Procedure 4.1504

CHEMICAL HYGIENE PLAN PROCEDURE

Purpose

This Chemical Hygiene Plan satisfies the requirements of the U.S. Department of Labor, and the NC Department of Occupational Safety and Health Administration, 29 CFR Part 1910.1450, Occupational Exposures to Hazardous Chemicals. The objective of this Standard is to protect employees from health hazards associated with hazardous chemicals in the laboratory.

The Beaufort County Community College (BCCC) Chemical Hygiene Plan (CHP) answers the questions that lab chemical users need to know to work safely. Lab chemical use must be planned to be safe.

Scope and Application

There is a preferred way to perform all work with chemicals which can both reduce the probability of an accident or exposure to a negligible level and reduce its consequences to minimal levels should one occur. The chemical's hazards will dictate the precautions to be taken. Few chemicals are without hazards of various kinds and degrees.

1. Staff and students should follow the Chemical Hygiene and Emergency Evacuation Plan to minimize their health and safety risks.
2. The design of the laboratory facility should provide sufficient space for all participants to work safely.
3. Laboratory facilities should only be used by qualified and trained personnel or students.
4. Before undertaking an unfamiliar activity employees and students shall consult each chemical's Safety Data Sheets, (SDS) and use proper precautions to minimize chemical exposure.
5. The decision to use a particular substance should be based on the best practice knowledge of each chemical's particular hazard and the availability of proper handling facilities and equipment.

Responsibilities

Responsibility for chemical hygiene exists at all levels, from the highest administrative level to the individual employee and student. The specific components of this responsibility are assigned to those units and/or individuals best positioned and suited to carry out that responsibility.

1. President

a. The President, as executive officer, has the ultimate responsibility for chemical hygiene at BCCC. The President shall, with prudent advice from other administrators, provide continuing support for BCCC chemical hygiene plans, including development and enforcement of the chemical hygiene plan.
b. The BCCC President is responsible for enforcement of all federal, state, and local health, safety, and environmental regulations and policies including the chemical hygiene plan.

2. Chemical Hygiene Officer

The Chemical Hygiene Officer should be qualified by training and experience to provide technical guidance, development, and implementation of the Chemical Hygiene Plan. The Chemical Hygiene Officer's responsibilities include:

a. Develop and implement the chemical hygiene plan and the safety plan for BCCC including training, reporting and other functions as needed.
b. Ensure that the chemical hygiene plan is reviewed annually and revised as needed so that it is always in compliance with current legal and regulatory requirements.
c. Work with administrators and instructors to develop and implement the safety plan and chemical hygiene plan.
d. Assure that inspections of buildings and grounds are performed and records of inspections are maintained.
e. Monitor the procurement, use, storage, and disposal of chemicals used at BCCC.
f. Provide technical assistance to employees on the chemical hygiene plan requirements.

g. Makes decisions regarding requests to use chemicals identified as explosive, carcinogenic, mutagenic, highly toxic, or otherwise unsuitable for general instructional laboratories.
h. Determine the need for personal protective equipment.
i. Implement appropriate training with regard to chemical hygiene for all employees whose normal work locations include laboratory areas.
j. Ensure that employees have access to the chemical hygiene plan SDSs, and other suitable reference materials.
k. Assists department deans in conducting lab risk assessments before new lab work commences

3. Division Deans

All laboratory supervisors, having direct supervisory authority, are responsible for maintaining a laboratory environment that protects the health and safety of employees under their supervision and ensures ongoing regulatory compliance.

Department Deans are responsible for monitoring compliance with BCCC Chemical Hygiene Plan within their department and enforcement of all federal state and local health, safety and environmental regulations and policies.

4. BCCC Employees

BCCC employees who normally work in an area that contains chemicals are responsible for:

a. Participating in training programs specific to job tasks.
b. Maintaining an awareness of health and safety hazards.
c. Planning and conducting each operation in accordance with BCCC Chemical Hygiene Plan.
d. Consulting reference materials, including SDSs, related to chemical safety.
e. Reporting accidents, injuries, unsafe practices and conditions to the lab supervisor, lead instructor, or division dean.
f. Read, understand, and follow all safety rules and regulations that apply to the work area.
g. Plan and conduct each operation in accordance with this Chemical Hygiene Plan.
h. Promote good housekeeping practices in the laboratory and other lab related work areas.
i. Use appropriate personal protective equipment (PPE) for each procedure or experiment that involves hazardous chemicals.

Standard Operating Procedures

The following general prudent practice guidelines have been shown through experience to be useful for avoiding accidents or reducing injuries associated with the laboratory use of hazardous chemicals:

5. Recommendations for Safety

a. Supervisors shall be informed of accidents, conditions or work practices they believe to be a hazard to themselves, others or the environment.
b. Before acquiring a chemical or conducting a procedure, chemical users must know the hazards from the SDS and plan and/or acquire or develop appropriate hazard control and emergency equipment.
c. Users need to know the hazards, safe handling procedures, hazard control measures, proper storage, waste disposal procedures and emergency procedures in advance to work safely.
d. Every employee involved with the use of hazardous chemicals must be properly trained in chemical hygiene.
e. There are general prudent safe work practices that apply to chemical use. Additional precautions are provided for those chemicals with significant potential to harm in the short or long-term (i.e., highly toxic, cancer, reproductive, explosive, flammable hazards).
f. Every chemical should be labeled, accounted for and have a definite, proper storage place. This minimizes safety and health hazards to personnel, equipment, buildings and the environment.
g. Chemical users are responsible for ensuring that all hazardous chemical wastes are disposed of accordingly. Failure to do so could have serious consequences.
h. Chemical users must be prepared to react appropriately with suitable emergency equipment to minimize injury to personnel and damage to equipment, buildings and the environment.
i. Eating, drinking, gum chewing, application of cosmetics, manipulation of contact lenses and other such activities are restricted.
j. Horseplay is prohibited.
k. Non employees shall not work alone in the lab or chemical storage area.
l. “Wafting” (waving the hand over the opening of the container) to test chemical odors should only be done with extreme caution and only when specifically directed to do so in the written experimental procedure.
m. Chemicals shall never be tasted.
n. Always use a bulb or other device for suction. Never pipette by mouth.
o. Do not force glass tubing into rubber stoppers. Lubricate the glass and hold the tubing with a cloth towel as the tubing is inserted into the stopper.
p. Avoid loose or baggy clothing and dangling jewelry. Confine or tie back long hair. Sandals or any open toed shoes are not permitted in the laboratory or areas where chemical exposure is possible.

6. Housekeeping

a. In the event of glass breakage, gloves should be worn and a dust pan and broom used to clean up the broken pieces. Broken glass

should be separated from other waste by placing it in a special container marked “Broken Glass”. If the glass was contaminated with chemicals, it must be treated and disposed of as hazardous waste.

b. All chemical storage and chemical work areas must be kept clean.
c. Place all wastes in appropriate, properly labeled, segregated receptacles.
d. Sinks are to be used only for disposal of water and certain solutions designated by the employees. Other solutions must be placed in the appropriate labeled waste container.
e. Chemicals shall be stored appropriately, and not in aisles or stairwells.
f. The work environment should be left clean and orderly.

7. Chemical Procurement

a. Hazardous chemicals shall be ordered in the smallest practical quantity for the application and within applicable storage quantity limitations. “Less is better” should be the guide for purchasing chemicals. The lower the chemical inventory, the fewer the problems associated with storage, and excessive costs to dispose of outdated or surplus chemicals. Chemicals should be ordered in quantities that are likely to be consumed in one year or less and should be purchased in the quantities for sufficient use.
b. Chemical manufacturers and suppliers are required to supply a copy of a safety data sheet the first time the chemical is purchased.
c. The chemical inventory list and SDS book should be updated each time a chemical is received.
d. All chemicals should be stored in sturdy, appropriate containers sealed tightly
e. Labels on incoming containers of hazardous chemicals are not to be removed or defaced. Incoming chemicals must be in compliance with GHS by 12/1/2015.
f. All chemicals should be accompanied by an SDS and adequate identifying labels with proper handling, storage, and disposal instructions.
g. The container should be marked with the full level and date(s) it is received and opened by the user of the chemical.
h. Donated chemicals should be accepted only after approval is obtained from the Chemical Hygiene Officer. It should be established that the donated chemical is in excellent condition, that an appropriate SDS is available, and that there is a specific use for the donated material.

8. Prior Approval

a. Whenever a new laboratory experiment or test is to be conducted, prior approval should be obtained from the Department Dean, Director of Campus Operations, and the Chemical Hygiene Officer, or

their designees. Approval shall be acquired using the Chemical Approval Form found in Section O of this Plan. This approval shall also be sought for experiments that have not been performed recently or for which the potential for harm is present.

b. A list of acceptable chemicals shall be developed for use in the classroom. An employee who desires to use a substance that is not on the acceptable list must seek the permission of the chemical hygiene officer. The decision to use the chemical will be based on the best practices knowledge of the user and the availability of proper handling facilities and equipment.
c. The potential for harm may be affected by a change in the amounts of materials being used, the conditions under which the experiment is to be conducted, or the substitution, deletion or addition of a chemical.

9. Storage and Distribution

The storage of hazardous chemicals shall be accomplished in a manner that minimizes safety and hazards to personnel, equipment, buildings, and the environment.

a. If a chemical has been transferred to a secondary container, the new container should be appropriately labeled to include chemical name, dilution if appropriate, initials of person making transfer, date of transfer, and transfer of major hazards.
b. The classification system used for the storage of chemicals should be displayed in the principal storage area. Chemicals should be stored based on the reactive nature, and compatibility group.
c. Large containers and containers with reactive chemicals, such as acids and bases, should be stored separately on lower shelves.
d. Packaging material such as paper and boxes should not be stored near flammable chemical storage cabinets.
e. All storage areas should be securely locked when not in use. Storage and preparation areas should be accessible only to those persons authorized to use the chemicals.
f. Glass bottles containing highly flammable liquids shall not exceed 500 ml. For larger volumes, metal or approved plastic may not exceed one (1) gallon, and safety cans shall not exceed two (2) gallons (NFPA 45).
g. Chemicals should not be distributed to other persons or to other areas of the college without the prior approval of the Chemical Hygiene Officer.
h. Chemicals should not be transferred to another location without a copy of the appropriate Safety Data Sheet nor without assurance that the person receiving the chemicals has had appropriate training in their use, storage and disposal.
i. Transporting Chemicals:

1. Secondary containment devices shall be used when transporting chemicals.
2. When transporting chemicals outside the laboratory or between stock rooms and labs, the transport container shall be break resistant or in secondary containment.
3. When transferring chemicals, use adequate ventilation such as a fume hood

j. Transferring Chemicals:
   1. Use adequate ventilation such as a fume hood, when transferring even a small amount of a hazardous chemical
   2. While drum storage is not appropriate for labs, chemical stockrooms may purchase drum quantities of chemicals used in high volumes. Ground and bond the drum and receiving vessel when transferring flammable liquids from a drum to prevent static charge buildup.
   3. If chemicals from commercial sources are repackaged into transfer containers, the new containers shall be labeled with all essential information that is on the original container.

k. Refrigerators used to store flammable chemicals shall be labeled and shall be of explosion proof or of lab safe design (NFPA 45). Household refrigerators are not to be used to store flammable chemicals.

10. Flammable Liquids Storage

Flammable liquid means a liquid having a flash point of not more than 93°C (199.4°F).

Flash point means the minimum temperature at which a liquid gives off vapor in sufficient concentration to form an ignitable mixture with air near the surface of the liquid, as determined by a method identified in Section B.6.3.

A flammable liquid shall be classified in one of four categories in accordance with OSHA Table B.6.1

TABLE B.6.1—CRITERIA FOR FLAMMABLE LIQUIDS

Category	Criteria
1	Flash point < 23°C (73.4°F) and initial boiling point ≤ 35°C (95°F)
2	Flash point < 23°C (73.4°F) and initial boiling point > 35°C (95°F)
3	Flash point ≥ 23°C (73.4°F) and ≤ 60°C (140°F)
4	Flash point > 60°C (140°F) and ≤ 93°C (199.4°F)

a. Not more than 25 gallons of flammable liquids may be stored in a room outside of an approved storage cabinet.
b. Not more than 60 gallons of category 1 and 2 flammable liquids may be stored in any one storage cabinet and not more than 120 gallons

of category 3 and 4 flammable liquids may be stored in any one storage cabinet.

c. Not more than three storage cabinets may be present in a single storage area. Quantities in excess of the above shall be stored in an inside storage room constructed to meet the specifications for the particular stored material (e.g., paint) as set forth in Standard Methods of Fire Test of Building Construction and Materials, NFPA 251- 1969.
d. When transferring significant quantities of flammable liquids from one container to another, it is particularly important that the containers be properly grounded to prevent accidental ignition of flammable vapors and liquids from static electricity or other sources of ignition.

11. Compressed Gas Use/Storage

When hazardous compressed gases are purchased, they shall either be bought in returnable cylinders or the vendor should agree to take back used non-returnable cylinders

a. Compressed Gas Storage
The storage of compressed gas cylinders requires some basic precautions and guidelines:
b. Cylinders are required to be secured in an upright position on a firm foundation (or otherwise firmly secured) in a safe, dry, well-ventilated place prepared and reserved for the purpose.
c. Cylinders should not being kept in unventilated enclosures such as lockers.
d. Cylinders should not being stored in the same area as flammable substances such as oil and volatile liquids, or near sources of heat such as radiators or furnaces.
e. Cylinders should not being stored near elevators, gangways, stairwells or other places where they can easily be knocked down or damaged.
f. Cylinder use should be planned so that cylinders are used in the order that they are received from the supplier
g. Empty and full cylinders are required to be stored separately, with empty cylinders being plainly identified as such to avoid confusion.
h. LPG tanks shall not be stored inside a building.
i. Storage locations shall have a BC type fire extinguisher of at least 20 pound capacity.
j. Oxygen cylinders should not be stored within 20 feet (6 meters) of highly combustible materials, oil, grease, wood shavings or cylinders containing flammable gases.
k. Oxygen and acetylene are typically paired on a common transfer cart for use. If closer than 20 feet, cylinders should be separated by a wall at least five feet high, with a fire-resistance rating of at least 30 minutes.

l. Hydrogen cylinders storage locations shall be permanently placarded as follows: “HYDROGEN-FLAMMABLE GAS-NO SMOKING-NO OPEN FLAMES” or equivalent.
m. Acetylene and liquefied fuel gas cylinders should be stored with the valve end up. If storage is within 100 feet (30.5 meters) of each other and not protected by automatic sprinklers, the total capacity of acetylene cylinders stored and used inside the building should be limited to 2,500 cubic ft.

12. Storage of Acids and Bases

There are several factors that should be taken into consideration when storing acids and bases.

First and most important, is to make sure that acids and bases are not stored together. If there were to be a spill, chemical reactions could occur if they are stored in the same storage area.

Second, make sure you check the SDS of the acid or base to determine you are not storing incompatible chemicals together. Also, be aware that all containers MUST be properly labeled, so that identification can be achieved as easy as possible. You should be paying close attention to expiration dates, making sure that the acid or base is disposed of on or before the expiration date.

The following is a list of some of the most common acids and bases and their specific incompatibilities. As a rule you should not be storing these acids or bases with each other.

Examples of Incompatible Acids and Bases Acid or Base Is Incompatible with, and Should Not Be Mixed or Stored With
Acetic Acid -- Chromic acid, nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, permanganates
Ammonia (anhydrous) -- Mercury, chlorine, calcium hypochlorite, iodine, bromine, hydrofluoric acid (anhydrous)
Ammonium nitrate -- Acids, powdered metals, flammable liquids, chlorates, nitrates, sulfur, finely divided organic or combustible materials
Bleach -- Acids, ammonia, drain cleaners Chromic acid Acetic acid, naphthalene, camphor, glycerol, alcohol, flammable liquids in general
Hydrocyanic acid -- Nitric acid, alkali
Hydrofluoric acid (anhydrous) -- Ammonia (aqueous or anhydrous)

Nitric acid (concentrated) -- Acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases, copper, brass, any heavy metals
Potassium chlorate -- Sulfuric and other acids
Potassium hydroxide -- Acids, organic materials, metals and moisture
Sodium Carbonate -- Acids, strong bases, strong oxidizers, fluorine, aluminum, zinc, phosphorous pentoxide
Sodium Hydroxide -- Acids, aluminum, organ halogen compounds, nitro- and chloro-organic compounds, flammable liquids, nitro methane, whey solids and nitrous compounds
Sulfides -- Acids
Sulfuric acid -- Potassium chlorate, potassium perchlorate, potassium permanganate (similar compounds of light metals, such as sodium, lithium)

13. Evaluation of Ventilation and Fume Hoods

Ventilation evaluation shall measure the quality and quantity of ventilation in laboratories. Airflow shall be consistent, with no areas of a lab exhibiting static or high velocity airflow.

Adequate ventilation systems change the room air at least four (4) times per hour. Higher air exchange rates may be needed depending upon chemicals being used. Airflow paths can be monitored using smoke tubes, however, these do not determine velocities. Pitot tubes are used for measuring duct velocities, and anemometers or velometers are used to measure airflow rates within rooms and at the faces of fume hoods.

Any experiment that uses a chemical with a PEL of 50 parts per million (ppm) or less, requires the use of a fume hood or an experiment seal. Fume hoods shall be inspected and labeled biannually, or when any changes have occurred that may alter fume hood operation. Any fume hood or monitoring device found to be not in a proper operating condition will be labeled: **FAIL-OUT OF SERVICE or DANGER-DO NOT OPERATE.**

Waste Disposal

Laboratory Supervisors are responsible for ensuring that all used and/or unneeded hazardous chemicals, or articles irreversibly contaminated with these hazardous chemicals are disposed of according to the rules established by BCCC. Generators of hazardous waste which is not acceptable for disposal are financially responsible for the proper and legal disposal of such materials.

BCCC Department Deans and the Chemical Hygiene Officer shall ensure that the disposal of any chemicals is in compliance with the North Carolina Department of Environment and Natural Resources.

BCCC is considered an Exempted Small Quantity Generator (SQG) and must not generate more than 100 kg of hazardous waste or 1 kg of acutely hazardous waste in each calendar month.

14. Guidelines for Waste Minimization
    The cost of disposing of excess and waste chemicals has become extremely expensive, and frequently exceeds the original cost of purchasing the chemical. Every reasonable effort shall be made to reduce the generation of hazardous waste.
    a. Substitutions, either of chemicals or experiments, should only be made to reduce hazards without sacrificing instructional objectives.
    b. When the risk outweighs the benefit and no substitute is available, then the experiment, procedure, or chemical should be eliminated.
    c. Employees shall minimize generation of hazardous wastes (micro-scale labs, selecting less hazardous materials, etc.).
    d. Chemicals should be ordered in quantities that are likely to be consumed in one year or less.
    e. Avoid the inadvertent accumulation of hazardous waste. Potential waste materials are surplus, old, and/or unnecessary chemicals.
    f. Prior to ordering new chemicals, using existing chemicals, or creating products from reactions, employees shall determine if the material should be treated as hazardous waste.
15. Guidelines for Hazardous Waste Disposal
    Laboratory Supervisors are responsible for ensuring that all used and/or unneeded hazardous chemicals or articles irreversibly contaminated with these hazardous chemicals are disposed of appropriately.
    a. Solutions of toxic substances shall not be poured down the drain.
    b. Separate waste containers should be provided for heavy metal compounds, chlorinated hydrocarbons, non-chlorinated hydrocarbons and any other categories recommended by your hazard waste transporter company. Separation of wastes in this manner will make disposal less costly.
    c. Waste chemicals should be stored in appropriately labeled containers.
    d. Hazardous wastes should never be placed in the common trash.
    e. All waste containers should be appropriately labeled and stored.

Chemical Spills and Other Accidental Releases

If the situation is life or health threatening or you are unsure, immediately evacuate the laboratory, floor, or building (whatever is appropriate), shut doors to the area and alert those in the vicinity to do the same. If necessary, activate the nearest fire alarm and evacuate the building.

16. From a remote location, immediately call emergency services.

17. If the chemical involved in the spill is judged to present an immediate hazard, evacuation is to be absolute, and the area should be isolated until a HAZMAT team arrives.
18. If hazardous vapors are present, the area should be isolated, and evacuated. This will frequently mean waiting for the arrival of a HAZMAT team.
19. If a volatile, flammable material is spilled, turn off all electrical apparatus and evacuate the area.
20. If the spill material was a hazardous chemical, all of the materials involved in the cleanup will usually be considered to be hazardous waste and must be disposed of as such.
21. Mercury Spill
    a. Each lab where mercury is present should have immediate access to a Mercury Spill Kit, which may be acquired through lab purchasing supply.
    b. Restrict foot traffic in the area, protect sinks and floor drains from contamination.
    c. Do not put sulfur on the spill; it hinders clean-up and makes ultimate disposal difficult and more expensive
22. If there is no immediate danger (flammable, toxic, reactive, corrosive) to personnel, containment should be accomplished by use of materials in the laboratory's material spill kit. A spill kit should be accessible for each science laboratory. The spill kit should include:
    a. Spill control pillows
    b. Inert absorbents such as vermiculite, clay, sand, or kitty litter
    c. Neutralizing agents for acid spills such as sodium carbonate and sodium hydrogen carbonate
    d. Neutralizing agents for alkali spills such as sodium hydrogen sulfate and citric acid
    e. Quantities of cleanup materials sufficient for the largest anticipated spill.
    f. Large plastic scoops and other equipment such as brooms, pails, bags, and dust pans.
    g. Appropriate personal protective equipment
23. Consult the SDS for appropriate cleanup procedures.
24. If the quantity of the spilled material exceeds the employee's ability or training, seal the area until appropriately trained personnel arrive.
25. If the situation is not health-threatening and trained people and proper clean-up equipment are on hand, clean-up the spill and dispose of waste materials properly.

Engineering Controls

All hazards can be controlled and this can most effectively be accomplished by first applying engineering controls (e.g., ventilation, isolation, etc.) that are

supplemented by administrative controls (e.g., training, policies, procedures, etc.). Personal protective equipment (e.g., gloves, goggles, lab coats, etc.) is only considered when other controls are not technically or operationally sufficient or financially feasible.

Engineering controls may be defined as an installation of equipment or other physical facilities including, if necessary, the selection and arrangement of experimental equipment. Engineering controls remove the hazard, either by initial design specifications or by applying methods of substitution, minimization, isolation or ventilation.

Engineering controls are the most effective hazard control methods, especially when introduced at the conceptual stage of planning when control measures can be integrated more readily into the design. They tend to be more effective than other hazard controls (administrative controls and personal protective equipment) because they remove the source of the hazard or reduce the hazard rather than lessen the damage that may result from the hazard.

26. Substitution

    Substitution refers to the replacement of a hazardous material or process with one that is less hazardous (e.g. the replacement of mercury thermometers with alcohol thermometers or dip coating materials rather than spray coating to reduce the inhalation hazard).

    Substitution is usually the least expensive and the most positive method of controlling hazards and should always be the first engineering hazard control measure considered.

27. Minimization

    Minimization is the expression used when a hazard is lessened by scaling down the hazardous process. Hence, the quantity of hazardous materials used and stored is reduced, lessening the potential hazards (e.g. using micro-scale glassware so that chemical reactions can be carried out on a smaller scale).

    Minimization should always be the next engineering control measure attempted after examining substitution followed by the consideration of isolation.

28. Isolation

    Isolation is the term applied when a barrier is interposed between a material, equipment or process hazard and the property or persons who might be affected by the hazard (e.g. glove box, blast shield).

Isolation is particularly useful when the material, equipment or process requires minimal contact or manipulations. When these previously mentioned control methods are not feasible, ventilation is the next desirable engineering option.

29. Ventilation

Ventilation is used to control toxic and/or flammable atmospheres by exhausting or supplying air to either remove hazardous atmospheres at their source or diluting them to a safe level.

a. The two types of ventilation are typically termed local exhaust and general ventilation. Local exhaust attempts to enclose the material, equipment or process as much as possible and to withdraw air from the physical enclosure at a rate sufficient to assure that the direction of air movement at all openings is always into the enclosure (e.g. fume hood).
b. General ventilation attempts to control hazardous atmospheres by diluting the atmosphere to a safe level by either exhausting or supplying air to the general area (e.g. evaporative cooler).
c. Local exhaust is always the preferable ventilation method but is typically more costly. For some situations, general ventilation may suffice but only if the following criteria are met: only small quantities of air contaminants are released into the area at fairly uniform rates; there is sufficient distance between the person and the contaminant source to allow sufficient air movement to dilute the contaminant to a safe level; only materials of low toxicity or flammability are being used; there is no need to collect or filter the contaminant before the exhaust air is discharged into the environment (including the rest of the building), and the contaminant will not produce corrosion or other damage to equipment in the area or in any way affect other building occupants outside the general use area (e.g. foul odors).

30. Fume Hoods

A standard fume hood is a fire and chemical resistant enclosure with one opening (face) in the front with a movable window (sash) to allow user access into the interior. Large volumes of air are drawn through the face and out the top to contain and remove contaminants from the laboratory.

a. Laboratory fume hoods are the most important components used to protect laboratory employees and students from exposure to hazardous chemicals and agents used in the laboratory.
b. Laboratory fume hoods are not meant for either storage or disposal of chemicals. For example, if a hood must be used for storage, it may not provide adequate ventilation for flammable chemicals.
c. Laboratory activities that may release airborne contaminants, hazardous vapors or gaseous substances above the Permissible Exposure Limit (PEL) or Thresholds Limit Value (TLV) concentrations must be carried out in the fume hood.

d. In most cases, the recommended face velocity of a fume hood is between 80 and 150 feet per minute (fpm).
e. Any fume hood that does not pass inspection must be taken out of service immediately, and should not be used until the hood has been repaired and will pass inspection.
f. Fume hood air velocity should be tested at least annually.

Administrative Controls

Administrative controls consist of managerial efforts to reduce hazards through planning, information and training (e.g. hazard communication), written policies and procedures (i.e. the Chemical Hygiene Plan), safe work practices, and environmental and medical surveillance (e.g. work place inspections, equipment preventive maintenance, and exposure monitoring).

Because they primarily address the human element of hazard controls, they are of vital importance and are always used to control chemical hazards.

31. Chemical Inventory

A chemical inventory should be updated each time a chemical is received or consumed. The list should be audited for accuracy at least annually.

a. You may add other information such as, is the chemical extremely hazardous, a carcinogen, the CAS number, container type/size and if it is a liquid or solid.
b. A printed copy of the most recent inventory should be kept by the chemical hygiene officer.
c. Laboratory chemicals should be properly labeled to identify any hazards.
d. All chemicals should remain stored in their original bottle. The original manufacturer's label identifying potential hazards, the date of purchase, the date opened and the initials of the person who opened the container.
e. If a chemical has been transferred to a secondary container, the new container should be appropriately labeled with the chemical name, formula, concentration (if in solution), solvent (if in solution), hazard warnings and name or initials of the person responsible for the transfer.
f. Unlabeled bottles should not be opened, and such materials should be disposed of promptly.
g. Emergency telephone numbers shall be posted in all laboratory areas.
h. Emergency evacuation and appropriate warnings 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 and other safety equipment.
i. Posters to reinforce laboratory safety procedures are recommended.

32. Personal Protective Equipment

Only when adequate engineering and administrative hazard controls are not technically, operationally or financially feasible, personal protective equipment (PPE) must be considered as a supplement. PPE does not eliminate hazards but merely minimizes damage from hazards.

a. Personal protective equipment (PPE) includes a wide variety of items worn by an individual to isolate the person from chemical hazards.
b. PPE includes articles to protect the eyes, skin, and the respiratory tract (e.g. goggles, face shields, coats, gloves, aprons, respirators). In some situations, PPE may be the only reasonable hazard control option, but for many reasons it is the least desirable means of controlling chemical hazards.
c. The effectiveness of PPE is highly dependent on the user.
d. Each type of PPE has specific applications, advantages, limitations and potential problems associated with their misuse, and those using PPE must be fully knowledgeable of these considerations.
e. PPE must match the hazards and the conditions of use and be properly maintained in order to be effective. Their misuse may directly or indirectly contribute to the hazard or create a new one.
f. The material of construction must be compatible with the chemical's hazards and must maximize protection, dexterity and comfort. It is the responsibility of BCCC to provide appropriate safety and emergency equipment for employees.
g. Laboratory aprons or coats, eye protection and non-permeable gloves are considered standard equipment for school laboratory programs and should be readily available to employees and students.
h. Lab coats or aprons worn in the laboratory should offer protection from splashes and spills and should be fire resistant and easy to remove in case of an accident.
i. All eye protection devices should conform to ANSI Standard Z87.1-1989.
j. Eyeglasses, even with side shields, are not acceptable protection against chemical splashes. Chemical splash safety goggles should be used as the standard protective eyewear. Such goggles should fit the face surrounding the eyes snugly to protect the eyes from a variety of hazards.
k. Any experiment that involves heating glassware or chemicals shall require the use of chemical splash safety goggles. The goggles also serve to reduce dust and fumes from reaching the eye.
l. Chemical splash goggles must be worn at all times when contact lenses are worn.
m. 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 should also be worn when an operation involves a pressurized system that may explode or an evacuated system that may implode. For full protection, safety goggles must be worn with the face shield.

n. Standing shields should be used when there is a potential for explosions, implosions or splashes, or when corrosive liquids are used.
o. A standing shield should be used for group protection from chemical splash and impact. The standing safety shield should be used with safety goggles and, if appropriate, with a face shield.
p. When gloves are required, many kinds of gloves are available but are not always suitable for all situations. The SDS should be consulted for information regarding the proper type of gloves to be used.

Safety/Emergency Response and Equipment

33. BCCC should ensure that adequate emergency equipment is available in the laboratory and inspected periodically to ensure that it is functioning properly. All employees should be properly trained in the use of each item.
34. Never block access to emergency equipment, showers, eyewashes, or exits. Exit doors will be clearly marked and free of obstructions to permit a quick and safe escape in an emergency.
35. Never leave a flame unattended. Proper Bunsen burner procedures shall be followed at all times. Should a fire drill or any other evacuation occur during a lab activity, turn off all Bunsen burners and electrical equipment. Leave the room as directed.
36. Safety equipment will be tagged following an inspection showing the date, inspector and results.
37. Emergency equipment items that should be available include: eyewash stations, fire extinguishers of the appropriate type, safety showers, first aid kits, telephone for emergencies, fire blankets and identification signs.
38. Multipurpose fire extinguishers should be available in the laboratory. A multipurpose, ABC fire extinguisher can be used on all fires EXCEPT for class D fires (burning metal). Extinguishers should be visually checked monthly and inspected and tested annually.
39. All eye wash stations and safety showers will be capable of supplying a continuous flow of aerated, tepid, potable water to both eyes for at least 15 minutes. The valve should remain in the open position without the need to hold the valve.
40. Each storeroom should be equipped with a heat sensor and smoke alarm.
41. All electrical outlets should have a grounding connection accommodating a three prong plug.
42. Laboratory lighting should be on a separate circuit from electrical outlets.
43. If electrical equipment shows evidence of overheating, it should be immediately unplugged.
44. Ground-fault circuit interrupters (GFCI) as required by code to protect users from electrical shock.

Training Requirements

45. The objective of the employee/student training and information program is to ensure that all individuals at risk are adequately trained and informed about:
    a. The laboratory standard, 29 CFR 1910.1450,
    b. Safety Data Sheets (SDS),
    c. Proper labeling
    d. The chemical hygiene plan
    e. The physical and health hazards associated with hazardous chemicals present in the laboratory
    f. The proper procedures to minimize risk of exposure
    g. The proper response to accidents
46. Records of any employee training, air concentration monitoring, exposure assessments, medical consultations and medical examinations must be kept for at least thirty (30) years after the employee ceases employment with BCCC.
47. Such information shall be provided at the time of the employee's initial assignment to a work area where hazardous chemicals are present and prior to reassignments into other areas where there may be exposure situations.
48. All employees should be trained in the methods and observations that may be used to detect the presence or release of hazardous chemicals.
49. Employees shall be informed of the signs and symptoms associated with exposures to hazardous chemicals used in the laboratory.
50. The frequency of refresher information and training shall be determined by BCCC.

Medical Consultations and Examinations

BCCC laboratory instructors do not regularly handle significant quantities of materials that are acutely or chronically toxic; therefore, regular medical surveillance is not necessary.

51. Factors which may raise the possibility of overexposure and therefore warrant an initial measurement of employee exposure include:
    a. The manner in which the chemical procedures or operations involving the particular substances were conducted.
    b. The existence of historical monitoring data that shows elevated exposures to the particular substance for similar operations.
    c. The use of a procedure that involves significant quantities or is performed over an extended period of time.
    d. There is reason to believe that an exposure limit may be exceeded.
    e. Signs or symptoms of exposure (e.g., skin or eye irritation, shortness of breath, nausea or headache)
52. If the substance in question does not have exposure monitoring or a medical surveillance requirement, exposure monitoring and medical surveillance shall be continued until exposure levels are determined to be

below the action level or 50% of the Permissible Exposure Limits (PEL). In the absence of PEL, the American Congress of Governmental Industrial Hygienist Threshold Limit Values (ACGIH TLV) should be referenced.

53. If the initial monitoring 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 for that substance.
54. The employer shall, within fifteen (15) working days after the receipt of any monitoring results, notify the employee of these results.
55. The following substances are regulated by OSHA standards and require monitoring: lead, benzene, 1, 2-dibromo-3-chloropropane, acrylonitrile, ethylene oxide, formaldehyde, asbestos, vinyl chloride and inorganic arsenic.
56. In the event that an employee is exposed to levels of a hazardous chemical that exceeds the established PEL or TLV, or should the employee exhibit signs or symptoms of such exposure, the employee should seek appropriate medical attention.
57. All medical examinations and consultations shall be provided without cost to the employee and shall be performed by or under the direct supervision of a licensed physician, without loss of pay and at a reasonable time and place.

Hazardous Chemicals

This section of the plan describes the specific and general control measures that are designed to reduce the exposure of instructors, aides, other employees and students to extremely hazardous substances (EHS). Employees should read and understand these practices before commencing a procedure using extremely hazardous substances

EHS include highly toxic chemicals, reproductive toxins and select carcinogens. In addition, our laboratory may contain highly flammable chemicals, highly reactive chemicals and highly corrosive chemicals.

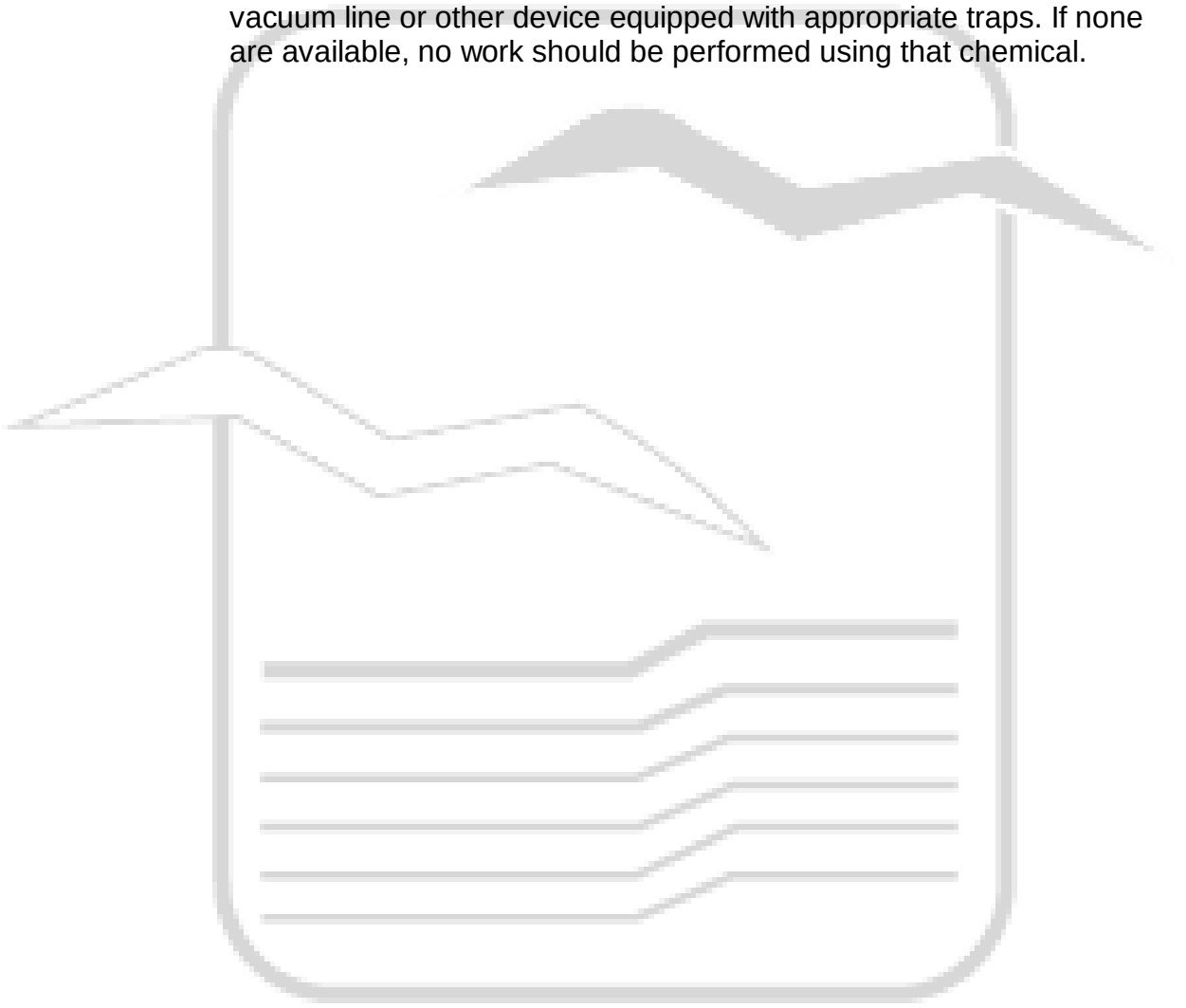
The use of these substances requires prior approval of the Chemical Hygiene Officer.

EHS shall be used only in designated areas and in fume hoods as directed by the instructor.

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

58. Highly Toxic Chemicals
    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.

a. When a PEL or TLV value is less than 50 ppm or 100 mg/m3, the user should use it in an operating fume hood, glove box, vacuum line, or other device equipped with appropriate traps. If none is available, no work should be performed using the chemical.
b. If a PEL, TLV or comparable value is not available, the animal or human median inhalation lethal concentration information, LC 50, should 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 should be used in an operating fume hood, glove box, vacuum line or other device equipped with appropriate traps. If none are available, no work should be performed using that chemical.



Commonly Used Term	LD_{50} Single Oral Dose for Rats (g/kg)	4-hr Vapor Exposure Causing 2-4 Deaths in 6-rat Groups (ppm)	LD_{50} Skin for Rabbits (g/kg)	Probable Lethal Dose for Humans
Extremely toxic	≤0.001	<10	≤0.005	Taste (1 grain)
Highly toxic	0.001-0.05	10-100	0.005-0.043	1 tsp (4 cc)
Moderately toxic	0.05-0.5	100-1,000	0.044-0.340	1 oz (30 cc)
Slightly toxic	0.5-5.0	1,000-10,000	0.35-2.81	1 pint (250 gm)
Practically nontoxic	5.0-15.0	10,000-100,000	2.82-22.6	1 quart
Relatively harmless	>15.0	>100,000	>22.6	>1 quart

59. Highly Flammable Chemicals
    Category 1 and 2 liquids are highly flammable chemicals with a flashpoint of less than 73.4° F. Examples of highly flammable chemicals are diethyl ether, acetone, pentane, petroleum ether, acetaldehyde and ligroines.
60. Highly Reactive Chemicals
    Reactivity information is often located in a manufacturer's SDS and on chemical labels.

    A reactive chemical is one that:
    - Is described as such on the label or in the SDS.
    - Is ranked by the NFPA as 3 or 4 for reactivity.
    - Is identified by the Department of Transportation (DOT) as an oxidizer, an organic peroxide, or an explosive (Class A, B, or C).
    - Fits the Environmental Protection Agency definition of reactive in 0 CFR 261.23.
    - Is known or found to be reactive with other substances.

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

61. Highly Corrosive and Contact Hazard Chemicals

Corrosively, allergen, and sensitizer information is provided in manufacturers' MSDS and on labels.

A corrosive chemical is one that:

- Fits the OSHA definition of corrosive in 29 CFR 1910.1200
- Fits the EPA definition of corrosive in 40 CFR 262.22 (has a pH greater than 12 or a pH less than 2.5)
- Is known to be reactive to living tissue, causing visible destruction or irreversible alterations of the tissue at the site of contact.

A contact hazard chemical is an allergen or sensitizer that:

- Is so identified or described in the SDS or on the label.
- Is so identified or described in medical or industrial hygiene literature.
- Is known to be an allergen or sensitizer.

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

62. Reproductive Toxins

A reproductive toxin refers to chemicals which affect reproductive capabilities including chromosomal damage (mutations) and which effect fetuses (teratogenesis). No reproductive toxins should be allowed in BCCC laboratories without written authorization from the Chemical Hygiene Officer.

A reproductive toxin is a compound that:

- Is described as such in the applicable SDS or label.
- Is identified as such by the Oak Ridge Toxicology Information Resource Center (TIRC), (615) 576-1746.

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

If such chemicals are used:

a. They should be handled only in a hood and when satisfactory performance of the hood has been confirmed.
b. Skin contact should be avoided by using gloves and wearing protective apparel.
c. Persons using such substances should always wash hands and arms immediately after working with these materials.
d. Unbreakable containers of these substances should be stored in a well- ventilated area and will be labeled properly.

63. Carcinogens

Carcinogen means any substance regulated by OSHA as a carcinogen or suspect carcinogen.

a. All work with these substances should 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 should be clearly marked with warning and restricted access signs.
b. Any procedure that may result in a generation of aerosols or vapors should be performed in a hood whose performance is known to be satisfactory.
c. Skin contact should be avoided by using gloves and other protective apparel as appropriate. Any protective clothing should be removed before leaving the designated area and placed in a labeled container. Hands, arms, and neck should be washed after working with these materials.
d. Carcinogens should be stored in unbreakable containers in a ventilated area with controlled access. All containers should be labeled with the identity and hazard of the substance. Immediately upon completion of the project, all unused reproductive toxin should be disposed of following standard hazardous waste disposal procedures.

Glossary of Terms, Abbreviations, and Acronyms

ACGIH: American Conference of Governmental Industrial Hygienists.

Acute Effect: A health effect that occurs soon after a brief exposure to the offending agent.

BCCC: Beaufort County Community College

Carcinogen: A chemical that is capable of causing cancer. Under the HCS, a carcinogen is any chemical that has been found to be a carcinogen or potential carcinogen by the International Agency for Research on Cancer, is listed as a carcinogen or potential carcinogen in the *Annual Report on Carcinogens* published by the National Toxicology Program, or is regulated by OSHA as a carcinogen.

Chemical Hygiene Plan : The BCCC chemical hygiene plan, as required by the OSHA Laboratory Standard.

CHP: Chemical Hygiene Plan

Chronic Effect: A health effect that occurs over a long period of time as a result of continued or periodic exposure to the offending agent.

Combustible Liquid: Any liquid having a flash point at or above 100 degrees F (37.8 degrees C), but below 200 degrees F (93.3 degrees C).

Compressed Gas: *I.* a gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70 degrees F (21 degrees C); or *II.* a gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130 degrees F (54.4 degrees C) regardless of the pressure at 70 degrees F; or *III.* a liquid having a vapor pressure exceeding 40 psi at 100 degrees F (37.8 degrees C) as determined by ASTM D-323-72.

Corrosive: A chemical that causes visible destruction of, or irreversible alterations in, living tissue by chemical action at the site of contact.

Employee: An individual receiving a paycheck from BCCC.

EPA: U.S. Environmental Protection Agency.

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

Flammable: A chemical that catches on fire easily and burns readily.

HCS – The OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Hazardous Chemical: Defined by OSHA as any chemical that is a health hazard or a physical hazard.

Hazard Warning: Any words, pictures, symbols, or combination thereof appearing on a label that convey the hazards of the chemical(s) in the container.

HAZMAT: Hazardous Materials, such as HAZMAT Response Team

Health Hazard: A chemical for which there is statistically 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. Chemicals covered by this definition include carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, that which act on the hematopoietic system, and agents that damage the lungs, skin, eyes, or mucous membranes.

Hematopoietic System: The body's blood system, including the production and circulation of blood and the blood itself.

Hepatotoxins: Chemicals that cause liver damage.

Importer: The first business with employees working with the Customs Territory of the United States that receives hazardous chemicals produced in other countries for the purpose of supplying them to distributors or employers within the United States.

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

Label: Any written, printed, or graphic material displayed on or affixed to containers of hazardous chemicals.

Mixture: A heterogeneous association of substances where the various individual substances retain their identities and can usually be separated by mechanical means. Includes solutions or compounds but does not include alloys or amalgams.

PPE: Personal protective equipment

SDS: Safety Data Sheet.

Nephrotoxins: Chemicals that cause kidney damage.

Neurotoxins: Chemicals that produce their primary toxic effects on the nervous system.

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

OSHA: Occupational Safety and Health Administration.

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

PEL: Permissible Exposure Limit

Permissible Exposure Limit (PEL): An exposure limit that is published and enforced by OSHA as a legal standard.

Physical Hazard: 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, pyrophoric, unstable (reactive), or water-reactive.

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

Reproductive Toxins: Chemicals that affect the reproductive capabilities including chromosomal damage (mutations) or effects on fetuses (teratogenesis).

ISIS Safety Profile: A laboratory-specific chemical hygiene plan required by the OSHA Laboratory Standard for research labs, teaching labs, and common facilities (those shared by more than one researcher).

Safety Data Sheet (SDS): Written or printed material concerning a hazardous chemical that includes information on the chemical's identity; physical and chemical characteristics; physical and health hazards; primary routes of entry; exposure limits; whether the chemical is a carcinogen; precautions for safe handling and use; control measures; emergency and first aid procedures; the date of preparation of the SDS or the last change to it; and the name, address, and telephone number of the manufacturer, importer, or employer distributing the SDS.

SARA Title III: Title III of the Superfund Amendments and Reauthorization Act, it is also known as the Emergency Planning and Community Right-To-Know Act (EPCRA).

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.

Small Quantity Generator, Exempted: does not generate more than 100 kg of hazardous waste or 1 kg of acutely hazardous waste in each calendar month.
SQG: Small Quantity Generator, Exempted

Threshold Limit Value (TLV): A time-weighted average concentration under which most people can work consistently for eight hours a day, day after day, with no harmful effects. The values are published in a table annually by the American Conference of Governmental Industrial Hygienists.

Toxic: Causing acute or chronic injury to the human body or suspected of being able to cause disease or injury under some conditions. The HCS defines "toxic" and "highly toxic" specifically by the chemical's median lethal dose and median lethal concentration for laboratory animals.

Unstable (reactive): A chemical that in the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure, or temperature.

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

Work area: A room or defined space in a workplace where hazardous chemicals are produced or used and where employees are present.

Workplace: An establishment, job site, or project at one geographical location containing one or more work areas.

Revision History

Date	Rev #	Changes
August 2017	6	Review by HS&C Hygiene Committee
May 2016	5	Review By HS&C Hygiene Committee
April 2015	4	Inclusions of App A, 29 CFR 1910.1450
September 2014	3	Inclusion of GHS & SDSs
October 2013	2	Various
May 2003	1	Various
February 1997	0	New Issue

Beaufort County Community College prior approval form for chemical purchase

Circumstances requiring pre-approval:

_____

_____

Description of procedure or operation:

_____

_____

To be carried out ONLY by the following employees:

_____

Protocol for this operation (employee initial each item as reviewed with supervisor):

1. _____

2. _____

3. _____

4. _____

5. _____

I have reviewed the above protocol:

Employee Signature:_____

Employee Printed Name: _____ Date: _____

Approved for this operation:

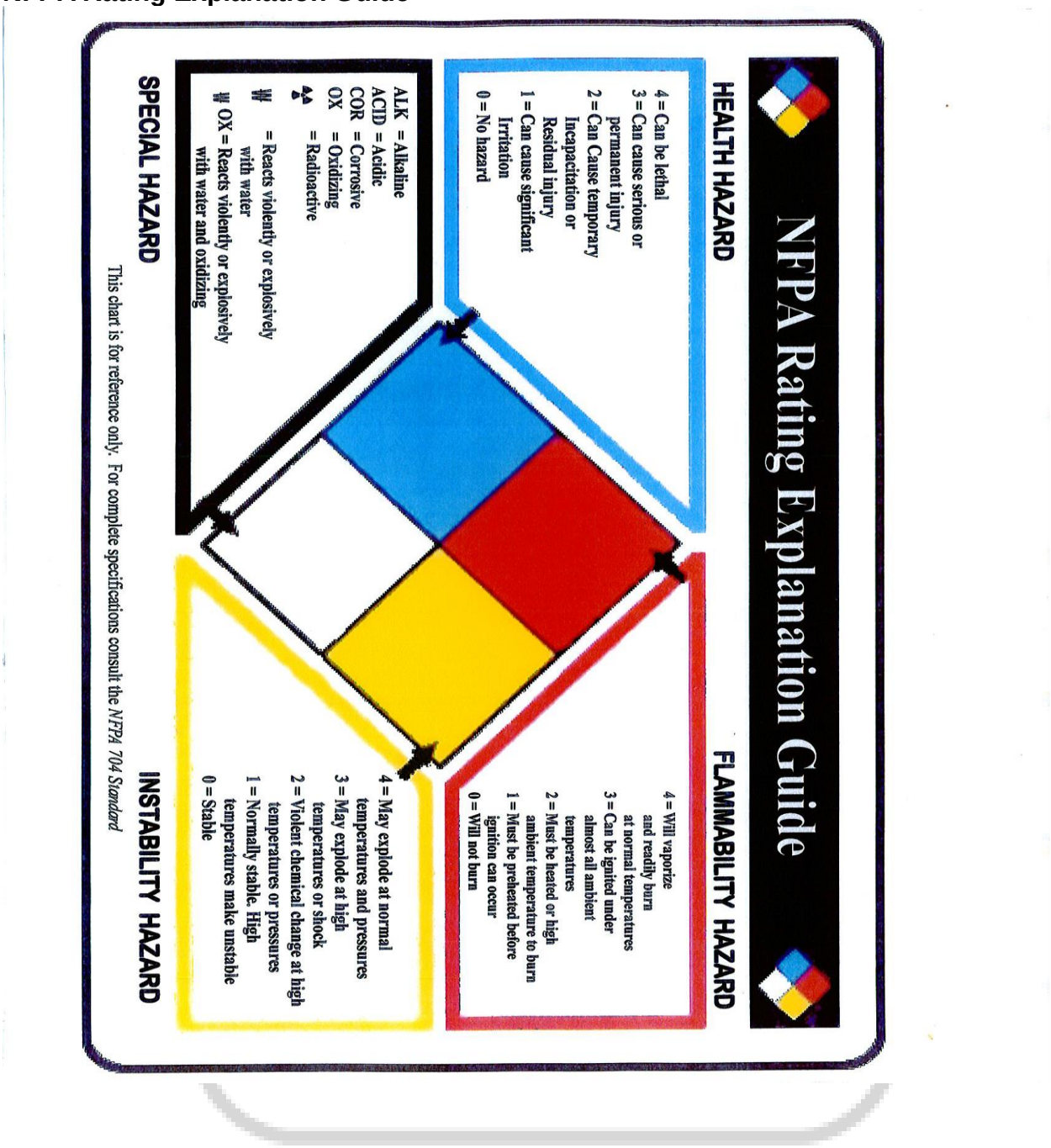
Supervisor Signature: _____

Supervisor Printed Name: _____ Date: _____

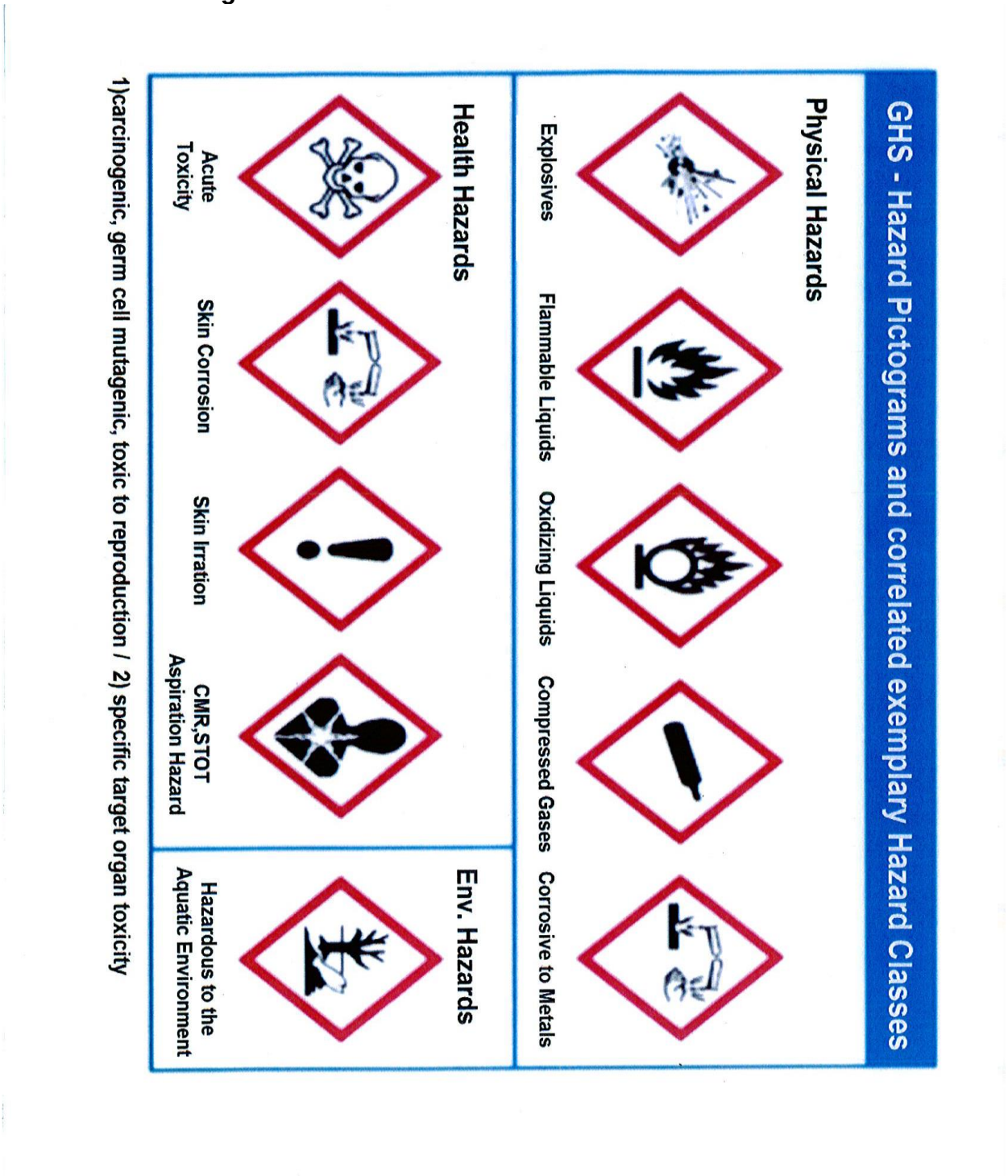
Chemical Hygiene Officer Signature: _____

Chemical Hygiene Officer Printed Name: _____Date:_____

NFPA Rating Explanation Guide



GHS Hazard Pictograms



References

Legal References: *29 CFR 1910.1450*

SACSCOC References: *CS 3.11.2*

Cross References: Safety Control Measures Policy

History

Senior Staff Review/Approval Dates: *11/6/13*

Board of Trustees Review/Approval Dates: *Enter date(s) here*

Implementation Dates: *11/6/13*