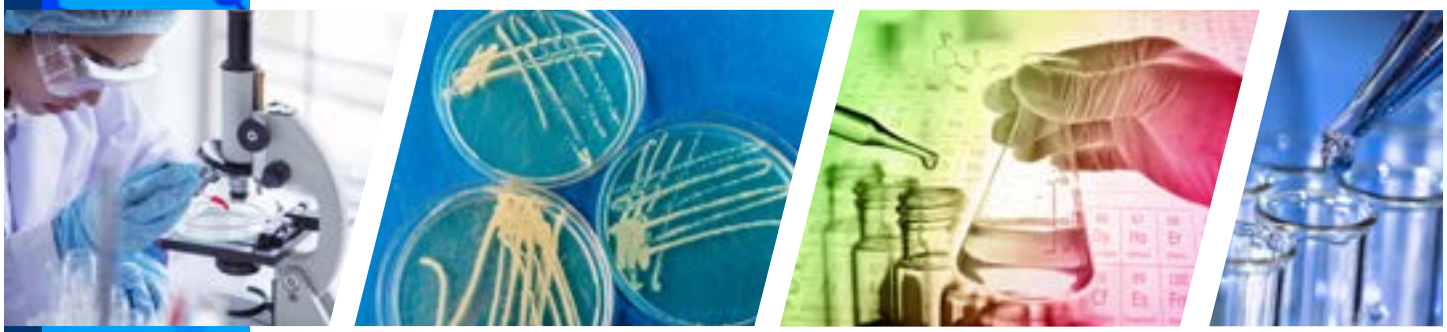
BLINN COLLEGE DISTRICT

HEALTH AND SAFETY MANUAL

and

CHEMICAL HYGIENE PLAN

REVISED: MAY 2022



BLINN COLLEGE DISTRICT

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I. SCIENCE LABORATORY SAFETY

Blinn College District Safety and Risk Management, in conjunction with the Science Department, has established this Science Laboratory Health and Safety Manual, which includes the Chemical Hygiene Plan, as a resource for faculty, students, as well as anyone interested in laboratory safety. This manual is intended to comply with federal, state, and local regulations, as well as industry best practices. A copy of Blinn College District GC (Local) – Safety Policy is included in the Resource Section of this manual. However, this manual is not exhaustive and should not be considered the only reference for laboratory health and safety concerns. In addition to this manual, Blinn College District Safety and Risk Management is readily available to address any health and safety concern. We are each responsible for creating and maintaining a safe and healthy learning environment by adherence to the following:

- **INFORMATION** – Blinn College District (BCD) must provide a specific Science Laboratory Health and Safety Manual, a Chemical Hygiene Plan, and maintain Safety Data Sheets (SDS) for all chemicals handled and/or stored in any BCD controlled laboratory or associated storage area. These documents must be regularly reviewed, revised as necessary, and made readily available to all BCD faculty, staff, students, and any other interested parties.

- **RESPONSIBILITY** – It is the responsibility of the Blinn College District (BCD) to provide manuals, policies, inspection, training, and information about the inherent and enumerated hazards in any of BCD's science laboratories. It is the responsibility of faculty, staff, and students to adhere to these protocols and work in a safe and conscientious manner.

- **PRIORITIES** – Safety is a necessary component in every aspect of working in a science laboratory. It shall be the top priority for everyone involved in any work conducted in all Blinn College District (BCD) laboratories.

- **ATTITUDE** - Maintain an "attitude of safety" by being mindful that our actions and attitudes have impact, both positive and negative. It is imperative that any safety issues encountered are immediately reported. All reports of safety issues, concerns, violations, and/or suggestions for improvement will be taken seriously and without any adverse action taken against the reporting party.

Science instructors should utilize the acronym PRISM to protect the health and safety of students, staff, and faculty while performing laboratory experiments:

- *PLAN* - If the experiment procedures are new or unfamiliar, complete the experiment yourself before having students attempt it. Always consider the worst possible outcome associated should the experiment suffer a failure. Consider the known hazards associated with the chemical or biological agent(s) being used. Most importantly, always consider safer alternatives if available. A Laboratory Risk Assessment Tool (LAB-RAT) MUST be completed for EACH separate experiment to be performed within a course.

- *REVIEW* – Once you are satisfied with plan, review and commit it to a "living" document. Does the plan for the experiment make sense? Are the instructions concise and easy to follow? Does the plan speak to an "attitude of safety?" Continue to review and refine as necessary to accomplish these goals.

- *INSTRUCT* – Instruction is leadership. Emphasize the safety precautions to be taken and

Personal Protective Equipment (PPE) to be used during the course of the experiment. As the instructional leader, ensure that you are properly wearing all required PPE along with your students. Immediately correct unsafe behavior and improper PPE utilization to maintain an "attitude of safety" within the laboratory environment.

- *SUPERVISE* – Instructors are required to be present and engaged for the entirety of all science classes to include active laboratory experiments.

- *MAINTAIN* – Organization is not only the key to success, but also the foundation of safety. Have a place for everything and put everything in its place. Keep all chemical and biological agents properly stored. Keep all reagent bottles clean and clearly labeled. Maintain Safety Data Sheets (SDS) in their required location and verify that all chemicals in use have a corresponding SDS on file. Inspect the laboratory prior to initiating any experiment to verify that facility is ready for use. Upon completion of the experiment, make sure that the laboratory is returned to pre-operational condition.

II. LABORATORY SAFETY GUIDELINES

- Distribute and receive acknowledgment of Blinn College District's Laboratory Safety Policy, per science discipline, and Lab Safety Agreement to affected students, faculty, and staff.
- All science work-study students, faculty and staff will be required to complete Laboratory Safety training annually or upon on-boarding for new faculty. Additional safety trainings may be required depending on the courses taught or materials and equipment used.
- All science students are required to sign an acknowledgment indicating that they received laboratory safety information, rules and guidelines from their science instructor.
- Require all science faculty and staff to read and acknowledge the Blinn College District Science Laboratory Health and Safety Manual.
- Maintain ALL safety policy and procedure acknowledgments for five (5) years.
- Endeavor to create and promote a pervasive "attitude of safety."
- Every prelab/pre-experiment discussion must include a reasonable consideration of the health and safety aspects involved.
- All accidents (incidents) shall be documented and reported to the appropriate Dean and forwarded to the Director of Safety and Risk Management for analysis, review and filing. The Director of Safety and Risk Management will work with the Dean to implement corrective action as necessary.
- Tobacco use of any type, vaping, eating, and drinking in the science laboratories is expressly prohibited.
- All long hair must be tied back and any dangling jewelry that may interfere with free movement or

come into contact with the work surface must be removed.

- Cellphone use, unless authorized by the science instructor for a specific purpose, is prohibited. Be mindful that cellphones both bring contaminants into the laboratory setting and can carry contaminants out if not properly decontaminated after use.
- Proper Personal Protective Equipment (PPE) and attire will be worn be students, faculty, and staff while in all science laboratories.
- Food and drinks shall are not allowed in ANY laboratory and shall NEVER be stored in chemical biological refrigerators.
- Work areas to be clean and free of clutter and non-essential items.
- Review and communicate plans for dealing with emergencies such as fire, explosion, poisoning, chemical spill or vapor release, electric shock, bleeding, and personal contamination.
- Emergency contact numbers of the local fire department, police department, poison control, and CHEMTREC shall be posted in each science laboratory and preparation area.
- Fire extinguishers, safety showers, eye wash stations, first aid kits, fire blankets and fume hoods are required to be available and operational in science laboratories where and when hazardous chemicals are in use.
- Safety Data Sheets (SDS) shall be located within each active science laboratory preparation room and maintained in a central, standardized location along with any additional equipment safety information. Additionally, electronic access to SDS is available to the lab instructor via computer at the instructor workstation.
- Laboratory chemicals shall be stored in secure, properly spaced and well-ventilated storage areas while flammable chemicals shall be stored in fireproof cabinets.
- Undiluted laboratory chemicals shall be labeled to indicate chemical name, nature and degree of hazard, precautionary statement, date, and PPE to be utilized to ensure safe handling.

III. TEXAS HAZARD COMMUNICATION ACT

Effective January 1, 1986, and select subsections since amended

<u>"The Right-To-Know Law" requires an employer to:</u>

- Inventory all hazardous materials and make the chemical list available to employees, their representative, or official inspectors.
- Obtain Safety Data Sheets (SDSs) for all hazardous materials and make them available to employees. These must be prominently displayed, immediately accessible, continually reviewed, and updated.
- Provide an explanation of all labeling systems in use.
- Post a copy of the Hazard Communication Act that explains what Blinn College District is required to do to be legally compliant.
- Provide training programs for all employees, at least annually, and more often if personnel change or new materials are used. The training must, at a minimum, cover the following points:
  a. An understanding of the "Right-To-Know" law.
  b. A knowledge of all hazardous materials in the workplace and their physical and health hazards.
  c. An explanation of the labeling system and Safety Data Sheets (SDS)
  d. Measures the employee may take to protect themselves during the use of, or accidental exposure to, the hazardous materials present in the workplace.
  e. All emergency and first-aid procedures in effect, emergency contact information, and how to properly operate emergency equipment.

EMPLOYEE RIGHTS UNDER THE ACT

Employees must:

- Have access to chemical lists and Safety Data Sheets (SDS).
- Be educated and trained on the hazards of chemicals and on measures they can take to protect themselves from those hazards.
- Be able to file complaints about violations without fear of reprisal.
- Not be required to work with hazardous chemicals from unlabeled containers, except portable containers for immediate use, the contents of which are known to the employee.

HOW TO PROTECT YOURSELF

ADMINISTRATIVE CONTROLS

Protecting oneself when working in a hazardous environment begins with Administrative Controls, which includes administrative actions, documented training, and pre-planning.

ADMINISTRATIVE ACTIONS

Departments are expected to enforce safety standards through administrative actions in a variety of ways. For instance, employee performance evaluations should reflect that laboratory personnel are following Blinn College District safety standards and protocols in their work areas. Also, it is each department's responsibility to establish whether safety performance should be included in the grading criteria for laboratory courses.

Appropriate safety signage is another way departments can promote safety in laboratories. Signs indicating the hazards present in the laboratory can be posted on laboratory doors. Signs pointing to the location of safety equipment in or near the laboratory can minimize the consequences of an incident by enabling employees to quickly locate needed equipment. Departments should ensure that all laboratory employees receive proper training for the hazards in their work areas and that such training is properly documented and filed with the Director of Safety and Risk Management.

EMPLOYEE HAZARD COMMUNICATION TRAINING

Before entering a laboratory, all new laboratory employees, including teaching assistants and student work staff, must receive training on the hazards they will encounter in their work area. This training includes both general and work area specific Hazard Communication Training. Hazard communication training is required by the Texas Hazard Communication Act (THCA).

General Training

General hazard communication training is provided by the Science Department through the Introduction to Laboratory Safety Training class and/or through Safe College Lab Safety Training (online). Additionally, specialized training may be required of both faculty and students as required by department and/or instructor. These courses are offered each semester, upon hire, and may be available on-line. If there is not a Laboratory Safety class available for the new employee, the on-line course may be taken to satisfy the general hazard communication training requirement. However, the classroom course covers much more safety information than the on-line course does, and BCD Safety & Risk Management recommends that all new employees take the classroom course as soon as possible, even if the on-line course has already been taken. If desired, the on-line Hazard Communication Training course may be used as refresher training.

Work Area Specific Training

Work area specific training is provided by the laboratory coordinator or a qualified designee. This training should focus on the specific hazards in the employee's work area, such as chemical hazards, equipment hazards, biological hazards, etc. Work area specific training should also include the location of SDSs, the proper use of personal protective equipment, the location and proper use of safety equipment (fume hoods, biological safety cabinets, autoclaves, etc.), the location and use of emergency equipment (showers, eyewashes, fire extinguishers, spill kits, etc.), and the proper response to emergency situations (fires, chemical spills, etc.). Training should also be provided for new hazards that are introduced into the work area. If new information becomes available for an existing hazard, additional training on that information should be provided.

Training Documentation

Employee safety training must be documented, and records maintained for at least five years per the THAC. Completion of both the Introduction to Laboratory Safety Training course and the on-line Hazard Communication Training course is documented via Blinn College District Human Resources. Additionally, a Hazard Communication Training Record is provided to each person who completes either of these courses. A copy of this record should be maintained in the employee's personnel records. This document lists the specific topics covered in the training and serves as proof of compliance that Hazard Communication Training has been provided to the employee.

Documentation of Work Area Specific Training should include the date of training, specific topics covered, the name of the person providing the training, and the signature of the trainee. Space is provided on the Hazard Communication Training Record for work area specific training. Departments may also utilize their own training forms.

A copy of the Hazard Communication Form is located in the RESOURCES section of this manual.

STUDENT SAFETY

Student Training and Acknowledgment Forms

All students enrolled in Laboratory Courses will receive appropriate safety information. The instructor or class supervisor will provide this training and the Acknowledgment Form specific to the scientific discipline involved.

Laboratory students must be provided a written notice of known potential laboratory hazards and a copy of safety rules at the beginning of the semester or summer term. Each student must sign a Student Acknowledgment Form, which indicates they have received and read the rules for that course. Students who have not signed the acknowledgment form shall not be permitted in the laboratory. The signed forms shall be retained by the department for at least a year following the end of the semester or term the course was taken.

Instruction on safe and proper use of laboratory equipment should also be provided to students as needed. Student training should be documented through written course instructions.

Departmental Oversight of Student Safety

Departments with teaching laboratories should periodically conduct self-evaluations and/or inspections to ensure instructors are enforcing safety rules and students are complying with them. These evaluations should be documented, as should any discrepancies found, and steps taken to correct them. These evaluations and/

or inspections shall be forwarded to BCD Safety & Risk Management for review, confirmation that necessary corrective action has been taken, and appropriate filing.

Incident/Injury Reporting

For any laboratory incident and/or injury, a Blinn College District Incident Report is to be completed within 48 hours via the form available on myBLINN, which is routed to the Director of Safety and Risk Management for review, initiation of corrective action if necessary, and filing. A copy of the form is available in the resource section of this manual for use in the instance of an inability to access the Blinn College District website.

Pre-planning

Many laboratory hazards can be minimized by pre-planning. Before beginning work on a new project, the associated hazards should be considered carefully. What are the sources of danger? Are there chemical, equipment, or electrical hazards? Consider also the risk of an accident or exposure occurring, and what the impact of that incident would be. Also, conduct a thorough safety review of new apparatus.

Once the hazards have been identified, steps to minimize risk should be implemented. This includes utilizing engineering controls (such as fume hoods) and personal protective equipment. If the hazard is chemical, another option would be to substitute a less hazardous chemical. Or perhaps the project can be designed in such a way as to separate incompatibles, such as electrical equipment and water. Careful planning is essential to a safe laboratory!

IV. SAFETY DATA SHEETS (SDS)

What is a Safety Data Sheet?

A safety data sheet, or SDS, is a standardized document that contains occupational safety and health data. The International Hazard Communication Standard (HCS) mandates that chemical manufacturers must communicate a chemical's hazard information to chemical handlers by providing a Safety Data Sheet. SDS's typically contain chemical properties, health and environmental hazards, protective measures, as well as safety precautions for storing, handling, and transporting chemicals.

Globally Harmonized System

GHS is a set of international guidelines that were developed by the United Nations. These guidelines were created to ensure the safe manufacturing, handling, use, disposal, and transport of hazardous materials. The GHS system is used to:

- Classify chemical data and hazard criteria.
- Identify a chemical's health, physical, and environmental hazards.
- Provide chemical manufacturers and distributors with a well-defined system to communicate a chemical's hazard information and protective measures.

The chart on the following page displays the GHS Hazard, Pictogram, Hazard Class, and Hazard Category:

GHS Hazard	Pictogram	Hazard class and hazard category
Explosive		• Unstable explosives • Explosives, Divisions 1.1, 1.2, 1.3,1.4 • Self-reactive substances and mixtures, Types A, B • Organic peroxides, Types A, B
Flammable		• Flammable gases, Category 1 • Flammable aerosols, Categories 1, 2 • Flammable liquids, Categories1, 2, 3 • Flammable solids, Categories 1, 2 • Self-reactive substances and mixtures, Types B, C, D, E, F • Pyrophoric liquids, Category 1 • Pyrophoric solids, Category 1 • Self-heating substances and mixtures, Categories 1, 2 • Substances and mixtures, which in contact with water, emit flammable gases, Categories 1, 2, 3 • Organic peroxides, Types B, C, D, E, F
Oxidizing		• Oxidizing gases, Category 1 • Oxidizing liquids, Categories 1, 2, 3 • Oxidizing solids, Categories 1, 2, 3
Compressed Gas		• Compressed gases • Liquefied gases • Refrigerated liquefied gases • Dissolved gases
Corrosive		• Corrosive to metals, Category 1
Toxic		• Acute toxicity (oral, dermal, inhalation), Categories 1, 2, 3
Corrosive		• Skin corrosion, Categories 1A, 1B, 1C • Serious eye damage, Category 1
Irritant		• Acute toxicity (oral, dermal, inhalation), Category 4 • Skin irritation, Categories 2, 3 • Eye Irritation, Category 2A • Skin sensitization, Category 1 • Specific target organ toxicity following single exposure, Category 3 • Respiratory tract irritation • Narcotic effects
Health Hazard		• Respiratory sensitization, Category 1 • Germ cell mutagenicity, Categories 1A, 1B, 2 • Carcinogenicity, Categories 1A,1B, 2 • Reproductive toxicity, Categories 1A, 1B, 2 • Specific target organ toxicity following single exposure, Categories 1, 2 • Specific target organ toxicity following repeated exposure, Categories 1, 2 • Aspiration hazard, Categories 1, 2
Environmentally Damaging		• Acute hazards to the aquatic environment, Category 1 • Chronic hazards to the aquatic environment, Categories 1, 2

Safety data sheets have sixteen sections. The early sections, one through eight, focus on quick access to essential information that might be required by chemical handlers for safe handling practices or by emergency response personnel. Sections nine through eleven contain technical and scientific data, e.g., stability, reactivity, physical & chemical properties. Sections twelve through fifteen are not mandatory; however, they are required to be fully GHS compliant. The last section, section sixteen, contains information about the SDS itself, e.g., the revision date and changes since the last version.

SDS Information for Employers

Employers must ensure that employees have access to safety data sheets for all the hazardous chemicals they handle. Employers may fulfill this requirement in a variety of ways. For example, SDS binders are quite common as are computer based SDS databases. What is important is that employees have access to the safety data sheets for each chemical that they are using. If the employer does not have an SDS for one of these chemicals, they should contact the manufacturer to obtain the current version of the SDS for that chemical. In this sense, the online SDS databases have a clear advantage over binder-based systems since the database vendor usually takes care of indexing and updating the safety data sheets.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) LABELING SYSTEM

The Federal OSHA Hazard Communication Standard requires that the following information appear on a label at a minimum:

- The identity of the hazardous material(s)
- An appropriate hazard warning
  a. Signal words:
  DANGER – can cause immediate serious injury or death
  WARNING – can cause potentially serious injury or possible death
  CAUTION – can cause potentially moderate injury
  b. Symbols: *CORROSIVE, FLAMMABLE, or POISON*
  c. Pictograms – used to illustrate the type of PPE required, methods of fire extinguishment, and the like.
- The name and address of the manufacturer or distributor of the chemical.

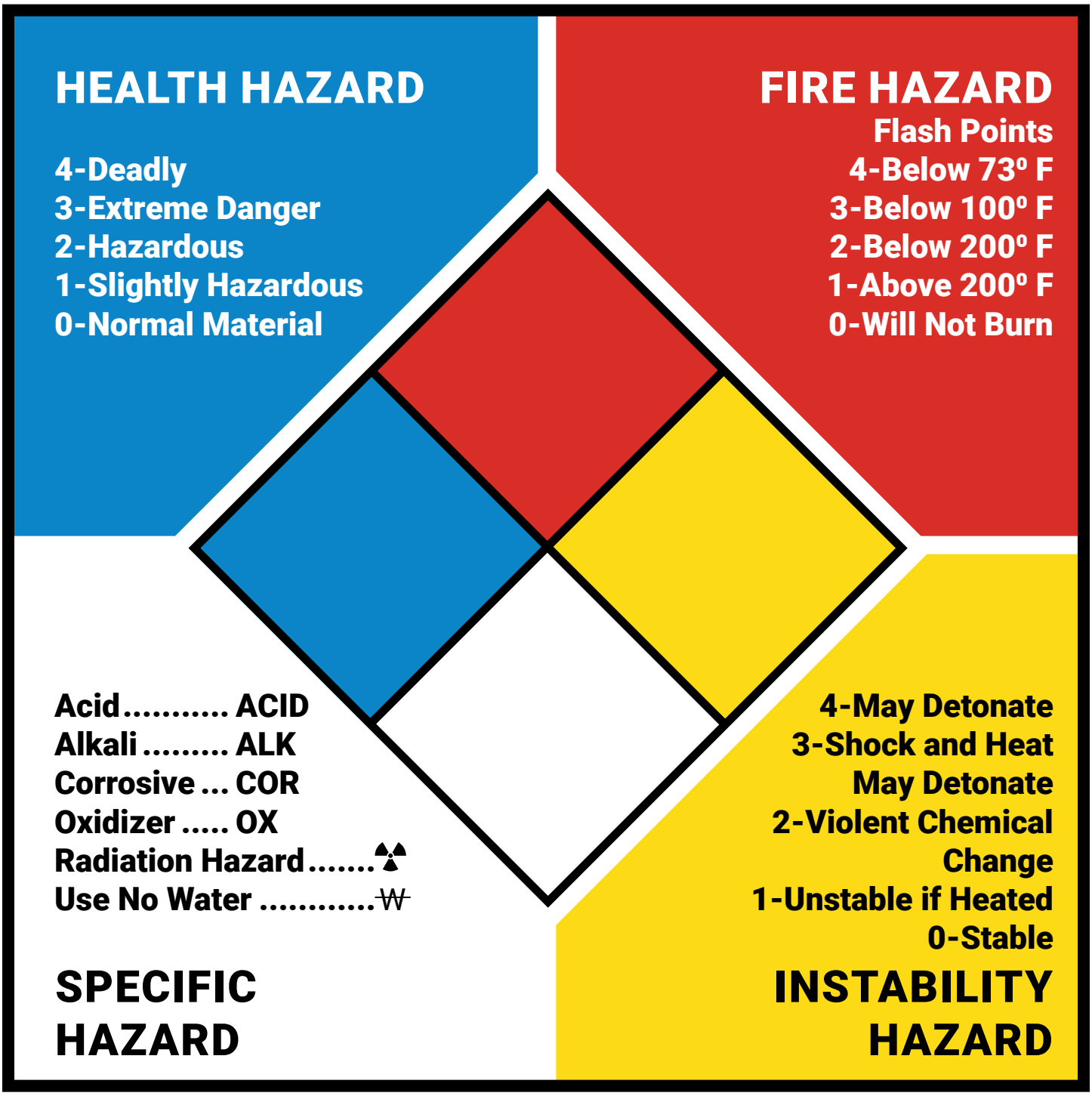
Voluntary requirements are:

- Statement of the hazard
- Precautionary measures
- First aid
- Methods of storage and handling
- Methods of handling spills and fires
- Manufacturer or distributor

THE NFPA LABELING SYSTEM:

Probably the most familiar system to be found on labels today is the “hazard diamond” of the NFPA 704M system. The diamond is divided into four quadrants, using these color codes: flammability (red), reactivity (yellow), and health hazard (blue). The white portion is used to issue specific warnings such as oxidizer, water reactive, etc. These quadrants are rated on a 0 to 4 basis with 0 meaning no effect and 4 an acute or immediately hazardous effect.

NFPA 704M LABELING SYSTEM DIAGRAM



NFPA Rating Explanation Guide

Rating Number	Health Hazard	Flammability Hazard	Instability Hazard
4	Can be lethal	Will vaporize and readily burn at normal temperatures	May explode at normal temperatures and pressures
3	Can cause serious or permanent injury	Can be ignited under almost all ambient temperatures	May explode at high temperature or shock
2	Can cause temporary incapacitation or residual injury	Must be heated or high ambient temperature to burn	Violent chemical change at high temperatures or pressures
1	Can cause significant irritation	Must be preheated before ignition can occur	Normally stable. High temperatures make unstable
0	No hazard	Will not burn	Stable

Rating Symbol	Special Hazard
ALK	Alkaline
ACID	Acidic
COR	Corrosive
OX	Oxidizing
	Radioactive
W	Reacts violently or explosively with water
W OX	Reacts violently or explosively with water and oxidizing

V. LABORATORY EMERGENCIES

Accidents may still happen despite a good safety program, adequate training, and proper use of precautions. To that end, the Blinn College District encourages students, faculty, and staff to be prepared:

- Start by knowing the layout of your lab and pay particular attention to the location of escape routes, alarms, and emergency equipment.
- Be familiar with Basic First Aid procedures.
- Be familiar with proper Automated External Defibrillator (AED) usage.
- Be familiar with proper Fire Extinguisher usage.
- Read and be familiar with the appropriate Safety Data Sheets (SDS) to learn the hazards of the chemicals you handle.
- The more knowledgeable you are, the better you'll be able to respond.

Should you experience an emergency within the laboratory, remember to:

1. Protect yourself from exposure.
2. Do not move the victim unless they are in immediate danger.
3. **DIAL 911** and stay on the line until dispatcher instructs you to disconnect.
4. Follow the emergency dispatcher's instructions regarding emergency medical assistance.
5. Keep the victim or injured person calm and still.

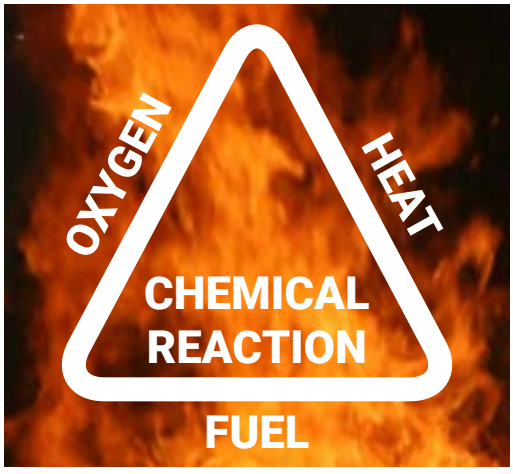
VI. FIRE SAFETY

<u>THE ANATOMY OF A FIRE</u>

All fires, no matter what type or size, are made of only three elements:

- Fuel – Fire is a very fast oxidation reduction reaction. The fuel is the reducing agent. Under the proper conditions, almost anything can burn.
- Oxidizer – Oxidizers support a fire. While available oxygen is the most common oxidizer, it is hardly the only one.
- Temperature – Fire, like any chemical reaction, needs the right conditions to initiate and remain burning. While burning, fuel sources usually generate enough heat to keep the fire going.

Remove any of these three elements and a fire will be extinguished…



FIGHTING A FIRE

It is unlikely that you will be able to remove the fuel source from a fire without burning yourself. The most effective method for extinguishing a fire is to smother it. This will eliminate the oxygen and aid in cooling the reaction.

For a small fire inside a beaker or other container, putting a lid over the container will smother it. You can also use inert materials such as sand, kitty litter or sodium bicarbonate.

For large fires, you will need a fire extinguisher. When choosing to use a fire extinguisher, consider the following:

- Fight or flee? – Your safety is the most important consideration. Do not fight the fire if:
  a. There is any possibility you will be trapped by the fire or smoke
  b. There is considerable heat
  c. There is a significant amount of smoke or fumes
  d. You are physically unable or unfit to fight the fire
- Call the fire department – Before fighting a fire, immediately designate a specific individual to evacuate the science laboratory and one to call 911 for Fire and EMS response.
- Choose the correct extinguisher - There are different types of extinguishers for the different class of fires. The wrong extinguisher may make the fire worse. Blinn College District science laboratories are equipped with ABC fire extinguishers. This type of extinguisher is designed for paper, wood, flammable liquids, grease, and electrical fires.

Evacuation floor plans are available in each laboratory, and fire extinguisher training and/or familiarization is required by all faculty and designated staff as close to hire as possible and before conducting laboratory exercises.

USING A FIRE EXTINGUISHER

The acronym to remember while operating a fire extinguisher is **PASS:**

- **PULL** the pin. Point the nozzle away from you and release the locking mechanism.
- **AIM** low. Hold the extinguisher upright. Aim at the base of the flame. Remain 6-10 feet away. If you're too close, you'll hit the fire with enough force to scatter it. If you're too far away, you may not reach the fire with enough material.
- **SQUEEZE** the trigger. Be prepared. The extinguishing agent may come out with considerable force and noise. Most portable extinguishers will last for only 15 to 30 seconds. You can prolong the effective firefighting time if you use short, controlled, bursts. If aimed well, these can be very effective.
- **SWEEP** side-to-side. Drive the fire back. As you extinguish the fire closest to you, move forward, but continue the sweeping motion.

WAYS TO STOP FIRE ON A PERSON

You must act quickly and calmly. Here are the steps you should take:

- Drop and roll – lying of the fire smothers it. You can do this right where you are. It's fast and effective.
- Remove burning clothing – it is a way to remove unburned fuel from the fire.
- Smother the fire – cover the burning area with a lab coat, other NON-PLASTIC garment, or fire blanket. Lie down on the floor at the same time. **Do not wrap a fire blanket around yourself while you're standing up.** This creates a chimney. Hot air from the fire will rise and draw fresh, oxygenated air from below.
- Douse the fire with water or an inert solid as a LAST RESORT. Avoid exposing eyes, mouth, nose, and

the rest of your face to the extinguishing material. Fires caused by water reactive chemicals require special action. Proper equipment and training are required.

VII. LABORATORY VENTILATION EQUIPMENT

Ventilation in a laboratory is a very important aspect of laboratory safety. General room exhaust is not sufficient to protect the laboratory worker who uses hazardous chemicals, works with biological agents or uses equipment that generates excess heat. Additional engineering controls are required.

CHEMICAL FUME HOODS

Chemical fume hoods provide primary containment in a chemical laboratory. They exhaust toxic, flammable, noxious, or hazardous fumes and vapors by capturing, diluting, and removing these materials. Fume hoods also provide physical protection against fire, spills, and explosions.

For optimum performance and most effective protection, chemical fume hoods should be located away from doorways, supply air vents, and high-traffic areas. Air currents created by passers-by can cause turbulence in a fume hood, which can result in contaminated air being drawn back out of the hood and into the room.

Similarly, a supply air vent located directly above a fume hood can also cause turbulence in the hood.

Blinn College District requires that all chemical fume hoods be ducted to the outside of the building and operate with an average face velocity that is consistent with industry standards. The acceptable range for the average face velocity of a general-purpose chemical hood is 95 – 120 feet per minute (fpm). The minimum face velocity at any single measuring point should be at least 80 fpm. (The face of the hood is the opening created when the hood sash – the movable glass window at the front of the hood – is in the open position.)

TYPES OF FUME HOODS

1. **Standard Fume Hoods:** (aka Constant Air Volume (CAV) fume hoods) These hoods exhaust a constant volume of air. The velocity of the air passing through the face of a standard fume hood is inversely related to the open face area. Thus, if the sash is lowered, the inflow air velocity increases.

   IMPORTANT: *Face velocity that is too high may cause turbulence, disturb sensitive apparatus, or extinguish Bunsen burners.*

2. **Bypass Fume Hoods:** Bypass fume hoods are also constant air volume hoods, but with an improved design. These hoods are designed with a grille-covered opening above the sash. When opened, the sash blocks the grille and does not allow air through. However, as the sash is lowered, air is drawn through the grille, allowing a constant exhaust volume without increasing the velocity of air at the face of the hood. This design helps keep the room ventilation system balanced and helps eliminate the problems with turbulence that high face velocity can cause.

3. **Auxiliary Air Fume Hoods:** Auxiliary air fume hoods are also known as "supplied air" or "make-up air" hoods. They use an outside air supply for 50% to 70% of the hood's exhaust requirements. This type of hood is designed to reduce utility costs and conserve energy by reducing the amount of conditioned room air that is pulled through the hood. One disadvantage, however, is that additional ductwork and fans increase the overall cost of these hoods. Also, if the supplied air is tempered, the energy savings is negated, while if it is not Diagram of a Bypass Fume Hood (Left – with sash open; Right – with sash lowered) 5-8 tempered, the user may be working under hot or cold air, depending on the season. Untempered air may also cause condensation in the hood, which can lead to rusting of the hood. The face velocity of an auxiliary air fume hood may vary.

4. **Variable Air Volume Fume Hoods:** Just as their name suggests, variable air volume (VAV) hoods are designed to vary the amount of air being exhausted from the fume hood based on the sash position. By varying the exhausted air, these hoods are able to maintain a constant face velocity, no matter where the sash is positioned. VAV hoods are often equipped with an audio/visual alarm to notify the user if the hood is not operating properly.

5. **Special Fume Hoods:** Special fume hoods are necessary when working with certain chemicals and operations. Examples of special fume hoods include the following:
   a. ***Perchloric acid fume hoods:*** Anyone working with perchloric acid must use a perchloric acid fume hood. These special fume hoods are equipped with a water spray system to wash down the entire length of the exhaust duct, the baffle, and the wall of the hood. Perchloric acid vapors can condense on the hood ductwork, forming dangerous, explosive metal perchlorates. Also, perchloric acid can react with organic materials to form organic perchlorates, which are also explosive. For

this reason, organic solvents should never be used or stored in a perchloric acid fume hood, and the hood should be labeled **"Perchloric Acid Use Only; No Organic Chemicals"**. The water wash down system, used periodically or after each use of the hood, removes any perchlorates or organic materials that may have accumulated in the hood exhaust system. The wash down system should be activated only when the exhaust fan has been turned off, so that complete coverage can be achieved.

b. ***Walk-in hoods:*** These fume hoods have single vertical sashes or double vertical sashes and an opening that extends to the floor. These hoods are typically used to accommodate large pieces of equipment.

<u>Fume Hood Safety Considerations</u>

The potential for glass breakage, spills, fires, and explosions is great within a fume hood. To ensure safety and proper fume hood performance, follow these guidelines:

1. Know how to properly operate a fume hood before beginning work.
2. Fume hoods provide the best protection when the fume hood sash is in the closed position.
3. Inspect the fume hood before starting each operation, including any airflow monitors. Do not use the hood if it is not functioning properly; *call BCD Safety & Risk Management to schedule an inspection.*
4. Keep traffic in front of the fume hood to a minimum and walk slowly when passing by the hood, especially when work is being conducted in the hood. This will reduce the likelihood of creating turbulence in the hood.
5. Use the appropriate type of hood for the work being conducted. For example, when using perchloric acid, use a perchloric acid fume hood.
6. Keep the area in front of the hood clear of obstructions. This will allow room for laboratory workers to move about and will allow sufficient airflow to the hood.
7. Place equipment and chemicals at least six inches behind the fume hood sash. This practice reduces the chance of exposure to hazardous vapors.
8. Do not allow equipment and chemicals to block baffle openings. Blocking these openings will prevent the hood from operating properly. Keep loose paper out of the fume hood. Paper or other debris that enter the exhaust duct of the hood can interfere with the hood's ventilation.
9. Do not store excess chemicals or equipment in fume hoods.
10. Elevate any large equipment within the hood at least three inches to allow proper ventilation under the equipment.
11. When working in a fume hood, set the sash at the lowest working height, about 12 – 15 inches from the base of the hood opening. Close the sash completely when no one is standing at the hood working in it. The only time the sash should be completely open is while setting up equipment. ***IMPORTANT:*** *A fume hood's sash is designed to protect the user from dangerous chemical gases and vapors, chemical splashes and potentially flying debris. The sash should be positioned to protect the user's face, neck and upper body. The lower the sash position, the more area of the user's body will be protected.*
12. Do not defeat sash stops by removing them or altering their design or function.
13. Wear personal protective equipment, including protective eyewear, as appropriate. The hood does not replace PPE.
14. Keep laboratory doors closed. Laboratory ventilation systems are designed to operate with the doors closed.
15. Do not alter/modify the fume hood or associated duct work. If additional equipment needs to be ventilated, *contact Blinn College District Safety & Risk Management.*
16. Clean up spills in the hood immediately. ***IMPORTANT:*** *If a power failure or other emergency occurs (e.g., building fire or fire within the fume hood), close the fume hood sash and ensure safe shutdown of the lab, paying special attention to equipment that may be reenergized when power is restored.*

Fume Hood Inspections

Fume hoods should and will be tested at least semi-annually by Blinn College District Safety & Risk Management.

Fume hoods should also be tested in the following circumstances:

- When an employee requests an inspection.
- After major repair work.
- After a fume hood is moved.

Fume hood testing includes measuring the velocity of airflow through the face of the hood as well as a general inspection of the hood's condition (sash, lighting, noise level, etc.). If you suspect a problem with your fume hood, contact Blinn College District Safety & Risk Management.

OTHER LABORATORY VENTILATION SYSTEMS

Biological Safety Cabinets (BSCs) BSCs provide containment for pathogenic materials and are not intended for use as a chemical fume hood. When used and maintained correctly, Class II biosafety cabinets protect the user from exposure to harmful biological agents and also protect the product from contamination by filtering the air inside the cabinet through High Efficiency Particulate Air (HEPA) filters. Before using a biological safety cabinet, laboratory personnel should be thoroughly trained on how to properly use and maintain the cabinet.

Follow these instructions for safe use of a biological safety cabinet:

a. Only biosafety cabinets that are certified according to National Sanitation Foundation (NSF) Standard # 49 may be used with pathogenic or recombinant DNA materials. BSCs must be certified upon installation, upon being moved, after major repair, and at least annually.
    i. BSC and laminar flow hoods are managed by Blinn College District Facilities Maintenance. Contact the appropriate campus location Facilities Maintenance office for additional information.
    ii. BSCs that are not certified annually or that fail certification will be tagged "Not Safe For Use With Pathogens."
b. Locate biosafety cabinets away from doorways and high traffic areas. As with chemical fume hoods, rapid movement in or near the cabinet can create turbulence, causing contaminants to be drawn out of the cabinet and into the general laboratory area.
c. Restrict entry into the laboratory when work is being conducted in the BSC.
d. Turn off UV light before beginning work in a BSC.
e. Disinfect the biosafety cabinet prior to beginning and after completing work in the cabinet.
f. Allow cabinet to operate without activity at least 15-20 minutes before and after use. This will allow all the air in the cabinet to circulate through the HEPA filters, removing any contaminants that may be present.
g. Keep the BSC clear of clutter and loose paper. Only place items that are needed in the cabinet.
h. Keep clean items and dirty items segregated in the BSC.
i. Provide a waste container inside of the cabinet and keep it covered.
j. Always wear appropriate personal protective equipment.
k. Keep face away from the BSC opening.
l. Never use a Bunsen burner in a biosafety cabinet. Dangerous levels of gas can build up in the cabinet. Also, heat from the open flame can damage the HEPA filters.
m. Clean up spills in the BSC immediately.

Glove Boxes

Glove boxes are designed to be leak-tight and can be used with highly toxic or air-reactive chemicals and materials. Some glove boxes may also be appropriate for use with some radioactive materials. The leak-tight design provides a controlled atmosphere, protecting both the product and the worker by preventing vapors/ moisture, gases, and particulates from entering or leaving the box.

VIII. SAFETY INSPECTION AND EQUIPMENT MAINTENANCE

Be mindful that most laboratory accidents can be prevented through proper space utilization, good housekeeping, proactive equipment maintenance protocols.

Proper Space Utilization:

There should be enough space in the laboratory to allow for students to move about with ease and with no overcrowding issues.

- Classroom capacity for non-fixed seating (e.g., tables and chairs) is determined using 15 net square footage per person. The net floor space of a room is determined by deducting the square footage for permanently fixed counter, furnishing, etc., from the gross square footage of the room. As an example, a 1050 net square foot classroom, using table and chairs, could accommodate 70 students per Life Safety Codes.

Housekeeping:

- Keep aisles clear of clutter to eliminate tripping hazards and to maintain a clear exit path in the event of an emergency.
- Dispose of empty boxes and other unneeded items that take up space in the work environment.
- Keep bench tops clear of clutter. Properly store chemicals and sharps when they are not in use and when preparing for the next laboratory class or closing out for the day. *A clear workspace will reduce the likelihood of accidental contact with hazardous items.*
- Clean-up spills, no matter the size, immediately.
- Replace bench liners regularly or when they become soiled or contaminated.

Missing, Defective, or Inoperative Equipment:

Every inspection of a working science laboratory should include an inspection of all safety and laboratory equipment, including the state of repair. Properly functioning life safety devices and laboratory equipment is the first priority regarding an “attitude of safety.”

- Electrical equipment – make sure cords and plugs are free of damage. Ensure outlets, power strips, and main circuits are not overloaded.
- Fire-fighting equipment – the best fire extinguisher for the laboratory is the ABC dry chemical-type, usually charged with ammonium phosphate. Carbon dioxide extinguishers should be reserved for the areas where electronic balances, spectrophotometers, and other delicate instruments are kept. Sand or clay-based “kitty litter” is also effective at smothering fires and/or absorbing spills.
- Eyewash Stations – Well-maintained eyewash stations are an essential laboratory safety component. Water shall be run through them at regularly intervals to keep bacteria growth in stagnant water to a minimum. Squeeze bottle eyewashes have a function as a supplementary form of protection but should not be the primary eye protective device. Most Safety Data Sheets (SDSs) will advise that

the eyes should be irrigated for a minimum of 15 minutes, upon exposure. Be mindful that squeeze bottle eyewashes can become contaminated after sitting for a semester or longer and can only be utilized to irrigate one eye at a time, which may allow damage to non-irrigated eye.

- Safety showers – safety showers should be well marked and kept free from all obstructions any time the laboratory is in use. Safety showers should be flushed at regular intervals to clear water lines of stagnant water.
- Spill kits – spill kits are available for acid and base spills, and biological fluids.
- Fire blankets – fire blankets may be used for throwing over small fires, wrapping the victim in shock, or may even serve as a makeshift litter.
- Detectors/Alarms – Smoke detectors may have limited value in the laboratory or stockroom because a fire is most likely well-engaged before standard smoke alarms activate. Detectors sensitive to heat change are recommended, as are those that pick up the release of certain gases associated with chemical fires.
- Ventilation – adequate ventilation is perhaps the most important safety feature in the science laboratory. A source of fresh air, free of fumes and vapors, is essential to the well-being of you and your students. The efficiency of a fume hood is measured by the air velocity in various areas of the hood in linear feet per minute.

SAFETY EQUIPMENT MAINTENANCE SCHEDULES

All safety equipment in the science laboratories is on scheduled maintenance programs and results are documented and maintained on permanent file with the Blinn College District Safety and Risk Management Director's office.

The following tests are performed, *at a minimum*, each semester:

- Air Quality – formaldehyde monitoring
- Fume Hood – air flow and function check
- Emergency Shower – flush
- Emergency Eyewash – flush
- Smoke Alarm/Detector – function check
- Master Switches – function check
- Ceiling exhaust fan – air flow check
- Fire Extinguisher – inspection
- Automated External Defibrillator (AED) – inspection

IX. CHEMICAL SAFETY AND HYGIENE PLAN

Chemical Safety and Hygiene

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

a. Wash hands frequently and before leaving the laboratory. Also, wash hands before eating, drinking, smoking or applying makeup.
b. Wear appropriate personal protective equipment (PPE). Always wear protective gloves when handling any hazardous chemicals.
c. Remove PPE before leaving the laboratory and before washing hands.
d. Remove contaminated clothing immediately. Do not use the clothing again until it has been properly decontaminated.
e. Follow any special precautions for the chemicals in use.

f. Do not eat, drink, smoke or apply makeup around chemicals.
g. Tie back long hair when working in a laboratory or around hazardous chemicals.
h. Do not keep food, beverages, or food and beverage containers anywhere near chemicals or in laboratories where chemicals are in use.
i. Do not use laboratory equipment, including laboratory refrigerators/freezers, to store or serve food or drinks.
j. Do not wash food and beverage utensils in a laboratory sink.
k. Do not sniff or taste chemicals.
l. Do not touch doorknobs, telephones, computer keyboards, etc. with contaminated gloves.
m. Any dangling jewelry that may interfere with free movement or come into contact with the work surface must be removed.

TYPES OF CHEMICAL HAZARDS

CORROSIVES: Corrosive chemicals destroy or damage living tissue by direct contact. Some acids, bases, dehydrating agents, oxidizing agents, and organics are corrosives. Examples of the different types of corrosive chemicals are listed below:

- Acidic corrosives:
  - Inorganic Acids
    - Hydrochloric acid
    - Nitric Acid
    - Sulfuric acid
  - Organic Acids
    - Acetic Acid
    - Propionic acid
- Alkaline, or basic, corrosives:
  - Sodium hydroxide
  - Potassium hydroxide
- Corrosive dehydrating agents:
  - Phosphorous pentoxide
  - Calcium oxide
- Corrosive oxidizing agents:
  - Halogen gases
  - Hydrogen peroxide (concentrated)
  - Perchloric acid
- Organic corrosive:
  - Butylamine

Health Consequences

Extreme caution should be taken when handling corrosive chemicals, or severe injury may result.

a. Concentrated acids can cause painful and sometimes severe burns.
b. Inorganic hydroxides can cause serious damage to skin tissues because a protective protein layer does not form. Even a dilute solution such as sodium or potassium hydroxide can saponify fat and attack skin.
c. At first, skin contact with phenol may not be painful, but the exposed area may turn white due to the severe burn. Systemic poisoning may also result from dermal exposure.
d. Skin contact with low concentrations of hydrofluoric acid (HF) may not cause pain immediately but can still cause tissue damage if not treated properly. Higher concentrations of HF (50% or greater) can cause immediate, painful damage to tissues.

Safe Handling Guidelines for Corrosives

To ensure safe handling of corrosives, the following special handling procedures should be used:

a. Always store corrosives properly. Segregate acids from bases and inorganics from organics. Refer to the Chemical Storage section of this chapter for more information.
b. Always wear a laboratory coat, gloves and chemical splash goggles when working with corrosives. Wear other personal protective equipment, as appropriate.
c. To dilute acids, carefully add the acid to the water, not the water to the acid. This will minimize any reaction.
d. Corrosives, especially inorganic bases (e.g., sodium hydroxide), may be very slippery; handle these chemicals with care and clean any spills, leaks, splashes, or dribbles immediately.
e. Work in a chemical fume hood when handling fuming acids or volatile irritants (e.g., ammonium hydroxide).
f. A continuous flow eye wash station should be in every work area where corrosives are present. An emergency shower should also be within 55 feet of the area.

Corrosive Example: Perchloric Acid

Perchloric acid is a corrosive oxidizer that can be dangerously reactive. At elevated temperatures, it is a strong oxidizing agent and a strong dehydrating reagent. Perchloric acid reacts violently with organic materials. When combined with combustible material, heated perchloric acid may cause a fire or explosion. Cold perchloric acid at less than 70% concentration is not a very strong oxidizer, but its oxidizing strength increases significantly at concentrations higher than 70%. Anhydrous perchloric acid (>85%) is very unstable and can decompose spontaneously and violently.

When using perchloric acid, remember the following:

a. Be thoroughly familiar with the special hazards associated with perchloric acid before using it.
b. If possible, purchase 60% perchloric acid instead of a more concentrated grade.
c. Always wear rubber gloves and chemical splash goggles while using perchloric acid. Consider also wearing a face shield and rubber apron if splashing is likely.
d. Store perchloric acid inside secondary containment (such as a Pyrex dish) and segregated from all other chemicals and organic materials. Do not store bottles of perchloric acid in wooden cabinets or on spill paper.

IMPORTANT: *Heated digestions with perchloric acid require a special fume hood with a wash-down system. A perchloric acid fume hood should also be used when handling highly concentrated (greater than 70%) perchloric acid. Refer to the "VII. Laboratory Ventilation Equipment" section for more information on these hoods.*

FLAMMABLES

A flammable chemical is any solid, liquid, vapor, or gas that ignites easily and burns rapidly in air. Consult the appropriate SDS before beginning work with flammables.

Flash Point, Boiling Point, Ignition Temperature, and Class

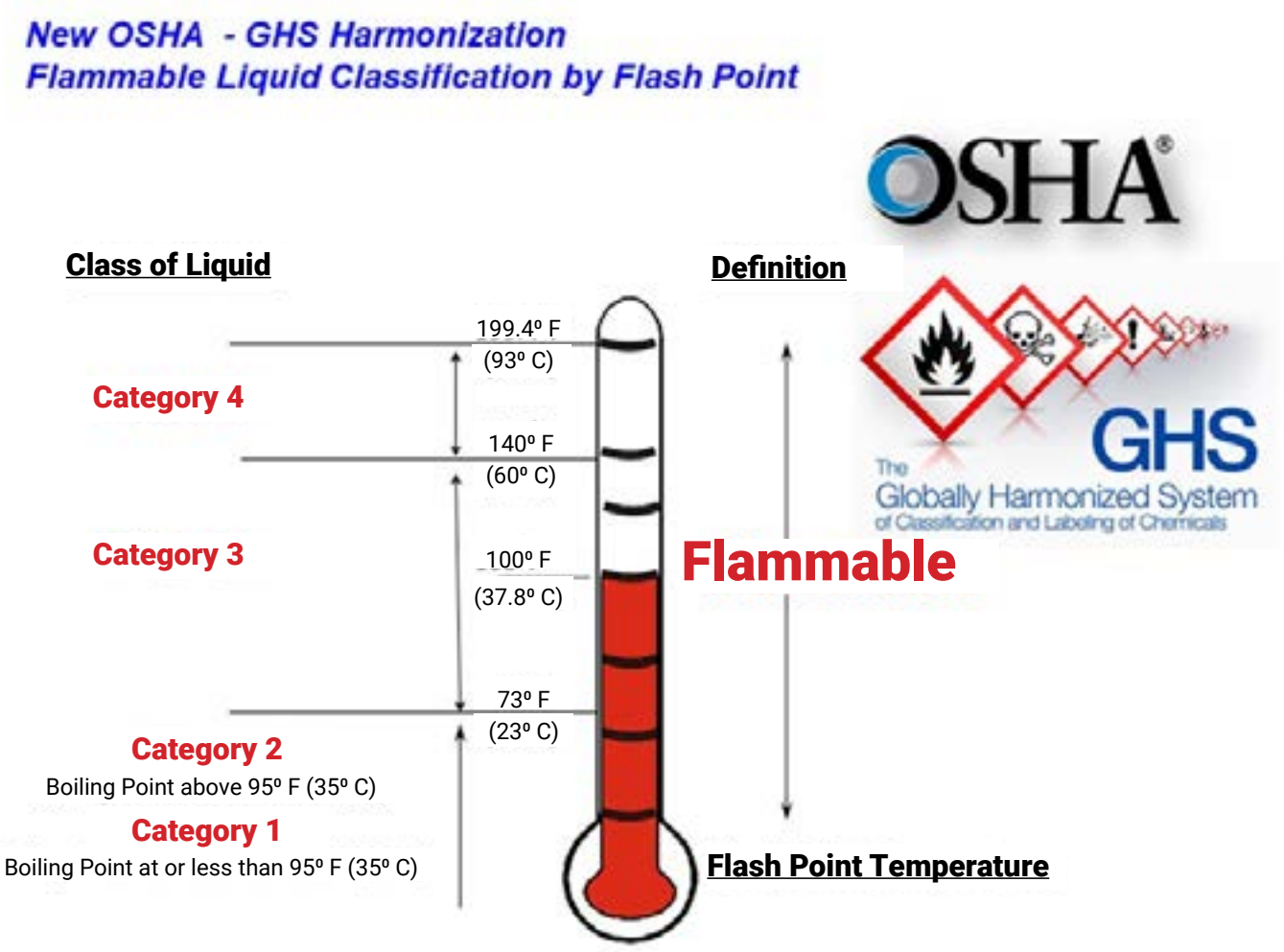
Flammable chemicals are classified according to flash point, boiling point, fire point, and auto-ignition temperature.

a. *Flash Point (FP)* is the lowest temperature at which a flammable liquid's vapor burns when ignited.
b. *Boiling Point (BP)* is the temperature at which the vapor pressure of a liquid is equal to the

atmospheric pressure under which the liquid vaporizes. Flammable liquids with low BPs generally present special fire hazards.

c. *Fire Point* is the temperature at which the flammable liquid will burn.
d. *Auto-ignition* Temperature is the lowest temperature at which a substance will ignite without an ignition source.

The following table provides Flammable Liquid Classifications:



Safe Handling Guidelines for Flammables

a. Handle flammable chemicals in areas free from ignition sources.
b. Never heat flammable chemicals with an open flame. Use a water bath, oil bath, heating mantle, hot air bath, hot plate, etc. Such equipment should be intrinsically safe, with no open sparking mechanisms.
   ***NOTE:** When using an oil bath, make sure the temperature is kept below the oil flash point.*
c. Use ground straps when transferring flammable chemicals between metal containers to avoid generating static sparks.
d. Work in an area with good general ventilation and use a fume hood when there is a possibility of dangerous vapors. Ventilation will help reduce dangerous vapor concentrations, thus minimizing this fire hazard.
e. Restrict the amount of stored flammables in the laboratory, and minimize the amount of

flammables present in a work area.

NOTE: The NFPA has established formal limits on the total amounts of flammable liquids that may be stored or used in laboratories. (NFPA 30 and 45)

Storage Grouping by Flash Point	NFPA Fire Diamond Number	NFPA 30 Classifications	Fire Area Storage Limits	
			Maximum Storage Outside Fire Cabinet	Maximum Storage Inside Fire Cabinet *
Group I (Flammable or Combustible liquids with a flash point of <140ºF)	4 3 2 with F.P.<140ºF	IA IB IC II	10 gallons in containers or 25 gallons in safety cans	60 gallons
Group II (Combustible liquid with a flash point of ≥140ºF and <200ºF)	2 with F.P.≥140ºF and <200ºF	IIIA	60 gallons	120 gallons minus the # of gallons of Group I liquids in cabinet
Group I (Combustible liquid with a flash point of ≥200ºF)	1	IIIB	No limit	No limit
* Maximum of three fire storage cabinets per fire area.				

f. Only remove from storage the amount of chemical needed for a particular experiment or task.

SOLVENTS

Organic solvents are often the most hazardous chemicals in the workplace. Solvents such as ether, alcohols, and toluene, for example, are highly volatile and flammable. Perchlorinated solvents, such as carbon tetrachloride (CCl4), are non-flammable. But most hydrogen-containing chlorinated solvents, such as chloroform, are flammable. When exposed to heat or flame, chlorinated solvents may produce carbon monoxide, chlorine, phosgene, or other highly toxic gases.

Always use volatile and flammable solvents in an area with good ventilation or preferably in a fume hood. Never use ether or other highly flammable solvents in a room with open flames or other ignition sources present, including non-intrinsically safe fixtures.

Solvent Exposure Hazards

Health hazards associated with solvents include exposure by the following routes:

- Inhalation of a solvent may cause bronchial irritation, dizziness, central nervous system depression, nausea, headache, coma, or death. Prolonged exposure to excessive concentrations of solvent vapors may cause liver or kidney damage. The consumption of alcoholic beverages can enhance these effects.
- Skin contact with solvents may lead to defatting, drying, and skin irritation.
- Ingestion of a solvent may cause sever toxicological effects. Seek medical attention immediately.

The odor threshold for the following chemicals exceeds acceptable exposure limits. Therefore, if you can smell it, you may be overexposed — increase ventilation immediately! Examples of such solvents are:

- Chloroform
- Benzene
- Carbon tetrachloride
- Methylene chloride

NOTE: *Do not depend on your sense of smell alone to know when hazardous vapors are present. The odor of some chemicals is so strong that they can be detected at levels far below hazardous concentrations (e.g., xylene).*

Some solvents (e.g., benzene) are known or suspected carcinogens.

Reducing Solvent Exposure

To decrease the effects of solvent exposure, substitute hazardous solvents with less toxic or hazardous solvents whenever possible. For example, use hexane instead of diethyl ether, benzene or a chlorinated solvent.

Solvent Example: DMSO

Dimethyl sulfoxide (DMSO) is unique because it is a good solvent with many water-soluble as well as lipid-soluble materials. Due to these properties, dimethyl sulfoxide is rapidly absorbed and distributed throughout the body.

DMSO can facilitate absorption of other chemicals – such as grease, oils, cosmetics – that may contact the skin.

- While DMSO alone has low toxicity, when combined with other, more toxic chemicals it can cause the more toxic chemical to be absorbed more readily through the skin.
- Some medications, such as liniment, also contain DMSO.

While relatively stable at room temperature, DMSO can react violently to other chemicals when heated.

Wear impervious clothing and personal protective equipment (laboratory coat, gloves, etc.) to prevent skin exposure. Use chemical splash goggles and/or a face shield if splashing may occur.

TOXINS AND IRRITANTS

The toxicity of a chemical refers to its ability to damage an organ system (kidneys, liver), disrupt a biochemical process (e.g., the blood-forming process) or disrupt cell function at some site remote from the site of contact. Any substance, even water, can be harmful to living things under the right conditions.

The biological effects – whether beneficial, indifferent or toxic – of all chemicals are dependent on a number of factors, including:

- Dose (the amount of chemical to which one is exposed)
- Duration of exposure (both length of time and frequency)
- Individual response history, including exposure to other chemicals
- Mixing toxin(s) with other chemicals
- Route of entry:
  - Ingestion
  - Absorption through the skin
  - Inhalation
  - Injection

  NOTE: *Dermal absorption and inhalation are most common routes of exposure within laboratories.*

The most important factor in toxicity is the dose-time relationship. Exposure to any toxic chemical should be minimized. In general, the more toxin to which an individual is exposed, and the longer they are exposed to it, the stronger their physiological response will be. However, an individual's response can also depend on several other factors, including:

- Health
- Gender
- Chemical mixtures (Combinations OFTEN increase toxicity)
- Genetic predisposition
- An individual's exposure to other chemicals
- Previous sensitization

NOTE: *When a person becomes sensitized to a chemical, each subsequent exposure may often produce a stronger response than the previous exposure.*

General Safe Handling Guidelines

a. Read the appropriate SDS.
b. Be familiar with the chemical's exposure limits.
c. Use a chemical fume hood.
d. Always wear appropriate PPE.
e. Never eat, drink, or use tobacco products around toxins or store them near any hazardous chemicals.
f. Avoid touching your face or other exposed skin with contaminated gloves or other contaminated materials.
g. Store toxic gases in a gas exhaust cabinet.

Acute Toxins vs. Chronic Toxins

The dose-time relationship forms the basis for distinguishing between acute toxicity and chronic toxicity.

The acute toxicity of a chemical is its ability to inflict bodily damage from a single exposure. A sudden, high-level exposure to an acute toxin can result in an emergency situation, such as a severe injury or even death.

Examples of acute toxins include the following:

- Hydrogen cyanide
- Hydrogen sulfide
- Nitrogen dioxide
- Ricin
- Organophosphate pesticides
- Arsenic
  IMPORTANT: *Do not work alone when handling acute toxins. Use a fume hood to ensure proper ventilation, or wear appropriate respiratory protection if a fume hood is not available.*

Chronic toxicity refers to a chemical's ability to inflict systemic damage as a result of repeated exposures, over a prolonged time period, to relatively low levels of the chemical. Such prolonged exposure may cause severe injury. Examples of chronic toxins include the following:

- Mercury
- Lead
- Formaldehyde

Some chemicals are extremely toxic and are known primarily as acute toxins. Some are known primarily as chronic toxins. Others can cause either acute or chronic effects.

The toxic effects of chemicals can range from mild and reversible (e.g. a headache from a single episode of inhaling the vapors of petroleum naphtha that disappears when the victim gets fresh air) to serious and irreversible (liver or kidney damage from excessive exposures to chlorinated solvents). The toxic effects from chemical exposure depend on the severity of the exposures. Greater exposure and repeated exposure generally lead to more severe effects.

<u>Types of Toxins</u>

Carcinogens are materials that can cause cancer in humans or animals. Several agencies including OSHA (Occupational Safety & Health Administration), NIOSH (The National Institute for Occupational Safety and Health), and IARC (International Agency for Research on Cancer) are responsible for identifying carcinogens. There are very few chemicals known to cause cancer in humans, but there are many suspected carcinogens and many substances with properties similar to known carcinogens.

Examples of known carcinogens include the following:

- Asbestos
- Benzene
- Tobacco smoke
- Hexavalent Chromium
- Aflatoxins

Zero exposure should be the goal when working with known or suspected carcinogens. Workers who are routinely exposed to carcinogens should undergo periodic medical examinations.

Reproductive toxins are chemicals that can adversely affect a person's ability to reproduce. **Teratogens** are chemicals that adversely affect a developing embryo or fetus. Heavy metals, some aromatic solvents (benzene, toluene, xylenes, etc.), and some therapeutic drugs are among the chemicals that can cause these effects. In addition, the adverse effects produced by ionizing radiation, consuming alcohol, using nicotine, and using illicit drugs are recognized. While some factors are known to affect human reproduction, knowledge in this field (especially related to the male) is not as broadly developed as other areas of toxicology. In addition, the developing embryo is most vulnerable during the time before the mother knows she is pregnant.

Therefore, it is prudent for all persons with reproductive potential to minimize chemical exposure.

Sensitizers may cause little or no reaction upon first exposure. Repeated exposures may result in severe allergic reactions.

Examples of sensitizers include the following:

- Isocyanates
- Nickel salts
- Beryllium compounds
- Formaldehyde
- Diazomethane
- Latex

NOTE: *Some people who often use latex-containing products may develop sensitivity to the latex. A sensitized individual's reaction to latex exposure can eventually include anaphylactic shock, which can result in death. To minimize exposure to latex, use non-latex containing gloves, such as nitrile gloves.*

Irritants cause reversible inflammation or irritation to the eyes, respiratory tract, skin, and mucous membranes. Irritants cause inflammation through long-term exposure or high concentration exposure. For the purpose of this section, irritants do not include corrosives.

Examples of irritants include the following:

- Ammonia
- Formaldehyde
- Halogens
- Sulfur dioxide
- Poison ivy
- Phosgene
- Dust
- Pollen
- Mold

Mutagens can alter DNA structure. Some mutagens are also carcinogens. Examples of mutagens are:

- Ethidium bromide
- Nitrous acid
- Radiation

Neurotoxins are chemicals that affect the nervous system. Examples of neurotoxins include:

- Methanol
- Many snake and insect venoms
- Botulinum toxin

<u>REACTIVES AND EXPLOSIVES</u>

Reactive chemicals may be sensitive to either friction or shock, or they may react in the presence of air, water, light, heat, or other chemicals. Some reactive chemicals are inherently unstable and may quickly decompose on their own, releasing energy in the process. Others form toxic gases when reacting. Explosive chemicals decompose or burn very rapidly when subjected to shock or ignition. Reactive and explosive chemicals produce large amounts of heat and gas when triggered, and thus are extremely dangerous.
Follow these guidelines when handling and storing reactive and explosive chemicals:

a. Read the appropriate SDS and other pertinent fact sheets on the chemical. Be familiar with

chemical specific handling and storage requirements.

b. Follow Standard Operating Procedures and to have a Plan of Action established for how to handle emergency situations.
c. Isolate the chemical from whatever causes a reaction.
    i. Store reactives separate from other chemicals.
    ii. Store reactives in a cool/dry area.
    iii. Keep reactive chemicals out of sunlight and away from heat sources.
d. Know where emergency equipment is located and how to use it.

CHEMICAL STORAGE GUIDELINES

Proper chemical storage is a key component in laboratory safety. The following are general rules or storage:

ALWAYS:

- Make certain all chemicals are labeled clearly to identify contents.
- Physically separate incompatible chemicals.
- Segregate by hazard class.
- Date when received and again when opened.
- Keep exits, passageways, areas under benches and desks, and emergency equipment free of stored equipment and materials.

NEVER:

- Store chemicals on benches.
- Store chemicals in fume hoods or under sinks.
- Expose chemicals to heat or direct sunlight.
- Store hazardous materials above shoulder height.

HAZARD SPECIFIC STORAGE RULES:

Health Hazards:

- Separate toxins and poisons from other chemicals in a Blue color-coded location or use a poison cabinet.

Oxidizers:

- Store in Yellow color-coded location.
- Store large bottles on the lower shelves of a corrosive cabinet.
- Segregate acid oxidizers from organic acids, flammable and combustible materials.
- Segregate acids from bases and active metals.

Corrosives/Sensitizers:

- Store in White color-coded location.
- Store water-reactive chemicals in a cool and dry place.
- Store oxidizers away from flammables, combustibles, and reducing agents.
- Store peroxide-forming chemicals in an airtight container in a cool, dry, dark place.
- Peroxide-forming chemicals should be disposed of within 12 months or opening or by expiration date.
- Shock sensitive and detonatable materials should be stored in a secondary container, large enough to hold entire contents in case of breakage.
- Store liquid organic peroxides at the lowest possible temperature consistent with solubility and/or freezing point.

Flammables/Combustibles:

- Store flammable liquids in flammable storage cabinet or in Red color-coded location.

- Do not store flammable liquids in domestic refrigerators or freezers.
- Store away from ignition and heat sources.
- Stay within NFPA rules for volume of flammables:
  a. Maximum for any lab is 120 gallons.
  b. With flammable safety cabinet – 10 gal/100 sq.ft. unsprinkled or 20 gal/100 sq.ft. of sprinkled area.
  c. Without flammable safety cabinet – 10 gallons in original containers & 25 gallons in 2.5-gallon safety cans.

Non-Reactives, General Storage:

- Non-reactive, low hazard chemicals such as Sodium Chloride, Glucose, Agars, etc. may be stored in Green color-coded locations.

Gas Cylinders:

- Strap or chain securely to bench top or wall.
- Cap cylinders not in use.

Chemical manufacturers include storage information on the label. This may be done with a color code or pictogram to indicate hazards.

Proper chemical storage can prevent many common laboratory accidents. The time and effort required to segregate and store chemicals according to their hazard classes is repaid by increasing the overall safety in any lab.

GENERAL FACTORS OF CHEMICAL REACTIVITY

- *Temperature* – the higher the temperature, the more reactive substances generally are.
- *Concentration* – the higher the concentration of substances the more reactive they generally are.
- *Rate of Addition* – the faster the addition, the more reactive substances generally are.
- *Nature of Substances* – certain substances are inherently more reactive than others, while certain substances will react vigorously together

CHEMICAL SPILLS

Most small spills (a few mL of dilute solution or a few grams of solids) can be cleaned up with a damp paper towel. Small spills of particularly hazardous materials, and large spills (a few hundred mL or a few liters) of less hazardous chemicals, require that you follow these basic rules:

- KNOW THE HAZARDS. Check the SDS for special precautions and clean-up instructions. Wear eye protection and any other suitable PPE.
- CONFINE THE SPILL. For a liquid, first pour an absorbent material around the edge of the spill to prevent spreading. Use an inert material such as sand or kitty litter.
- NEUTRALIZE. Sodium bicarbonate works well for both acids and bases. Strong oxidizers should be neutralized with weak or dilute reducers, and so on. Check the SDS for suitable materials to use. Work slowly and carefully. Add several small quantities periodically to avoid a violent reaction, but enough material to completely neutralize the spill.
- REMOVE. The absorbed mixture is now safe enough to handle and may be disposed of in accordance with safety rules.

***NOTE:** Chemical Spills Too Large to Confine: **CALL 911** and notify the Laboratory Coordinator and a Chemist Immediately*

CHEMICAL SPILLS ON YOUR BODY

Small spills can be treated using the sink and running water over the affected area if possible, while large spills can be treated using the emergency shower. An emergency shower removes hazardous chemicals from your clothing and skin as quickly as possible, but it cannot clean your clothing or flush chemical through it. Remove all clothing from affected area while flushing.

***IMPORTANT:** In all cases, **CALL 911** for immediate medical help.*

LABORATORY WASTE DISPOSAL

Disposal of hazardous materials is regulated by various federal and state agencies. Laboratory waste very often includes hazardous chemical, biological, or radiological materials. Thus, proper disposal of laboratory waste is not only prudent, it is mandatory. Environmentally sound disposal methods prevent harm to the water, land, and air and by extension, to people as well. Proper disposal techniques also protect waste handlers from harm.

Laboratory waste disposal can be broken down into five categories – hazardous (chemical) waste, biological waste, radioactive waste, glass waste, and metal (sharps) waste – which are discussed below.

HAZARDOUS CHEMICAL WASTE

The term "hazardous waste" refers to hazardous chemical waste. If waste chemicals contain infectious materials or biological hazards, the waste must be treated first as biological waste. Once the biological hazard has been eliminated, then the waste can be treated as hazardous waste.

Disposal of hazardous waste is governed by the Environmental Protection Agency (EPA) and by the Texas Commission on Environmental Quality (TCEQ) through Federal and State regulations. Blinn College District complies with ALL hazardous waste disposal regulations and through contracted hazardous waste disposal services.

Laboratory personnel can ensure compliance with the Hazardous Waste Management Program by following a few simple steps:

1) Never dispose of chemicals improperly. Improper disposal includes…
    a. Pouring undiluted chemicals down the drain, unless noted as appropriate in the SDS;
    b. Leaving uncapped chemical containers in the fume hood to evaporate off the chemical, unless noted as appropriate in the SDS; and
    c. Disposing of chemicals in the regular trash, unless noted as appropriate in the SDS.
2) Collect waste in a leak proof container that is in good condition, that can be securely closed, and that is appropriate for the given chemical.
3) When reusing a container to collect chemical waste, completely deface or remove the original label.
4) Label the container:
    a. The words "Hazardous Waste" must be written on the container.
    b. Identify the contents of the waste container on the container itself.
    Example: "Nitric Acid Waste," or "Phenol Waste."
5) Do not mix incompatible waste chemicals in a single container. Use separate waste containers for different waste streams.
6) Do not overfill the waste container.
    a. For liquid hazardous waste:
        i. Do not fill jugs and bottles past the shoulder of the container.
        ii. When filling closed head cans (5 gallons or less), leave approximately two inches of space

between the liquid level and the top of the container.
   iii. When filling closed head drums (larger than 5 gallons), leaving approximately four inches of space.
b. For solid hazardous waste materials:
   i. Do not fill beyond the weight capacity of the container
   ii. Do not fill past shoulder of the container
   iii. Leave at least two inches head space for closure.

7) Keep waste containers closed. Waste containers should only be open when adding or removing material.

HAZARDOUS WASTE DISPOSAL AND WASTE COLLECTION

When the waste container is ready for disposal, and is properly labeled, the appropriate Laboratory Coordinator will contact the contracted hazardous waste disposal company to schedule a pick-up. Every effort should be made to coordinate with other Laboratory Coordinators, at the same campus, to consolidate hazardous waste collection. However, hazardous waste should not be allowed to accumulate in excess and should be collected and removed as soon as practical.

DISPOSING OF EMPTY CHEMICAL CONTAINERS

Empty chemical containers may be disposed of in the regular trash provided the following EPA requirements are met:

1) Containers must not contain free liquid or solid residue.
2) Containers must be triple rinsed.
3) Product labels must be defaced or removed.
4) Container lids or caps must be removed.
5) Render metal containers and plastic jugs unusable by punching holes in the bottom of the containers before disposing of them in the regular trash. (It is not necessary to break empty glass containers.)

IMPORTANT: *Containers that do not meet the requirements mentioned here must be treated as hazardous waste.*

BIOLOGICAL WASTE

The Texas Department of State Health Services (TDSHS) and the Texas Commission 4-4 on Environmental Quality (TCEQ) regulate the disposal of biohazardous materials. Biohazardous materials include organisms or substances derived from biological materials or organisms that may be harmful to humans, animals, plants, or the environment. Biohazardous waste includes any waste materials that contain biohazardous materials, such as:

- Waste (including blood) from and bedding or litter used by infectious animals
- Bulk human blood or blood products and waste materials contaminated with human blood
- Microbiological waste (including pathogen-contaminated disposable culture dishes and disposable devices used to transfer, inoculate, and mix pathogenic cultures)
- Biological pathogens
- Sharps
- Any recombinant (rDNA) materials and products of genetic manipulation

IMPORTANT: *All biohazardous material must be decontaminated prior to disposal.*
Biohazardous waste mixed with hazardous chemical waste must be treated to eliminate the biohazard prior to disposal. After treatment, the waste can be managed as hazardous chemical waste.

There are strict safety requirements regarding segregation, labeling, packaging, treatment (including documentation), and transportation of biohazardous waste. The guidelines below should be followed:

1) Do not mix biological waste with chemical waste or other laboratory trash.
2) Segregate hazardous biological waste from nonhazardous biological waste.
3) Clearly label each container of untreated biohazardous waste and mark it with the Biohazard Symbol.
4) It is recommended to label nonhazardous biological waste as "non-hazardous biological waste."

GLASS WASTE

Glassware should never be disposed of in the regular trash. Pasteur pipettes and broken glass can break through trash bags and cut individuals who handle trash. Follow these guidelines when disposing of broken glass:

- Do not pick up broken glass with bare or unprotected hands. Use a brush and dustpan to clean up broken glass. Remove broken glass in sinks by using tongs for large pieces and cotton held by tongs for small pieces and slivers.
- Glass contaminated with biological agents must be decontaminated by thermal or chemical treatment before disposal.
- Glassware contaminated with chemical materials must also be decontaminated prior to disposal. If decontamination is not possible, the glass should be disposed of as hazardous waste. Place non contaminated broken glass in a rigid, puncture resistant container such as a sturdy cardboard box. Mark the box "Non-contaminated Broken Glass." Once the box is three-quarters full, seal it shut. The box should then be placed in the dumpster by laboratory personnel.

***NOTE:** If broken glass is commingled with metal sharps, it must be treated as sharps waste and encapsulated before for disposal.*

METAL SHARPS

All materials that could cause cuts or punctures, must be contained, encapsulated, and disposed of in a manner that does not endanger other workers. Needles, blades, etc. are considered biohazardous even if they are sterile, capped, and in the original container. The following guidelines apply to handling and disposing of sharps:

1) Metal sharps must be segregated from all other waste.
2) Sharps that have been used with chemical or biological materials should be decontaminated prior to disposal whenever possible.
3) Dispose of sharps in a rigid container, such as a sturdy plastic jar or a metal can.
4) When the container is three-quarters full, contact waste disposal vendor for collection via appropriate Dean or Safety & Risk Management.

X. GENERAL BIOLOGICAL SAFETY

General biology laboratory experiments involve the use of chemicals, reagents, stains, dyes, plants and animals that must be handled with caution. The following safety rules apply:

- Use caution when using an open flame – point objects, such as test tubes, away from self and others when heating
- Use caution when heating flammable liquids
- Avoid contact with eyes, skin and mucous membranes when using acid/base solutions, reagents, and stains
- Always use appropriate personal protective equipment
- Dispose of broken glass in broken glass containers

- Plants – there is a potential of allergic reaction. Instructors should identify students who have self reported plant-based allergies and limit exposure.
- Animals – there two types of exposures to infectious materials from animal handling:
  a. Zoonotic agents – organisms that are normally present in/on the animal that have the potential to infect humans.
  b. Disease agents – bacterial, fungal, viral or parasitic agents that are known to be present and are being studied. Use appropriate precautions when working with these animals.

XI. MICROBIOLOGICAL SAFETY

Like chemicals, some microbiological hazards are more harmful than others; some even deadly. Microbiological hazards are unlike chemicals in that they can reproduce. Exposure to even a small number of organisms can create serious problems.

Laboratories working with potentially infectious agents have not been shown to represent a significant threat to the community. Only rarely has secondary infection developed from contact with laboratory personnel and students. However, regardless of how infrequent community infections have been, there is a need for guidelines and standard operating procedures to minimize the potential for laboratory associated infections.

Persons working with potentially infectious agents must be aware of the hazards and must be trained and proficient in the practices and techniques required for handling such materials safely. You will protect yourself by understanding and using the various types of engineering controls, work practices and personal protective equipment (PPE) available.

Persons must have the following training requirements:
- Disinfection
- Aseptic transfer
- Biohazardous waste management
- Spills, containment, and clean-up
- Pipetting
- Material safety data sheets
- Universal precautions
- First aid stations
- Eye wash stations
- Fire extinguisher
- Labeling laboratory materials
- Broken glassware
- Sharps disposal

Personal Protective Equipment (PPE) list:
- Lab coat (preferably liquid and flame resistant)
- Vinyl or latex exam gloves
- Masks (required only if heat/flame in use)
- Goggles

<u>STANDARD MICROBIOLOGICAL PRACTICES</u>

1. Do not mouth pipette.

2. Do not touch face, mouth, eyes, ears or nose and under no circumstances is any type of make-up, lipstick or lip balm to be applied while in the laboratory.
3. Manipulate infectious fluids carefully to avoid spills and the production of aerosols and droplets.
4. Use extreme caution when handling needles; and dispose of sharps in leak and puncture resistant containers.
5. Use protective laboratory coats, gloves and eye protection when appropriate.
6. Declutter work area to provide ample space for safe manipulation of substances and equipment.
7. Wash hands following all laboratory activities, following the removal of gloves, and immediately following contact with infectious materials.
8. Decontaminate work surfaces before and after use, and immediately after spills using a 10% solution of household bleach or an appropriate disinfectant.
9. Do not eat, drink, store food, or smoke in the laboratory.
10. Access to the laboratory is limited to the discretion of the instructor when work with cultures, media, and specimens is in progress.
11. All cultures, stocks, and other regulated wastes are decontaminated before disposal by an approved decontamination method, such as autoclaving.

MICROBIOLOGICAL HAZARDS

- Bloodborne pathogens – bloodborne pathogens are bacteria, viruses, and parasites that are present in the blood or other body fluids of infected individuals. There are many different diseases caused by bloodborne infectious agents. In the U.S., the two most common and of the greatest concern are hepatitis (A,B,&C), and human immunodeficiency virus (HIV). One can become infected if blood or other potentially infectious material makes contact with one's bloodstream. The principal routes of entry are:
  a. injection, such as needlestick or cuts involving a contaminated "sharp"
  b. contact with open wounds, lesions, or sores on the skin
  c. contact with mucosa
  d. ocular invasion
- Microbes – major groups of microbes: bacteria, viruses, protozoans, and fungi. Practice prudent universal precautions when handling microbes.

There are four biohazard safety levels (BSLs) of biological agents, each based on the degree of hazard, type of agent, and modes of transmission:

BSL-1: No known or minimal potential hazard of exposure to infectious agents.
BSL-2: Moderate potential hazard (low risk) of exposure to infectious agents.
BSL-3: Moderate risk of exposure to agents that can cause serious or potentially lethal disease.
BSL-4: High individual risk of exposure to dangerous or exotic agents which cause life-threatening disease.

Blinn College District's microbiology department houses microbes that are BSL-1 and some that are BSL-2. BSL-3 and BSL-4 microbes are NOT housed in any Blinn College District controlled laboratory.

Biosafety Level 1 represents a basic level of containment that relies on standard microbiological practices with no special primary or secondary barriers recommended, other than a sink for hand washing.

Biosafety Level 2 practices are applicable to the broad spectrum of indigenous moderate-risk agents present in the community and associated with human disease of varying severity. With good microbiological techniques, these agents can be used safely in activities conducted on the open bench, provided the potential for producing splashes or aerosols is low.

***NOTE:** Secondary barriers, such as handwashing, and waste decontamination, such as autoclaving, must be available to reduce potential environmental contamination.*

MICROBIOLOGICAL SPILLS OUTSIDE SAFETY CABINETS

Biological spills outside biological safety cabinets may generate aerosols that can be dispersed in the air throughout the laboratory. Appropriate personal protective equipment is particularly important when decontaminating spills. This equipment includes lab coat with long sleeves, disposable gloves, closed-toed shoes. The process for spill clean-up is as follows:

- Notify others of spill
- Soak paper towels in a Lysol solution and place over spill for 10 minutes
- Place paper towels in biohazard bag and leave bag open
- Remove and place gloves into biohazard bag and secure for proper disposal
- Wash hand thoroughly and don a new pair of gloves
- Clean spill area, again, with Lysol-soaked paper towels
- Dispose of paper towels and gloves in regular trash bin
- Once spill has been cleaned per procedure, work may resume in affected area

If a spill contaminates any paper material, books, manuals, or disposable lab coat, they will be collected, autoclaved and DISPOSED of.

Contaminated CLOTH lab coats may be collected, autoclaved, and RETURNED.

MICROBIOLOGICAL WASTE DISPOSAL

Biological waste must be handled with precautions. Always wear gloves when handling waste.
The biological waste is autoclaved at the appropriate time, temperature, and pressure (120 C, 15 psi, for 25 min.). If the tape indicator turns black, then it is safe to dispose of the biological waste in the dumpster.

XII. PHYSICS SAFETY

Hazards that may be present within the physics laboratory generally involve the following:

- Electricity
- Electromagnetic radiation – lasers
- Nuclear radiation

ELECTRICITY

There is a significant difference in the degree of hazard posed by DC and AC sources. Low voltage DC sources are not normally fatal although they can cause burns, while sources as low as 24 volts AC have been known to be fatal to humans. The severity of the shock sustained depends on the:

- Amount of voltage involved
- Resistance to the flow of current
- Duration of current flow
- Current frequency if AC
- Portion of the body involved

ELECTRICAL SAFETY

- Make sure electrical cords are not frayed or broken

- Only persons qualified by training or experience should repair or maintain electrical equipment.
- Do not overload electrical outlets or extension cords.
- Keep all electrical equipment far away from water and clean all spills promptly.
- Inspect equipment periodically to make sure it is properly grounded.
- Use spark-free devices near combustible and flammable liquids.
- Remove all metal or conductive jewelry when working with electrical devices.

ELECTROMAGNETIC RADIATION

Lasers sold by educational supply companies for use in schools are, for the most part, completely eye safe. Check the class of laser before using it with the students.

Laser Class I	Eye safe
Laser Class II	Probable Eye damage after direct, long-term exposure
Laser Class IIIa	Probable Eye damage after direct, moderate exposure
Laser Class IIIb	Eye damage upon short exposure
Laser Class IV	Eye and Skin damage upon short exposure

Be sure to warn against looking directly at the beam or aperture. It is recommended that the room be kept well-illuminated when lasers are in operation. Low light levels cause the pupils to dilate, increasing the hazard.

NUCLEAR RADIATION

The degree of hazard associated with radionuclides is dependent upon the type of emitter it is and on the intensity (i.e., the number of disintegrations per second measured in curies). Typically, beta-particle and gamma-ray emitters are considered more hazardous than alpha-particle emitters simply because more shielding is required to protect against them. Also, radionuclides with very short half-lives are more hazardous than those with longer half-lives.

The radioactive sources used in Blinn College District physics labs are all solid sealed sources. That is, the radioactive material is deposited in a plastic disk and sealed inside with durable epoxy. These sources contain isotopes with long half-lives, and low activity, and one is not faced with possible spills and decontamination.

Hazard Communication Training Record

I hereby acknowledge receipt of the Blinn College District Hazard Communication Program Training, which includes:

General and Chemical Safety

1._____Information on interpreting Safety Data Sheets (SDSs) and labels, and the relationship between the two methods of hazard communication.
2._____General methods of obtaining SDSs at Blinn College District.
3._____Generic information on chemical hazard classes, including:
   a) Hazards associated with chemical hazard classes (i.e., Flammables, Corrosives, Toxins, Reactives, and Irritants) including acute and chronic effects.
   b) Methods for identifying specific chemicals within each chemical hazard class (e.g., DOT labels, NFPA 704 System, chemical container labels).
   c) Safe handling procedures, including proper storage and separation of incompatibles.
4._____Proper use of appropriate protective equipment to minimize exposure to hazardous chemicals and information on emergency safety equipment.
5._____General instructions on first aid treatment to be used with respect to hazardous chemicals.
6._____General instructions on spill cleanup procedures and proper disposal of hazardous chemicals and hazardous chemical waste.

Instructor Name(s) (Print) _____ Date _____

Work Area Specific Training

1._____Information on hazardous chemicals known to be present in the employee's work area and to which the employee may be exposed, including:
   a) Location within the work area.
   b) Specific hazards, including acute and chronic effects.
   c) Safe handling and disposal procedures.
   d) Procedures to follow in the event of an accident or spill.
2._____Work area location of SDSs, or procedures for obtaining SDSs.
3._____Location of emergency safety equipment (e.g. emergency eyewash station, emergency shower, fire extinguisher) and instruction on activation procedures and use.
4._____Location and use of the appropriate personal protective equipment the employee will need for working with hazardous chemicals.
5._____Location of the first aid kit and first aid treatments to be used in the event of an accident.
6._____Location of the chemical spill kit and instructions on spill cleanup procedures.

Instructor Name(s) (Print) _____

Instructor Signature _____ Date _____

Employee Name (Print) _____ Employee Department _____

*Employee Signature _____ Date _____

***The employee is responsible for ensuring that this completed form is given to the person within their department/unit who is responsible for maintaining personnel records or is responsible for sending the form to the centralized personnel files.**

Blinn College

Incident Report

***Form to be completed within 48 hours of the incident**

Today's Date:			Time: ☐ A.M. ☐ P.M.		
PERSON INVOLVED INFORMATION					
Name: (last) (first)					Sex:
☐Faculty ☐Staff ☐Student ☐Visitor			Campus: ☐Brenham ☐Bryan ☐Schulenburg ☐Sealy		
Phone: ( )		Email:		Blinn ID:	
Work Phone:		Department:		Bld:	
Job Title:		Supervisor:			Supv. Ext.
INCIDENT INFORMATION					
Incident Date:				Incident Time: ☐A.M. ☐P.M.	
Campus: ☐Brenham ☐Bryan ☐Schulenburg ☐Sealy			Building:		Area/ Room:
☐Off site:					
INCIDENT TYPE	**CAUSE**		**RESULT OF EVENT**		
☐Medical	☐Machinery	☐Motor Vehicle	☐Abrasion	☐Laceration	☐Amputation
☐Trauma	☐Electrical	☐Fall	☐Sprain	☐Fracture	☐Burn
☐Safety	☐Chemical	☐Slip/Trip	☐Vision loss	☐Heat Exhaust	☐Heat Stroke
☐Fire	☐Tool	☐Vehicle	☐Cold Expose	☐Elec. Shock	
☐Near Miss ☐Other:	☐Other:		☐Other:		
INVOLVED BODY PART					
☐Head ☐Face ☐Neck ☐Chest ☐Abdomen ☐Back					
☐Right ☐Left	☐Arm ☐Wrist ☐Hand ☐Fingers ☐Leg ☐Knee ☐Ankle ☐Foot				
MEDICAL ACTIONS					
☐First Aid (only)	Transported to: ☐Clinic ☐Hospital		By: ☐EMS ☐Car	Admitted: ☐Yes ☐No	
Back to work/class: ☐Yes ☐No		Work Restrictions: ☐No ☐Yes (list):			
What happened:					
What was supposed to happen:					
Immediate Actions:					
Corrective Actions:					
SUBMITTER INFORMATION					
Name:			Phone Ext.:	Email:	
Signature:					

* Completed form to be submitted to the Emergency Management/Safety Coordinator for All Incidents.
Human Resources to additionally receive a copy for employee injury or illness.

Ver. 4-2014

SEMI-ANNUAL INSPECTION OF
BLINN COLLEGE NATURAL and PHYSICAL SCIENCES TEACHING LABORATORIES

CAMPUS:_____**BLDG/ROOM:** _____**DATE:**_____

INSPECTION OF PHYSICAL FACILITIES: Describe deficiencies in the appropriate notes.

1.	Sufficient space was available for students and faculty.	A_____D_____N/A____
2.	Teaching space was neat, clean, and maintained in good repair.	A_____D_____N/A____
3.	Teaching area was free from potential physical and chemical hazards.	A_____D_____N/A____
4.	Adequate means of disinfecting the physical facilities were available.	A_____D_____N/A____
5.	Adequate hand washing facilities were available and functional in the teaching area.	A_____D_____N/A____
6.	Sharps containers were available and appropriately maintained.	A_____D_____N/A____
7.	Broken glass containers were available and appropriately maintained.	A_____D_____N/A____
8.	Biohazard waste disposal containers were accessible and completely enclosed to prevent leaks.	A_____D_____N/A____
9.	Appropriate secondary labeling was present on containers.	A_____D_____N/A____
10.	With the exception of items used for demonstration purposes, any reagent or test was currently dated and properly maintained.	A_____D_____N/A____
11.	An eyewash station was present and functional, and the inspection log was up to date.	A_____D_____N/A____
12.	A safety shower was present and functional and the inspection log was up to date.	A_____D_____N/A____
13.	Appropriate safety signage was present.	A_____D_____N/A____
14.	SDS were accessible and up to date.	A_____D_____N/A____
15.	Laboratory activity risk assessments were accessible and up to date.	A_____D_____N/A____
16.	First Aid kits were accessible and up to date.	A_____D_____N/A____
17.	Chemical spill cleanup kits were accessible and up to date.	A_____D_____N/A____
18.	Waste disposal measures are appropriate for the facilities.	A_____D_____N/A____
19.	Appropriate personal protective equipment (PPE) was available and in good repair.	A_____D_____N/A____
20.	Laboratory equipment was in good repair.	A_____D_____N/A____

A = Acceptable **D** = Deficient **N/A** = Not Applicable

GENERAL COMMENTS:

DEFICIENCIES: Attach a plan and schedule for corrective action of any deficiencies.

NPS LABORATORY INSPECTION TEAM

Lab Coordinator	**Non-departmental Faculty**
Departmental Faculty	**Divison Leadership**

MICROBIOLOGY BACTERIA INFORMATION

❖Biosafety Level 1:

Cintrobacter freundii: https://www.canada.ca/en/public-health/services/laboratory-biosafety-biosecurity/pathogen-safety-data-sheets-risk-assessment/citrobacter.html

Escherichia Coli: https://www.canada.ca/en/public-health/services/laboratory-biosafety-biosecurity/pathogen-safety-data-sheets-risk-assessment/escherichia-coli-enteroinvasive.html

Enterobacter cloacae: https://www.canada.ca/en/public-health/services/laboratory-biosafety-biosecurity/pathogen-safety-data-sheets-risk-assessment/enterobacter.html

Serratia marcescens: https://www.canada.ca/en/public-health/services/laboratory-biosafety-biosecurity/pathogen-safety-data-sheets-risk-assessment/serratia.html

Neisseria sicca: https://www.canada.ca/en/public-health/services/laboratory-biosafety-biosecurity/pathogen-safety-data-sheets-risk-assessment/neisseria.html

Moraxella catarrahalis: https://www.canada.ca/en/public-health/services/laboratory-biosafety-biosecurity/pathogen-safety-data-sheets-risk-assessment/branhamella-catarrhalis.html

Alcaigenes faecalis: https://catalog.hardydiagnostics.com/cp_prod/Content/hugo/Alcaligenes.htm

Staphylococcus epidermis: https://www.canada.ca/en/public-health/services/laboratory-biosafety-biosecurity/pathogen-safety-data-sheets-risk-assessment/staphylococcus-aureus.html]

Micrococcus luteus: https://www.msdsonline.com/resources/sds-resources/free-safety-data-sheet-index/micrococcus-spp/

Kocuria rosea: https://www.msdsonline.com/resources/sds-resources/free-safety-data-sheet-index/micrococcus-spp/

Streptococcus bovis: https://www.microbiologics.com/0463P

Bacillus subtilis: https://agro.basf.ca/East/Products/Related_Files/HISTICK%20L%20NT%20-%20Bacillus%20subtilis%20Component%20-%2030589584%20English.pdf

Mycobacterium smegmatis: https://www.canada.ca/en/public-health/services/laboratory-biosafety-biosecurity/pathogen-safety-data-sheets-risk-assessment/mycobacterium.html

Lactococcus lactis: https://www.microbiologics.com/0149K

❖Biosafety Level 2:

Klebsiella pneumonia: https://www.msdsonline.com/resources/sds-resources/free-safety-data-sheet-index/klebsiella-spp/

Proteus vulgaris: https://www.canada.ca/en/public-health/services/laboratory-biosafety-biosecurity/pathogen-safety-data-sheets-risk-assessment/proteus.html

Salmonella typhimurium: https://www.canada.ca/en/public-health/services/laboratory-biosafety-biosecurity/pathogen-safety-data-sheets-risk-assessment/salmonella-enterica.html

Shigella dysenteriae: https://www.msdsonline.com/resources/sds-resources/free-safety-data-sheet-index/shigella-spp/

Pseudomonas aeruginosa: https://www.canada.ca/en/public-health/services/laboratory-biosafety-biosecurity/pathogen-safety-data-sheets-risk-assessment/pseudomonas.html

Staphylococcus saprophyticus: https://www.msdsonline.com/resources/sds-resources/free-safety-data-sheet-index/staphylococcus-aureus/

MICROBIOLOGY BACTERIA INFORMATION

❖Biosafety Level 2 *(cont.)*:

Staphylococcus aureus: https://www.canada.ca/en/public-health/services/laboratory-biosafety-biosecurity/pathogen-safety-data-sheets-risk-assessment/staphylococcus-aureus.html

Streptococcus pyogenes: https://www.msdsonline.com/resources/sds-resources/free-safety-data-sheet-index/streptococcus-pyogenes/

Streptococcus agalactiae: https://www.msdsonline.com/resources/sds-resources/free-safety-data-sheet-index/streptococcus-agalactiae/

Enterococcus faecalis: https://www.msdsonline.com/resources/sds-resources/free-safety-data-sheet-index/enterococcus-faecalis-and-faecium/

Steptococcus mitis: https://www.msdsonline.com/resources/sds-resources/free-safety-data-sheet-index/streptococcus-pneumoniae/

Streptococcus pneumoniae: https://www.canada.ca/en/public-health/services/laboratory-biosafety-biosecurity/pathogen-safety-data-sheets-risk-assessment/streptococcus-pneumoniae.html

Streptococcus salivarius: https://www.msdsonline.com/resources/sds-resources/free-safety-data-sheet-index/streptococcus-salivarius/

Bacillus polymyxa: http://www.ec.gc.ca/ese-ees/default.asp?lang=En&n=9F3909AA-1

Cornybacterium xerosis: https://www.msdsonline.com/resources/sds-resources/free-safety-data-sheet-index/corynebacterium-diphtheriae/

AUTOCLAVE INSTRUCTIONS

Operating Autoclave

1 Steam indicator tag must be filled out if it is the first time for use that day
   a Write the month, day, and year and your initials
   b Place in front of autoclave with first run
   c When the autoclave is done, hang the tag on the clipboard

2 All items to be placed in the autoclave must have autoclave tape on them
   a Autoclave tape is found in the drawer

3 Fill the autoclave with water
   a Check the drain is closed, located at bottom of autoclave
   b Use the bucket to fill the bottom of the autoclave with RO
   c The water should not breech the opening
   d If there is no water, the autoclave will not start

4 Place items in autoclave
   a Flasks and tubes do not need to be set in a foil pan
   b Waste must always be put in a foil pan

5 Close the autoclave door

6 Make sure the settings are correct
   a 121 C
   b Slow Liquids

7 Turn the knob to 15 mins
   a It will take a couple of minutes for the autoclave to start
   b You will not be able to open the door once it starts
   c For 15 min run, the autoclave can take up to 30-45mins between heating up and cooling down

8 When the autoclave is done-
   a Use hot hands to remove items carefully
   b Place steam indicator tag on clipboard
   c Drain autoclave

Lab Coat Disinfection/Sterilization

Faculty/Staff Instructions:

- Lab coats must be worn at all times while in the lab or prep spaces when conducting experiments or working on set-up or take-down of activities.
- Faculty should use discretion when wearing lab coats in the hallways and common areas. This should be avoided if at all possible.
- If a lab coat becomes contaminated with a chemical or biological hazard:
- A disposable lab coat will be autoclaved and disposed of and the faculty will need to purchase a new lab coat.
- A cloth lab coat will be autoclaved and returned to the faculty.
- Lab coats may be autoclaved using the following settings:
- No more than 4 cloth lab coats per cycle.
- Cycle should be 121ºC for 20 minutes at 15 psi.
- Faculty may take their lab coats home to wash IF there has been no chemical or biological hazardous materials spilled on the coat, or it has run through an autoclave cycle first.

Student Instructions (Biology and Chemistry only):

- Lab coats must be worn at all times while in the laboratory.
- Students are not allowed to take their lab coats home or wear them in the hallways or common areas.
- Students must keep their lab coats in the bags within the tubs for the entirety of the semester.
- If a lab coat becomes contaminated with a chemical or biological hazard:
- A disposable lab coat will be autoclaved and disposed of and the student will need to purchase a new lab coat.
- A cloth lab coat will be autoclaved and returned to the student.
- At the end of the semester, lab coats will be autoclaved using the following settings:
- No more than 4 cloth lab coats per cycle.
- Cycle should be 121ºC for 20 minutes at 15 psi.
- Disposable lab coats will be autoclaved and NOT returned.
- Cloth lab coats will be autoclaved and may be returned.

Laboratory Risk Assessment Tool for Science Experiments (LAB-RAT)

This tool is designed to help reduce the risk of injuries and incidents. A separate form should be completed for each experiment performed in the course.

Course:	
Completed By:	Date:
Experiment Number and Name:	

Identify Hazards: Review lab manual materials and methods for the following general and specific hazards. Refer to Safety Data Sheets (SDS), equipment manuals, materials, and processes for additional hazards.

Check all hazards that apply. Use a separate sheet to attach additional information as needed.

General Lab Hazards

- ☐ Needles or sharps stick
- ☐ Glassware breakage/cuts
- ☐ Pests/rodents
- ☐ Electrical shock
- ☐ Trip hazard
- ☐ Ventilation
- ☐ Burns
- ☐ Freezing
- ☐ Projectiles
- ☐ Mechanical trauma
- ☐ Other:
- ☐ Other:

Hazardous Chemical Agents

Physical Hazards of Chemicals

- ☐ Compressed gases
- ☐ Flammables
- ☐ Organic peroxides
- ☐ Oxidizers
- ☐ Peroxide-forming chemicals
- ☐ Water-reactive
- ☐ Other hazard:
- ☐ Other hazard:

Health Hazards of Chemicals

- ☐ Acute toxicity
- ☐ Carcinogen
- ☐ Eye damage/irritation
- ☐ Skin corrosion/irritation
- ☐ Other hazard:
- ☐ Other hazard:

Hazardous Conditions or Processes for Chemicals

- ☐ Gases produced
- ☐ Heating chemicals
- ☐ Hand/power tools/machinery
- ☐ Other hazard:
- ☐ Other hazard:
- ☐ Generation of air contaminants (gases, aerosols, or particulates)
- ☐ Chemical spillage
- ☐ Other hazard:

Biological Hazards

Physical Hazards of Biologicals

- ☐ Biosafety Level 1
- ☐ Biosafety Level 2
- ☐ Bodily fluids
- ☐ High cell density cultures
- ☐ Suspension volume
- ☐ Cell Cultures (animal or human)
- ☐ Aerosolization
- ☐ Biohazard spillage
- ☐ Other hazard:

Health Hazards of Biologicals

- ☐ Direct skin, eye, mucosal membrane
- ☐ Ingestion of liquid suspension of an infectious agent, or by contaminated hand to mouth exposure
- ☐ Inhalation of infectious aerosols
- ☐ Parenteral exposure
- ☐ Other biohazard:
- ☐ Other biohazard:

Indicate the controls utilized in the experiment:

Personal Protective Equipment (PPE)

- ☐ Appropriate attire
- ☐ Closed-toe shoes
- ☐ Gloves (indicate type):
- ☐ Lab coats
- ☐ Safety glasses/goggles
- ☐ Other PPE:

Engineering Controls

- ☐ Fume hood
- ☐ Biosafety cabinet
- ☐ Thermocouplers
- ☐ Other:
- ☐ Other:

Indicate any unique considerations for the processes below:

☐ Safety Data Sheets:
☐ Lab-specific training for students:
☐ Lab-specific training for instructors:
☐ Lab SOP(s) to review:
☐ Decontamination procedures:
☐ Hazardous waste:
☐ Special emergency procedures:

SAFETY PROGRAM CG
(LOCAL)

Comprehensive Safety Program

The College District shall take every reasonable precaution regarding the safety of its employees, students, visitors, and all others with whom it conducts business. The emergency management/ safety coordinator shall be responsible for developing, implementing, and promoting a comprehensive safety program.

The general areas of responsibility include, but are not limited to, the following:

1. Guidelines and procedures for responding to emergencies.
2. Program activities regarding fire-safety education and training.
3. Program activities intended to reduce the frequency of accident and injury, including:
    a. Inspecting work areas and equipment.
    b. Training frontline and supervisory staff.
    c. Establishing safe work procedures and regulations.
    d. Reporting, investigating, and reviewing accidents.
    e. Promoting responsibility for College District property on the part of students, employees, and the community.
4. Program activities intended to reduce the ultimate cost of accidents and injuries through investigation and documentation.
5. Program activities that identify and develop prudent methods of financing loss costs on an annual basis, including assisting the senior administrator for budgets, contracts, and insurance with the purchase of commercial insurance, self-insured retentions, and risk pooling.
6. Driver education programs, when available.
7. Vehicle safety programs.
8. College District Police Department assistance with traffic safety programs and studies related to employees, students, and the community.

Information Management

The Chancellor or designee shall be responsible for the collection, storage, and analysis of relevant operational and historical data required to develop sound procedures for implementation and operation of the comprehensive safety program.

ASM Teaching Lab Guidelines

For the *American Society for Microbiology Guidelines for Biosafety in Teaching Laboratories*, visit https://asm.org/Guideline/ASM-Guidelines-for-Biosafety-in-Teaching-Laborator

Chemical Waste Procedures

Blinn College
Natural and Physical Sciences Division
Department of Chemistry
March 22, 2021- last updated

Purpose- The purpose of this document is to revise and define the standard operating procedure (SOP) for waste handling and management for Chemistry Laboratory Coordinators of the Blinn College District. If a certain lab is not listed, then either it produces no waste, or the waste is disposed of in the lab by instructors and students according to the lab manual.

Current Hazardous Waste Disposal Company (updated March 2021):

Mike Cammack
Disposal Coordinator
ENERGYCLEAN
by MTI Services, LLC

D: 713-947-1510
C: 832-671-0789
mcammack@energyclean.com
camwstree@aol.com
www.energyclean.com 1409 General Chemistry for Engineering Majors

1409 General Chemistry for Engineering Majors

1409 Lab #2 Polymers

Summary: Produce nylon polymers and polyvinyl gels to observe differences in properties.

Safe Handling:
Always wear gloves, lab coat, and goggles when handling any chemicals associated with this lab. Wash hands thoroughly after handling.

- Adipoyl Chloride in Hexanes- Causes severe skin burns. Harmful if swallowed, inhaled, and contact with skin. Only use under a chemical fume hood with PPE.
- Hexamethylenediamine Solution- Causes severe skin burns and eye damage. May cause respiratory irritation. Harmful if swallowed. Only use under a chemical fume hood with PPE.
- Polyvinyl Alcohol 5%- Causes serious eye damage.

Waste Procedures:
Nylon and any residual monomers are waste that must be collected. Gels made in class can be taken home or thrown in the trash.

- Lab Coordinators will provide a labeled container to instructors and students for the collection of waste.
- Lab Coordinators will package the waste for disposal with an approved chemical waste disposal company.

1409 Lab #4 Percent Copper in a Compound

Summary: To determine the percentage of copper in copper compounds and calculate the molar mass.

Safe Handling:
Always wear gloves, lab coat, and goggles when handling any chemicals associated with this lab. Wash hands thoroughly after handling.

- Exposure to the copper chemicals in this lab can be harmful. Cupric Acetate is used in pesticides. All copper chemicals in this experiment can irritate and burn skin, eyes, and respiratory tract.
- Magnesium is highly flammable. Keep away from open flame when handling. If it catches fire, do NOT use water. Smother the fire with sand or kitty litter.
- 6M Hydrochloric Acid and its fumes are corrosive. Use under the fume hood.

Waste Procedures:
The filtrate is moderately acidic waste and can be dumped down the drain. Recovered copper and the filter paper can be thrown in the trash.

1409 Lab #8 Periodic Behaviors of Metals

Summary: Observe Chemical Reactivity in several metals and arrange them in an activity aeries based on ease of oxidation.

Safe Handling:
Always wear gloves, lab coat, and goggles when handling any chemicals associated with this lab. Wash hands thoroughly after handling.

- Exposure to copper in this lab can be harmful.
- Exposure to lead in this lab can be harmful.
- 6M Hydrochloric Acid and its fumes are corrosive. Use under the fume hood.

Waste Procedures:
All liquids and metal shots will be collected in one container during the lab. After the lab has finished, the Lab Coordinator will add mossy zinc or magnesium turnings to the collection container. After the liquid in the container is clear, the liquid is dumped down the drain. Metal collected will be sent to the waste disposal company.

1409 Lab #10 Calorimetry

Summary: Determine the specific heat of a metal and molar heat of neutralization of some acid/base reactions.

Safe Handling:

- 3M HCl and its fumes are corrosive to skin tissue, respiratory tract, and cause serious eye damage. Use under the fume hood.
- 3M Acetic Acid is a flammable liquid and vapor. Corrosive to skin and eyes.
- 3M NaOH causes severe skin burns and eye damage. Maybe corrosive to metals.
- 3M NH3OH causes severe skin burns and eye damage. Very toxic to aquatic life.
- Exposure to copper in this lab can be harmful.

Waste Procedure:
Lab Coordinators will set out a beaker in the lab for the collection of used copper beads. The copper beads will be reused. Acids and bases can be safely dumped down the drain with running water.
If the beads are not shiny or black:

1. Rinse beads with DI to remove any acid or base. Place the beads in a glass beaker and soak them in vinegar for 15 to 20. Rinse off with DI.

1409 Lab #11 Factors Influencing the Rate of RX

Summary: Observe experimentally some factors that influence the rate of chemical reactions.

Safe Handling:

- All acids used in this experiment are corrosive to skin tissue and cause eye damage.

Waste Procedure:
All acids can be dumped down the drain with running water. Mossy zinc will be recovered and used in the waste procedure for Periodic Behaviors of Metals.

1411 General Chemistry I

1411 Lab #4 Gravimetric Determination of the Formula Weight of a Copper Compound

Summary: To determine the percentage of copper and formula weight of the unknown copper compound.

Safe Handling:
Always wear gloves, lab coat, and goggles when handling any chemicals associated with this lab. Wash hands thoroughly after handling.

- Exposure to the copper chemicals in this lab can be harmful. Cupric Acetate is used in pesticides. All copper chemicals in this experiment can irritate and burn skin, eyes, and respiratory tract.
- Magnesium is highly flammable. Keep away from open flame when handling. If it catches fire, do NOT use water. Smother the fire with sand.
- 6M Hydrochloric Acid and its fumes are corrosive. Use under the fume hood.
- Acetone and Isopropyl Alcohol are highly flammable. Keep away from open flame. Exposure to fumes can irritate the nose and throat and may include headache, dizziness, and confusion. Severe exposure

can cause unconsciousness.

Waste Procedures:
The filtrate is moderately acidic and can be dumped down the drain with running water by students. The filtrate from acetone/isopropyl alcohol washings is diluted and can be dumped down the drain with running water by the students. Recovered copper and the filter paper can be thrown in the trash.

1411 Lab #5 Relative Reactivities of Metals and the Activity Series

Summary: Reactions of metals with water, HCl, and metal ions.

Safe Handling:
Always wear gloves, lab coat, and goggles when handling any metals or chemicals associated with this lab. Wash hands thoroughly after handling.

- 6M HCl and its fumes are corrosive to skin tissue, respiratory tract, and cause serious eye damage. Use under the fume hood.
- Except for Iron, all metals in this lab have an NFPA health rating of 2 or higher. Wash hands thoroughly after handling.
- Magnesium is highly flammable. Keep away from open flame when handling. If it catches fire, do NOT use water. Smother the fire with sand or kitty litter.
- 0.1M Silver Nitrate is an oxidizing agent and can cause eye and skin irritation. Harmful to aquatic life with lasting effects. This chemical has explosive properties in the presence and/or mixed with other chemicals, such as ethanol- please read SDS.
- 0.1M Cupric nitrate is an oxidizing agent and may cause serious eye and skin burns.
- 0.1M Lead (II) Nitrate is an oxidizing agent and may cause skin and eye irritation.

Waste Procedures:
Lab Coordinators will provide a container for the collection of .1M $AgNO_3$, .1M $Cu(NO_3)_2$, and .1M $Pb(NO_3)_2$. 6M HCl can be dumped down the drain, however, HCl collection is expected. The container will be sent to an approved waste disposal company.
Lab Coordinators will provide 2 beakers for the collection of rinsed and dried lead and copper metals. Lab Coordinators will determine if these metals can be reused. If not, copper will go in the trash. The lead will be sent to an approved waste disposal company.
Instructors will instruct students to dispose of Al, Ca, Fe, Mg, Sn, and Zn in the trash.

1411 Lab #6 Atomic Emission Spectra

Summary: To understand the relationships between atomic structure and emission spectroscopy.

Safe Handling:
Always wear gloves, lab coat, and goggles when handling any chemicals associated with this lab. Wash hands thoroughly after handling.

- All chemicals associated with this lab can cause mild to severe skin and eye irritations. Review SDS.

Waste Procedures:
Instructors will instruct students to flush any residue down the drain with running water.

1411 Lab #7 Identification of Unknown Metals

Summary: To use chemical reactions between cations and anions to identify unknown metals.

Safe Handling:
Always wear gloves, lab coat, and goggles when handling any metals or chemicals associated with this lab.

Wash hands thoroughly after handling.

- Ammonium Sulfide is toxic if inhaled. Causes severe burns and eye damage. Highly flammable liquid and vapor. Use under the fume hood.
- Petroleum Ether can be fatal if inhaled. Highly flammable liquid and vapor. Use under the fume hood.

Waste Procedures:
Lab Coordinators will provide one container for the collection of both cation and anion solutions. The container will be sent to an approved waste disposal company.

1412 General Chemistry II

1412 Lab #1 MW by Freezing Pt. Depression

Summary: To determine the molecular weight of an unknown organic compound by freezing point depression.

Safe Handling:
Always wear gloves, lab coat, and goggles when handling Benzophenone. Use adequate ventilation, such as a fume hood, to keep airborne concentrations low. Wash hands after handling.

Waste Procedure:
Benzophenone cannot be dumped down the drain as it solidifies and will clog pipes. Due to the smell, it is recommended by the department to not dispose of it in the trash. Benzophenone shall be collected for disposal through an approved waste disposal company.

- Lab Coordinators will provide a container for instructors and students to collect the Benzophenone waste.
- The waste container shall have “Benzophenone Waste” written on the outside of the container.
- Lab Coordinators will schedule with an approved waste disposal company to pick up the waste.

How to separate waste if there is a layering of water and acetone:

1. Under a fume hood, put waste into a separatory funnel.
2. Mix the liquids by swirling gently and allow the funnel to vent by turning the funnel upside down and opening the stopcock. You may have to do this several times.
3. Put a funnel on the ring stand and a large beaker under the funnel.
4. When the layers have separated, carefully open the stop cock of the separatory funnel.
5. Allow the bottom layer to slowly drain into the beaker and close the stopcock as soon as the bottom has drained.
6. Put another beaker under the funnel and allow the second layer to drain.
7. Water layer can be discarded down the drain by flushing with more water. The acetone layer can be left under the fume hood to evaporate. Use a heating mantel to accelerate evaporation.
8. Any remaining waste will be disposed of with an approved waste disposal company.

1412 Lab #2 Factors that Influence Reaction Rates

Summary: To examine factors that affect the rate of chemical reactions.

Safe Handling:

Always wear gloves, lab coat, and goggles when handling Lead. Wash hands thoroughly after handling Lead.

Waste Procedures:

Lead will be collected for disposal through a waste disposal authority.

- Lab Coordinators will provide instructors and students with 3 beakers. The beakers shall be labeled the following:
    - Cu
    - Pb
    - Mossy Zinc
- Instructors shall instruct students to rinse and dry the copper, lead, and mossy zinc and put the metal in the correct breaker.
- Instructors shall dump the 2M acids down the drain with water running to dilute.
- Instructors shall throw away any other metals (zinc, iron, magnesium granules/ turnings) in the trash.
- Lab Coordinators are to determine if the copper, lead, and mossy zinc can be reused.
    - If copper can be reused- rinse with DI and soak in vinegar for 15-20 mins. Rinse again with DI and allow to dry before putting back in jar.
    - Mossy zinc will be saved and used to treat the waste in 1409 Periodic Behaviors of Metals Lab.
    - If copper shot and mossy zinc can not be reused, it shall be thrown in the trash.
    - The lead will be packaged for disposal with an approved waste disposal company.

REFERENCES

Safety in School Science Labs by Clair G. Wood, James A. Kaufman & Associates, 192 Worcester Road, Natick, MA 01760-2252

Laboratory Safety Pocket Handbook, Ramin USA Corporation, Genium Publishing Corporation, One Genium Plaza, Schenectady, NY 12304-4690

Safe T Line Newsletter, Texas A&M University Environmental Health and Safety Dept., College Station, TX 77843

When Minutes Count: A Citizen's Guide to Medical Emergencies, Texas Department of Health, Bureau of Emergency Management, 1100 West 49th Street, Austin, TX 78756, (512)458-7550

Laboratory Safety Manual, Texas A&M University, Environmental Health & Safety, Rev. November 2016, College Station, TX 77843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COLLEGE DISTRICT