Chemical Hygiene and Laboratory Safety Plan

Office of Public Safety

January 2024

(last update July 2024)

Record of Changes and Distribution

This plan will be reviewed annually to reflect changes in the Laboratory Safety Program, Blue Ridge Community College policies, and government regulations. under the governance of the Financial and Administrative Services Committee.

Recommended changes to this document will be submitted to the Vice President of Finance and Administration for review and final approval.

This plan will be distributed electronically to all laboratory personnel and will be available to all BRCC faculty, staff, and students on the BRCC website.

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I. INTRODUCTION

1. Purpose

Blue Ridge Community College is required under U.S. Code of Federal Regulations (CFR) Section 29, part 1910.1450 to provide a chemical hygiene plan that establishes minimum safety standards for working with chemicals in the laboratory and outlines procedures that minimize both the risk of chemical exposure to laboratory personnel and the risk of chemical releases into the environment. The term *hazardous substance*, as used in this manual, refers to any material that may present a danger to human health and welfare or the environment. This includes hazardous chemicals (e.g., laboratory chemicals, pesticides, and petroleum products), biohazardous materials (infectious materials), and radioactive materials.

This *Chemical Hygiene and Laboratory Safety Manual* serves as the chemical hygiene plan for Blue Ridge Community College and provides guidance on the safe handling of hazardous substances, general laboratory safety practices, and procedures for proper acquisition, use, storage, transfer, and disposal of chemicals.

This plan will act as the overarching guidance related to Chemical Hygiene and Laboratory Safety. Supplemental Laboratory Safety Plans are required for each individual lab to detail specific activities and the proper safety protocol when performing said activities. See Appendix A.

The Office of the Vice President of Finance and Administration oversees the development and implementation of Blue Ridge Community College's Chemical Hygiene Program. This plan and all its contents apply to the entire campus community, including faculty, staff, students, and visitors.

2. Training and Exercises

BRCC shall conduct annual training for all faculty and staff managing and/or supporting laboratory activities to include but not limited to the following:

- o Proper storage, handling, and disposal of hazardous materials and waste;
- o Laboratory-specific emergency procedures, contact information, evacuation procedures, and the location(s) and use of spill supplies;
- o Location, use, storage, and maintenance of PPE;

3. Inspections

Building & Grounds is responsible for inspecting and maintaining the inspection records of the fume hoods, eye wash stations, safety showers, and fire extinguishers.

- Fire extinguishers are inspected monthly by B&G personnel and evaluated and repaired annually by a third-party contractor.

- Safety showers & eye wash stations are inspected monthly, and
- Fume hoods are evaluated annually by a third-party contractor.
- Other equipment will be inspected prior to use or as required by the manufacturer.
- All equipment should be checked by the end user (student or instructor) prior to use.

4. Employee rights

The Occupational Safety and Health Act of 1970 provides rights to employees that offer protection from hazards in the workplace. For more information visit osha.gov/workers.

5. Reporting

Incidents, Accidents, or Occurrences resulting in personal injury and/or illness, disruption of normal activities or business interruption shall be reported as follows;

- Any serious injury, illness or fatality shall be reported to the Emergency Preparedness and Safety Manager at the VCCS System Office immediately.
- Employees: Incidents or accidents that involve employees shall be reported to Human Resources, Public Safety and any other appropriate college officials.
- Students: Incidents or accidents that involve students shall be reported to the Dean of Students (or appropriate Vice President), Public Safety and any other appropriate college officials.
- Non-Employees/Non-Students: Incidents or accidents that involve non-employees or non-students shall be reported to Public Safety and appropriate college officials.

6. Regulatory Agencies

The following agencies regulate laboratory activities and provide guidance and direction concerning the use of chemicals in the laboratory.

- **The Occupational Safety and Health Administration (OSHA)** develops and enforces regulations based on federal statutes. (www.osha.gov)
- **The Environmental Protection Agency (EPA)** develops and enforces environmental regulations to protect human health and the environment. (www.epa.gov)
- **The National Institute for Occupational Safety and Health (NIOSH)** is a research division of the Centers for Disease Control and Prevention (CDC) created by the Occupational Safety and Health Act of 1970. (www.cdc.gov/niosh)
- **The National Fire Protection Association (NFPA)** provides codes and standards for fire safety, chemical storage, egress, and laboratory engineering controls for laboratories using chemicals (www.nfpa.org)
- **The United States Department of Transportation (DOT)** regulates packaging, shipping, and documentation of hazardous materials during transportation and distribution including shipping and receiving (www.dot.gov)

- **Virginia Occupational Safety and Health (VOSH)** is the Commonwealth's counterpart to the federal Occupational Safety and Health Administration (OSHA). The VOSH Program is responsible for enforcing occupational safety and health laws and regulations in the private and public sectors **https://www.doli.virginia.gov/vosh-programs/**
- **The Virginia Department of Environmental Quality (DEQ)** develops and enforces environmental regulations in the Commonwealth of Virginia. (www.deq.virginia.gov)

II. ROLES AND RESPONSIBILITIES

It is the responsibility of all employees, affiliates, students, and visitors to conduct laboratory work and activities in a manner that will not adversely impact themselves, other laboratory personnel, Blue Ridge Community College property, the surrounding community, or the environment. The implementation of a comprehensive laboratory safety program relies on the complete support and cooperation of various university entities.

- **Vice President of Finance and Administration (VPFA):** The office of the VPFA is responsible for implementation of the *Chemical Hygiene and Laboratory Safety Manual*.
- **Deans or Directors:** Each Dean or Director has the responsibility for overseeing all instructional and research laboratory work and activities in their unit.
- **Chemical Hygiene Officer:** BRCC has contracted with James Madison University to provide services related to the Chemical Hygiene Officer position for the College.
- **Human Resources:** The Human Resources Office is responsible for managing the Medical Surveillance and Hearing Protection programs. In addition, the Human Resources Department is responsible for notifying OSHA when an employee is killed on the job (within 8 hours) or suffers a work-related hospitalization, amputation, or loss of an eye (within 24 hours).
- **Laboratory Manager:** The Laboratory Manager is responsible for ensuring that the administrative pieces of this plan are complete to include but not limited to: Chemical Inventories and SDS information, ensuring that labs are in compliance with audit recommendations, maintaining updated supplement standard operating plans, hazmat removal and ensuring that all training requirements have been met and are documented.
- **Public Safety:** The Public Safety Office is the main point of contact for any safety related concerns in laboratory spaces including but not limited to accidents, spills, unsafe conditions, etc.
- **Buildings and Grounds –** The Building and Grounds department is responsible for the maintaining laboratory equipment to include inspections, new installations, and repairs.

All BRCC personnel working in laboratories are charged with the following:

- Completing required safety and laboratory training
- Overseeing all laboratory work, activities, and employees in the laboratory

- Adhere to laboratory safety policies and procedures and comply with safety regulations
- Provide information to all BRCC students, faculty, and staff regarding hazardous substances and other laboratory hazards specific to the lab being conducted and provide instruction in safe laboratory practices and procedures for dealing with these hazards.
- Plan adequately for experiments to reduce the likelihood of exposure to hazardous conditions and substances.
- Implement appropriate security precautions to prevent unauthorized individuals from gaining access to laboratory materials and equipment.
- Ensure that labs are not occupied by anyone except administrative staff (including student, and visitors) without instructional supervision.
- Ensure that inventory is locked when not in use.
- Ensure that labs are only used for their designated purpose. No meetings, alternate office space, or other social or student study activities are allowed. Lab areas are unique spaces and present an opportunity for injury when used for purposes other than specified lab activity.
- Implement signage and labeling requirements.
- Maintain required laboratory safety records to include accurate inventory records.
- Provide, maintain, and replace PPE worn by laboratory personnel.
- Implement storage requirements for hazardous substances.
- Adhere to shipping and transportation requirements for hazardous materials.
- Properly manage laboratory waste.
- Maintain spill supplies and be familiar with spill response procedures
- Communicate instances of spills, accidents, near-accidents, and unsafe work conditions to Director of Public Safety.

III. RISK MANAGEMENT AND CONTROLS

Accurate assessment of the risks associated with laboratory operations and the implementation of measures to effectively manage those risks are critical components of laboratory safety. Risk assessment focuses primarily on the prevention of laboratory-associated exposure to physical, chemical, biological, and radiation hazards. Risk management is the application of the OSHA standard for hierarchy of control which identifies and ranks safeguards of protection. These safeguards, in order of most to least effective are as follows: Elimination, Substitution, Engineering Controls, Administrative Controls, and Personal Protective Equipment (PPE). While eliminating the use of hazardous chemicals or substituting them for lower or non-hazardous materials are the preferred methods of control, these options are not necessarily viable in a laboratory environment therefore this plan will focus on Engineering Controls, Administrative Controls, and PPE.

The assessment and management of these risks is an ongoing process and must be continually evaluated to reflect changes in the quantity or type of hazardous substances present in the laboratory, types of procedures to be performed, and current regulations and recommendations from government agencies regarding safe laboratory practices.

The following factors should be considered when determining the risk associated with a particular project or procedure:

- Hazards associated with the procedure;
- Potential for a harmful personal exposure to occur;
- Potential for release of a hazardous substance to the environment;
- Level of training and experience of personnel;
- Use and condition of laboratory equipment;
- Availability of safety equipment such as chemical fume hoods and/or biosafety cabinets;
- Appropriate PPE;
- Type and volume of hazardous substances used and waste generated;
- Proper storage;
- Potential for production of harmful byproducts; and
- Appropriate response procedures in the event of an emergency.

When evaluating laboratory procedures, Laboratory personnel should consider likely routes of exposure for the hazardous substances used in the laboratory, safety precautions and equipment (such as PPE and chemical fume hoods) that can be utilized to minimize the risk of exposure, and exposure response procedures to be implemented in the event of an exposure.

1. *Engineering Controls*

Engineering controls are facility features and equipment intended to reduce the likelihood or severity of an exposure. This includes laboratory design, safety equipment, and safety guards on laboratory equipment. All modifications to laboratory spaces must be approved by the Office of the Vice President of Finance and Administration.

The table below illustrates Engineering Controls in place at the College

Control	Requirement(s)
Laboratory Ventilation	• Air exchange rate for laboratories between six and 12 air changes per hour, depending on laboratory activities • Systems are designed to be single-pass systems that support a negative pressure environment with respect to adjacent hallways and rooms.
Fire Safety	In accordance with NFPA-45 Standard on Fire Protection for Laboratories using Chemicals: • Passageways and aisles must be a minimum of 36 inches wide and must remain unobstructed. • The location of emergency exits for each laboratory and laboratory support room must be clearly marked. If possible, there should be two exits for each laboratory area.

	• Exits, stairs, and passageways should be permanently illuminated to facilitate evacuation in the event of an emergency. Emergency exits must be clearly marked. • Fire doors, fire strobes, and fire extinguishers must remain unobstructed. • Flammable chemicals must be stored in NFPA-approved flammable liquid storage cabinets.
Laboratory Bench Tops	• Constructed of synthetic materials resistant to the effects of acids, bases, solvents and moderate heat. • Must be capable of supporting the weight of equipment and should be resistant to chipping or damage from routine laboratory operations. • Sufficient space must be provided for research activities and equipment placement. • Desks and shelves should not be used as a substitute for properly designed bench tops.
Chemical Fume Hoods	• During use, the sash should be opened to 18 inches or below the user's breathing zone. • All apparatus and equipment should be located at least six inches away from the hood face. • When not in use, the sash should be closed completely and the surface should be free of all materials and equipment. • Chemicals should not be stored in a chemical fume hood but should alternatively be placed in appropriate chemical storage cabinets. • Apparatus used in hoods should be fitted with condensers, traps, or scrubbers to contain and collect waste solvents or toxic vapors or dusts. • Fume hood should not be used for waste disposal by way of evaporation. It is a violation of environmental regulations to intentionally evaporate hazardous chemicals in the chemical fume hood.
Chemical Fume Hood Inspections	• Conducted at least annually • Following installation of a new chemical fume hood or renovation of a room where a chemical fume hood is located; • When maintenance is performed on a chemical fume hood; • Per request by the Laboratory Personnel if chemical fume hood performance is unsatisfactory; and • As required due to specific laboratory operations conducted in a laboratory. • Fume hood should be labeled with an inspection sticker that displays the date that the hood was inspected, the measured face velocity, and the name of the inspector who conducted the test. • Chemical fume hoods that fail inspection cannot be used until they are repaired and retested.
Chemical Fume Hood Best Practices	• Use a chemical fume hood or other local ventilation device when working with volatile substances with a threshold limit value (TLV) less than 50 parts per million (ppm). • Design experiments in consideration of chemical fume hood space and air flow. • Before beginning work, verify that the type of chemical fume hood to be used and the face velocity are appropriate for the chemicals involved and the procedure to be performed. • Do not use perchloric acid in a conventional chemical fume hood. Perchloric acid vapors accumulate in ductwork and form perchlorate crystals that have the potential to explode, causing serious injury to personnel and damage to property. • Check areas around the chemical fume hood for sources of cross drafts

	that may cause turbulence and result in leaks from the hood into the laboratory. Other personnel working in the laboratory should avoid walking behind individuals conducting work at the fume hood to reduce negative turbulence. Doors should remain closed reduce to maintain negative pressure in the laboratory relative to the hallway. • Verify that the reading from the continuous airflow monitoring device is no less than 80 fpm, no greater than 120 fpm, and within 15% of the face velocity value listed on the inspection sticker. If the reading differs significantly from that on the sticker, the chemical fume hood may not be operating properly. Contact B&G so that the hood can be reevaluated. • Visually inspect the baffles (openings at the top and rear of the hood) to be sure that the slots are open, unobstructed, and set to the proper configuration based on the chemicals used. • Provide secondary containment for containers that could break or spill. • If large equipment must be placed in the chemical fume hood, use blocks to raise it approximately two inches above the surface so that air may pass beneath it. • Ensure that all electrical devices are connected outside the chemical fume hood to avoid an electrical arc that can ignite a flammable or reactive chemical. • Clean all chemical residues from the chemical fume hood chamber after each use. • Biosafety cabinets should be used for work involving infectious materials. Chemical fume hoods are not designed to protect against aerosolized biohazardous material.

2. *Administrative Controls*

Administrative controls are precautionary measures implemented to reduce the risk of accidents in the laboratory through training, signage and labeling, record keeping, and medical surveillance. Administrative controls should be established prior to beginning a laboratory project or protocol.

The table below illustrates Administrative Controls in place at the College

Control	Requirement(s)
Training	• Laboratory personnel, students, support services staff, and visitors entering laboratories or laboratory support rooms are required to receive safety training commensurate with their level of participation in laboratory activities and the duties they are to perform.
Signs and Labels	• Signs and labels are used to clearly identify specific laboratory hazards, safety equipment, emergency supplies, designated areas within the laboratory and other important information.
Emergency Contact Information	• Each laboratory must post emergency contact information near the laboratory exit.
Labeling Equipment and Designated Areas	The following items must be identified with labels or signage: • Safety equipment; o Emergency shower;

	- Eyewash station; - First aid supplies; - Fire extinguishers; - Fire blankets; and - Spill supplies. • Designated areas for work with particularly hazardous substances; including select carcinogens, reproductive toxins, and substances which have a high degree of acute toxicity • Satellite accumulation area • Chemical storage areas • Unique hazards • Electromagnetic equipment • Thermal hazards • Electrical hazards • Mechanical hazards • Ionizing radiation hazards
Laboratory Equipment	• Broken equipment that is not operational must be taken out of service and labeled to prevent further use by laboratory personnel. • Notify Building & Grounds immediately of broken or malfunctioning safety equipment (e.g., chemical fume hoods, biosafety cabinets, emergency shower, etc.).
Additional Signage	• All laboratory equipment (e.g., refrigerators, freezers, centrifuges, and incubators) and waste disposal containers in which biohazardous material or radioactive materials are used or stored must be labeled to indicate the type of hazard present. • For biohazardous materials, the label must contain the universal symbol for biohazard and the word "Biohazard". • For radioactive materials and instruments that produce radiation, the label must contain the universal symbol for radiation, the words "Caution, Radioactive Materials" or "Caution, Radiation," and identify the specific radioisotope, if applicable. • Labels should be affixed to the container or as close as possible to the container using string, wire, adhesive, or any other method that prevents their loss or unintentional removal.
Required Safety Records	Lab Personnel are required to maintain records regarding laboratory safety and compliance to include the following: • Chemical Hygiene and Laboratory Safety Plan • Supplemental Laboratory Safety Plan detailing Standard Operating Procedures • Chemical Inventory • Safety Data Sheets • Training Records • Additional Records for Biological Laboratories
Laboratory Inspections	• BRCC may be periodically inspected by federal, state, and local agencies to assess safety and compliance at the College. • During these visits, inspectors may ask to examine laboratories and laboratory support rooms, question laboratory personnel, and examine laboratory records.

Exposure Monitoring	• Exposure monitoring is conducted when there is reason to believe that exposure levels for a chemical may exceed the regulated limits. • Exposure monitoring may be required when modifications to laboratory ventilation equipment are made or when particularly hazardous substances are used regularly. • After an exposure the operations of the laboratory will be reviewed and corrective actions implemented to reduce or eliminate exposure to hazardous substances.

Medical Surveillance	• OSHA 29 CFR and Virginia Administrative Code (16 VAC 25-90) requires that employees exposed to health hazards at work are included in a medical surveillance program.
	• Employees have the right to seek medical care at no cost related to the following
	  o Signs or symptoms associated with chemical exposure.
	  o A spill, leak, explosion, or other occurrence results in the likelihood of an exposure
	  o Exposure monitoring reveals an exposure level above the action level or PEL.
	  o The employee routinely (e.g., three times a week) uses chemicals with high chronic toxicity.

3. *Personal Protective Equipment (PPE)*

PPE must be provided to and worn by all laboratory personnel, students, and visitors, when entering a laboratory including spaces where animals are present. The extent and type of PPE selected for a particular activity depends on the risks associated with laboratory operations to be performed. At a minimum, gloves, clothing that covers the torso, legs, and closed–toe shoes must be worn when working with laboratory materials. Shoe covers, lab coats, forearm protection, eye protection, or a respirator may be required depending on the type of work being conducted.

SDS provide specific PPE recommendations for handling chemicals. PPE should be durable, designed to provide adequate protection, and capable of preventing exposure to hazardous substances. PPE must be removed before leaving the laboratory unless it is being used to safely transport substances between rooms and buildings. PPE should be worn to transport materials between laboratories in the same building. PPE worn for this purpose should be clean to prevent contamination of communal areas. Only one hand should be gloved so that one hand is free to touch communal surfaces (e.g., door handles, elevator buttons).

While PPE is an important component of a comprehensive laboratory safety program, it is most effective when used in conjunction with and should not be a substitute for engineering controls, administrative controls, good laboratory practices, and safety equipment. OSHA requires the use of PPE to reduce employee exposure to hazards when engineering and administrative controls are not feasible or effective in reducing these exposures to acceptable levels.

The table below illustrates Personal Protective Equipment controls in place at the College:

Control	Requirement
Personal Clothing	• Personal attire must be considered when working in a laboratory since clothing, accessories, and hair may become entangled in equipment, accidentally spill substances, or pass through flames unintentionally. • Proper personal attire includes clothing that provides adequate coverage for the upper body, legs and close-toed footwear that provides adequate support and has suitable traction for laboratory activities. • Hair should be confined or tied back. • The following should not be worn in the laboratory: loose sleeves, dangling jewelry, clothing that leaves the legs exposed, or shoes with heels greater than one inch.
Eye Protection	• Must be worn when working with substances or equipment that present a hazard to the eye. • Eye protection must meet design requirements set forth by ANSI Z87 and must be appropriate for the activity being performed. • Safety glasses and goggles should fit securely and be free of smudges or scratches that may obstruct vision. • Safety glasses are designed for impact hazards and may be equipped with side shields to provide more complete protection than those without. • Goggles provide protection from impact, dust, mists, and splashes.
Face Shields	• Face shields are designed to be used in combination with safety goggles to provide additional protection to the face and eyes against splashes and particulate matter. • Face shields do not provide adequate protection against large projectiles or liquids, unless they are used in combination with safety goggles. • Polycarbonate face shields that offer protection against ultraviolet (UV) radiation should be worn when using instruments that produce UV light and do not have UV filter.
Gloves	• Gloves should always be worn when working with chemicals even if the chemical containers are tightly closed or the experiment being conducted is within a closed system. • Gloves should be comfortable, of sufficient length to prevent exposure of the hand and wrist, and should be appropriate for the type of work to be performed. • Gloves should be inspected for visible tears before use, changed when they become soiled or compromised, and discarded appropriately after use. • Laboratory personnel should use gloves that provide the highest level of protection against the substances to be used.
Lab Coats and Aprons	• Lab coats must be provided to and worn by all laboratory personnel, students (including those in instructional laboratories), and visitors when the hazards of the substances necessitate their use.

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	• Lab coats must provide adequate protection from the risk of contamination and must be laundered on a routine basis.
	• Only single use disposable lab coats or lab coats that are routinely laundered by an approved vendor may be used
	• Additional considerations when selecting lab coat are listed below.
	    o Lab coats should be properly sized, provide body coverage from the neck to the knees, and cover the full length of the arm.
	    o Lab coats should have fasteners (such as snaps) that allow for easy removal in case of contamination.
	    o Lab coats should be made with flame-retardant material if working with open flames, large quantities of flammable materials, or pyrophoric chemicals.
	    o Pockets should be on the outside of the coat (not the inside) to minimize potential contamination of street clothes or skin.
	    o Personnel operating at BSL-2 should have cuffed sleeves to provide continuous coverage from the wrist to the forearm and prevent the coat from riding up during work with infectious material.
	• Lab aprons are designed to be worn in combination with a lab coat to provide extra protection when pouring corrosive chemicals, using an acid bath, or manipulating chemicals in a manner that increases the likelihood of splashes or spills.
	• Lab aprons should fit comfortably and extend from just below the neck to just above the tops of the feet.

Respiratory Protection	• Respiratory protection requirements vary depending on the type of respiratory hazard present. In general, respiratory protection should fit snugly and form a seal so that air may not leak through the sides of the respirator. • If your work requires you to wear respiratory protection [e.g., half face, full face, PAPR, particulate mask (including N95 or N99)], you must be medically cleared, fit-tested annually or when circumstances affecting the respirator fit may have changed (e.g., weight loss/gain, dentures, etc.), and receive annual training.
Hearing Protection	• Hearing protection, provided by earplugs or earmuffs, should be worn by personnel exposed to 85 dBA over an eight-hour period. • In some laboratories, the combination of noises

	generated by continuously running equipment (e.g., refrigerators, freezers, and incubators) and intermittent use of equipment such as centrifuges, motors, sonicators, and homogenizers may reach levels that exceed 85 dBA. • As a general rule, if an employee must raise his/her voice to speak with someone less than 1 meter away, then noise levels probably exceed 85 dBA. • If you believe noise levels may exceed the action level, contact the Office of Public Safety.

IV. CHEMICAL HAZARDS

The hazardous nature of a chemical is determined by the potential for the chemical to cause adverse health effects (toxicity) and the physical hazards inherent to the properties of the chemical (e.g., flammability, reactivity). It is critically important that laboratory personnel are aware of and recognize the signs and symptoms of chemical exposure. Prior to work, each chemical's SDS should be reviewed for associated signs and symptoms. The table below defines common terms that are found in an SDS.

Signs and symptoms of chemical exposure may include (these symptoms may also be associated with conditions other than chemical exposure):

- Skin that has become dried, whitened, reddened, swelled, blistered, and itchy or exhibits a rash;
- A chemical odor. Many chemicals can be smelled at concentrations below harmful levels. Harmful levels may also be present for some chemicals without a detectable odor. Consult the SDS;
- A chemical taste;
- Tearing or burning of the eyes;
- Burning sensations of the skin, nose or throat;
- Cough, headache or dizziness.

Term	Definition
Toxicity and Toxicology	The toxicity of a chemical is the ability of that chemical to cause a reproducible dose-dependent effect on a biological system.
Dose-Response Relationship	Dose-response is the measurable relationship between the dose of a chemical and a toxic effect caused by the chemical and is the most fundamental concept in toxicology
Toxicokinetics	Refers to the disposition of chemicals in the body. All chemicals have the potential to cause toxic effects.
Chemical and Physical Properties of Materials	A physical property of a substance is one that can be measured or observed without affecting the composition of the substance and include properties such as melting point, freezing point, density, solubility, vapor pressure, and the physical state (solid, gas, liquid). In contrast, properties that describe how a substance changes into a completely different substance are called chemical properties.
Exposure Scenario	The exposure scenario refers to the dosage (how much), frequency (how often), duration (for how long), and route of exposure.
Routes of Entry into the Body	The route of entry is the path by which a chemical enters the body.
Chemical Interactions	Simultaneous exposure to other hazardous substances may interact in the body to

	produce responses that are different than if exposed independently.
Allergic Reactions	Allergic reactions, including hypersensitive and sensitization reactions, result from the body's production of antibodies in response to an allergen.
Immediate or Acute Toxicity	Immediate or acute toxicity occurs rapidly after a single exposure.
Delayed or Chronic Toxicity	Delayed or chronic toxicity manifests itself after a period of latency (maybe many years).
Reversible or Irreversible Effects	Reversible effects are those adverse effects that wear off (or reverse), given sufficient time after the exposure ceases.
Local Toxicity or Systemic Toxicity	Local toxicity occurs at the site of chemical contact. The chemical need not be absorbed to cause this reaction. Examples include skin and eye irritation and respiratory tract irritation. Systemic toxicity occurs at a site or sites distant from the site of chemical absorption.
Particularly Hazardous Substances	Particularly hazardous substances have been identified by OSHA as requiring special consideration and additional safety provisions because of their toxic effects.
Physical Hazards of Chemicals	Hazardous chemicals possess a spectrum of physical and chemical properties that must be understood before beginning work in a laboratory.

V. HAZARDOUS MATERIALS PROCUREMENT, STORAGE, AND DISPOSAL

1. Procurement

Before a chemical is ordered, evaluate any chemical surplus available in your department. Review the storage, security and disposal requirements, and consider the properties of the chemical to determine if a safer substitute is available for use. Safer alternatives must be purchased whenever possible, unless use of the safer alternative will negatively impact the outcome of the planned usage. Proper storage facilities and safety equipment must be available prior to acquisition of any hazardous chemical.

Laboratories shall receive prior approval from BRCC before ordering any chemical of high or moderate chronic toxicity, or of high acute toxicity, not currently on hand, and before implementing any new procedure which may lead to routine exposure of employees and/or students to such chemical.

2. Chemical Storage

Each laboratory must have adequate chemical storage areas that provide sufficient and defined barriers between incompatible chemicals. Information on proper chemical storage can be found in the SDS for each chemical.

Follow these guidelines when storing chemicals:

- Storage areas should be dry, well ventilated, and located away from sunlight and ignition sources.
- Chemicals should be stored in cabinets treated, coated or constructed of materials that are compatible with the chemicals being stored that have a lip or guard along the exposed edge.
- Cabinets should be easily accessible and clearly labeled as chemical storage areas by:
    - Using a pictogram of the primary hazard category contained in the cabinet;
    - A sign indicating that the cabinet contains chemicals;
    - See-through panes that allow visibility of the cabinet's contents; or
    - Other marking that clearly indicates the storage of chemicals.
- Chemicals should be stored below eye level to minimize accidental exposure from spills.
- Solids should be stored above liquids.
- Chemicals must be segregated by chemical compatibility.
- Secondary containment should be used to segregate incompatible chemicals and control spills for containers of hazardous liquids greater than 1.3 gallons (5L).
- Only limited quantities of chemicals should be stored in the laboratory.
- Storage areas should be inspected frequently to identify deteriorating containers and faded or missing labels.

3. Container Labeling

OSHA requires that each chemical container, regardless of size or use, be properly labeled with the complete chemical name (formulas, abbreviations, and sketches of the molecule are not acceptable), manufacturer's information (if the chemical is in its original container), and appropriate hazard information (words, pictures, symbols, or any combination thereof) that provides at least general information regarding the hazards of the chemical. If a chemical is transferred from the original manufacturer's container to a secondary container, it must be clearly labeled using the complete chemical name and associated hazards of the chemical. Chemical formulas or abbreviations are not sufficient.

Follow these guidelines when labeling containers:

- The date received (for ordered chemicals) or the date generated (for chemical dilutions and experimental samples) should be recorded on all containers to prevent excessive waste and ensure proper disposal of expired chemicals.

- Permanent ink should be used to label containers, and labels should be securely attached to the side of the container. Labels affixed to container lids or stoppers are not reliable for identifying chemicals because lids may inadvertently be switched during use.
- Experimental samples and small reagent vessels may be identified by an alpha, numeric, or alphanumeric label as long as this label and corresponding label information is provided in a log that lists the chemical name represented by each sample and the hazards associated with that chemical. Laboratory personnel should be aware of the log and the hazards associated with the samples.
- Unlabeled containers must be assumed to contain hazardous components until the contents can be identified. Contact Public Safety for assistance in handling unlabeled containers.
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4. Chemical and Waste Disposal

Hazardous waste is defined by the EPA as any waste material that is ignitable, corrosive, reactive, or toxic, and that may pose a substantial or potential hazard to human health and safety and to the environment when improperly managed. To comply with EPA regulations, laboratory personnel must manage all chemical waste as hazardous waste.

- Collection containers will be provided for hazardous chemicals. Carefully deposit all hazardous chemicals in these containers.
- Immediately upon being generated, hazardous waste must be labeled with the words "hazardous waste", the contents, and the hazards of the contents. Once moved to the accumulation area, the container must be dated.
- Never touch broken glassware with your bare hands; use a dustpan and broom. Place broken or cracked glassware in the box designated for broken glassware unless the glassware is contaminated by a hazardous chemical.
- Spilled hazardous chemicals must be cleaned up by trained personnel and disposed of as hazardous waste. Do not throw any hazardous materials in the trash can or broken glassware container.
- Never throw solids, including such things as filter paper, boiling stones, and broken glass, in the sinks.

VI. EMERGENCY PROCEDURES

Emergencies are unpredictable and unexpected events that pose a potential threat to health and safety of personnel, property, and the environment. OSHA defines a chemical emergency as "equipment failure, rupture of containers or failure of control equipment that results in an uncontrolled release of a hazardous chemical into the workplace." Examples include:

- An accidental and uncontrollable spill from a broken bottle or leaking container;
- A reaction between two incompatible reagents while in storage;
- A process or experiment begins to react unpredictably or uncontrollably;
- An exposure to hazardous substances occurs that results in injury;
- A chemical fume hood that contains a toxic or hazardous substance fails to evacuate vapors from the hood; or
- A strong odor is detected, and the origin cannot be determined or the release cannot be brought under control.

If a situation poses imminent danger to health and safety and cannot be isolated, contained, or controlled, evacuate the room or building (if necessary), call 911 and contact Public Safety. Above all else, laboratory personnel should take measures to ensure the safety of themselves and other laboratory personnel.

In case of injury:

- Do not attempt to remove foreign objects from the eye or body.
- In cases of chemical exposure, follow the guidance in the SDS.
- Be sure you know the locations of the fire extinguishers, safety shower, eyewash, and first aid kits.
- Report all injuries or accidents to Public Safety, no matter how minor.
- If chemical comes in contact with skin, wash it off immediately with cool water. Continue rinsing for at least 5 minutes. Do not use soap.
- For large spills of hazardous chemicals to the skin or clothing, immediately enter the safety shower. Once in the shower, remove all contaminated clothing.
- For chemical splashes to eyes, immediately rinse your eyes at the eyewash station. Continue rinsing for at least 15 minutes.
- If a chemical is ingested seek medical attention.
- If a chemical is inhaled, leave the area and immediately
- Bathe skin burns in cool running water.
- In cases of clothing fires, stop drop and roll to smother the fire or walk to the safety shower and turn it on. Fire blankets should never be used to smother clothing fires.
- A fire in a small container can be smothered by covering the opening with something such as a watch glass.

APPENDIX A – SUPPLEMENTAL LABORATORY SAFETY PLAN

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APPENDIX B – REFERENCES

OSHA Laboratory Standard

https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1450

OSHA Hazard Communication Standard

https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1200

OSHA Respiratory Protection Standard

https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.134

EPA Resource Conservation and Recovery Act (RCRA)

https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.134