BLUFFTON-HARRISON METROPOLITAN SCHOOL DISTRICT

CHEMICAL HYGIENE PLAN

Extended Version

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A. Introduction

1. Goal of the Chemical Hygiene Plan

It is the policy of this Corporation to provide a place of employment and learning that is free from chemical exposures likely to harm employees' or students' health, and that complies with all federal, state, and local laws and regulations affecting the safety and health of its employees and students. This Chemical Hygiene Plan addresses this goal for the laboratory workplace by including the requirements of the Occupational Safety and Health Administration (OSHA) Standard on Occupational Exposure of Hazardous Chemicals in Laboratories.

B. Chemical Hygiene Personnel

1. Goal

Successful development and implementation of a Chemical Hygiene Plan requires the full commitment of the administrators, the Corporation Safety Program Manager and laboratory Chemical Hygiene Officer. Implementation of this plan is the responsibility of the Safety Program Manager and the Chemical Hygiene Officer(s). The Chemical Hygiene Officer's goal is to ensure that responsibility for chemical hygiene and safety in the laboratories is shared by all who work in those laboratories, including students.

2. Key Personnel and Their Responsibilities

- **Chemical Hygiene Officer**

  The Corporation's Safety Program Manager must appoint a Chemical Hygiene Officer for each school that contains a laboratory. Their responsibilities include:
  - Making sure this chemical hygiene plan is readily available to employees and their representatives;
  - Maintaining adequate records detailing efforts and results of employee exposure monitoring (including associated accident reports, if applicable) and medical consultations and examinations;
  - Ensuring that employees are provided with the required and appropriate training to carry out their responsibilities; and
  - Monitoring, in coordination with Corporation legal counsel, the legal requirements concerning hazardous substances.

- **Laboratory Instructors**

  Laboratory instructors are responsible for planning and conducting laboratory operations in accordance with the appropriate procedures and rules outlined in the Chemical Hygiene Plan. The instructors are also responsible for developing good personal chemical hygiene habits.

- **Students**

  Although students are not covered under the Chemical Hygiene Plan, good personal chemical hygiene habits must also be taught to all students who use the lab while enrolled in science courses. Students must not be allowed to use Corporation laboratories outside of regular science course classes unless they first obtain permission and are directly supervised by instructors during their work.

C. Standard Operating Procedures for Laboratories

1. Goal

To protect employees and students working in the laboratory, and others who may be exposed, and to protect the environment from injury or contamination due to hazardous chemicals.

2. Online Resources

Visit these websites and familiarize yourself with laboratory safety information:

- School Chemistry Laboratory Safety Guide - https://www.cdc.gov/niosh/docs/2007-107/pdfs/2007-107.pdf?id=10.26616/NIOSHPUB2007107

- School Science Laboratories – A Guide to Some Hazardous Substances - https://stacks.cdc.gov/view/cdc/12078/cdc_12078_DS1.pdf

3. Employee Exposure Protection

Laboratory operations must be conducted in a manner that prevent employee exposure to chemical substances in excess of the PELs (Permissible Exposure Limits) set forth in 29 CFR 1910.1000, and 1910.1001 through 1910.1450. Personal protective equipment (PPE) and instructions on the proper use of this equipment must be provided to employees, as appropriate, to minimize exposure to hazardous chemicals.

4. Laboratory Facilities Design Criteria

The work conducted in a lab must be appropriate to the physical facilities available and to the quality of the ventilation system.

- **Laboratory Design** (*See Appendix 3, School Chemistry Laboratory Safety Guide, for a detailed list of requirements.*) Laboratory facilities should include, where appropriate:
  - An adequate general ventilation system with air intakes and exhausts located to avoid intake of contaminated air;

  - Well-ventilated stockrooms and storerooms;

  - Proper chemical storage for specific hazardous materials; e.g., flammables, corrosives, poisons and oxidizers;

  - Adequate laboratory hoods and sinks;

    - Emergency equipment including fire extinguishers, spill kits, and alarms;

    - First aid equipment including first aid kits, eyewash fountains and drench showers; and

    - Drain-free floors in chemical storage rooms.

- **Laboratory Ventilation**
    - The general laboratory ventilation system should provide a source of air for breathing and for input to local ventilation devices, ensuring that laboratory air is continually circulated, and direct air flow into the laboratory from non-laboratory areas and out to the exterior of the building.

    - General laboratory ventilation should operate at a rate of 4-to-12 room air changes per hour. Use local exhaust systems such as chemical fume hoods to control exposures from hazardous fumes, dusts and vapors.

    - There must be at least one fume hood for each laboratory where hazardous chemicals are being used. With the sash raised to 12 inches, air should enter the fume hood at 60-to-125 linear feet per minute - checked quarterly with a velocity meter or anemometer. Maintain written documentation of all tests.

    - Cabinets that store corrosive acids should have open ventilation holes to prevent accumulation of corrosive vapors.

    - Flammable liquids cabinets must be kept closed unless they are equipped with an explosion-proof auxiliary exhaust ventilation system. Stockrooms should have their own dedicated ventilation system that provides additional air exchanges.

    - The quality and quantity of ventilation should be evaluated when installed, monitored regularly (at least every six months), and reevaluated whenever a change in ventilation devices is made.

5. **Employee Exposure Determination and Monitoring**
   If there is reason to believe that exposure levels for an OSHA-regulated substance routinely exceed the PEL, the Safety Program Manager or Chemical Hygiene Officer will ensure that employee or student exposure to that substance is measured.

6. **Medical Consultations and Medical Exams**
   Employees who work with hazardous chemicals will be allowed to receive medical attention when overexposure to a hazardous chemical is suspected.

7. **Chemical Procurement**

Do not accept donations of chemical compounds. Purchase chemicals for the laboratory in accordance with the Chemical Hygiene Plan. Staff are prohibited from purchasing or storing restricted chemicals. (*See list in Appendix 1, Restricted Chemicals.*)

- **Purchase Approval**
  - Buy no more than a five-year supply of laboratory chemicals at a time. It is only acceptable to exceed this limit if the chemical is not available in a smaller container.

- **Receiving Shipments**
  - Request safety data sheets for all chemicals being purchased. Understand proper handling, storage and disposal before ordering chemicals. Inspect chemical containers when they arrive. Open shipping boxes and Styrofoam outer containers when chemical products arrive; this allows you to see if containers or contents have been damaged in shipping. Return even slightly damaged new containers for refund and replacement.

  - Carcinogens, reproductive toxins or highly acute toxins are **not allowed** in middle school or high school laboratories in this Corporation without written approval of the Safety Program Manager or Chemical Hygiene Officer.
    - Many of these compounds are on the Restricted Chemicals List.

    - Carcinogenic metals include chromates, dichromates, cadmium compounds, cobalt compounds, and nickel compounds.

    - Reproductive toxins include lead compounds, mercury compounds, bromates and the carcinogenic metals.

8. **Hazard Identification**

Properly label laboratory chemicals to identify any hazards associated with them.

- **Container Labels**
  - Labels on incoming containers of hazardous chemicals must not be removed or defaced. Do not open unlabeled bottles of chemicals. Dispose of unknown chemical compounds promptly as outlined herein.

- **Waste Disposal**
  - When dispensing chemicals from one container to another, label the new container with the chemical's name and hazards. Label all secondary containers in this manner unless they are intended for immediate use by the person who dispensed the chemicals.

- **Safety Data Sheets**
    - Maintain safety data sheets received with incoming shipments of hazardous chemicals and make them readily available to staff and students. Contact your chemical supplier and request replacement safety data sheets to replace old ones that remain in your collection after this date. Archive old safety data sheets according to your school's record-retention schedule.

- **Laboratory Signs**
    - Laboratory areas that have special or unusual hazards should be posted with warning signs. Signs should be posted to show the location of safety showers, eyewash stations, exits, first aid kits, fire extinguishers, emergency numbers, etc. Extinguishers should be labeled to show the type of fire for which they are intended. Label waste containers to show the type of waste that can be safely deposited in them. Consumption of food and beverages is not permitted in areas where laboratory operations are being carried out. Mark areas where food is permitted with a warning sign (e.g., EATING AREA - NO CHEMICALS). Refrigerators used for chemical storage must have this warning sign posted: "CHEMICAL STORAGE – NO FOOD OR BEVERAGES ALLOWED" All other refrigerators in laboratory spaces must have this warning sign posted: "FOOD STORAGE ONLY – NO CHEMICALS OR LAB SPECIMENS ALLOWED"

9. **Material handling**

   Store, distribute, and handle hazardous chemicals in a manner that minimizes the potential for accidents and employee exposure.

- **Stockrooms/Storerooms**
    - Segregate hazardous chemicals by hazard class in a well-identified area with local exhaust ventilation. Stockrooms should be under the control of one person who handles safety and inventory control. Examine stored chemicals for replacement, deterioration, and container integrity annually. Ensure safety data sheets (SDSs) are available for all chemical compounds in stock.

- **Distribution**
    - Transport chemical containers using a laboratory cart, if possible. Carts should provide sufficient secondary containment capacity to control potential spills.

- **Laboratory storage**
    - Keep quantities of chemicals stored in the laboratory to a minimum. Store chemicals away from heat sources and direct sunlight. Keep chemical inventories current when containers are disposed of, added, or replaced.

When inventorying, track the size of the container, not how much it contains. Segregate incompatible materials in storage:

- Acids away from bases in dedicated cabinets.
- Oxidizers away from organic compounds and flammable materials.
- Bleach away from ammonia.
- Water-reactive compounds away from alcohols, aqueous solutions, and sinks.
- Flammable glacial acetic acid in the flammables cabinet, not the acid cabinet.
- Store concentrated sulfuric acid on a separate shelf in the acid cabinet away from concentrated hydrochloric acid.
- Store nitric acid in a secondary container in the acid cabinet.

- **Use of a Chemical Fume Hood**
  Use the chemical fume hood for processes that may release hazardous chemical vapors, fumes or dusts. Use the hood when working with any volatile liquid or fine powders. Limit chemical storage in the hood to 24 hours. Chemicals stored in the hood should not block the flow of air. Provide secondary containment for all stored chemicals. Secondary containment must hold 100 percent of the largest container's capacity. Keep the hood ventilation system running while chemicals are stored in it.

- **Working Alone**
  Experiments must not be conducted by an instructor or student working alone in a laboratory. Instructors working outside of their class time to prep or test run experiments should ensure that there are other instructors present nearby. There are no exceptions to this policy.

- **Dispensing Chemicals**
  When transferring chemicals from one container to another, be sure the new container is compatible with the chemical and is labeled with the name of the chemical. The label must have the date and name of the employee filling the container. Hazard warning statements on chemical labels are required. (Poison, corrosive, flammable, oxidizer, etc.)

10. Laboratory Operations and Activities Requiring Approval

These laboratory operations require review and prior approval by the Chemical Hygiene Officer:

- Non-routine procedures for which the employee or student has not been trained;
- Analytical work with an unknown substance;
- Disposal of chemical wastes, including evaporation or disposal in drains;
- Operations or activities for which there are no written procedures; and
- Purchase of chemicals.

11. Emergency Prevention and Response

Laboratory instructors and other employees must be familiar with emergency procedures in order to prevent and reduce the impact of laboratory accidents.

- Emergency procedures should address chemical spills, laboratory accidents, a failure in the ventilation systems, and evacuation of the laboratory.
- Departments must have personnel trained in first aid available during working hours to render assistance until medical help can be obtained. All laboratory science personnel in the Corporation are required to possess a valid first aid card.
- The Safety Program Manager and Chemical Hygiene Officer must ensure that adequate emergency equipment is available in the laboratory and inspected regularly. (Refer to Appendix 3)
- Carefully investigate all accidents and near accidents. Forward the results of this investigation and recommendations for the prevention of similar occurrences to the Safety Program Manager. Accident reports must be kept on file with the Safety Program Manager and made available upon request.

12. Waste Disposal

The Safety Program Manager and Chemical Hygiene Officer must ensure that laboratory chemicals are properly disposed of in a way that limits risk to human health and the environment.

- Label chemical wastes with the words Hazardous Waste and the type of hazard it presents (e.g., Flammable, Corrosive, Toxic) on each container. Segregate waste chemicals based on their hazards in the same way that chemical products are stored in the stockroom. Once the hazardous waste collection container is mostly full, contact the Safety Program Manager and Chemical Hygiene Officer to arrange for proper disposal. Unlabeled containers of chemical wastes are unacceptable.

- Laboratory wastes must be properly disposed of. Before disposing of any laboratory waste materials, consult the Safety Program Manager for the proper disposal method or procedure. Don't dispose of volatile organic compounds by evaporating them in a fume hood.

13. Information and Training

The Safety Program Manager and Chemical Hygiene Officer must provide laboratory and other appropriate employees (e.g., receiving and shipping personnel, custodial, maintenance, stockroom personnel, emergency teams) with training and other information on the hazards of chemicals present in their work area and what to do if an accident occurs. Appropriate and authoritative on-line training can be used as a substitute for some of this training. Training must consist of at least these subjects:

- Procedures to follow to prevent the release of hazardous chemicals.
- Techniques for identifying a chemical release.
- The physical and health hazards of chemicals in the work area.
- Steps instructors can take to protect themselves and their students from chemical hazards, including general laboratory safety rules, emergency procedures and protective equipment to be used.

Employees must be provided with the following information:

- Location and availability of the Chemical Hygiene Plan.
- Signs and symptoms associated with exposure to hazardous chemicals used in the laboratory.
- Location and availability of reference material on the hazards, safe handling, storage and disposal of hazardous chemicals found in the laboratory including Safety Data Sheets.

Information and training must be provided at the time of the employee's initial assignment to the work area where hazardous chemicals are present and prior to assignments involving new exposure situations. Refresher information and training will be provided at least annually. Students must receive general laboratory safety training at the beginning of each semester and whenever practice demonstrates a need. Specific safety procedures must be taught whenever the need dictates.

1. **Record-Keeping**

   Document training of laboratory personnel and keep it in the employee's file.

2. **Information and Training Frequency**

The laboratory standard requires that employees receive information and training at the time of their initial assignment to a work area where hazardous chemicals are present and prior to assignments involving new exposure situations. Refresher training and information must be provided at least annually.

3. **Information Program**

   Laboratory employees must be informed of at least the following information:

   - The location and availability of the Chemical Hygiene Plan.
   - Signs and symptoms of exposure to hazardous chemicals used in the laboratory.
   - The location and availability of known reference materials on the hazards, safe handling, storage and disposal of hazardous chemicals found in the lab including Safety Data Sheets received from the chemical suppliers.

4. **Inspections and Reviewing the Chemical Hygiene Plan**

   Safety inspections of the laboratory and annual review of the Chemical Hygiene Plan contributes to overall laboratory and employee safety. The Safety Program Manager must ensure that these procedures are followed in each department and by each Chemical Hygiene Officer. Laboratory safety inspections must include all areas covered in https://www.cdc.gov/niosh/docs/2007-107/pdfs/2007-107.pdf?id=10.26616/NIOSHPUB2007107.

   - Inspect laboratory safety equipment at least semi-annually to ensure fitness for use, including:
     - Fume hoods & other protective equipment (environmental controls);
     - PPE (e.g., gloves, goggles, respirators);
     - Emergency equipment (e.g., fire extinguishers, spill kits); and
     - First aid equipment (e.g., showers, eyewash stations). (See Appendix 3. Science classroom and lab safety reference.)
   - The Chemical Hygiene Plan must be reviewed by the Safety Program Manager, Chemical Hygiene Officer, Hazardous Waste Coordinator, and others designated by the Safety Program Manager, at least annually for:
     - Compliance with current regulations;
     - Adequacy in protecting employees from the health and physical hazards associated with chemicals in use in the laboratory;

- The results of this review must be recorded, including notes on needed changes, and when those changes were made; and

- The plan must be updated as necessary (e.g., when there are changes in laboratory operations, laboratory personnel, regulations, etc.) and in a timely manner.

D. General Laboratory Safety Rules

1. Goal

To protect the health and safety of laboratory instructors and students who work with hazardous chemicals through training and careful attention to safe operation practices.

2. General Rules

The following pages contain the general laboratory safety rules for all Corporation laboratories. Other specific laboratory safety rules for individual laboratories can be added to these rules by the Chemical Hygiene Officer of that laboratory.

- Know the safety rules and procedures that apply to the work at hand. Before beginning any new operation, determine the potential hazards and appropriate safety precautions to take.

- Know the location and use of emergency equipment in the area, as well as ways to obtain additional help in an emergency. Be familiar with emergency procedures.

- Know the types of protective equipment that are available and use the proper equipment for each job.

- Watch out for unsafe conditions and report them so corrections can be made as soon as possible. One person's accident can be a danger to everyone in the lab area.

- Consuming food or beverages in laboratories or areas where chemicals are being used or stored is prohibited.

- Practical jokes or other behavior that might distract, startle, or confuse another worker can be dangerous and must be avoided.

- Use equipment for its designed purpose only.

- If you leave an operation unattended for any period of time, leave the laboratory lights on, post a sign, and take the necessary precautions for the event of a failure of a utility service (such as electricity or cooling water).

- Never leave laboratory chemicals unattended in an unsecured room.

- Notify the Chemical Hygiene Officer immediately if someone has been exposed to a hazardous chemical.

3. **Chemical Handling**
    - Do not smell or taste chemicals.

    - Always add acid to water. Never add water to acid.

    - Know the hazards posed by the different classes of chemicals, including oxidizers, flammables, corrosives, reactives, compressed gases, acutely hazardous, and chronically hazardous chemicals.

    - Read and understand the Safety Data Sheet (SDS) before using any new chemical.

    - Chemical wastes must be disposed of properly. Consult with the Chemical Hygiene Officer about waste management prior to instituting a new laboratory experiment.

    - Be sure equipment is carefully secured before use. Combine reagents in the proper order and avoid adding solids to hot liquids.

    - Never work alone in the laboratory. Make arrangements to have someone monitor your activities.

    - When transporting, storing, using, or disposing of any substance, be sure that it can't accidentally come into contact with an incompatible substance. This contact could result in an explosion, fire, or the production of hazardous gases, fumes or vapors. See Appendix 2. Storage pattern for chemicals where space is limited.

4. **Health and Hygiene**
    - Wear appropriate eye protection at all times in areas where chemicals are used or stored. Do not use contact lenses in the laboratory. Plastic contact lenses can absorb chemical vapors which may then cause serious eye damage.

    - Use protective apparel, including face shields, gloves, and other special clothing, as needed. Inspect gloves before each use and replace them if they appear degraded or contaminated. Avoid contact between gloves and exposed skin, clothing, and eyes or mucous membranes during use.

    - Secure long hair and loose clothing to avoid accidents. Lab smocks or aprons are highly recommended. Wear clothing that covers the arms, legs and feet. Closed-toe shoes must be worn.

- A pipetter, pipette bulb, aspirator, or other mechanical device must be used to provide vacuum. Using the mouth to pipette chemicals or to start a siphon is not permitted for any laboratory procedure.

- Avoid exposure to gases, vapors, and aerosols. Use the chemical fume hood when this type of exposure could occur.

- Wash well with soap and water before leaving the laboratory. Chemicals on hands can be transferred to food.

5. **Food Handling**
   - Do not be store, handle or consume food or beverages in the laboratory or other areas where chemicals are used or stored.

   - Do not bring chemicals or chemical equipment into areas that are designated for food consumption or smoking.

   - Never use laboratory glassware or utensils to prepare or consume food. Laboratory refrigerators, ice chests, microwave ovens and cold rooms must not be used for food storage or preparation. Laboratory refrigerators must have spark-proof motors to avoid setting off explosions of leaking vapors.

6. **Housekeeping**
   - Keep work areas clean and free from obstructions.

   - Cleanup should follow the completion of each operation and at the end of each day.

   - Attend to laboratory accidents and spills immediately. Follow the appropriate emergency procedures. The Center for Disease Control (CDC) has published Emergency Procedures in Schools in the Event of a Chemical Spill at www.cdc.gov/niosh/docs/2004-101/append.html.

   - Keep chemical and waste containers labeled at all times. Inform the Chemical Hygiene Officer immediately of the presence of any unlabeled containers. Do not open unlabeled containers. Label chemical product containers with the name of the product that matches its SDS and its primary hazards (toxic, corrosive, reactive, flammable).

   - Never block access to exits, emergency equipment, controls, etc.

   - Notify the laboratory supervisor immediately if equipment malfunctions. Discontinue use of the equipment if a safety hazard exists.

- Keep chemical storage under the hoods to a minimum. Leave the hood ventilation system turned on if chemicals are stored in or under the hood. Limit chemical storage in fume hoods to under 24 hours.

7. **Glassware**
   - Accidents involving glassware are the leading cause of laboratory injuries. Use careful storage and handling procedures to prevent glassware breakage.

   - Use adequate hand protection when inserting glass tubing into rubber stoppers or corks or when placing rubber tubing on glass hose connections. Tubing should be fire polished or rounded and lubricated. Hold hands close together to limit movement of glass should a fracture occur.

   - Handle vacuum-jacketed glass apparatus with extreme care to prevent implosions. Only glassware designed for vacuum work should be used for that purpose.

   - Wear protective gloves when picking up broken glass. Wear disposable chemical-resistant gloves under durable gloves when handling contaminated glass shards. Sweep up small pieces with a brush and dustpan.

8. **Flammability Hazards**
   - Never use an open flame to heat flammable liquids. Extinguish open flames as soon as its purpose is served.

   - Before lighting a flame, remove all flammable substances from the immediate area and check all containers of flammable substances to ensure they are tightly closed.

   - Store flammable materials in a flammable storage cabinet or other appropriate location.

   - Flammable cabinets must be kept closed or provided with ventilation piping that leads directly outside and is equipped with an explosion-proof exhaust fan.

E. Specific Exposure Control Measures

1. **Goal**

   To reduce instructor or student exposure to hazardous chemicals through unique exposure control measures.

2. **Exposure potential**

   The primary routes of exposure to chemicals are by inhalation, ingestion, and contact with skin or eyes.

- Inhalation of chemical vapors, mists, gases, fumes or dusts can produce poisoning through the mucous membrane of the nose, mouth, throat, and lungs and can seriously damage these tissues.

- Ingestion of many chemicals can be extremely dangerous.

- Contact with skin and eyes can lead to significant chemical injury. Most chemicals are damaging to the eyes, which are very sensitive organs. Alkaline materials like hydroxides, phenols, and strong acids can cause permanent loss of vision. Chemicals that are highly volatile or prone to corrode their container's caps increase the risk of harmful exposures. Find out whether staff or students have particular sensitivities to any chemical. Risk factors include asthma, chemical sensitivities, pregnancy and compromised immune systems.

F. Exposure Monitoring and Medical Attention

1. Goal

To provide laboratory instructors, other laboratory employees, and students with an appropriate level of exposure monitoring, and medical attention to protect them from adverse health effects resulting from potential exposure to hazardous chemicals.

2. Medical Attention

Medical examinations are to be provided at no cost to the employee. The Safety Program Manager must maintain an accurate record for each laboratory employee undergoing medical consultations or medical examinations as required by the laboratory standard. Keep this information in an employee's file:

- Exposure monitoring test methods and results.

- Safety Data Sheet of the hazardous chemical(s) involved.

- Accident Report.

- Information submitted to, and received from, the physician.

3. Medical consultations and medical exams

Employees who work with hazardous chemicals must be provided with an opportunity to receive medical attention when overexposure to a hazardous chemical is suspected. Medical attention must be provided to an employee under the following circumstances:

- Employees showing symptoms of chemical exposure must be permitted to receive a medical examination.

- When exposure monitoring reveals an exposure level routinely above the substance's action level, medical surveillance must be conducted as required by the laboratory standard.

- Whenever a spill, leak or other event makes it likely a hazardous exposure has occurred, the affected employee must be provided with the opportunity for medical consultation to determine the need for a medical exam.

All medical examinations and consultations must be performed under the direct supervision of a licensed physician without cost to the employee, without loss of pay and at a reasonable time and place. Direct all questions regarding medical consultations and examinations to the Safety Program Manager.

Provide the following information to a physician conducting medical consultations and exams:

- The identity of hazardous chemicals to which the employee may have been exposed.

- A description of the conditions under which the exposure occurred, including quantitative exposure data if available.

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

A written opinion from the examining physician for any consultations or exams performed under this Operating Procedure must include:

- Any recommendations for further medical follow-up.

- The results of the medical examination and any associated tests.

- Any medical condition revealed during the course of the exam which might compromise employee safety during, or as a result of, exposure to hazardous chemicals found in the workplace.

- A statement that the employee has been informed by the physician of the results of the consultation or medical exam and any medical condition that may require further examination or treatment. The written opinion should not reveal specific diagnoses unrelated to occupational exposure, except as noted above.

Accurate records of medical consultations or medical examinations must be kept by the Safety Program Manager.

Appendix 1.

Restricted Chemicals

Chemicals used in the laboratory may be hazardous because of the following:

- Safety risks (i.e., highly flammable or explosive material)
- Acute and chronic health hazards
- Environmental harm
- Impairment of indoor air quality

Assessment of the chemicals in this list indicates that their hazardous nature is greater than their potential usefulness in many school programs. Evaluation included physical hazards (i.e., flammability, explosive propensity, reactivity, corrosivity) and health hazards (i.e., toxicity, carcinogenicity).

This following list of chemicals was generated from the Manual of Safety and Health Hazards in the School Science Laboratory published by U.S. Department of Health and Human Services, National Institute for Occupational Safety and Health [1984].

Carcinogenic substances were identified from the Report on Carcinogens (10th Edition) generated by the National Toxicology Program (2002).

Chemical	**CAS Number**	**Hazard**
Acrylonitrile	107–13–1	Flammable (NFPA = 3), reasonably anticipated human carcinogen
Ammonium chromate	7788–98–9	Oxidizer, known human carcinogen
Aniline	62–53–3	Combustible, may be fatal if inhaled, ingested or absorbed through the skin
Aniline hydrochloride	142–04–1	May be fatal if inhaled, ingested, or absorbed through the skin
Anthracene	102–12–7	Irritant, may cause an allergic skin reaction
Antimony trichloride	10025–91–9	Corrosive
Arsenic and its compounds	N/A	Known human carcinogen
Asbestos	1332–21–4	Known human carcinogen

Ascarite II	N/A	Corrosive, may be fatal if ingested
Benzene	71–43–2	Flammable (NFPA = 3), known human carcinogen, mutagen
Benzoyl peroxide	94–36–0	Flammable (NFPA = 3), explosive, oxidizer
Calcium cyanide	592–01–8	May be fatal if inhaled or ingested
Carbon disulfide	75–15–0	Flammable (NFPA = 4), acute cns toxicity and peripheral neurotoxicity
Carbon tetrachloride	56–23–5	May be fatal if inhaled or ingested, reasonably anticipated human carcinogen
Chloral hydrate	302–17–0	Controlled barbiturate
Chlorine	7782–50–5	Oxidizer, corrosive, may be fatal if inhaled
Chloroform	67–66–3	Reasonably anticipated human carcinogen
Chloropromazine	50–53–3	Controlled substance
Chromium hexavalent compounds	N/A	Known human carcinogen
Chromium trioxide	1333–82–0	Oxidizer, Corrosive, known human carcinogen
Colchicine	64–86–8	May be fatal if ingested, mutagen
p-Dichlorobenzene	106–46–7	Combustible, reasonably anticipated human carcinogen
Dimethylaniline	121–69–7	May be fatal if inhaled, ingested, or absorbed through the skin
p-Dioxane	123–91–1	Flammable (NFPA = 3), forms peroxides (Group 2), reasonably anticipated human carcinogen

Ethylene dichloride (1,2-Dichloroethane)	107–06–2	Flammable (NFPA = 3), reasonably anticipated human carcinogen, mutagen
Ethylene oxide	75–21–8	Flammable (NFPA = 4), explosive (NPFA = 3), may be fatal if inhaled or absorbed through the skin, known human carcinogen
Gunpowder	N/A	Explosive
Hexachlorophene	70–30–4	May be fatal if inhaled, ingested or absorbed through the skin, possible teratogen
Hydrobromic acid	10035–10–6	Corrosive, may be fatal if inhaled or ingested
Hydrofluoric acid	7664–39–3	Corrosive, may be fatal if inhaled or ingested (liquid and vapor can cause severe burns not always immediately painful or visible but possibly fatal)
Hydrogen	1333–74–0	Flammable (NFPA = 4)
Hydriodic acid	10034–85–2	Corrosive, may be fatal if inhaled or ingested
Lead arsenate	7784–40–9	Known human carcinogen, teratogen
Lead carbonate	1319–46–6	May be fatal if inhaled or ingested, neurotoxic
Lead (VI) chromate	7758–97–6	May be fatal if inhaled or ingested, known human carcinogen
Lithium, metal	7439–93–2	Combustible, water reactive
Lithium nitrate	7790–69–4	Oxidizer
Magnesium, metal (powder)	7439–95–4	May ignite spontaneously on contact with water or damp materials
Mercury	7439–97–6	Corrosive, may be fatal if inhaled or ingested
Mercuric chloride	7487–94–7	May be fatal if inhaled, teratogen
Methyl iodide (iodomethane)	74–88–4	May be fatal if inhaled, ingested or absorbed through the skin, potential carcinogen (NIOSH)

Methyl methacrylate	80–62–6	Flammable (NFPA = 3), explosive (vapor)
Methyl orange	547–58–0	Possible mutagen
Possible mutagen	493–52–7	Possible mutagen
Nickel, metal	7440–02–0	Reasonably anticipated human carcinogen, mutagen
Nickel oxide	1314–06–3	Reasonably anticipated human carcinogen, mutagen
Nicotine	45–11–5	May be fatal if inhaled, ingested, or absorbed through the skin
Osmium tetroxide	20816–12–0	May be fatal if inhaled or ingested
Paris green	12002–03–8	May be fatal if inhaled, ingested or absorbed through the skin, known human carcinogen
Phenol	108–95–2	Combustible (liquid and vapor), corrosive, may be fatal if inhaled, ingested or absorbed through the skin
Phosphorus pentoxide	1314–56–3	Water reactive, corrosive
Phosphorous, red, white	7723–14–0	May ignite spontaneously in air
Phthalic anhydride	85–44–9	Combustible/finely dispersed particles form explosive mixtures in air, corrosive
Potassium, metal	7440–09–7	Flammable (nfpa = 3), water reactive, forms peroxides
Potassium oxalate	583–52–8	Corrosive, may be fatal if ingested
Potassium sulfide	1312–73–8	Spontaneously combustible, explosive in dust or powder form, corrosive
Pyridine	110–86–1	Flammable (nfpa = 3), possible mutagen
Selenium	7782–49–2	Severe irritant

Silver cyanide	506–64–9	May be fatal if inhaled, ingested or absorbed through the skin
Silver nitrate	7761–88–8	Oxidizer, corrosive, may be fatal if ingested
Silver oxide	20667–12–3	Oxidizer
Sodium arsenate	7778–43–0	May be fatal if inhaled or ingested, known human carcinogen
Sodium arsenite	7784–46–5	Known human carcinogen, teratogen
Sodium azide	26628–22–8	Explosive, may be fatal if ingested or absorbed through the skin
Sodium chromate	7775–11–3	Oxidizer, corrosive, known human carcinogen
Sodium cyanide	143–33–9	May be fatal if inhaled, ingested or absorbed through the skin
Sodium dichromate	10588–01–9	Oxidizer, corrosive, may be fatal if ingested, known human carcinogen
Sodium nitrite	7632–00–0	Oxidizer
Sodium sulfide	1313–82–2	Corrosive, may be fatal if inhaled or ingested
Sodium thiocyanide	540–72–7	Contact with acid liberates very toxic gas
Stannic chloride (anhydrous)	7646–78–8	Corrosive, hydrochloric acid liberated upon contact with moisture and heat
Stearic acid	57–11–4	May form combustible dust concentration in the air
Strontium	7440–24–6	Water reactive
Strontium nitrate	10042–76–9	Oxidizer
Sudan IV	85–83–6	Irritant, toxic properties have not been thoroughly evaluated

Sulfuric acid, fuming	8014–95–7	Corrosive, may be fatal if ingested
Tannic acid	1401–55–4	Irritant
Tetrabromoethane	79–27–6	May be fatal if inhaled, ingested or absorbed through the skin
Thioacetamide	62–55–5	Reasonably anticipated human carcinogen
Thiourea	62–56–6	Reasonably anticipated human carcinogen
Titanium trichloride	7705–07–9	Water reactive, corrosive
Titanium tetrachloride	7550–45–0	Water reactive, corrosive, may be fatal if inhaled
o-Toluidine	95–53–4	Reasonably anticipated human carcinogen, mutagen
Uranium	7440–61–1	Radioactive material
Uranyl acetate	541–09–3	Radioactive material
Urethane	51–79–6	Combustible, reasonably anticipated human carcinogen
Wood's metal	8049–22–7	May be fatal if inhaled or ingested, known human carcinogen (cadmium), neurotoxic

Appendix 2.

Storage Pattern for Chemicals

A proper chemical storage system separates materials according to chemical compatibility and hazard class. Unfortunately, many school stockrooms are too small to provide 23 separated locations for classes of chemicals. https://www.cdc.gov/niosh/docs/2007-107/pdfs/2007-107.pdf?id=10.26616/NIOSHPUB2007107

Here are some tips for creating safer chemical storage rooms:

- Complete an inventory of the chemical compounds in each stockroom.
- Do not store chemical containers above eye level if possible.
- Separate inorganic compounds from organic compounds.
- Store solids above and liquids below.
- Storage cabinets for acids, bases and flammables are meant for liquids, not dry solids.
- Vent acid cabinets to prevent vapor build-up.
- Store concentrated sulfuric acid on one shelf of the acid cabinet and concentrated hydrochloric acid on another.
- Store nitric acid in a secondary container with other inorganic acids or a separate cabinet.
- Do not vent flammable liquid storage cabinets unless you're using an explosion-proof fan that is carrying the vapors out of the building.
- Glacial acetic acid is a flammable liquid; store it in a dedicated organic acid cabinet or in the flammable liquids cabinet.
- Flammable liquids like alcohols must not be stored in conventional refrigerators. Dilute solutions at or below 1.0 molar can be stored on shelves rather than in cabinets. Segregate inorganic and organic compounds. Check containers annually for condition of containers, labels and contents. Replace degraded lids, dropper tops and solutions. To prevent release of corrosive vapors, avoid storing pipettes holding acids or bases in test tubes taped to the side of bottles. Wrap fritted glass stoppers on acid bottles in parafilm to reduce evaporation. Store Iodine crystals in a sealed plastic bag to monitor degradation of the container's cap and reduce indoor air pollution.

Appendix 3.

Safety Program Manager: Director of Maintenance

Laboratory Chemical Hygiene Officers: Science Department Team Leaders

Bluffton-Harrison Metropolitan School District

Adopted: January 13, 2025