Director. Donated chemicals must have the appropriate Safety Data Sheets.

6. Chemicals shall be inventoried as described in section II.B.1.

E. Transportation of Chemicals between Work and Storage Areas

1. The time and route of chemical transport should be planned to minimize potential for exposure to large numbers of people in the event of an incident.

2. All containers of chemicals should be carried within a second container capable of containing the substance if the first container breaks or leaks. Employees should use a rubber pail or a cardboard box and appropriate cart as necessary.

3. The total amount transported should be kept small on any single trip (5 gallons is recommended as a maximum quantity).

4. Elevators should be used to transport chemicals, not stairs.

5. Gas cylinders must be stored and transported with their caps in place. Large cylinders must be transported using a cylinder cart.

6. Biohazardous waste should be transported within a closed container with “Biohazard” labels.

F. Storage and Distribution

1. All chemicals shall be in tightly closed, sturdy, and appropriate containers.

2. If the chemical has been transferred to a secondary container, the new container shall have an adequate identifying label.

3. Chemicals shall be stored based on the reactive nature and compatibility group of the chemical.

4. Large containers and containers with reactive chemicals, such as acids and bases, shall be on low shelves.

5. Flammable chemicals shall be stored in approved storage containers and in approved flammable chemical storage cabinets.

6. No combustible material, such as paper products, shall be stored in FP 527 (Chemical Storage Room). No trash/recycling receptacles shall be kept in FP 527.

7. All storage areas shall be securely locked when not in use. Storage and preparation areas shall be accessible only to those persons authorized to access the chemicals.

8. Glass bottles containing highly flammable liquids (Class 1A) shall not exceed 500 ml. For larger volumes, metal or approved plastic may not exceed 1 gallon, and safety cans shall not exceed 2 gallons.

9. Chemicals shall not be distributed for purposes other than instruction without the prior approval of the Chemical Hygiene Officer. Chemicals transferred to other Tri-County campuses, shall be accompanied by their applicable SDS information. All college employees who transfer and receive chemicals shall have appropriate training in their use, storage, and disposal.

10. Refrigerators used to store flammable chemicals shall be labeled and shall be of explosion proof or of lab safe design.

11. Chemicals transported in elevators shall be protected from breakage and carried in secondary containers that will contain spills, such as unbreakable tubs. All chemicals transported in elevators shall be carried by cart, not by hand. The elevator shall not be used by the public during transportation of significant quantities (over 100 grams) of chemicals.

12. Compressed Gases – A compressed gas is defined as any material or mixture having in the container either an absolute pressure greater than 276 kPa (40 lb/in 2) at 21 °C, or an absolute pressure greater than 717 kPa (104 lb/in 2) at 54 °C or both, or any liquid flammable material having a Reid vapor pressure greater than 276 kPa (40 lb/in 2) at 38 °C.

    a. Gas cylinders shall only be moved from one location to another with the protective cap securely in place. A wheeled gas cylinder carrier will be used when moving a cylinder. Moving cylinders by rolling is prohibited. No one will travel in the elevator with a gas cylinder. Transportation in elevators will use the send and receive method.

    b. Both full and empty cylinders shall only be stored where they may be securely restrained by straps, chains, or a suitable stand.

    c. A cylinder shall be considered empty when there is still a slight positive pressure and an “EMPTY” label shall be placed on it.

    d. An empty cylinder shall be returned to the supplier as soon as possible after having been emptied or when it is no longer needed.

    e. Cylinders shall not be exposed to temperatures above 50 °C.

    f. Store flammable gases separately from oxidizer gases.

G. Chemical Classes and Separation of Hazardous Chemicals

The primary concerns for chemical storage are minimizing the amounts, avoiding contact between incompatible chemicals and ensuring that hazardous storage conditions (inadequate ventilation, light, heat, etc.) are not present. Because an alphabetical storage system may place incompatible chemicals next to each other, chemicals should first be grouped according to their hazard category (i.e., acids, bases, flammables, etc.), then alphabetically (where appropriate) within that group. In some cases, because of container type or size, alphabetical order will not be possible. The following guidelines should be used when storing various classes of chemicals:

1. Flammables, both liquid and solid, should be kept in a locking, fireproof cabinet. If flammables must be stored cold, an intrinsically safe "explosion-proof" or "explosion-safe" refrigerator or cold room should be used.

2. Corrosives should be stored in a cool, dry place separate from all other chemicals. There are four general types of corrosive compounds: acids, bases, oxidizers, and reducing agents. These types of corrosives should be stored separately from one another.

3. Reactive compounds which cannot be exposed to air or water should be stored separately in appropriate air or water-tight containers in a cool, dry place.

4. Certain types of reactive compounds should receive special treatment. For example: cyanides, sulfides and sulfites should be stored separately, away from acids in a cool, dry place.

5. Peroxides present a special storage hazard and should be monitored carefully. Diethylether, *p*-dioxane, tetrahydrofuran, and other commonly used peroxide-forming materials should be labeled with the date the container was first opened, and disposed of within six to twelve months of the opening date. If a manufacturer’s expiration date exists, the above does not apply.

6. All other compounds not covered in the above categories should be stored first by hazard class, then alphabetically in a clean, ventilated stockroom storage area.

7. Acids must be separated from bases. These chemicals should be stored near floor level.

8. Perchloric acid should be isolated from organic materials. Perchloric acid should not be stored on a wooden shelf.

9. Highly toxic chemicals and carcinogens should be separated from all other chemicals. This storage location should have a warning label and should be locked.

10. Acids should be separated from flammables.

11. Peroxide-forming chemicals should not be kept past the expiration date.

The following table provides examples of some incompatible chemicals:

	Incompatible
Acetic Acid	Chromic acid, nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, permanganates
Acetylene	Chlorine, bromine, copper, fluorine, silver, mercury
Acetone	Concentrated nitric and sulfuric acid mixtures
Alkali Metals	Water, carbon tetrachloride or other chlorinated hydrocarbons, carbon dioxide, halogens
Ammonia	Mercury, chlorine, calcium hypochlorite, iodine, bromine, hydrofluoric acid
Ammonium nitrate	Acids, powdered metals, flammable liquids, chlorates, nitrites, sulfur, finely divided organic combustible materials
Aniline	Nitric acid, hydrogen peroxide
Arsenic materials	Any reducing agent
Azides	Acids
Bromine	See chlorine
Calcium oxide	Water
Carbon (activated)	Calcium hypochlorite, all oxidizing agents
Chlorates	Ammonium salts, acids, powdered metals, sulfur, finely divided organic or combustible materials
Chlorine	Ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), hydrogen, sodium carbide, benzene, finely divided metals, turpentine
Chromic acid and chromium trioxide	Acetic acid, naphthalene, camphor, glycerol, alcohol, flammable liquids in general
Chlorine dioxide	Ammonia, methane, phosphine, hydrogen sulfide
Copper	Acetylene, hydrogen peroxide
Cumene hydroperoxide	Acids (organic or inorganic)
Cyanide	Acids
Flammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens
Fluorine	Most other chemicals
Hydrocarbons (such as butane, propane, benzene)	Fluorine, chlorine, bromine, chromic acid, sodium peroxide
Hydrocyanic acid	Nitric acid, alkali
Hydrofluoric acid (anhydrous)	Ammonia (aqueous or anhydrous)
Hydrogen sulfide	Fuming nitric acid, oxidizing gases
Hypochlorites	Acids, activated carbon
Iodine	Acetylene, ammonia (aqueous or anhydrous), hydrogen
Mercury	Acetylene, fulminic acid, ammonia
Nitrates	Sulfuric acid
Nitroparaffins	Inorganic bases, amines
Oxalic acid	Silver, mercury
Oxygen	Oils, grease, hydrogen, flammable liquids, solids, or gases
Perchloric Acid	Acetic anhydride, bismuth and its alloys, alcohol, paper, wood, grease, oils
Peroxides, organic	Acids (organic or inorganic), avoid friction, store cold
Phosphorus (white)	Air, oxygen, alkalis, reducing agents
Potassium	Carbon tetrachloride, carbon dioxide, water
Potassium chlorate	Sulfuric and other acids
Potassium perchlorate see also chlorates	Sulfuric and other acids
Potassium permanganate	Glycerol, ethylene glycol, benzaldehyde, sulfuric acid
Selenides	Reducing agents

Silver	Acetylene, oxalic acid, tartaric acid, ammonium compounds, fulminic acid
Sodium	Carbon tetrachloride, carbon dioxide, water
Sodium nitrite	Ammonium nitrate and other ammonium salts
Sodium peroxide	Ethyl or methyl alcohol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural
Sulfides	Acids
Sulfuric acid	Potassium chlorate, potassium perchlorate, potassium permanganate (similar compounds of light metals, such as sodium, lithium)
Tellurides	Reducing Agents

H. Waste Minimization and Disposal

1. The Tri-County Technical College Chemical Hygiene Officer shall ensure that the disposal of laboratory chemicals is in compliance with the South Carolina Department of Environmental Quality, Hazardous Waste Management Rules.
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2. The College is considered a Small Quantity Generator according to the South Carolina Hazardous Waste Rules (SCDHEC).

3. Waste minimization - Employees shall minimize generation of hazardous wastes by:

   a. Every reasonable attempt will be made to recycle and/or reuse chemicals in an environmentally acceptable manner as the preferred method of disposal. This will be accomplished where appropriate, only by the laboratory specialists, or course instructor.

   b. Using microscale labs and selecting less hazardous materials.

   c. Ordering chemicals in quantities that are likely to be consumed in one year or less.

   d. Avoiding the inadvertent accumulation of hazardous waste. Potential waste materials are surplus, old, and/or unnecessary chemicals.

   e. Determining if the material will need to be treated as hazardous waste by referring to the Hazardous Waste Management Rules prior to ordering new chemicals.

4. Hazardous waste disposal

   a. All hazardous materials shall be disposed of in accordance with South Carolina Hazardous Waste Management (SCDHEC) rules.

   b. Only non-hazardous aqueous solutions between pH 3 and pH 9 may be poured down the drain.

c. Separate hazardous waste containers shall be provided by the Lab Specialists for:

- heavy metal compounds
- chlorinated hydrocarbons
- non-chlorinated hydrocarbons
- biohazardous waste
- other categories as recommended by the Chemical Hygiene Officer.

d. Waste chemicals shall be stored in appropriately labeled containers, inside secondary containment.

e. Hazardous wastes shall never be placed in any common solid trash container.

f. All hazardous waste containers shall have an up-to-date log of the material that is in the container. When any material is added to the container, the chemical name, the amount of the chemical, the date, and the initials of the individual adding the hazardous chemical, shall be recorded in the log for that container. This recording task is the responsibility of the laboratory instructor.

g. Upon completion of the laboratory activity cycle, the waste containers shall be returned to the preparation room. Waste materials shall not be stored in the laboratory.

h. When the waste containers become full, or 90 days after the container is first used, the containers shall be transferred to the designated waste storage area Cleveland Hall or FP 527.

i. Unlabeled containers apparently containing liquid and/or solid chemicals shall be treated as hazardous waste and disposed of using the procedures described above.

I. Spills

1. If the chemical involved in the spill is judged to present an immediate hazard, evacuation is to be absolute, and the area shall be isolated until Campus Police and the Chemical Hygiene Officer are contacted and the HAZMAT team arrives.

2. If hazardous vapors are present, the area shall be isolated, and Campus Police and Chemical Hygiene Officer contacted. Only personnel trained in the use of respirators may enter the area.

3. If a volatile, flammable material is spilled, immediately extinguish flames such as Bunsen burners and evacuate the area. Consult the SDS for appropriate cleanup procedures. If the quantity exceeds the employee's ability or training to handle the spill, seal the area and contact the Chemical Hygiene Officer.

4. If there is no immediate danger (flammability, toxicity, reactivity, corrosivity) to personnel, and the spill can be contained, containment shall be accomplished by use of spill pillows, towels, rolls, or other devices that will keep the spill from spreading. If a major spill occurs (cannot be cleaned-up safely by yourself), the Chemical Hygiene Officer should be immediately contacted.

5. If there is no immediate danger, cleanup procedures listed on the SDS shall be followed. Appropriate personal protective equipment (PPE) shall be used.

6. A spill kit shall be maintained in each laboratory working with chemicals. Spill kits for lab rooms will include kitty litter, gloves, good quality absorbent paper towels, broom, dustpan and bucket. It will be clearly marked "For Safety Emergency Only". Spill kit(s) for Prep Rooms (FP 520, Anderson Campus 134, 235, Easley Campus 201) will be provided by the Chemical Hygiene Officer. Kits shall be inspected before the beginning of each semester by the laboratory specialists.

7. If the spill material is a hazardous chemical, all of the materials involved in the cleanup will be considered to be hazardous waste and must be disposed of as such.

J. Accidents

1. All personnel shall be trained in the proper use of fire extinguishers during their orientation and annually thereafter.

2. All employees who might be exposed to chemical splashes shall be instructed in the location and proper usage of emergency showers and eyewashes.

3. In the case of accident requiring medical attention or assistance, contact EMS (911) and Campus Police immediately to arrange for an escort and any necessary transportation. The following guidelines regarding accidents in the laboratory do not replace the need for proper medical consultation and treatment. These guides are general recommendations only.

    a. In the case of **eye contact**: Promptly flush eyes with water for a prolonged period (15 minutes) and seek medical attention.

    b. In the case of **ingestion**: Encourage the victim to drink large amounts of water, contact the poison control center if necessary and seek medical attention.

    c. In the case of **skin contact**: Promptly flush the affected area with water and remove any contaminated clothing. If symptoms persist after washing, seek medical attention.

    d. Personnel trained in first aid should be available during working hours and an emergency room with medical personnel should be readily available (within 15 minutes of campus).

4. The most common injuries in the lab involve cuts from broken glass and heat burns. Treat minor burns as needed with antiseptic/antibacterial creams. For small cuts, the affected area should be washed with cold water and a bandage should be applied. For larger cuts which may require stitches, severe burns, or for instances where chemicals may have been absorbed into the cut, medical attention should be sought. Have someone call Campus Police before the injured person leaves the building, and make sure someone accompanies the injured person. All injuries shall be reported.

5. Chemical burns may result when corrosive materials like strong acids, bases, oxidizers, and reducing agents are handled improperly. For chemical splashes, wash the affected area with water for 15 minutes and remove all contaminated clothing. Use the lab shower for spills over large areas of the body. After rinsing thoroughly, seek immediate medical attention.

6. Medical Exams and Consultation - TCTC must provide all personnel 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:
    a. Whenever a worker develops signs or symptoms associated with a hazardous chemical to which the worker may have been exposed in the laboratory, the worker must be provided an opportunity to receive an appropriate medical examination.
    b. 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 must be established for the affected worker(s) as prescribed by the particular standard.
    c. 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 worker(s) must be provided an opportunity for a medical consultation to determine the need for a medical examination.
    d. All medical examinations and consultations must be performed by or under the direct supervision of a licensed physician and be provided without cost to the worker, without loss of pay and at a reasonable time and place.

K. Container Labeling

1. Specific labeling requirements for laboratory waste are described below. All portions of the label are to be completed by the laboratory specialist prior to the experiment except the final pH of the product, which will be determined by the laboratory specialist at the time the container is to be transferred to the approved storage area. The label shall contain the following information:

    - Hazardous Waste
    - Generator's name, address, and phone number, e.g. TCTC, address for Pendleton, Anderson, or Easley campus
    - Accumulation Start Date
    - Lab Specialist's Name
    - EPA ID Number
    - Physical State
    - Hazardous Properties: flammable, toxic, corrosive, reactive, other

- Contents
- Class and Experiment Number: for example, CHM 110 Experiment #6
- Confirmed pH

2. The following basic labeling practices will be enforced in the labs regardless of the method used:

   a. All containers in the laboratory shall be labeled. This includes chemical containers and waste containers. The label shall be informative and durable, and at a minimum will identify contents, source, date of acquisition, storage location, and indication of hazard.

   b. Exemptions for labeling requirements shall be made for chemical transfers from a labeled container into a container which is intended only for immediate use.

   c. The labeling program shall be reviewed periodically by the Chemical Hygiene Officer to ensure that labels have not been defaced or removed.

   d. Prominent signs and labels shall be posted giving emergency telephone numbers.

   e. Location signs shall be posted for safety showers, eyewash station, and other safety and first aid equipment, exits, and areas where food and beverage consumption and storage are not permitted.

   f. Signs shall be posted warning of areas or equipment where special or unusual hazards exist.

L. Equipment to be used for Specific Procedures

Some specific operations should be confined to limited areas in the lab to minimize exposure. Each Program Director shall identify those processes in their labs requiring special handling and assign those chemicals or processes to the available fume hoods. The following guidelines should also be observed:

1. Fume hoods should be used for all procedures involving concentrated acids, alkalis and toxic chemicals with PELs or TLVs less than 50 ppm.

2. When using the fume hood, chemicals should be kept away from the face.

3. Operation of the hood should be monitored and any problems reported immediately.

4. A closed system should never be used for carrying out chemical reactions that involve heating or evolution of a gas. Experiments should always be vented to either a fume hood or to the laboratory (where appropriate).

M. Laboratory Equipment and Glassware

1. All laboratory equipment shall be used only for its intended purpose.

2. All glassware shall be handled and stored with care to minimize breakage; all broken glassware will be disposed of immediately in the broken glass container.

3. All evacuated glass apparatus shall be shielded to contain chemicals and glass fragments should implosion occur.

4. All laboratory equipment shall be inspected on a periodic basis and replaced or repaired as necessary.

II. Control Measures

CCR Title 8, Section 5191(e)(3)(B) Control Measures (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: (B) 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

A. Personal Protective Equipment

1. It is the responsibility of the College to provide appropriate safety and emergency equipment for employees and students.

2. Laboratory aprons or coats, eye protection, and non-permeable gloves are considered standard equipment for College laboratory programs and will be used as specified in the course syllabus. The Chemical Hygiene Officer shall annually review protective equipment requirements for all laboratory courses. Home laundering of laboratory coats and other protective clothing is ***not permitted***.

3. Protective apparel shall be compatible with the required degree of protection for the substances being handled.

4. All eye protection devices used in the Science Department shall conform to ANSI Standard Z87.1-2003. Eyeglasses, even with side shields, are not acceptable protection against chemical splashes.

5. Any experiment that involves heating or the use of chemicals or glassware shall require the use of chemical splash safety goggles.

6. Wearing contact lenses is acceptable but is strongly discouraged. All students must sign a statement saying that they will accept responsibility for any injury caused by the wearing of contact lenses.

7. Full face shields protect the face and throat. They must be worn for protection when there is a greater risk of injury from flying particles and harmful chemical splashes. A full face shield shall also be worn when an operation involves a pressurized or evacuated system. For full protection, safety goggles must be worn with the face shield.

8. Standing shields shall be used when there is a potential for explosions, implosions, or splashes, or when corrosive liquids are used. The standing safety shield shall be used with safety goggles and, if appropriate, with a face shield.

9. When gloves are required, the SDS shall be consulted for information regarding the proper type of gloves to be used. The correct type of gloves shall be available in every laboratory for the procedures to be carried out that day.

B. Administrative Controls

1. Inventory Control

    a. A chemical inventory shall be updated annually. The list shall be audited for accuracy on an annual basis. The Chemical Hygiene Officer will be responsible for maintaining this inventory.

    b. The chemical inventory list shall contain the following information about each chemical found in storage:

        - the chemical name
        - location
        - the date purchased
        - the amount present
        - the CAS number
        - the date for review for possible disposal.

2. Hazard Identification and Labels

    a. Labels on incoming containers of hazardous chemicals are not to be removed or defaced.

    b. Laboratory chemicals shall be properly labeled to identify any hazards associated with them for the employee's information and protection.

    c. If a chemical is stored in its original bottle, it shall have the manufacturer's original label identifying potential hazards, the date of purchase, the date opened, and the initials of the person who opened the container.

    d. If a chemical has been transferred to a secondary container, the new container shall be appropriately labeled with the chemical name, concentration (if in solution), solvent (if in solution other than water), and initials of the person responsible for the transfer.

    e. Unlabeled bottles shall not be opened, and such materials shall be disposed of promptly, as outlined in the section on disposal procedures.

3. Signs and Posters

    a. Emergency telephone number is 911.

    b. Signs shall be used to indicate the location of exits, evacuation routes, safety showers, eyewash stations, fire extinguishers, fire blankets, first aid kits, fume hoods, other safety equipment, and areas where food and drink are prohibited.

4. Safety Data Sheets (SDS)

    a. Safety Data Sheets for all chemicals shall be maintained and made readily available.

    b. The material safety data sheets for each chemical in the laboratory usually give recommended limits or OSHA-mandated limits, or both, as guidelines to exposure limits. Typical limits are expressed as threshold limit values (TLVs), permissible exposure limits (PELs), or action levels. When such limits are stated, that limit, along with any other information about the hazardous characteristics of the chemical, shall be used to set laboratory guidelines. These laboratory guidelines shall be used in determining the safety precautions, control measures, and personal protective equipment that apply when working with the toxic chemical.

5. Records

    a. The up-to-date Chemical Inventory List (section II.B.1.) shall be maintained on the Science Department network shared drive.

    b. Inspection Records

        1) Reports must be completed and retained by the Chemical Hygiene Officer.

        2) Safety equipment shall be marked to indicate the date and the results of the last inspection conducted by the Chemical Hygiene Officer.

        3) Records indicating the dates of repairs and regular maintenance of safety equipment shall be retained by the Physical Plant Department.

    c. Training Records – Human Resources shall maintain records of employee training, and records of completed training will be made available to the Chemical Hygiene Officer, as necessary.

    d. Incident Report - Incident reports will be completed by the Campus Police Department.

    e. Medical and Exposure Records - Records of air concentration monitoring shall be maintained by the Chemical Hygiene Officer. Exposure assessments, medical consultations, and medical examinations shall be maintained by the College Human Resources Department.

    f. Waste Disposal Records - The Chemical Hygiene Officer shall retain records of disposal of hazardous waste. The records shall conform to the requirements of the South Carolina Department of Environmental Quality Hazardous Waste Rules.

6. Exposure Monitoring

    a. If there is reason to believe that exposure levels for a regulated substance have exceeded the action level or permissible exposure limit, the Chemical Hygiene Officer shall ensure that the employee or student exposure to that substance is measured.

    b. If a substance has an exposure monitoring requirement and if there is reason to believe that exposure levels for that substance routinely exceed the action level or in the absence of the action level, the PEL, the College Safety Committee shall be notified.

    c. In the event that an employee is exposed to levels of a hazardous chemical exceeding the established PEL or TLV, or the employee shall exhibit signs or symptoms of such exposure, the employee shall be provided appropriate medical treatment and the Campus Police Department will be contacted.

III. Safety/Emergency Facilities and Equipment

A. Equipment

1. The Chemical Hygiene Officer shall ensure that adequate emergency equipment is available in the laboratory and inspected periodically to ensure it is functioning properly. Records of these inspections will be retained by the Chemical Hygiene Officer. All employees shall be properly trained in the use of each item.

2. Emergency equipment items that shall be available include:

    - eyewash station
    - fire extinguisher of the appropriate type
    - safety shower
    - telephone for emergencies
    - fire blanket
    - identification signs.

3. Each laboratory shall have a standard first aid kit inspected and stocked by the respective department(s).

4. Multipurpose fire extinguishers shall be available in the laboratory. A multipurpose, ABC fire extinguisher can be used on all fires EXCEPT class D fires. Extinguishers shall be visually checked monthly and inspected and tested annually by the Campus Police Department.

5. Every eye wash station will be capable of supplying a continuous flow of aerated, tepid, potable water to both eyes for at least 20 minutes. The valve shall remain in the open position without the need to hold the valve. Eyewashes shall be inspected and operated at least twice a year by designated personnel in each department and documented on the attached tag. Repairs to eyewash stations will be made by the Physical Plant Department.

6. Safety showers shall be capable of supplying a continuous flow of tepid potable water for at least 20 minutes. The shower shall have a quick-opening valve requiring manual closing (ANSI Z358.1-1990). The valve shall remain in the open position without the need to hold the valve. Safety showers shall be inspected and operated at least twice a year by the Physical Plant Department and marked to document this inspection and use.

7. Laboratories in which hazardous substances are being used shall have spill control kits. Kit contents are described in section I.I.6.

B. Facilities

1. Fume hoods

    a. Laboratory classroom fume hoods are not to be used for either storage or disposal of chemicals.

    b. Laboratory activities that may release airborne contaminants above the Permissible Exposure Limit (PEL) or Thresholds Limit Value (TLV) concentrations must be carried out in the fume hood. Also, if laboratory activities produce potentially hazardous vapors or gaseous substances, the laboratory activities shall be conducted in the fume hood.

    c. All fume hoods shall be inspected annually and certified by the Chemical Hygiene Officer. Any hood not passing inspection must be taken out of service immediately and not be used until such time as the hood has passed inspection. It is the responsibility of the Physical Plant Department to purchase the parts and replace the unit in a timely fashion so as not to endanger the health and well-being of the employee or place the facility at risk.

2. Ventilation

    a. Ventilation systems shall be constructed and maintained to comply with OHSA or other applicable standards.

    b. Inspection and certification of ventilation systems will be carried out by the Chemical Hygiene Officer. The Physical Plant Department will maintain the ventilation systems.

3. Flammable Storage

    a. Chemicals with a flash point below 93.3° C (200° F) shall be considered “fire hazard chemicals”. Any chemical whose Material Safety Data Sheet (MSDS) or label states “Flammable” is in this category.

    b. Fire hazard chemicals in excess of 500 mL shall be stored in a flammable solvent storage area, safety cans, or in storage cabinets designed for flammable materials.

    c. Flammable materials shall be stored in a flammable liquid storage cabinet or other appropriate location. When transferring significant quantities of flammable liquids from one container to another, it is particularly important that they be properly grounded (by touching hand to work surface prior to pouring) to prevent accidental ignition of flammable vapors and liquids from static electricity or other sources of ignition. Large quantities of flammable chemicals stored

in outside cabinets shall be in flame-proof storage cans which conform to NFPA guidelines and/or the applicable local fire codes.

4. Electrical

    a. All building electrical systems shall be constructed and maintained in accordance with state and local applicable standards.

    b. In the event that power needs to be immediately turned off at the circuit breaker, the Physical Plant Department should be contacted.

IV. Training and Information

A. Training for Employees

1. The College shall provide employees with information and training to ensure they are aware of the hazards of chemicals present in their work area.

2. The College shall provide Right-To-Know training opportunities for all laboratory employees at risk. The Science Department shall provide training opportunities for all laboratory employees at risk about the hazards of chemicals present in the laboratory and sources of information concerning hazards in the laboratory. In particular, the training program shall cover the Chemical Hygiene Plan, material safety data sheets, and the responsibilities of Science Department employees, and others, as appropriate.

    a. Laboratory employees shall be trained on the potential chemical hazards in the employees' work areas and on appropriate sections of the Chemical Hygiene Plan. This training shall be provided to all employees who actually work in the laboratory, as well as to other employees whose assignments may require that they enter a laboratory where exposure to hazardous chemicals might occur. Employees who are responsible for receiving and handling shipments of new chemicals or chemical wastes shall also be informed of the potential hazards and appropriate protective measures for chemicals they may receive.

    b. Laboratory employees shall be trained on the applicable details of the Chemical Hygiene Plan, including a review of the general rules of laboratory safety. The training program shall describe appropriate sections of the standard operating procedures, particularly those procedures that require prior approval of the College Safety Committee. The training an employee receives shall be determined by the nature of the work assignment in the laboratory.

    c. Laboratory employees shall be trained in measures they may take to protect themselves from exposure to hazardous chemicals, including the location and proper use of protective equipment and emergency equipment. In addition, the training must also include a discussion of inventory procedures to be followed, proper storage and ordering rules, and district hazardous waste disposal procedures.

    d. All laboratory employees will be trained to read and understand Safety Data Sheets (SDS).

    e. Laboratory employees shall be trained in labeling and storage practices (see sections I.F. and II.B.2.).

3. Training shall be carried out as designated by the College Safety Committee.

B. Access to Information

1. Employees shall be informed of the location, availability, content and use of:

    - the "Laboratory Standard" 29 CFR Part 1910.

- the Chemical Hygiene Plan.
- personal protective equipment and emergency equipment as outlined in the Chemical Hygiene Plan.

C. Training for Students

Faculty shall provide a safe environment for student learning by providing safety training to students.

1. At the beginning of the term and prior to laboratory activities, class time shall be devoted to safe laboratory practices and to the student safety agreement.

2. Instruction in laboratory safety shall be provided to all students enrolled in laboratory classes. Students enrolling after safety instruction has taken place shall receive instruction prior to being permitted to engage in laboratory activities.

3. The extent of student training shall be determined by their course of study, the laboratory facility, College policies, the Chemical Hygiene Plan, and the level of chemical handling and potential exposure to hazardous chemicals.

4. Safety training shall include the importance and the content of the label and of material safety data sheets. As appropriate, the student shall also be introduced to other sources of chemical safety information.

V. Approval of Experimental Design

1. Existing laboratory experiments will be reviewed by departmental curriculum committees on an on-going basis.

VI. Responsibilities

A. TCTC President

Provide support for the TCTC Chemical Hygiene Plan through appropriate staffing and funding.

B. Deans / Department Heads / Program Coordinators

1. Ensure departmental implementation of the TCTC Chemical Hygiene Plan within their department(s) and program(s).

2. Each area is responsible for providing all necessary supplies such as personal protective equipment, spill kits.

3. Provide visible support for the TCTC Chemical Hygiene Plan, by instilling safety attitudes/behaviors through leadership by example.

C. Chemical Hygiene Officer

The Chemical Hygiene Officer has primary responsibility for the implementation and enforcement of the Chemical Hygiene Plan.

1. The Chemical Hygiene Officer is identified by job function.

2. The Chemical Hygiene Officer shall be qualified by education, certification, and experience to provide technical guidance in the development and implementation of the Chemical Hygiene Plan.

3. The Chemical Hygiene Officer has the responsibility to:

    a. Work with administrators and instructors to develop and implement the safety program.

    b. Assure that inspections in the laboratory are performed when appropriate and that records of inspections are maintained.

    c. Provide technical assistance to employees and laboratory supervisors on the chemical hygiene plan.

    d. Arrange for disposal and transportation of chemical and biological waste through a qualified vendor.

    e. Maintain required documentation.

D. Supervisors

1. Shall be responsible for ensuring their employees comply with the provisions of this plan.

2. Ensure employees receive required annual training

3. Document training conducted with all new personnel and annually thereafter.

E. Faculty

1. Shall be responsible for ensuring students in classes generating hazardous waste comply with the provisions of this plan.

2. Shall take the appropriate steps to ensure the safety and well-being of all users (faculty, staff, and students).

3. Shall assure compliance with these requirements within his/her laboratory or area of responsibility.

F. Employees

Employees who normally work in a laboratory with chemicals or biological substances are responsible for:

1. Participating in required training programs provided by the College.

2. Maintaining an awareness of health and safety hazards.

3. Planning and conducting each operation in accordance with the chemical hygiene plan procedures and appropriate safety procedures.

4. Consulting reference materials, including SDSs, related to chemical safety where appropriate.

5. Using, modeling, and enforcing good personal chemical hygiene and safety habits.

6. Reporting accidents, injuries, unsafe practices, and unsafe conditions.

G. Students

Students shall practice good chemical hygiene and safety habits. They shall report accidents and maintain an awareness of health and safety hazards. Students shall conduct all activities according to the Chemical Hygiene Plan procedures.

VIII. SPECIAL PRECAUTIONS/PROCEDURES

A. FLUORESCENT BULBS

1. Producers of this material are responsible for packaging of bulbs. Bulbs may be packaged in original containers (use the box the bulbs were supplied in with packing material removed). If appropriate packaging is not available, the Physical Plant Department should be contacted.

2. Any broken bulbs will be immediately cleaned up with residue placed in a suitable container, marked as to its contents and disposed of with spent bulbs.

B. BATTERIES

1. Lead-Acid batteries, automotive type or sealed, are disposed of by the Automotive Technology Program Director or designee.

2. Standard alkaline batteries, such as those used in flashlights, do not normally require handling as hazardous material and can usually be disposed of as normal trash.

3. Non alkaline, rechargeable batteries, e.g., Nickel-Cadmium Metal (Nickel, Lithium, et al) Hydride, Lithium Ion, etc., used in cell phones, pagers, hand-held radios, computers and powered hand-tools are potentially hazardous and should be properly disposed of - not placed in normal trash. Even when discarded, these batteries should be handled carefully, by placing the batteries in individual plastic bags or taping over the electrodes. These batteries will be collected and recycled by the Physical Plant Department.

C. COMPUTERS

Computers and related equipment (monitors, keyboards, scanners, etc.) and parts (cards, cords etc.) are an environmental concern. Most components contain metals such as lead, which are regulated by the Environmental Protection Agency, and hence, cannot be disposed of as normal trash. The Information Technology Department stores and disposes of all computers and related equipment.

XI. ACRONYNMS, DEFINITIONS, AND COMMON TERMS USED IN SAFETY DATA SHEETS

Acid: Any chemical which undergoes dissociation in water with the formation of hydrogen ions. Acids turn litmus paper red and have pH values of 0 to 6. They may cause severe skin burns.

Acute Effect: Adverse effect on a human or animal which has severe symptoms developing rapidly and coming quickly to a crisis. Also see chronic effect.

Acute Toxicity: Acute effects resulting from a single dose of or exposure to a substance.

Air-purifying respirator: A respirator that uses chemicals to remove specific gases and vapors from the air or that uses a mechanical filter to remove particulate matter. An air-purifying respirator must only be used when there is sufficient oxygen to sustain life and the air contaminant level is below the concentration limits of the device.

Alkali: The hydroxides and carbonates of the alkali metals and alkaline earth metals. They neutralize acids, impart a soapy feel to aqueous solutions and are the most common cause of occupational dermatitis.

Allergic Reaction: An abnormal physiological response to chemical or physical stimuli.

Anesthetic: A chemical that causes a total or partial loss of sensation. Overexposure to anesthetics can cause impaired judgement, dizziness, drowsiness, headache, unconsciousness, and even death. Examples include alcohol, paint remover, and degreasers.

Asphyxiant: A vapor or gas that can cause unconsciousness or death by suffocation (lack of oxygen). Most simple asphyxiants are harmful to the body only when they become so concentrated that they reduce oxygen in the air (normally about 21 percent) to dangerous levels (18 percent or lower). Asphyxiation is one of the principal potential hazards of working in confined and enclosed spaces.

Auto-Ignition Temperature: The minimum temperature required to initiate or cause self-sustained combustion independent of the heat source. A steam line or a glowing light bulb may ignite carbon disulfide (ignition temperature 80C). Diethyl ether (ignition temperature 160C) can be ignited by the surface of a hot plate.

Base: A water soluble compound capable of reacting with an acid to form a salt by releasing an unshared pair of electrons to the acid or by receiving a proton from the acid.

Benign: Not recurrent or not tending to progress.

Biodegradable: Capable of being broken down into individual components by the action of living things.

Boiling Point (BP): The temperature at which a liquid changes to a vapor state at a given pressure. The boiling point is usually expressed in degrees Fahrenheit at sea level pressure (760mmHg, or one atmosphere).

Carcinogen: A substance or agent capable of causing or producing cancer in mammals, including humans.

CAS: Chemical Abstracts Service is an organization under the American Chemical Society. CAS abstracts and indexes chemical literature from all over the world in "Chemical Abstracts." "CAS Numbers" are used to identify specific chemicals or mixtures.

CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act of 1980. The Act requires that the Coast Guard National Response Center be notified in the event of a hazardous substance release. The Act also provides for a fund (the Superfund) to be used for the cleanup of abandoned hazardous waste disposal sites.

CFR: Code of Federal Regulations. A collection of the regulations that have been promulgated under United States law.

Chemical: Any element, chemical compound or mixture of elements and/or compounds where chemical(s) are or distributed.

Chemical Cartridge Respirator: A respirator that uses various chemical substances to purify inhaled air of certain gases and vapors. This type respirator is effective for concentrations no more than ten times the TLV of the contaminant, if the contaminant has warning properties (odor or irritation) below the TLV.

Chemical Name: The name given to a chemical in the nomenclature system developed by the International Union of Pure and Applied Chemistry (IUPAC) or the Chemical Abstracts Service (CAS).

Chemical Family: A group of single elements or compounds with a common general name. Example: acetone, methyl ethyl ketone (MEK), and methyl isobutyl ketone (MIBK) are of the "aldehyde" family.

Chronic Effect: An adverse effect on a human or animal body, with symptoms which develop slowly over a long period of time or which recur frequently. Also see "acute."

Chronic Exposure: Long-term contact with a substance.

Chronic Toxicity: Adverse (chronic) effects resulting from repeated doses of or exposures to a substance over a relatively prolonged period of time. Ordinarily used to denote effects in experimental animals.

Compressed Gas: (a) a gas or mixture of gases having, in a container, an absolute pressure exceeding 40 pounds per square inch (psi) at 70F (21.1C) or (b) a gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130F (54.4C) regardless of the pressure at 70F or (c) a liquid having a vapor pressure exceeding 40psi at 100F (37.8C) as determined by ASTM D-323-72.

Concentration: The relative amount of a substance when combined or mixed with other substances. Examples: 2 ppm hydrogen sulfide in air, or a 50 percent caustic solution.

Confined Space: Any area that has limited openings for entry and exit that would make escape difficult in an emergency, has a lack of ventilation, contains known potential hazards, and is not intended nor designed for continuous human occupancy.

Container: Any bag, barrel, bottle, box, can, cylinder, drum, reaction vessel, storage tank, or the like that contains a hazardous chemical. For purposes of material safety data sheets or the Hazard Communication Standard, pipes or piping systems are not considered to be containers.

Corrosive: A chemical that causes visible destruction of, or irreversible alterations in, living tissue by chemical action at the site of contact. For example, a chemical is considered to be corrosive if, when tested on the intact skin of albino rabbits by the method described by the U.S. Department of Transportation in Appendix A to 49 CFR Part 173, it destroys or changes irreversibly the structure of the tissue at the site of contact following an exposure period of 4 hours. This term shall not refer to action on inanimate surfaces.

Decomposition: Breakdown of a material or substance (by heat, chemical reaction, electrolysis, decay, or other processes) into parts or elements or simpler compounds

Density: The mass (weight) per unit volume of a substance.

Dermal Toxicity: Adverse effects resulting from skin exposure to a substance. Ordinarily used to denote effects in experimental animals.

Dike: A barrier constructed to control or confine hazardous substances and prevent them from entering sewers, ditches, streams, or other flowing waters.

DOL: Department of Labor. OSHA and MSHA are part of DOL.

DOT: Department of Transportation regulates transportation of chemicals and other substances.

Edema: An abnormal accumulation of clear watery fluid in the tissues.

Environmental Toxicity: Information obtained as a result of conducting environmental testing designed to study the effects on aquatic and plant life.

EPA: U.S. Environmental Protection Agency.

Evaporation Rate: The rate at which a material will vaporize (evaporate) when compared to the known rate of vaporization of a standard material. The evaporation rate can be useful in evaluating the health and fire hazards of a material.

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

Exposure or Exposed: State of being open and vulnerable to a hazardous chemical in the course of employment by inhalation, ingestion, skin contact, absorption, or any other course; includes potential (accidental or possible) exposure.

Flammable: A chemical that includes one of the following categories:

a. "Aerosol, flammable". An aerosol that, when tested by the method described in 16 CFR 1500.45, yields a flame projection exceeding 18 inches at full valve opening, or a flashback (a flame extending back to the valve) at any degree of valve opening.
b. "Gas, flammable". (1) 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 (2) 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.

c. "Liquid, flammable". 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 mixture.
d. "Solid, flammable." 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 is a 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.

Flashpoint: The minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite.

Foreseeable Emergency: Any potential occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment which could result in an uncontrolled release of a hazardous chemical into the workplace.

Grounding: The procedure used to carry an electrical charge to ground through a conductive path. A typical ground may be connected directly to a conductive water pipe or to a grounding bus and ground rod.

Hazard Warning: Words, pictures, symbols, or combination thereof presented on a label or other appropriate form to inform of the presence of various materials.

Hazardous Chemical: Any chemical whose presence or use is a physical hazard or a health hazard.

HSC: Hazard Communication Standard is an OSHA regulation issued under 29 CFR Part 1910.1200.

Health Hazard: A chemical for which there is 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 system, and agents which damage the lungs, skin, eyes, or mucous membranes.

Hepatotoxin: A substance that causes injury to the liver.

Highly Toxic: A chemical falling within any of the following categories:

a. A chemical with a median lethal dose (LD50) of 50 milligrams or less per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.
b. A chemical with a median lethal dose (LD50) of 200 milligrams or less per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between 2 and 3 kilograms each.
c. A chemical that has a median lethal concentration (LC50) in air of 200 parts per million by volume or less of gas or vapor, or 2 milligrams per liter or less of mist, fume, or dust, when administered by continuous inhalation for 1 hour (or less if death occurs within 1 hour) to albino rats weighing 200 and 300 grams each.

Incompatible: Materials that could cause dangerous reactions by direct contact with one another.

Irritant: A chemical, which is not corrosive, but which causes a reversible inflammatory effect on living tissue by chemical action at the site of contact.

Irritating: An irritating material, as defined by DOT, is a liquid or solid substance which, upon contact with fire or when exposed to air, gives off dangerous or intensely irritating fumes (not including poisonous materials).

Laboratory: 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.

LC: Lethal concentration is the concentration of a substance being tested that will kill.

LC50: The concentration of a material in air that will kill 50 percent of a group of test animals with a single exposure (usually 1 to 4 hours).

LD: Lethal dose is the quantity of a substance being tested that will kill.

LD50: A single dose of a material expected to kill 50 percent of a group of test animals.

LEL or LFL: Lower explosive limit, or lower flammable limit, of a vapor or gas; the lowest concentration (lowest percentage of the substance in air) that will produce a flash of fire when an ignition source (heat, arc or flame) is present. At concentrations lower than the LEL, the mixture is too "lean" to burn.

Local exhaust: A system for capturing and exhausting contaminants from the air at the point where the contaminants are produced (welding, grinding, sanding, other processes or operations).

Mechanical exhaust: A powered device, such as a motor-driven fan for exhausting contaminants from a workplace, vessel, or enclosure.

Mechanical Filter Respirator: A respirator used to protect against airborne particulate matter like dusts, mists, metal fume, and smoke. Mechanical filter respirators do not provide protection against gases, vapors, or oxygen deficient atmospheres.

Melting Point: The temperature at which a solid substance changes to a liquid state.

Mutagen: A substance or agent capable of altering the genetic material in a living cell.

Narcosis: A state of stupor, unconsciousness, or arrested activity produced by the influence of narcotics or other chemicals.

NFPA: National Fire Protection Association is an international membership organization which promotes/improves fire protection and prevention and establishes safeguards against loss of life and property by fire.

Nephrotoxin: A substance that causes injury to the kidneys.

Neurotoxin: A material that affects the nerve cells and may produce emotional or behavioral abnormalities.

Neutralize: To eliminate potential hazards by inactivating strong acids, caustics, and oxidizers. For example, acids can be neutralized by adding an appropriate amount of caustic substance to the spill.

Non-Sparking Tools: Tools made from beryllium-copper or aluminum-bronze greatly reduce the possibility of igniting dusts, gases, or flammable vapors. Although these tools may emit some sparks when striking metal, the sparks have a low heat content and are not likely to ignite most flammable liquids.

NRC: National Response Center is a notification center that must be called when a significant oil or chemical spill or other environmental-related accident occurs.

OSHA: Occupational Safety and Health Administration, U.S. Department of Labor.

Odor Threshold: The lowest concentration of a substance's vapor that can be smelled by most people.

Oral Toxicity: Adverse effects resulting from taking a substance into the body by mouth.

Organic Peroxide: An organic compound that contains the bivalent -O-O structure and may be considered a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms has been replaced by an organic radical.

Oxidizer: A chemical other than a blasting agent or explosive that initiates or promotes combustion in other materials, causing fire either by itself or through the release of oxygen or other gases.

Oxidizing Agent: A chemical or substance that brings about an oxidation reaction. The agent may (1) provide the oxygen to the substance being oxidized (in which case the agent has to be oxygen or contain oxygen), or (2) it may receive electrons being transferred from the substance undergoing oxidation (chlorine is a good oxidizing agent for electron-transfer purposes, even though it contains no oxygen).

PEL: Permissible exposure limit is an exposure limit established by OSHA'S regulatory authority. It may be a time weighted average (TWA) limit or a maximum concentration exposure limit.

pH: The symbol relating the hydrogen ion (H+) concentration to that of a given standard solution. A pH of 7 is neutral. Numbers increasing from 7 to 14 indicate greater alkalinity. Numbers decreasing from 7 to 0 indicate greater acidity.

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

ppm: Parts per million is the concentration of a gas or vapor in air; parts (by volume) of the gas or vapor in a million parts of air; also the concentration of a particulate in a liquid or solid.

ppb: Parts per billion is the concentration of a gas or vapor in air; parts (by volume) of the gas or vapor in a billion parts of air. Usually used to express extremely low concentrations of unusually toxic gases or vapors; also the concentration of a particular substance in a liquid or solid.

Pyrophoric: A chemical that will ignite spontaneously in air at a temperature or 130F (54.4C) or below.

RCRA: Resource Conservation and Recovery Act is environmental legislation aimed at controlling the generation, treating, storage, transportation and disposal of hazardous wastes. It is administered by EPA.

Reactivity: Chemical reaction with the release of energy. Undesirable effects--such as pressure buildup, temperature increase, formation of noxious, toxic or corrosive by-products may occur because of the reactivity of a substance to heating burning, direct contact with other materials, or other conditions in use or in storage.

REL: Recommended Exposure Limit (NIOSH). The highest allowable airborne concentration which is not expected to injure the workers. It may be expressed as a ceiling limit or as a time-weighted average (TWA).

Reproductive toxin: Substances that affect either male or female reproductive systems and may impair the ability to have children.

Routes of Entry: The means by which material may gain access to the body. These are: inhalation, ingestion, contact with the skin or eyes, and injection.

Self-Contained Breathing Apparatus: A respiratory protection device that consists of a supply or a means of respirable air, oxygen, or oxygen-generating material, carried by the wearer.

Sensitizer: A chemical that causes a substantial proportion of exposed people or animals to develop an allergic reaction in normal tissue after repeated exposure to the chemical.

SDS: Safety Data Sheet

Solvent: A substance, usually a liquid, in which other substances are dissolved. The most common solvent is water.

Specific gravity: The weight of a material compared to the weight of an equal volume of water is an expression of the density (or heaviness) of a material. The specific gravity of water is 1.0. Insoluble materials with specific gravity of less than 1.0 will float in (or on) water. In soluble materials with specific gravity greater than 1.0 will sink in water.

Splash-proof goggles: Eye protection made of a noncorrosive material that fits snugly against the face, and has indirect ventilation ports.

Systemic Poison: A poison that spreads throughout the body, affecting all body systems and organs. Its adverse effect is not localized in one spot or area.

Target Organ Toxicity: Chemicals that can cause adverse effects or disease states manifested in specific organs of the body

Teratogen: A substance or agent, exposure to which by a pregnant female can result in malformations in the fetus.

TLV: Threshold Limit Value is a term used by ACGIH to express the airborne concentration of material to which nearly all persons can be exposed day after day without adverse effects.

Torr: A unit of pressure, equal to 1/760 atmosphere.

Toxic: A chemical falling within any of the following categories:

a. A chemical with a median lethal dose (LD50) of more than 50 milligrams per kilogram but not more than 500 milligrams per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.
b. A chemical that has a median lethal dose (LD50) of more than 200 milligrams per kilogram but not more than 1,000 milligrams per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between two and three kilograms each.
c. A chemical that has a median lethal concentration (LC50) in air of more than 200 parts per million but not more than 2,000 parts per million by volume of gas or vapor, or more than two milligrams per liter but not more than 20 milligrams per liter of mist, fume, or dust, when administered by continuous inhalation for one hour (or less if death occurs within 1 hour) to albino rats weighing between 200 and 300 grams each.

Toxicity: The sum of adverse effects resulting from exposure to a material, generally by the mouth, skin, or respiratory tract.

TSCA: Toxic Substances Control Act (Federal Environmental Legislation administered by EPA) regulates the manufacture, handling, and use of materials classified as "toxic substances."

TWA: Time-weighted average - airborne concentration of a material to which a person is exposed, averaged over the total exposure time, generally the total workday (8 to 12 hours).

UEL or UFL: Upper explosive limit or upper flammable limit of a vapor or gel; the highest concentration (highest percentage of the substance in air) that will produce a flash of fire when an ignition source is present. At higher concentrations, the mixture is too “rich” to burn.

Vapor Density: The weight of a vapor or gas compared to the weight of an equal volume of air, air density =1.0. Materials lighter than air have vapor densities less than 1.0 (e.g., acetylene, methane, hydrogen). Materials heavier than air (e.g., propane, hydrogen sulfide, ethane, butane, chlorine, sulfur dioxide) have vapor densities greater than 1.0. All vapors and gases will mix with air, but the lighter materials will tend to rise and dissipate (unless confined). Heavier vapors and gases are likely to concentrate in low places—along or under floors, in trenches and ditches—where they may create fire or health hazards.

Vapor Pressure: The pressure exerted by a saturated vapor above its own liquid in a closed container.

Volatility: A measure of how quickly a substance forms a vapor at ordinary temperature

Water-Reactive: A chemical that reacts with water to release a gas that is either flammable or presents a health hazard.

APPENDIX A

Definitions and Procedures for Use of Particularly Hazardous Substances (PHS)

A. General

1. This section of our plan describes the specific and general control measures which are designed to reduce the exposure of instructors, aides, students, and other employees to especially hazardous substances. Employees shall read and understand these practices before commencing a procedure using particularly hazardous substances.

2. PHSs include highly toxic chemicals, reproductive toxins, and select carcinogens. In addition, the Science Department includes highly flammable chemicals, highly reactive chemicals, and highly corrosive chemicals.

3. The use of these substances requires prior approval of the Chemical Hygiene Officer.

4. PHSs shall be used in designated areas and in fume hoods.

5. The use of PHSs shall require removal of contaminated waste and the decontamination of contaminated areas.

B. Highly Toxic Chemicals

1. When a PEL or TLV value is less than 50 ppm or 100 mg/m3, the user shall use it in an operating fume hood, glove box, vacuum line, or other device equipped with appropriate traps. If none is available, no work shall be performed using the chemical.

2. If a PEL, TLV, or comparable value is not available, the animal or human median inhalation lethal concentration information, LC 50, shall be used as a guideline. If that value is less than 200 ppm or 2000 mg/m3 when administered continuously for one hour or less, then the chemical shall be used in an operating fume hood, glove box, vacuum line, or other device equipped with appropriate traps. If none are available, no work shall be performed using that chemical.

3. Examples of highly toxic chemicals (acute or chronic) that were commonly used in the past are benzene, chloroform, formaldehyde, bromine, carbon disulfide, carbon tetrachloride, cyanide salts, and hydrofluoric acid.

C. Highly Flammable Chemicals

1. The Science Department will define Class 1A liquids as highly flammable chemicals. Class 1A liquids have a flashpoint of less than 73° C and a boiling point of less than 100° C.

2. Highly flammable chemicals shall be used only in approved fume hoods, and shall be kept away from sources of possible ignition (such as sparks, flames, hot surfaces, etc.)

3. Examples of highly flammable chemicals are diethyl ether, acetone, pentane, petroleum ether, acetaldehyde, and ligroines.

D. Highly Reactive Chemicals

1. Reactivity information may be given in a manufacturers' MSDSs and on labels. The most complete and reliable reference on chemical reactivity is the current edition of Bretherick's Handbook of Reactive Chemical Hazards.

2. A reactive chemical is one that:

    a. Is described as such on the label, in the SDS, or by Bretherick.

    b. Is ranked by the NFPA as 3 or 4 for reactivity.

    c. Is identified by the Department of Transportation (DOT) as an oxidizer, an organic peroxide, or an explosive (Class A, B, or C).

    d. Fits the Environmental Protection Agency definition of reactive in 40 CFR 261.23.

    e. Is known or found to be reactive with other substances.

3. Reactive chemicals shall be handled with all proper safety precautions, including segregation in storage, and prohibition of mixing even small quantities with other chemicals without prior approval and appropriate personal protection and precautions.

4. Examples of commonly encountered highly reactive chemicals are ammonium dichromate, nitric acid, perchloric acid, hydrogen peroxide, and potassium chlorate, azides, organic nitrates, and acetylides.

E. Highly Corrosive Chemicals and Contact Hazard Chemicals

1. Corrosivity, allergen, and sensitizer information is provided in manufacturers' SDSs and on labels.

2. A corrosive chemical is one that:

    a. Fits the SC OSHA definition of corrosive.

    b. Fits the EPA definition of corrosive in 40 CFR 262.22 (has a pH greater than 12 or less than 2.5).

    c. Is known to be reactive to living tissue, causing visible destruction, or irreversible alterations of the tissue at the site of contact.

3. A contact-hazard chemical is an allergen or sensitizer that:

a. Is so identified or described in the SDS or on the label.

b. Is so identified or described in medical or industrial hygiene literature.

c. Is known to be an allergen or sensitizer.

4. Corrosive and contact-hazard chemicals will be handled with all proper safety precautions, including wearing safety goggles, using gloves tested for the absence of pinholes and known to be resistant to permeation or penetration by the chemical, and wearing a laboratory apron or laboratory coat.

5. Examples of highly corrosive chemicals are hydrochloric, sulfuric, nitric, phosphoric, and perchloric acids (all acids in greater than 1 Molar concentration), and potassium hydroxide (either solid or in aqueous solution greater than 1 Molar concentration).

F. Reproductive Toxins

1. A reproductive toxin refers to chemicals which affect reproductive capabilities including chromosomal damage (mutations) and which effect fetuses (teratogenesis).

2. A reproductive toxin is a compound that:

   a. Is described as such in the applicable SDS or label.

   b. Is identified as such by the Oak Ridge Toxicology Information Resource Center (TIRC), (615 576-1746).

3. No reproductive toxins shall be allowed in the College laboratories without written authorization from the Chemical Hygiene Officer.

4. If such chemicals are used:

   a. They shall be handled only in a hood and when satisfactory performance of the hood has been confirmed.

   b. Skin contact shall be avoided by using gloves and wearing protective apparel.

   c. Persons using such substances shall always wash hands and arms immediately after working with these materials.

   d. Unbreakable containers of these substances shall be labeled properly and stored in a well ventilated area.

5. Examples of reproductive toxins are organomercurial compounds and ethidium bromide, carbon disulfide, xylene, toluene, benzene, mercury, lead compounds, ethyl ethers, vinyl chloride.

G. Select Carcinogens

1. Select carcinogen means any substance which meets one of the following criteria:

    a. It is regulated by SC OSHA as a carcinogen.

    b. It is listed under the category, “known to be carcinogens,” in the National Toxicology Program (NTP) Annual Reports on Carcinogens.

    c. It is listed under Group 1 “carcinogenic to humans” by the International Agency for Research on Cancer Monograms (IARC).

    d. It is listed in either Group 2 A or 2 B by IARC or under the category “reasonably anticipated to be carcinogens” and causes statistically significant tumor incident in experimental animals under set criteria of exposure.

2. All work with these substances shall be conducted in a designated area, such as a fume hood, glove box, or a portion of a laboratory designated for use of chronically toxic substances. Such a designated area shall be clearly marked with warning and restricted access signs.

3. Any procedure that may result in a generation of aerosols or vapors shall be performed in a hood whose performance is known to be satisfactory.

4. Skin contact shall be avoided by using gloves and other protective apparel as appropriate. Any protective clothing shall be removed before leaving the designated area and placed in a labeled container. Hands, arms, and neck shall be washed after working with these materials.

5. Select carcinogens shall be stored in unbreakable containers in a ventilated area with controlled access. All containers shall be labeled with the identity and hazard of the substance. Immediately upon completion of the project, all unused carcinogens shall be disposed of following standard hazardous waste disposal procedures.

6. No select carcinogens are allowed without written authorization from the Chemical Hygiene Officer.

7. Examples of select carcinogens are benzene, nickel metal dust, vinyl chloride, and formaldehyde.

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