

G175-R CHEMICAL HYGIENE PLAN

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A. Introduction

1. Goal of the Chemical Hygiene Plan

It is the policy of this school 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.

2. Who is covered by the Laboratory Standard?

The laboratory standard covers "laboratory use of hazardous chemicals," where chemical manipulations that are not part of a production process occur. "Laboratory scale" means work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safely manipulated by one person. This definition excludes workplaces whose function is to produce commercial quantities of materials. Employees who are to be addressed in the Chemical Hygiene Plan are individuals employed in the laboratory workplace who may be exposed to hazardous chemicals in the course of his or her assignments. This includes employees who actually work in the laboratory (instructors and aides) or employees who may be required to enter a laboratory where potential exposures may occur (such as maintenance or custodial personnel).

B. Chemical Hygiene Personnel

1. Goal

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

2. Key personnel and their responsibilities

a. Chemical Hygiene Officer

The Chemical Hygiene Officer is the Superintendent or his or her designee. The Safety Program Manager is the Director of Operations.

The CHO's responsibilities include:

- Ensuring this chemical hygiene plan is readily available to employees and their representatives.
- Records: Maintaining adequate records detailing efforts and results of employee exposure monitoring* (including associated accident reports, if applicable) and medical consultations and examinations.
- Training: Ensuring employees are provided with the required and appropriate training to carry out their responsibilities.
- Monitoring, in coordination with school legal counsel, the legal requirements concerning hazardous substances.

**Do not get alarmed. This provision is included in the Lab Standard but clearly states you only have to monitor exposure levels if you know you routinely have an exposure level that is above the*

permissible exposure level (PEL) and an OSHA Standard exists for the chemical which requires monitoring. You do not have to monitor exposure levels if you have no reason to believe you have exceeded a PEL.

b. Laboratory staff

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

c. Students

Although students are not covered under the Chemical Hygiene Plan, good personal chemical hygiene habits must be taught to all students who use the lab while enrolled in science courses. Students must not be allowed to use school 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. Employee exposure protection

Laboratory operations must be conducted in a manner that prevents employee exposure to chemical substances in excess of the PELs set forth in 29 CFR 1910.1000, and 1910.1001 through 1910.1450

a. Personal protective equipment

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.

3. Laboratory facilities design criteria

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

a. Laboratory design

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 includes kits, eyewash fountains, and drench showers.
- Drain-free floors in chemical storage rooms.

b. 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 airflow 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 to hazardous fumes, dusts, and vapors.
- There must be at least one fume hood for each laboratory where hazardous chemicals are used. With the sash raised to 12 inches, air should enter the fume hood at 60-to-125 linear feet per minute - checked quarterly by the Chemical Hygiene Officer with a velocity meter or anemometer. Maintain written documentation of all tests.
- Cabinets that store corrosive acids should have open ventilation holes to prevent the accumulation of corrosive vapors.
- Flammable liquid cabinets must be kept closed unless 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 by maintenance staff (at least every six months), and reevaluated whenever a change in ventilation devices is made.

4. 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.

5. 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.

6. Chemical procurement

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

a. 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.

b. Receiving shipments

Request electronic 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.

- c. Carcinogens, reproductive toxins, or highly acute toxins are not allowed in this school corporation's junior high school or high school laboratories without the 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 carcinogenic metals.

Minimize the number, variety, and amount of these compounds in storage. Purchase as prediluted solutions if possible and only handle them in the fume hood if dusts or vapors could be released.

7. Hazard identification

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

- a. Container labels

Labels on incoming containers of hazardous chemicals must not be removed or defaced. Do not open unlabeled bottles of chemicals. Ask laboratory staff if they know what is stored in unlabeled containers. Dispose of unknown chemical compounds promptly as outlined herein.

- b. 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.

- c. Safety data sheets

Teachers will maintain an electronic database of safety data sheets received with incoming shipments of hazardous chemicals and make them readily available to staff and students.

- d. 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"

8. Material Handling

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

a. Stockrooms/Storerooms

Segregate hazardous chemicals by hazard class in a well-identified area with local exhaust ventilation. Stockrooms should be controlled by chemistry teachers who handle safety and inventory control. Examine stored chemicals for replacement, deterioration, and container integrity annually. Ensure electronic safety data sheets (SDSs) are available for all chemical compounds in stock.

b. Distribution

Transport chemical containers using a laboratory cart, if possible. Carts should provide sufficient secondary containment capacity to control potential spills. Place containers in a laboratory bottle carrier to reduce risks of breakage. If possible, transport chemicals on freight-only elevators to avoid exposure to elevator passengers. Purchase plastic-coated chemical containers to reduce the risk of spills. Never roll or drag compressed gas cylinders. Transport cylinders with a suitable handcart with the cylinder strapped in place.

c. 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.
- Glacial acetic acid is a flammable liquid; store it in a dedicated organic acid cabinet or in the flammable liquids cabinet.
- 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.
- 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 the condition of containers, labels, and contents. Replace degraded lids, dropper tops, and solutions. To prevent the 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 the degradation of the container's cap and reduce indoor air pollution.

d. 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.

e. Working Alone

Experiments must not be conducted by an instructor or student working alone in a laboratory. There are no exceptions to this policy.

f. 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.)

9. Laboratory operations and activities requiring approval

- a. 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.
 - Purchase of chemicals.

10. 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.

- a. Emergency procedures: Emergency procedures should address chemical spills, laboratory accidents, failure in the ventilation systems, and evacuation of the laboratory.
- b. First aid: 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.
- c. Emergency equipment: The Safety Program Manager and Chemical Hygiene Officer must ensure adequate emergency equipment is available in the laboratory and regularly inspected.
- d. Accident reports: Carefully investigate all accidents and near-accidents. Forward the results of this investigation and recommendations for the prevention of similar occurrences to the Chemical Hygiene Officer. Accident reports must be kept on file with

the Chemical Hygiene Officer. and made available upon request. If a student injury occurs when conducting a lab, a Student Incident Report in the Skyward/Student Management System. The form can be accessed by navigating to the Online Form Module in Skyward.

11. Waste disposal

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

- a. Waste handling - 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 waste are unacceptable. Ask instructors if they know what these containers may hold. Waste disposal companies cannot dispose of unknown materials, so their field chemist will have to test the contents. This is an expensive process that is avoidable in a well-run laboratory.
- b. Waste disposal - 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.

12. Training and Other Information

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 online training can be used as a substitute for some of this training.

a. Training Program

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.

b. Information for employees

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.

c. When to provide training and information

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 for each course or whenever practice demonstrates a need. Specific safety procedures must be taught whenever the need dictates.

13. Inspections and reviewing the chemical hygiene plan

Safety inspections of the laboratory and annual review of the Chemical Hygiene Plan contribute 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.

a. Inspecting laboratory safety equipment

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).
- First aid equipment (e.g., showers flush quarterly, eyewash stations flush monthly or before conducting laboratory experiments with students).

b. Review of the Chemical Hygiene Plan

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.
- 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 operating practices.

2. General rules

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

- a. 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.
- b. 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.

- c. Know the types of protective equipment that are available and use the proper equipment for each job.
- d. 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.
- e. Consuming food or beverages in laboratories or areas where chemicals are being used or stored is prohibited.
- f. Practical jokes or other behavior that might distract, startle, or confuse another worker can be dangerous and must be avoided.
- g. Use equipment for its designed purpose only.
- h. 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).
- i. Never leave laboratory chemicals unattended in an unsecured room.
- j. Notify the Chemical Hygiene Officer immediately if someone has been exposed to a hazardous chemical.

3. Chemical handling

- a. Do not smell or taste chemicals.
- b. Always add acid to water. Never add water to acid.
- c. Know the hazards posed by the different classes of chemicals, including oxidizers, flammables, corrosives, reactives, compressed gasses, acutely hazardous, and chronically hazardous chemicals.
- d. Read and understand the Safety Data Sheet (SDS) before using any new chemical.
- e. Chemical wastes must be disposed of properly. Consult with the Chemical Hygiene Officer about waste management prior to instituting a new laboratory experiment.
- f. Be sure equipment is carefully secured before use. Combine reagents in the proper order and avoid adding solids to hot liquids.
- g. Never work alone in the laboratory. Make arrangements to have someone monitor your activities.
- h. 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 gasses, fumes, or vapors.

4. Health and hygiene

- a. Wear appropriate eye protection at all times in areas where chemicals are used or stored.
- b. 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.
- c. 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.
- d. A pipetter, pipette bulb, aspirator, or another mechanical device must be used to provide a vacuum. Using the mouth to pipette chemicals or to start a siphon is not permitted for any laboratory procedure;
- e. Avoid exposure to gasses, vapors, and aerosols. Use the chemical fume hood when this type of exposure could occur.
- f. Wash well with soap and water before leaving the laboratory. Chemicals on hands can be transferred to food.

5. Food Handling

- a. Do not store, handle, or consume food or beverages in the laboratory or other areas where chemicals are used or stored.
- b. Do not bring chemicals or chemical equipment into areas that are designated for food consumption.
- c. 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

- a. Keep work areas clean and free from obstructions.
- b. Cleanup should follow the completion of each operation and at the end of each day.
- c. Attend to laboratory accidents and spills immediately. Follow the appropriate emergency procedures:
 - i. Notify the principal and ask them to call 911. Tell them the name of the material, the spill's location, and the spilled material's approximate volume.
 - ii. Evacuate all students from the classroom using the steps in the evacuation procedure (this is a separate document).
 - iii. Evacuate adjacent classrooms if the spread of contamination is enough to affect them.
 - iv. Do not permit any persons to enter the spill area, contact the spilled material, or place themselves at risk unless they have appropriate training and personal protective equipment.
 - v. Take immediate steps to prevent spilled materials from entering drains or spreading to other environmentally sensitive areas. These steps include placing absorbent materials (stored in classrooms with a high likelihood of a spill) around the perimeter of the spill and blocking drains.
- d. 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).
- e. Never block access to exits, emergency equipment, controls, etc.
- f. Notify the laboratory supervisor immediately if equipment malfunctions. Discontinue use of the equipment if a safety hazard exists.
- g. 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

- a. Accidents involving glassware are the leading cause of laboratory injuries. Use careful storage and handling procedures to prevent glassware breakage.
- b. 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.
- c. Handle vacuum-jacketed glass apparatus with extreme care to prevent implosions. Only glassware designed for vacuum work should be used for that purpose.

- d. 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

- a. Never use an open flame to heat flammable liquids. Extinguish open flames as soon as its purpose is served.
- b. 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.
- c. Store flammable materials in a flammable storage cabinet or other appropriate location.
- d. Make sure that all flammable cabinets and containers are properly grounded to prevent accidental ignition of flammable vapors and liquids from static electricity or other sources of ignition.
- e. 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. Criteria

Three situations may require unique specific exposure control measures:

- a. Use of Ban Candidate or other high-hazard chemicals.
- b. Experimental procedures that increase the risk of harmful exposures.
- c. Procedures that could exceed the capacity of protective equipment or practices.

3. Chemicals of special concern

Purchase of chemicals listed in Appendix 1. (Ban Candidate Chemicals) is prohibited without written authorization from the Safety Program Manager. OSHA publishes a list of PELs for air contaminants (<https://www.osha.gov/dsg/annotated-pels/>). Several of the listed airborne contaminants may be found in secondary school science stockrooms. Follow these guidelines when working with the chemicals listed below to avoid exceeding the PELs:

- a. Cadmium
 - Cadmium compounds are carcinogenic. Purchase and use of cadmium compounds are prohibited.
- b. Chromium - hexavalent
 - Hexavalent chromium compounds (chromate compounds, dichromate compounds, and chromium trioxide) are carcinogenic. Minimize the use of these compounds and the amount kept in storage.
 - The use of hexavalent chromium compounds is discouraged. If they must be used, buy the smallest amount necessary and only use them in the fume hood while wearing chemical-resistant gloves.
 - Purchase hexavalent chromium compounds pre-diluted to reduce the risk of dust formation.
- c. Lead

- Lead compounds are neurotoxic by ingestion and inhalation.
 - Only open powdered lead compounds in chemical fume hoods.
 - Purchase lead compounds pre-diluted to reduce the risk of dust formation.
- d. Methylene chloride
- Methylene chloride is a probable carcinogen that is highly volatile, easily inhaled, and absorbs into the bloodstream through unprotected skin.
 - Use of methylene chloride is discouraged. If it must be used, buy the smallest amount necessary and only use it in the chemical fume hood while wearing chemical-resistant gloves.
- e. Mercury compounds and apparatus
- Secondary schools in Indiana are prohibited from having elemental mercury, mercury compounds, mercury novelty items, mercury thermometers, or mercury-containing sphygmomanometers. One calibrated mercury barometer is allowed per school.

4. Exposure potential

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

- a. Inhalation of chemical vapors, mists, gasses, fumes, or dusts can produce poisoning through the mucous membrane of the nose, mouth, throat, and lungs and can seriously damage these tissues. The degree of injury resulting from exposure depends on the toxicity of the material, its solubility in tissue fluids, its concentration, and the duration of exposure.
- b. Ingestion of many chemicals can be extremely dangerous. Some are poisonous in small doses while others can cause health problems from long-term low-level exposures. Many chemicals will also directly damage the tissue of the mouth, throat, nose, lungs, and gastrointestinal tract.
- c. Contact with skin and eyes can lead to significant chemical injury. Skin contact frequently will cause local irritation, but many chemicals can be absorbed through the skin and cause systemic poisoning. 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. These factors must be considered when determining the amount of time a person should be working with a specific chemical compound.

5. Exposure controls

Check the need for exposure controls when staff handle chemicals or use lab procedures. Include a review of existing engineering controls, administrative practices, and PPE. Make sure ventilation systems provide protection for employees from chemical exposures. For example, use a chemical fume hood when procedures generate smoke, dust, fumes, or vapors. Provide training to ensure employees are adequately protected from overexposure to hazardous chemicals. Keep track of the chemicals being used in experiments and demonstrations. Higher hazard chemicals require a higher degree of protection from harmful exposures. Use this information to decide if medical monitoring is needed. Choose the right PPE for the compounds you are using. Before working with hazardous chemicals, ask the Chemical Hygiene Officer what type of PPE is

necessary. Receive training in proper use and maintenance of PPE prior to using it – especially respirators.

6. Decontamination procedures

The Chemical Hygiene Officer and Hazardous Waste Manager shall develop procedures for decontaminating chemical usage areas in the laboratory. Decontaminate contaminated equipment and glassware in the hood before moving them. Decontaminate fume hoods after use and always before resuming normal work.

7. Procedures for handling reproductive toxins

Examples: Lead, cobalt and nickel compounds, formaldehyde, ethidium bromide.

- a. Only handle dry forms of these substances in a fume hood.
- b. Use gloves and other protective clothing to prevent skin contact.
- c. Always wash hands and arms immediately after working with these materials.
- d. Keep records of the amounts of these materials on hand, amounts used, and the names of the workers using them.
- e. Train employees in emergency procedures for accidents or spills involving these substances. Notify the Chemical Hygiene Officer of all chemical exposures or spills.
- f. Store containers of these substances in a well-ventilated area and label them properly.

8. Procedures for handling chemicals with high acute toxicity

Examples: Fluoride compounds, nitric acid, bromine, phenol.

- a. Seek safer alternative compounds for use in experiments.
- b. Use and store these substances in restricted access areas with warning signs.
- c. Always use a hood when working with concentrated forms of these substances.
- d. Always wash your hands and arms immediately after working with these materials.
- e. Keep records of the amount on hand, the amount used, and the names of the workers using them.

9. Procedures for handling select carcinogens

Examples: Formaldehyde, perchloroethylene and chromate, nickel, cobalt, and cadmium compounds.

- a. Seek safer alternative compounds for use in experiments.
- b. The use and disposal of these substances should be approved by the Chemical Hygiene Officer prior to this activity.
- c. Use and store these substances in areas of restricted access with special warning signs.
- d. Always use a hood when working with concentrated forms of these substances.
- e. Always wash your hands and arms immediately after working with these materials.
- f. Keep records of the amounts on hand, the amounts used, and the names of the workers using them.

F. Inspection And Plan Review

1. Goal

To develop a well-organized laboratory inspection program that allows the Chemical Hygiene Officer to identify and correct the cause of chemical exposures before they occur. The objectives of this inspection program are to:

- a. Generate and maintain a high level of prevention consciousness.
- b. Educate staff and students in the merits and methods of detecting and eliminating hazardous situations.
- c. Demonstrate the school corporation's interest in protecting the health and safety of staff and students.
- d. Foster a better understanding of the responsibilities that each must assume in the prevention of accidents.
- e. Help determine where additional training or instruction may be required.
- f. Develop a Chemical Hygiene Plan review process that evaluates the plan's effectiveness and identifies the need for updates.

2. Inspection procedures

Chemical Hygiene Processes and Procedures Task List

- a. Conduct regular inspections of safety and first aid equipment as often as requested by the administration. Record the inspection date and the inspector's initials on the attached equipment inspection tag.
- b. Notify the administration in writing if a hazardous or possibly hazardous condition (e.g., malfunctioning safety equipment or chemical hazard) is identified in the laboratory and follow through on the status.
- c. Never use defective equipment.

3. Emergency, first aid, and PPE

Inspect safety equipment every six months to ensure it is functioning properly and that there are adequate supplies. Note and promptly correct deficiencies.

4. Review of the Chemical Hygiene Plan

The effectiveness of the Chemical Hygiene Plan must be reviewed and evaluated at least annually and updated if necessary. Factors to consider in the review include:

- a. Changes in laboratory procedures, operations, or equipment may affect the potential for personal exposure to hazardous chemicals.
- b. The addition or deletion of the use of specific hazardous chemicals that warrant a review of laboratory safety procedures.
- c. Changes in laboratory personnel or their responsibilities.
- d. The review and evaluation of inspection records, accident investigations, and professional research on chemical hygiene techniques.

G. 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. Exposure monitoring

The laboratory standards for exposure monitoring are summarized on the following pages. The Safety Program Manager or Chemical Hygiene Officer must maintain records of exposure

monitoring, including the test method and results. Keep employee exposure monitoring records in the employee's file. If there is reason to believe that exposure levels for regulated substances routinely exceed the action level (or in the absence of an action level, the PEL), employee exposure to that substance must be measured.

- a. Initial exposure determination This is a list of common situations that increase the risk of employee exposures.
 - Laboratory operations using hazardous chemicals in a way that increases releases.
 - Past data that shows elevated exposures to the particular substance for similar operations.
 - Procedures that use large volumes of hazardous chemicals.
 - Procedures that use hazardous chemicals over a long period of time.
 - Employees with exposure symptoms like skin irritation, difficulty breathing, nausea, or headache. None of these conditions should exist in middle or high school laboratories.
- b. Exposure monitoring when the action level is exceeded If an exposure determination exceeds a substance's PEL, the school corporation must follow the OSHA exposure monitoring requirements. Monitor airborne concentrations of individual hazardous chemicals in these circumstances:
 - When testing or redesigning the hoods and other local ventilation devices.
 - When a specific substance that is toxic or highly toxic is regularly and continuously used.
 - When requested by a laboratory employee because of a documented health concern or suspicion that a PEL may be exceeded.
- c. Exposure record-keeping Send exposure testing procedures and results to the Safety Program Manager for coordination and record maintenance. The employee must be notified of any monitoring results within 15 working days of receiving the results, either individually or by posting the results in an appropriate location that is accessible to employees, such as the safety bulletin board.

3. 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:

- a. Exposure monitoring test methods and results.
- b. Safety Data Sheet of the hazardous chemical(s) involved.
- c. Accident Report.
- d. Information submitted to and received from, the physician.

4. 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.

- a. 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.

b. Type of medical attention

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.

c. Information for the physician

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.

d. Physician's report

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 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.

e. Medical record-keeping

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. The evaluation included physical hazards (i.e., flammability, explosive propensity, reactivity, corrosivity) and health hazards (i.e., toxicity, carcinogenicity).

The following list of chemicals was generated from the Manual of Safety and Health Hazards in the School Science Laboratory published by the 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).

For a complete list of Chemicals, CAS (Chemical Abstract Service) Number and Hazard, please see pages 33-39 at:

<https://www.cdc.gov/niosh/docs/2007-107/pdfs/2007-107.pdf?id=10.26616/NIOSH PUB2007107>