



CHEMICAL HYGIENE PLAN

BEDFORD COUNTY PUBLIC SCHOOLS

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SECTION 1 INTRODUCTION

A. Purpose of this document

The Chemical Hygiene Plan is a document designed to express the policies and procedures adopted by the Bedford County Public School Division, and relating to the safe operation of the school laboratory. The document is derived from the Laboratory Standard, a set of codes developed and presented in the Occupational Safety and Health Act Standard on Occupational Exposure to Hazardous Chemicals.

The OSHA Laboratory Standard requires that employers protect workers through the development and implementation of a Chemical Hygiene Plan tailored to the individual laboratory workplace. The purpose of the Laboratory Standard and of this Chemical Hygiene Plan is to protect the employee from harm due to exposure to hazardous chemicals while working in the laboratory.

Many policies and practices may not be part of the Chemical Hygiene Plan as such, and yet they are crucial to the planning process that must be part of maintaining a safe environment for employees and students. Such items as the number of students per class (or per teacher) or the amount of physical space available to each student are examples of policies and practices that impact the establishment of a safe environment, but which are not required by OSHA to be part of the Chemical Hygiene Plan.

B. Application of the OSHA Laboratory Standard

The Occupational Safety and Health Act is administered as part of the US Department of Labor, and its full text is found in the Code of Federal Regulations (CFR) under the Title 29, Section 1920 (cited as (“29 CFR 1910.1450”). The full text of the applicable code is found in Appendix A of this document, but will be summarized in a later section of the introduction.

One requirement of the Laboratory Standard is that the Bedford County Public School Division must have a Chemical Hygiene Plan and a Chemical Hygiene Officer. There may be a division-wide officer, but there should also be a person designated at each individual school.

1. What **IS** covered by the Laboratory Standard?

Laboratories are defined as facilities where the “laboratory use of hazardous chemicals” occurs. “Laboratory use of hazardous chemicals” refers to the handling or use of such chemicals in which all of the following conditions are met:

- (a) Chemical manipulations are carried out on a laboratory scale.
- (b) Multiple chemical procedures are used.
- (c) Protective laboratory practices and equipment are available and commonly used.

(d) The procedures involved are not part of a production process whose function is to produce commercial quantities of materials, nor do the procedures in any way simulate a production process.

“Hazardous Chemicals” are those which pose a health hazard, defined by OSHA as any substance for which there is statistically significant evidence, based on at least one scientific study, showing that acute or chronic harm may result from exposure to that chemical. Health hazards include carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, oxidizers, and corrosives.

“Employees” who are addressed by this document are those individuals employed in the laboratory workplace who may be exposed to hazardous chemicals in the course of the individual’s assignment. This includes employees who actually work in the laboratory (instructors and aides) and those who simply must be in the laboratory to perform their assigned responsibilities (maintenance and custodial personnel, etc.)

“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.

2. What **IS NOT** Covered by the Laboratory Standard?

The Laboratory Standard does not apply to:

- (a) Students. Because students are not employees, they are not formally covered by the provisions of the Chemical Hygiene Plan (CHP). However, there are recommendations in this document that suggest appropriate student rights and responsibilities related to issues of chemical safety.
- (b) Uses of hazardous chemicals which do not meet the definition of “laboratory use” even if such use occurs in a laboratory.
- (c) Laboratory uses of hazardous chemicals which provide no potential for employee exposure, such as procedures using chemically impregnated test media.
- (d) Commercially prepared kits in which all of the reagents needed to conduct the test are contained in the kit.

The occasional visitor to the laboratory, such as a guest or sales person, does not need to be addressed in the Chemical Hygiene Plan. It is recommended that such persons be offered the same protection offered to students, and they conform to the same expectations as students in the laboratory.

C. Summary of the Chemical Hygiene Plan

In compliance with the Laboratory Standard, the division has prepared and implemented the Chemical Hygiene Plan. Adherence to the Plan will assure that employees will be:

- 1. Protected from health hazards associated with hazardous chemicals in the laboratory; and
- 2. Exposed to regulated substances at a level that will not exceed the permissible exposure limits.

The Chemical Hygiene Plan is organized into the following sections:

- 1. Introduction- states the goal and basis for the Bedford County Public School Division Chemical Hygiene Plan.
- 2. General Principles- outlines the guidelines for working with laboratory chemicals.
- 3. Standard Operating Procedures for School Laboratories- the implementation of which will help the Chemical Hygiene Officer and all employees in meeting the goal of the Chemical Hygiene Plan.
- 4. A List of the Bedford County Public School Division Personnel responsible for various aspects of the Chemical Hygiene Plan and implementation.
- 5. Requirements for Records, record-keeping, and procedures for reporting items related to laboratory health and safety.

6. Laboratory Safety Procedures.
7. Procedures for Inspections of laboratories and reviewing of the Chemical Hygiene Plan.
8. A description of the situation where Specific Exposure Control Measures must be used by employees.
9. Information regarding Training Opportunities for employees.
10. A description of Emergency Response Procedures.
11. Appendices which provide a variety of reference material and other useful information.

SECTION 2. General Principles

The following statements and explanations are general principles for the use of those handling laboratory chemicals. While the list is not complete, these items provide the fundamental underpinning for laboratory work in this school division.

A. Minimize Exposure to Chemicals

It is prudent to minimize all chemical exposures because most laboratory chemicals present hazards of one type or another. Employees will follow general precautions for handling all laboratory chemicals. Specific guidelines for some chemicals, such as those found in the appropriate Safety Data Sheets, will also be followed.

B. Consider the Risk

Employees should not underestimate risk, and exposure to hazardous substances should be minimized. The decision to use a particular substance will be based on the best available knowledge of each chemical's particular hazard, the availability of proper handling facilities and equipment. Substitutions, either of chemicals or experiments, will be made where appropriate to reduce hazards without sacrificing instructional objectives. When the risk outweighs the benefit and no substitute is available, then the experiment, procedure or chemical will be eliminated.

C. Provide Adequate Ventilation

The best way to prevent exposure to airborne substances is to prevent their escape into the atmosphere by using hoods or other ventilation devices. Those devices should be kept in good working condition in order to provide employees with a safe working area. The later section on Inspections in the laboratory establishes procedures for assuring that equipment is working properly.

D. Use the Chemical Hygiene Plan

The Chemical Hygiene Plan provides specific laboratory practices designed to minimize employee exposure to hazardous substances. Employees shall follow the practices specified in the Chemical Hygiene Plan in order to minimize their health and safety risks.

E. Observe PEL's and TLV's

The Permissible Exposure Limits (PEL's) and Threshold Limit Values (TLV's) of chemicals typically used in the laboratory are available on the Safety Data Sheet for that chemical. Employee exposure to hazardous chemicals should not exceed those limits.

F. Use Safety Data Sheets

The Bedford County Public School Division will not accept a chemical from a supplier unless it is accompanied by the corresponding Safety Data Sheet (SDS).

G. Be Prepared

Bedford County Public Schools will train employees in how to find and use information from the SDS, this Chemical Hygiene Plan, and other safety publications. Employees should familiarize themselves with the hazards associated with the chemicals they expect to use, and should take appropriate steps to minimize their exposure to those chemicals.

SECTION 3 Standard Operation Procedures

The goal of the Chemical Hygiene Plan is to protect employees and students who work in the school laboratory, others who may be exposed, and the environment for injury due to hazardous chemicals. This section is written in several parts and is meant as a guide for the Bedford County Public School Division and its employees. Other specific safety rules for a particular laboratory may be added by the Chemical Hygiene Officer as needed.

A. General Rules

1. The instructor (and aide, if any) should review laboratory instructions, safety procedures, and reagents prior to each laboratory activity. The instructor (aide) should be aware of the following:

- (a) The chemical hazards for each chemical, as determined from the SDS or other appropriate reference.
- (b) Appropriate safeguards for using each chemical, including personal protective equipment.
- (c) The location and proper use of emergency equipment.
- (d) How and where to properly store the chemical when it is not in use.
- (e) Proper personal hygiene practices.
- (f) Proper methods for transporting chemicals within the laboratory facility.
- (g) Appropriate procedures for emergencies, including evacuation routes, spill cleanup procedures, and fire control.
- (h) Proper procedures for the cleanup of spills
- (i) Proper procedures for the disposal of hazardous substances.
- (j) Procedures by which supervisory persons will be notified in case of an accident or injury.
- (k) Procedures by which emergency help may be contacted.

2. The employee should not work alone in a laboratory or chemical storage area unless other employees are in the vicinity and are aware that someone is in the laboratory, in which case periodic checks should be made. No student should ever work or be placed alone in a laboratory, chemical storage area, lab storage, and/or the area between science classrooms.

3. Whenever chemicals are in the laboratory (out of locked cabinets or storerooms) the unattended laboratory will be locked.

B. Personal protective Equipment and Clothing

The employee should use appropriate protective clothing and equipment.

1. Laboratory aprons or coats, eye protection, and non-permeable gloves are considered standard equipment for school laboratory programs and should be readily available to employees and students.

2. Eye Protection

- (a) Eye protection should be worn by all persons in the laboratory (including visitors) at all times when working with chemicals.
- (b) Eye goggles should provide splash and impact protection and should conform to ANSI Standard Z87.1-1989. Eyeglasses, even with side shields, are not acceptable protection against chemical splashes.
- (c) Equipment should be available with which to clean and sterilize goggles and should be used whenever two or more persons use the same goggles. It is recommended that a sterilization cabinet be available, in particular, for use with goggles used by students. If not available each student will disinfect eyewear prior to storage, after use.
- (d) Contact lenses may be worn in the chemical lab; however, students must indicate on their safety contract that they do wear contact lenses. Contact lenses are not appropriate eye protection; eye goggles must be worn at all times in the laboratory setting.
- (e) Approved standing shields or face shields should be used when there is potential for explosions, implosions or splashing, or when corrosive liquids are used. Goggles should be worn when using sanding or face shields.

3. Clothing

- (a) Clothing worn in the laboratory should offer protection from splashes and spills, should be easy to remove in case of an accident, and should be fire-resistant.
- (b) Nonflammable, non-porous aprons (rubber or plastic) offer the least expensive protection. They should be long enough to cover from the neck area to the knees. Aprons will be available if students choose to wear them in the lab.
- (c) Clean chemical and fire resistant laboratory coats may be worn. They should be long-sleeved and cover at least to the knees. Snap fasteners or Velcro closures are better than buttons because the laboratory coat is more easily removed in an emergency.
- (d) Laboratory coats, jackets, aprons or clothes on which chemicals have been spilled should be washed separately from personal laundry. The school is not responsible for washing clothing.
- (e) At no time should shorts, cutoffs or short skirts be allowed in the laboratory.
- (f) Shoes should have low heels with fully covered "uppers". There should be no open toes or uppers constructed of woven material.
- (g) Long hair and loose clothing should be confined.
- (h) Jewelry such as rings, bracelets or watches should not be worn in order to prevent chemical seepage under the jewelry, contact with electric sources, catching on equipment, or damage to the jewelry itself.

4. Gloves

- (a) No gloves are good for all situations. Corrosive resistant gloves should be worn when working with corrosive liquids.
- (b) Gloves that resist permeation by chemicals that are allergenic, sensitizing or toxic should be worn when appropriate.
- (c) The appropriate type of glove should be selected for use with various solvents and corrosives. The SDS should be consulted for information regarding the proper type of gloves to be used.
- (d) Gloves should be removed before leaving the laboratory, touching doorknobs, telephones, laboratory notebooks, etc.

- (e) Gloves should be checked before each use to ensure the absence of cracks and for small holes.

C. Planning

1. The employee should not rely solely on the textbook, laboratory manual, or other instructional material for an indication of safety precautions required for a particular experiment. The SDS for chemicals and safety references for equipment should be consulted, particularly when the anticipated experiment is a new one.
2. It is recommended that the instructor (lab aide, etc.) review potential hazards and specifically describe them to all classes and all students. A plan for an emergency or accident shall be reviewed prior to beginning work.
3. The scale of the procedure should be reduced to a minimum in order to reduce generation of used chemicals.
4. Only those chemicals for which the quality of the ventilation system is appropriate should be used.

D. Personal Behavior

1. Horseplay, pranks, or acts of mischief will not be tolerated in chemical work areas and laboratories.
2. Activities using unauthorized chemicals will not be performed by employees or students.
3. The laboratory should not be left unattended while an experiment is in progress. It is recognized that some experimental procedures, such as evaporation of a large quantity of solvent, crystallization, incubation, etc. are a normal part of some experiments and that such procedures may safely be left while they are in progress. The employee should use the best available information when deciding whether a particular experiment may be left unattended.

E. Personal Hygiene

All employees should use appropriate personal hygiene practices, including the following:

1. Wash promptly whenever a chemical being used for an experiment has contacted the skin.
2. Avoid inhalation of chemicals used for an experiment, including gases, vapors and aerosols. "Wafting" to test chemical odors should only be done with extreme caution, and only when specifically directed to do so.
3. Wash well with soap and water before leaving the laboratory, even if gloves have been worn. Never wash with organic solvents.
4. Never apply cosmetics in any chemical laboratory.
5. Seek immediate and appropriate medical treatment whenever signs or symptoms of exposure to a hazardous chemical are manifested.
6. Never pipette or siphon by mouth.

It is recommended that these standards be communicated to students, expected of students, and promoted by the school and laboratory personnel.

F. Housekeeping

1. Work areas should be kept clean and free from obstructions. Cleanup should follow the completion of each operation and at the end of each day. Unnecessary hazards should be avoided by keeping drawers and cabinets closed when not in use. Stools and chairs are potential safety hazards and should not be present.
2. Wastes should be placed in appropriate receptacles, each of which should be correctly labeled.

3. Both equipment and chemicals should be stored properly. Chemicals should not be stored in aisles, on the floor, in stairwells, on desks or laboratory tables. Chemicals should not be left overnight on shelves over the workbench.
4. Access to emergency equipment, showers, eyewashes, and exits should never be blocked by anything, not even a temporarily parked cart.
5. All containers with chemicals should be labeled with the identity of the contents and the hazards those contents present to users, and concentration of said chemical (if in liquid form). All labels should be consistent with state, federal, and school division requirements.
6. All working surfaces and floors should be cleaned regularly. Slipping hazards should be avoided by keeping the floor clear of ice, spilled liquids, stoppers, glass beads or rods, and other small items.
7. All chemical spills should be promptly cleaned up. The chemicals and cleanup materials should be disposed of in a proper manner.

G. Food Handling

1. No food or beverages should be stored, handled, prepared or consumed in the laboratory or other areas where chemicals are used or stored.
2. No laboratory chemicals or laboratory chemical equipment should be brought into areas that are designated for food consumption or smoking.
3. Glassware or utensils that have been used for laboratory operations should never be used to prepare or consume food. Laboratory refrigerators, ice chests, microwave ovens, cold rooms, etc., should not be used for food storage or preparation.

H. Glassware

1. Careful storage and handling procedures should be used to avoid glassware breakage.
2. Adequate hand protection should be used when inserting glass tubing into rubber stoppers or corks or when placing rubber tubing on glass hose connections. Hand protection may be in the form of heavy gloves or heavy cloth towels.
3. Tubing should be fire polished or rounded at the end.
4. When inserting glass tubing into a stopper, the hands should be held close together to limit movement of glass, and the glass should be lubricated.
5. Protection for the hands should be worn when picking up broken glass. Small pieces should be swept up with a brush and pan.
6. Broken glass should be placed in a special container marked for "BROKEN GLASS", thereby separating it from other waste.
7. Broken glass contaminated with chemicals should be disposed of as hazardous waste.

I. Flammability Hazards

1. Open flames should not be used to heat a flammable liquid or to carry out a distillation under pressure.
2. Flammable materials should be stored in a properly marked and approved flammable liquid storage cabinet or other appropriate location.
3. Cabinets for storage of flammable liquids and containers should be properly grounded to prevent accidental ignition of flammable vapors and liquids from static electricity or other sources of ignition. This is especially important during the transfer of liquids from one container to another.
4. Before lighting a flame, all flammable substances should be removed from the immediate area of the flame. All containers of flammable substances in the area should be checked to ensure that they are tightly closed.
5. Large quantities of flammable chemicals stored outside cabinets should be in flame-proof storage

cans which conform to NFPA guidelines.

J. Electrical Hazards

1. All electrical outlets should have a grounding connection requiring a 3-prong plug. All electrical equipment should be wired with a 3-prong plug. The grounding post will never be removed from a cord or appliance.
2. Some equipment is designed for use with 2-prong plugs. If the appliance comes with that type of plug, there is no need to change it; it will work in a 3-prong socket.
3. All laboratories should have circuit breakers readily accessible. Employees should know how to cut off electrical service to the laboratory in case of emergency.
4. Laboratory lighting should be on a separate circuit from the electrical outlets in case electrical service must be cut off during an emergency.
5. If electrical equipment shows evidence of undue heating, it should be immediately unplugged.

K. Compressed Gases

If compressed gas cylinders are used in the laboratory, procedures for their use should be in accordance with guidelines established by the Compressed Gas Association {(CGA P-1 919965), "Safe Handling of Compressed Gases"}

1. No cylinder should be moved from one location to another until the protective cap is securely in place.
2. Both full and empty cylinders should only be stored where they may be securely restrained by straps, chains, or a suitable stand.
3. All cylinders should be used with a correct gauge and/or regulator, and should be fitted with delivery tubes that do not leak and which are tightly fastened to the cylinder.
4. A cylinder should be considered to be "empty" when there is still a slight positive pressure.
5. An empty cylinder should be returned to the supplier as soon as possible after having been emptied, or when no longer needed.
6. Cylinders should not be exposed to temperatures above 50 C.

L. Prior Approval

Teachers, instructors and aides should obtain prior approval from the appropriate Chemical Hygiene Office whenever a new laboratory experiment or test is to be carried out with one or more students, it has not been performed at a prior time, and the potential for harm is very high. The potential for harm may be affected by a change in the amounts of materials being used, the conditions under when the experiment is to be conducted or the substitution, deletion or addition of some chemical is anticipated. Prior approval should be sought in any of the following cases:

1. When there exists the:
 - (a) Potential for a rapid rise in temperature.
 - (b) Potential for a rapid increase in pressure.
 - (c) Substitution of flammable solvent for one less flammable.
 - (d) Potential for chemical explosion.
 - (e) Potential for spontaneous combustion.
 - (f) Potential for the emission of toxic gas(es) that could produce concentrations in the air that exceed toxic limits. Or
 - (g) There is a change in a procedure, even if it is very similar to prior practices, such as an increase in

the amount of chemicals used by a factor of 10% or more.

2. When there is a failure of any of the equipment needed for the process, especially of safeguards such as fume hoods.

SECTION 4 Division Organization

A. Superintendent

The Superintendent, as Chief Executive Officer, has the ultimate responsibility for chemical hygiene within the Bedford County Public School Division. The Superintendent should, with other administrators, provide continuing support for division-wide chemical hygiene programs.

B. Principal

The principal is responsible for chemical hygiene programs at his/her particular school. The Principal should monitor school employees' compliance with the Chemical Hygiene Plan. Provide regular, formal chemical hygiene and housekeeping inspections.

C. Employer Responsibilities

The following items indicate responsibilities of the school division, who is the employer of record:

1. Appoint a Chemical Hygiene Officer (CHO). Assign the CHO the various responsibilities outlined in Section E, below.
2. Make manufacturer's Safety Data Sheets accessible to employees.
3. Provide employees with training and information regarding chemical and physical hazards.
4. Post "designated areas" if any select carcinogens, reproductive toxins or acute toxins are in the laboratory.
5. Measure the concentration of hazardous chemical(s) if it is believed that the action level has been exceeded.
6. Keep the records of employee exposure to hazardous chemicals for a period of 30 years beyond the time of exposure. These records should be filed by the employee, in writing, within two weeks of the exposure.
7. Provide medical consultations and examinations required as a result of exposure to hazardous chemical(s).
8. Provide respirators when necessary.

D. Employee Responsibilities

The school employee, whose normal work locations include a laboratory area, is responsible for:

1. Maintaining awareness of health and safety hazards.
2. Participating in training programs provided by the division.
3. Consulting reference materials related to chemical safety whenever appropriate.
4. Planning and conducting each operation in accordance with the division's chemical hygiene procedures.
5. Using good personal chemical hygiene habits.
6. Reporting accidents, injuries, unsafe practices and unsafe conditions.

E. Chemical Hygiene Personnel

The Bedford County Public School Division has six secondary schools covered by this Laboratory Standard, and have elected to have a Division Chemical Hygiene Officer and a single Chemical Hygiene Officer (CHO) for each school.

1. Division Chemical Hygiene Officer

The responsibilities of this position require the Division Hygiene Officer to:

- (a) Develop and implement the Chemical Hygiene Plan and the safety program for the division, including training, reporting and other functions noted here.
- (b) Work with administrators and teachers to develop and implement the safety program.
- (c) Maintain a list of School Chemical Hygiene Officer(s) in school buildings in which laboratories are found.
- (d) Work with the School Chemical Hygiene Officer(s) to monitor procurement, use, and disposal of chemicals used in the schools' laboratory programs.
- (e) Assure that inspections of equipment and space in the laboratory are performed when appropriate and that records of inspections are maintained.
- (f) Provide technical assistance to schools and employees on the Chemical Hygiene Plan.
- (g) Assure the Chemical Hygiene Plan is revised as needed to assure that it is in compliance with current legal requirements.
- (h) Consult qualified individuals regarding requests to use chemicals identified as explosive, carcinogenic, mutagenic, highly toxic, or otherwise unsuitable for general school laboratories.
- (i) Determine the need for personal protective equipment beyond that specified for general laboratory use.
- (j) Implement appropriate training with regard to chemical hygiene for all division employees whose normal work locations include laboratory areas.
- (k) Conduct annual review and revision of the Chemical Hygiene Plan.

2. School Chemical Hygiene Officer

The school chemical hygiene officer will serve in that position for the school. The school Chemical Hygiene Officer will be designated by the Principal. The School CHO will serve as the building's contact person for all chemical hygiene programs.

The School CHO will have the responsibilities listed below:

- (a) Ensure that employees have received appropriate training.
- (b) Ensure that employees have access to the Chemical Hygiene Plan, Safety Data Sheets, and other suitable reference materials. Maintain updated chemical inventory through Flinn Chemventory system. This online database will be updated when a new chemical is received, used, moved, or disposed of throughout the year.
- (c) Coordinate requests to the Division Chemical Hygiene Officer and Principal for acquisition and use of chemicals identified as explosive, carcinogenic, mutagenic, highly toxic, or otherwise unsuitable for general school laboratories, as indicated in Appendix B.

F. Students

Students are not specifically covered by the Laboratory Standard. However, good personal chemical hygiene habits should be taught to all students at every reasonable opportunity, particularly to those who use the laboratory while enrolled in science courses. Students should not be allowed to use school laboratories outside of regular science course classes unless they first obtain permission and are directly supervised by the instructor during their work. No student should work alone in the laboratory area, chemical storage area, or

area between two science classrooms. Never should a student be unsupervised in ANY science area.

SECTION 5 Record-Keeping Procedures

The Division should maintain specific records to verify safety practices.

A. Air Concentration Monitoring

The division requires that records of air concentration monitoring results be maintained for at least 30 years and that they be accessible to employees or their representatives. Such monitoring should be done following the procedures established by the division CHO.

Regular instrumental monitoring of airborne concentration is not usually justified or practical in laboratories. It may be appropriate when toxic materials are used or stored or ventilation devices are tested or redesigned. It also required after each reported incident of exposure to toxic chemicals.

B. Training Records

The division should maintain records of employee training for at least 30 years and should make those records available to employees or their representatives when requested.

C. Safety Data Sheets

The Division should maintain a file of manufacturer's when a new chemical is received by the receiving personnel, that chemical should not be used until an SDS is obtained. SDS are to be available to teachers, nurses, and school administrators.

D. Exposure Testing Records

1. Records of exposure assessments should be maintained for at least 30 years, and should be made accessible to employees or their representatives upon request.
2. Exposure testing procedures and results of that testing should be sent to the Division Chemical Hygiene Officer, who maintains these records.
3. The employee should be notified of any monitoring results within fifteen working days after receipt of the results, either individually, in writing, or by posting the results in an appropriate location that is accessible to employees.
4. An accurate record of any measurements taken to monitor employee exposures should be kept by the Division Chemical Hygiene Officer. Records should be made available to the employee upon request.

E. Medical Records

The Division requires the records of medical consultations, medical examinations and all reports derived from such consultations and examinations be maintained for at least 30 years, and that they be accessible to employees or their representatives upon requests.

F. Prior Approval

Teachers should inform the Division Chemical Hygiene Officer of any lab procedures, activities, and/or operations that require prior approval. Requests for approval must be made in writing or via email to the

Division Chemical Hygiene Officer.

G. Accident Reports

Each incidence of an accident or injury should be reported to both the local CHO and the division CHO, in writing, within 5 working days of the accident. If staff or students were witnesses to the accident/injury, they should also complete the appropriate forms, all of which are found in Appendix C. The Division should keep records, for 30 years from the time of the lost work, in the event of lost work resulting from an exposure to a hazardous chemical or a job related accident.

H. Chemical Inventory Records

Each school should maintain a Chemical Inventory List (CIL) using Flinn Chemventory, which will be updated periodically. The Division CHO should maintain the backup copies of the inventory program.

I. Records of Waste Disposal

The Division should maintain records of waste chemicals, chemicals and products from reactions or processes that are transferred to an authorized and/or certified chemical disposal agent, and chemicals that are transported to a new site. These records should conform to requirements of the Environmental Protection Agency and Department of Transportation, either of which may have jurisdiction involved in these types of transfers. They should also conform to state requirements.

J. Safety Suggestions

The Division should receive safety suggestions, in writing, from employees and should keep a record of those suggestions, including the dates they were submitted, the name of the person submitting the suggestion, the disposition of the suggestion and the reasons for that particular action.

K. Safety Audits and Inspections

1. The Division should keep records of the regular safety inspections, including the date of the inspection and the person conducting the inspection.
2. The Division should keep records of permanent safety equipment, showing the dates of inspection and the result of any inspection. This will include fire extinguishers, drench showers, eyewash fountains, safety fire blankets, etc.
3. The Division should maintain records showing periods of repair and maintenance for control systems.

Section 6 Laboratory Safety Procedures

A. Employee Exposure Protection and Monitoring

If there is reason to believe that exposure levels for a regulated substance routinely exceed the action level or Permissible Exposure Limits (PEL), the School Chemical Hygiene Officer should ensure that employee or student exposure to that substance is measured.

1. Initial Exposure Determination

Factors which may raise the possibility of overexposure and therefore warrant an initial measurement of employee or student exposure include:

- (a) The manner in which the chemical procedures or operations involving the particular substance are conducted.
- (b) The existence of historical monitoring data which shows elevated exposures to the particular substance for similar operations.
- (c) The use of a procedure which involves significant quantities or is performed over an extended period of time.
- (d) Signs or symptoms of exposure (e.g. skin or eye irritation, shortness of breath, nausea, headache, etc.) which are experienced by the employee or student(s).

2. Exposure Monitoring

If the initial exposure determination described above diagnoses employee or student exposure over the action level for a particular substance, the school division should immediately comply with the exposure monitoring requirements for that substance. Monitoring airborne concentrations of individual hazardous chemicals should be conducted in the following circumstances.

- (a) In testing or redesigning the hoods and other local ventilation devices in the laboratory.
- (b) When a specific substance that is highly toxic is regularly and continuously used.
- (c) When requested by a laboratory employee because of a documented health concern or suspicion that a PEL may be exceeded.

B. Laboratory Facilities

The work conducted in a laboratory and its scale should be appropriate to the physical facilities available and to the quality of the ventilation system. A laboratory should include, where appropriate:

1. An adequate general ventilation system with air intakes and exhausts located so as to avoid intake of contaminated air.
2. Well ventilated stockrooms and storerooms.
3. Proper chemical storage for specific hazardous materials (e.g. flammable, corrosives, carcinogens, highly toxic chemicals, etc.).
4. Adequate laboratory hoods and sinks.
5. Emergency equipment, including proper fire extinguishers, spill kits, alarms, access to a telephone with an outside line, eyewash, drench safety shower, fire blanket, etc.
6. First aid equipment including first aid kits and a fire blanket. All employees and students should know that the fire blanket should not be wrapped around the victim, but should be used only to smother the flames.
7. Arrangement for proper waste storage and disposal.

The CHO will review each facility and curriculum designated chemicals and usage to ensure the facilities are adequate. The CHO can order the change of usage where facilities are inadequate.

C. Laboratory Ventilation

Laboratory fume hoods are not meant for either storage or disposal of chemicals. IF a hood must be used for storage, in order to provide adequate ventilation for flammable chemicals, for instance, then it must not be used for laboratory experiments or transfers of chemicals. In that event, it must be used only for storage.

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

General laboratory ventilation should not be relied on for protection from exposure to hazardous chemicals. A rate of 8-12 room air changes per hour should be the accepted standard when local exhaust systems such as hoods are used as the primary method of control. Laboratory airflow should not be turbulent and should flow continuously throughout the laboratory. AHA recommends 15-20 cubic feet per person in school classrooms and higher rates for hazardous areas such as laboratories.

A laboratory hood with a minimum of 2-3 linear feet of hood space per person should be provided for every two students if they spend most of their time working with chemicals. Airflow into and within the hood should not be excessively turbulent, which may be produced when a hood face velocity exceeds 100 linear feet per minute. Fume hoods should provide adequate airflow at about 60-100 linear feet per minute. This should be measured by the instructor or school CHO.

Cabinets which store hazardous chemicals should be fitted with auxiliary ventilation systems. Stockrooms should be well ventilated.

The quality and quantity of ventilation should be elevated when installed, regularly monitored and reevaluated whenever a change in ventilation devices is made.

D. Medical Consultation and Medical Examinations

Employees who work with hazardous chemicals should be provided with an opportunity to receive medical attention when overexposure to a hazardous chemical is suspected.

1. Cause for Consultation or Examination

In relation to the exposure of hazardous chemicals, medical attention should be provided to an employee under the following circumstances:

- (a) Whenever an employee develops signs or symptoms of exposure to a hazardous chemical to which the employee may have been exposed in the laboratory, the employee should be provided with the opportunity to receive an appropriate medical examination.
- (b) When exposure monitoring reveals an exposure level routinely above the action level (or PEL) for an OSHA-regulated substance, medical observations should be conducted in a manner prescribed by the particular local standard.
- (c) Whenever an event takes place in a laboratory which results in the likelihood of exposure to a hazardous substance, such as a spill, leak, or explosion, the affected employee should be provided with the opportunity for medical consultation to determine the need for a medical examination.

2. Type of Medical Attention

All medical examinations and consultations should be performed under the direct supervision of a licensed physician and should be provided without cost to the employee, without loss of pay and at a reasonable time and place. All questions regarding medical consultations and examinations should be directed to the Division Chemical Hygiene Officer, who should arrange for consultation with the division's medical consultant.

3. Information for the Physician

The following information should be provided to the physician conducting medical consultations and examinations:

- (a) The identity of hazardous chemical(s) to which the employee may have been exposed.
- (b) A description of the conditions under which the exposure occurred, including quantitative

exposure data, if available.

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

4. Physicians Report

A written opinion from the examining physician for any consultations or examinations performed under the Procedure should include:

- (a) Any recommendation for further medical attention.
- (b) The results of the medical examination and any associated tests.
- (c) Any medical condition revealed during the examination which might compromise employee safety during, or as a result of, exposure to hazardous chemicals found in the workplace.
- (d) A statement that the employee had been informed by the physician of the results of the consultation or examination 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. Chemical Procurement, Storage and Disposal

To minimize hazards the purchase and storage of chemicals should be minimized.

1. Chemical Purchase and Procurement

- (a) Chemicals should be ordered in quantities that are likely to be consumed in one year or less.
- (b) Chemicals should be purchased only when needed for specific experiments or research projects. The chemicals should be purchased only in the quantity sufficient for the declared use.
- (c) All chemicals should be contained in tightly closed, sturdy, and appropriate containers.
- (d) A chemical should not be accepted without being accompanied by the SDS.
- (e) The container should be marked with the date at the time it is received and the date it is opened.
- (f) Chemicals should not be accepted if the original container has been broken, opened, or has been compromised in some other way.
- (g) The Chemical Inventory List should be updated each time a chemical is received.
- (h) Donated chemicals should be accepted only after approval is obtained from the Division Chemical Hygiene Officer. It should be established that the donated chemical is in excellent condition, that an appropriate SDS is available, and that there is a specific use for the donated material.

2. Storage and Distribution

- (a) All chemicals should be contained in tightly closed, sturdy, and appropriate containers.
- (b) If the chemical has been transferred to a secondary container, the new container should be appropriately labeled as indicated in the appropriate section.
- (c) Chemicals should be stored based on the reactivity nature of the chemical. Storage patterns should never be based solely on the alphabetical arrangement of chemicals.
- (d) All shelves on which chemicals are stored should have a lip of approximately $\frac{3}{4}$ " or greater in order to prevent bottles from sliding off the shelf.
- (e) Flammable chemicals should be stored in approved storage cans or approved flammable chemical storage cabinets. These cans and cabinets should be kept tightly closed at all times when not using the chemicals themselves. Combustible packaging material should not be stored near flammable chemical storage cabinets.
- (f) All storage areas should be kept securely locked when not in use by the employee. Storage and

preparation areas should be accessible only to those persons authorized to use the chemicals and with proper training in the handling and use of the chemicals.

(g) Those chemicals classified as acute poisons should be kept in a separate, locked location, which has been labeled as to its purpose.

(h) Fire-hazard chemicals should be stored in quantities less than 500 mL, unless metal safety cans are used. If approved metal safety cans are used.

1. The spring-loaded closure should not be disabled.
2. The flame-arrestor screen should be kept in place,
3. The arrestor screen should be replaced when punctured or damaged, and
4. The arrestor should never be immersed in the liquid.

(i) Chemicals should not be distributed to other persons or to other areas of the school without prior approval of the School Chemical Hygiene Officer. They should not be transferred to another location without the simultaneous transfer of a copy of the appropriate SDS, nor should they be transferred without the person receiving the chemicals having had appropriate training in their use, storage and disposal.

3. Inventory

(a) A Chemical Inventory List (CIL) should be updated regularly when a new chemical is received, chemicals are used, or disposed of.

(b) The classification system used for the storage of chemicals should be displayed in the principal storage area.

© Large containers and containers with reactive chemicals, such as acids and bases, should be on low shelves. No chemical should be stored on top of a storage shelf or cabinet.

(d) The Chemical Inventory List should contain the following

1. Chemical name
2. Hazard Identification and Labels (on SDS)

4. Labels

(a) Laboratory chemicals should be properly labeled to identify any hazard(s) associated with them for employee information and protection.

(b) If a chemical is stored in its original bottle, it should contain the manufacturer's original label, identifying potential hazard(s), the date of purchase or the date opened, and the initials of the person who opened the container.

(c) If a chemical has been transferred to a secondary container, the new container should be appropriately labeled with the chemical name, formula, concentration (if in solution), and solvent (if in solution).

(d) Labels on incoming containers must not be removed or defaced. Unlabeled bottles should not be accepted or opened and should be returned to the supplier.

(e) After a chemical has been in storage, unlabeled bottles should not be opened and such materials should be disposed of promptly, as outlined in the section on disposal procedures.

5. Safety Data Sheets

(a) The Safety Data Sheets for each chemical used in the laboratory should express recommended limits or OSHA-mandated limits, or both, as guidelines to exposure limits. Typical limits are expressed as threshold limit values (TLV), Permissible Exposure Limits (PEL), or action levels. When such limits are stated, that limit, along with any other information of hazardous characteristics that the chemical presents, should be used to set laboratory guidelines. Those laboratory guidelines may be used by the Division CHO, School CHO,

and the teacher in determining the safety precautions, control measures, and safety apparel that apply when working with that toxic chemical.

(b) The SDS received with incoming shipments of chemicals should be maintained and made readily available to laboratory employees and, upon request, to students.

(c) An SDS for each compound on the Chemical Inventory List should be available in the department. SDS information can often be obtained by requesting them from 3E or companies that currently sell chemicals. Chemical manufacturers and suppliers are required to supply one copy of an SDS the first time the chemical is purchased by the school.

(d) All laboratory employees will be trained to read and understand the SDS sheets.

(e) The symbols below are to be used on chemical bottles to indicate any safety concerns. Employees should be familiar with these symbols prior to using chemicals in the laboratory setting.

6. Waste Disposal

The division and School Chemical Hygiene Officers should ensure that laboratory chemicals are disposed of in compliance with appropriate regulations and in a manner which minimizes damage to human health and the environment. Every process that uses chemicals has the potential for producing hazardous waste. The purchase or production of chemicals should take into consideration the waste that should be produced and the cost of the waste disposal. The product of a reaction or process only becomes hazardous waste when:

(a) It is removed from the reaction system and called "waste" and

(b) It is hazardous material.

Treatment of hazardous waste must be done by a licensed facility. If a process generates a hazardous waste, either that waste should be collected for treatment outside the school or the experimental procedure should be altered to avoid production of the waste.

There are several references concerning the deactivation of hazardous materials that may be used to help devise suitable schemes for modifying experiments.

The following are specific guidelines for hazardous waste disposal:

(a) Purchase and store only those chemical supplies that will be needed during the current academic year.

(b) Potential waste materials are surplus, old, and/or necessary chemicals. Every attempt must be made to avoid accumulating such chemicals.

(c) No flammable, combustible or water immiscible material will be poured down the drain. If the material is combustible and miscible with water, it may be disposed down the drain provided it is mixed with 100 times its volume of water prior to placing it down the drain.

(d) Separate waste containers should be provided for:

1. Heavy metal compounds,
2. Chlorinated hydrocarbons, and
3. Non-chlorinated hydrocarbons.

(e) Acids and bases should be neutralized before disposal down the drain.

(f) Hazardous waste should never be placed in the common solid trash container(s).

(g) Waste chemicals should be stored in appropriate containers. Liquids should be stored in screw-cap bottles.

(h) Paper and similar solid waste may be stored in sealed plastic bags.

(i) Other solid waste chemicals should be stored in bottles, jars, or plastic-lined sealed boxes, all of which should be correctly labeled.

(j) The product of projects, experiments or other chemical procedures should be recycled and/or decontaminated whenever possible.

(k) All waste containers should have an up-to-date log of the material that is in the container. Each entry for an addition to the container should be dated and initialed by the instructor. The entry should provide the correct chemical name and amount of chemical added; the formula may be given but it is not sufficient by

itself.

- (l) When feasible and safe, a large container of a given waste should be used instead of small containers of the same material.
- (m) Waste materials should not be allowed to accumulate in laboratories or preparation rooms. The sealed containers should be removed to the designated waste storage location.
- (n) Solutions containing heavy metals should be treated by precipitating the heavy metal as its sulfide, carbonate, or hydroxide, as appropriate, followed by filtering and drying. If the aqueous filtrate is suitable it may be disposed of in the sewer after adjustment of the pH. The solid precipitate should be properly labeled and saved for disposal.
- (o) Waste materials should be identified using a chemical identification form and/or label ensuring sufficient information for the safe transportation, treatment, storage and disposal.
- (p) The disposal of hazardous waste will be coordinated with the Supervisor of Maintenance, Supervisor of Science, and should follow the guidelines established by the appropriate state and federal regulations.

Section 7 Procedures for Inspections

The employee should be alert to unsafe conditions and should inform the principal and school CHO, in writing, when an unsafe condition occurs. The employee and school division should do all within their power to correct unsafe conditions.

1. The presence of necessary safety equipment will be verified at least quarterly by the school CHO. The following general standards will apply:

- (a) Hood: face velocity of 60-100 linear feet per minute.
- (b) Shower: continuous flow of tepid, clean water.
- (c) Eyewash: continuous gentle flow of aerated, tepid, clean water for both eyes.
- (d) Fire extinguisher: fully charged.
- (e) Goggle Sanitizer: UV bulb and timer operating properly. A sanitation dip can be used as a substitute for the goggle sanitizer

Equipment will be tagged following the inspection, showing the date, inspector, and results. Written records will be maintained of all inspections. A copy of the inspection will be sent to the Division CHO.

2. Inspections in the laboratory will be conducted at least twice a year. These general inspections will cover all of the emergency equipment identified above, but also the following items:

- (a) Gas cylinders are firmly secured.
- (b) Chemicals are not stored in the hood in which experimentation is done.
- (c) Egress routes are clear of any impediment.
- (d) Chemicals are not stored on top of cabinets or on shelves that do not have lips.
- (e) Electrical cords are in good condition.
- (f) Rubber hoses are not cracked and are otherwise in good condition.
- (g) Other items shown on the "Safety Audit" sheet.

A form for conducting these inspections (sometimes called a "safety audit") is shown in Appendix G.

SECTION 8 Specific Exposure Control Measures

This section addresses criteria that would invoke the use of specific exposure control measures, which are

more stringent than those procedures specified as Standard Operating Procedures or General Laboratory Safety Rules. These specific exposure control measures are designed to reduce the exposure of instructors, aides, students and other employees to especially hazardous chemicals.

Employees should read and understand these practices before commencing a procedure using one or more of these chemicals.

A. Toxic Chemicals

The SDS and labels for many of the chemicals used in the laboratory recommended specific limits for exposure. Other limitations may be specified by OSHA-mandated limits. Typical limits are threshold limit values (TLV), permissible exposure limits (PEL), and action levels. When such limits are stated, they should be used to assist the chemical hygiene officer(s) and the teacher in determining the safety precautions, control measures, and safety apparel that apply.

1. When a TLV or PEL value is less than 50 ppm or 100/mg m³ the user should use it in an operating fume hood, glove box, vacuum line, or other device equipped with appropriate traps. If none are available, no work should be performed using that chemical.
2. If a TLV, PEL, or comparable value is not available, the animal or human median inhalation lethal concentration information, LC₅₀, should be used as a guideline. If that value is less than 200 ppm or 200 mg/m³ when administered continuously for one hour or less, then the chemical should be used in an operating fume hood, glove box, vacuum line or similar device, equipped with appropriate traps. If none are available, no work should be performed using that chemical.
3. Whenever laboratory handling of toxic substances with moderate or greater vapor pressures is likely to exceed air concentration limits, work with such liquids and solids should be conducted in a fume hood, glove box, vacuum line, or similar device equipped with appropriate traps. If none are available, no work should be performed using that chemical.
4. Examples of toxic chemicals are benzene, chloroform, formaldehyde, bromine, carbon disulfide, carbon tetrachloride, cyanide salts and hydrofluoric acid.

B. Flammable Chemicals

In general, the flammability of a chemical is determined by its flash point, the lowest temperature at which an ignition source can cause the chemical to ignite momentarily under certain controlled conditions.

1. Chemicals with a flash point below 200F (93.3 C) should be considered “fire-hazard chemicals”. Any chemical whose SDS or label states “Flammable” is in this category.
2. OSHA standards and the National Fire Protection Association (NFPA) guidelines on when a chemical is considered flammable apply to the use of flammable chemicals in the laboratory.
3. Fire-hazard chemicals in excess of 500 mL should be stored in a flammable solvent storage area, safety cabinets designed for flammable materials.
4. Fire-hazard chemicals should be used only in vented hoods and away from sources of ignition.
5. Examples of flammable chemicals are ether (diethyl ether), acetone, methanol, ethanol, glacial acetic acid and petroleum ether (ligroine).

C. Reactive Chemicals

The most complete and reliable reference on chemical reactivity is the current edition of Handbook of Reactive Chemical Hazards, by L. Bretherick, published by Butterworths Publishers. Reactivity information may be given in manufacturers’ SDS and on labels. Other useful references are cited in Appendix C.

A reactive chemical is one that:

1. Is described as such by Bretherick, the SDS, or the label,
2. IS ranked by the NFPA as “3” or “4” for reactivity,
3. IS identified by the Department of Transportation as an oxidizer, organic peroxide or an explosive in classes A, B, or C.
4. Fits the EPA definition of reactive in 40 CFR 261.23,
5. Fits the OSHA definition of unstable in 29 CFR 1910.1450, or
6. Is known or found to be reactive with other substances.
7. Examples of reactive chemicals are ammonium dichromate, nitric acid, perchloric acid, hydrogen peroxide, potassium chlorate, etc.

Reactive chemicals should be handled with all proper safety precautions, including segregation in storage and prohibition of mixing even small quantities with other chemicals without prior approval and appropriate personal protection and precautions.

D. Corrosive Chemicals and Contact Hazard Chemicals

Corrosivity, allergenic, and sensitizer information is sometimes provided in manufacturers’ SDS’s and on labels. Other guidelines on which chemicals are determined to be corrosive can be found in the publications cited in Appendix C.

A corrosive chemical is one that:

- (a) Fits the OSHA definition of corrosive in Appendix A of 29 CFR 1910.1200,
- (b) Fits the EPA definition of corrosive in 40 CFR 261.22 (has a pH greater than 12 or less than 2.5), or
- (c) Is known to be reactive to living tissue, causing visible destruction of, or irreversible alterations of, tissue at the site of contact.

A contact-hazard chemical is an allergen or sensitizer that:

- (a) Is so identified or described in the SDS or on the label,
- (b) Is so identified or described in medical or industrial hygiene literature, or
- (c) Is known to be an allergen or sensitizer.

Corrosive and contact-hazard chemicals will be handled with all proper safety precautions, including wearing safety goggles, gloves tested for the absence of pin holes and known to be resistant to permeation of penetration by the chemical, and a laboratory apron or laboratory coat.

Examples of corrosive chemicals are hydrochloric, sulfuric, nitric, phosphoric and perchloric acids (all acids in greater than 1 Molar concentration), and sodium hydroxide and potassium hydroxide and potassium hydroxide (either solid or in aqueous solution of greater than 1 Molar concentration).

E. Reproductive Toxins

A reproductive toxin is a compound that:

- (a) Is described as such in the applicable SDS, or
- (b) Any substance identified as such by the Oak Ridge Toxicology Information Resource Center (TIRC). TIRC phone – (615) 576-1746.

No reproductive toxins will be allowed in the laboratories without written authorization from the Division CHO.

Examples of reproductive toxins are organomercurial compounds and ethidium bromide, a reagent used with DNA analysis.

F. Select Carcinogens

1. No select carcinogens are allowed in the laboratories without written authorization from the Division CHO.
2. Examples of select carcinogens are benzene, nickel metal dust and vinyl chloride.

G. Exposure Potential

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

1. Inhalation of chemical vapors, aerosols, gases or dusts can produce poisoning through the mucous membrane or the nose, mouth, throat and lungs. The degree of injury resulting from exposure to these chemicals depends on the toxicity of the material, its solubility in tissue fluids, its concentration, and the duration of exposure.
2. Ingestion is extremely dangerous. The relative acute toxicity can be evaluated by determining the LD50, which is defined as the quantity of chemical that will cause death of 50% of the test animals when ingested in a single dose. Many chemicals will directly damage the tissue of the mouth, throat, nose, lungs and gastrointestinal tract.
3. Contact with skin and eyes can lead to significant chemical injury, including local irritation. In addition, many chemicals can be absorbed through the skin and may cause permanent loss of vision.
4. Injection of chemicals can occur through mechanical injection from glass or other materials contaminated with chemicals.

SECTION 9 Training Opportunities

The School Division will provide annual training opportunities for all employees. These training opportunities should include the transfer of information about the hazards of chemicals present in the laboratory and about sources of information found in manufacturers' SDS, this Chemical Hygiene Plan, and the responsibilities of both the division and the employee.

A. Employee Training

Employees should be trained on the potential chemical hazards in the employee's work areas and on appropriate sections of the Chemical Hygiene Plan.

B. Who Should Be Trained?

This training should be provided to all employees who actually work in the laboratory as well as to other employees whose assignments may require that they enter a laboratory where exposure to hazardous chemicals might occur.

Employees who are responsible for receiving and handling shipments of new chemicals or chemical wastes should also be informed of the potential hazards and appropriate protective measures for chemicals they may receive.

Students should receive training by employees appropriate to their level of chemical handling and potential

exposure. The education of students is particularly important, since they are near the beginning of their experience with science, chemicals, and chemical safety.

D. Training Frequency

Employees should receive information and training at the time of their initial assignment to a laboratory and prior to assignments involving new exposure situations. Opportunities to refresh their working knowledge should be provided at least once a year.

E. Information Program

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

1. The contents of appropriate governing standards, as shown in Appendix A.
2. The location and availability of the Chemical Hygiene Plan.
3. The use and location of Safety Data Sheets.

F. Employee Training Program

1. Laboratory employees should be trained on the applicable details of the Chemical Hygiene Plan, including a review of the General Rules for Laboratory Safety.
2. The training program should describe appropriate sections of the Standard Operating Procedures, particularly the Chemical Hygiene Officer responsible for the laboratory in which they work.
3. Employees should be informed as to the responsibilities of the Chemical Hygiene personnel, particularly the Chemical Hygiene Officer responsible for the laboratory in which they work.
4. Emergency procedures adopted by the School Division, including response to spills, fires, explosions, evacuation, and decontamination, should be described.
5. Employees should be trained in measures they may take to protect themselves from exposure to hazardous chemicals, including the location and proper use of protective apparel and emergency equipment.

G. Training of Students

The Bedford County Public School Division requires that instruction in comparable laboratory safety practices be provided to students, such training to be appropriate to their potential exposure to hazardous chemicals. The degree of training should vary based on their grade level, courses of study, the laboratory facility and the individual policies of the school division, school, instructor, local health district, and other factors.

SECTION 10 Emergency Prevention and Response

Laboratory instructors, aides and other laboratory employees should be familiar with emergency procedure in order to prevent and reduce the impact of laboratory accidents.

A. Standard Emergency Procedures

1. Emergency procedures should address a failure in the ventilation systems, evacuation and fire response, or the breakdown of other procedures to limit exposure of employees to hazardous chemicals. These emergency procedures should be established and should be posted in appropriate public places, and will include the following:

- (a) Routes of egress from the laboratory.
- (b) Procedures by which to notify appropriate individuals.

(c) Telephone numbers of fire, police, ambulance, and school authorities.

2. Specialized equipment such as self-contained breathing apparatus (respirators) requires specialized training prior to use.
3. The laboratory should have a plan for everyone to follow if an evacuation is necessary. The employee should be sure that he/she knows the main and alternate routes, as well as the procedure for accounting for each person in the laboratory.
4. The employee should call for assistance if there is any doubt about his/her ability to handle an emergency. The most appropriate response to a fire is evacuation and subsequent action by the fire department.
5. Individual items of safety equipment and their proper use are discussed in training.

B. Specific Emergency Response Procedures

The employee should follow procedures that have been established and practiced.

When helping another person, the employee should evaluate the potential danger to himself/herself before taking action. The following actions are recommended:

- (a) Report the nature and location of the emergency to the CHO and principal.
- (b) Tell anyone in the area about the nature of the emergency.
- (c) Do not move any injured persons unless they are in immediate danger from chemical exposure.
- (d) Keep victims warm.

C. First Aid

Suitable first aid equipment should be available in the laboratory area, including a blanket, a general first aid kit, and small bandages for minor cuts and abrasions.

Personal injury beyond the purely superficial requires professional medical treatment.

The school should have personnel trained in first aid available during working hours to render assistance until medical help can be obtained. The teacher, instructor or aide should be trained in the use of standard first aid procedures.

D. Emergency Equipment

The School and Division Chemical Hygiene Officer(s) should ensure that adequate emergency equipment is available in the laboratory and inspected periodically to ensure that is functioning properly. All personnel should be properly trained in the use of each item. We recommend that students also know how, and be trained by appropriate instruction, to use the fire blanket, eyewash fountain, safety drench shower, and telephone for safety purposes. Equipment items that should be available in the laboratory include:

1. Eyewash fountain
2. Fire extinguisher of an appropriate type
3. Safety drench shower
4. Telephone
5. Fire Blanket
6. Identification signs

Refer to the laboratory safety checklist in Appendix F.

E. Fire Response

1. Fire Prevention

The best way to fight a fire is to prevent it. Fires can be prevented or their severity considerably reduced by proper housekeeping and by thoughtful reflection about what is being done. This includes the prompt removal of waste, separation of flammable liquids from combustible material, storage of only limited quantities of flammable material, and the maintenance of unobstructed aisles and exits.

2. Dealing with a Fire

When a fire occurs, the following actions should be followed, depending on its severity:

- (a) The fire alarm should be activated and the Fire Department called.
- (b) Nearby flammable materials should be removed to avoid spread of the fire.
- (c) If a fire occurs, all persons should evacuate the area, except those trained and equipped to fight structural fires.
- (d) A fire in a small vessel should be suffocated by covering the vessel. The vessel should not be picked up, nor covered with dry towels or cloths.
- (e) The fire extinguisher should be used only by trained people, and only from a position from which escape is possible.
- (f) Firefighters should be informed of what chemicals are involved. A copy of the current Chemical Inventory List (CIL) should be available outside the work area.
- (g) Laboratories should be posted with the National Fire Protection Association diamond, which provides much emergency information. The information of the NFPA warning must be current.
- (h) Fires involving laboratory chemicals increase the possibility of explosions. Special care should be taken to keep fire or excessive heat from volatile solvents, compressed gas cylinders, reactive metals and explosive compounds.
- (i) As soon as possible, all extinguishers that were used should be recharged or replaced with full extinguishers.

3. Personal Injuries Involving Fires

Persons whose clothing is ablaze should be drenched under the safety shower. If the shower is not convenient, the individual may be doused with water, covered with a blanket, or another procedure to quench the fire.

After the fire is out, the individual should be wrapped to avoid shock and exposure. The individual should be kept warm, and medical attention will be promptly sought.

F. Chemical Spills on Personnel

1. For spills covering small amounts of skin, the area should be washed with flowing water for fifteen minutes. "Small amounts" are defined as less than 10 mL of a hazardous liquid or less than 3 grams of hazardous solid.

- (a) Jewelry should be removed to facilitate cleaning.
- (b) If there is no visible burn, the area should be washed with water.
- (c) After washing, the SDS should be consulted to determine if any delayed effects should be expected.
- (d) If a burn is visible, medical attention should be sought after the washing has been completed.

2. For larger spills, the same procedures should apply, except that it may be appropriate to use the safety

drench shower to assure thorough and complete washing.

3. For spills on clothing and whenever necessary, the clothes should be removed as quickly as possible.

- (a) Shoes and jewelry should be removed to facilitate washing.
- (b) The safety drench shower should be used for fifteen minutes.
- (c) Special care should be taken to prevent chemicals from entering the eyes.
- (d) Any affected skin should be thoroughly flooded for fifteen minutes, and the washing should be resumed if pain continues.
- (e) No creams, slaves or lotions should be placed on the burned area.
- (f) Medical attention should be sought as soon as possible.
- (g) Contaminated clothes should be washed separately from other personal clothing. This is the responsibility of the owner of the clothing.

4. Dealing with Medical Help

Medical personnel should be fully informed as to the chemical involved in the spill, and of the circumstances of the spill.

5. Splashes in the Eyes

The eye(s) should be immediately flushed with tempered potable water from a gently flowing source for at least fifteen minutes. The eyelids should be held away from the eyeball while the eyeball is moved up, down, and sideways to wash behind the eyelid(s).

First aid should be immediately followed by treatment by qualified medical personnel.

G. Other Accidents Involving Personal Injury

- 1. Anyone overcome with smoke or fumes should be removed to uncontaminated air and treated for shock. The rescuer should evaluate the possibility for harm before entering or continuing to remain in a toxic environment.
- 2. If hazardous chemicals are ingested, the first aid treatment shown on the label or Safety Data Sheet should be undertaken.
- 3. If an injured person is not breathing, the rescuer should provide mouth-to-mouth resuscitation, using appropriate methods. Special training is required to provide cardiopulmonary resuscitation (CPR).
- 4. Bleeding should be controlled by compressing the wound with a clean cloth or other appropriate compress. The injury should be elevated above the level of the heart. After bleeding is controlled, the injured person should be covered to avoid shock. Medical attention should be called as soon as possible.
- 5. If a person is in contact with a live electrical circuit, the power should be shut off at the most convenient switch. The person should not be contacted until the power has been disconnected.
- 6. Never place anything in the mouth of an unconscious person.

H. General Chemical Spills

- 1. All spills should be cleaned up promptly. Any individual at risk of involvement should be warned about the spill.
- 2. Local procedures should be established and followed for determining when evacuation is necessary.
- 3. The spread of chemicals in a spill is important, so absorbent material should be used to surround the spill area. After the spill has been contained, it can be cleaned up with appropriate tools,

including commercial spill control kits, for example.

4. If the spill is for an acid or base, it may be neutralized by an appropriate solid:

(a) Vinegar (dilute acetic acid) will neutralize bases.

(b) Sodium bicarbonate will neutralize acids.

5. For halogen spills, sodium thiosulfate should be used for decontamination

6. When dry, the spilled material must be treated as chemical waste.

I. Accident Reports

All accidents and near accidents should be carefully investigated. The results of that investigation and recommendations for the prevention of similar occurrences should be forwarded to the Principal and Division Chemical Hygiene Officer. Accident reports will be kept on file, as indicated in the Record-keeping section of this document. Instructions for reporting an accident can be found in Appendix C.

APPENDIX A: Chemical Inventory Teacher Quick Guide

[Click here](#) to access the Chemical Inventory Teacher Quick Guide.

APPENDIX B: Glossary

ACGIH	American Conference of Governmental Industrial Hygienists
ACS	American Chemical Society. 1155- 16th St. NW, Washington, DC 20036, (202) 8872-4600.
Acute	An adverse effect with symptoms of high severity that develop over a short period of time.
Allergen	An agent capable of producing an immunologic reaction.
ANSI	American National Standards Institute. 1430 Broadway, New York, NY 10018, (212) 354-3300
ASHRAE	American Society of Heating, Refrigeration, and <i>Air Conditioning Engineers</i> .
Carcinogen	A substance capable of causing cancer. C FA Code of Federal Regulations.
CGA	Compressed Gas Association.
Chemical Hygiene	An employee who is designated by the employer and who is qualified by training or experience to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan.
Chemical Hygiene Plan	A written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment and work practices that are both capable of protecting employees from the health hazards presented by hazardous chemicals used in that particular workplace and meets the requirements of CFR 1910.1450.
Chronic	An adverse effect with symptoms that develop slowly over a long period of time or that often recur.
Designated Area	Able to catch fire and burn. These are liquids with flash points at or above 100oF (37.8oC) and below 200oF (93.3oC).
Designated Area	An area which may be used for work with "select carcinogens", reproductive toxins, or substances which have a high degree of acute toxicity .A designated area may be the entire laboratory, an area of a laboratory, or a device in the laboratory, such as a fume hood.
DOT	Department of Transportation.
Emergency	Any occurrence which results in an uncontrolled release of a hazardous chemical into the workplace.
EPA	Environmental Protection Agency.
Flammable	Capable of being easily ignited and of burning with extreme rapidity. Liquids with a flashpoint below 100oF
Flash Point	The lowest temperature at which a combustible or flammable material can be made to ignite

FR	momentarily in air. Federal Register, the "Nation's Newspaper", usually cited as FR 55,3312 (Jan 31,1990), meaning Volume 55, page 3312 of the issue dated Jan 31,1990.
Hazardous Chemical	A chemical for which there is statistically significant evidence that acute or chronic health effects may occur in exposed persons.
Hazardous Chemical	A chemical for which there is statistically significant evidence that acute or chronic health effects may occur in exposed persons.
HCS	Hazard Communication Standard, 29 CFR 1910.1200
IARC Laboratory	International Agency for Research on Cancer A facility (building, room, etc.) "laboratory use of chemicals" occurs. A workplace where relatively small quantities of hazardous chemicals <i>are</i> used on a non- production basis.
Laboratory Scale	Work with chemicals in which containers used can easily and safely be manipulated by one person, excluding commercial production of chemicals for sale.
Laboratory Use	Handling or use of chemicals which satisfy the following conditions: 1] manipulations are carried out on a "Laboratory scale"; 2] multiple chemicals or procedures are used; 3] procedures involved are not part of a production process; and 4] protective laboratory practices and equipment are available in common use to minimize the potential -for employee exposure to hazardous chemicals.
LC 50	The concentration of a substance in air that causes death in 50% of the animals exposed by inhalation. A mea- sure of acute toxicity.
LD 50	The dose that causes death in 50% of the animals exposed by swallowing a substance. A measure of acute toxicity .
Medical Consultation	A consultation which takes place between an employee and a licensed physician for the purpose of determining what medical examinations or procedures, if any, are needed in cases where a significant exposure to a hazardous chemical may have taken place.
SDS Material Safety Data Sheet	A document provided by the manufacturer or supplier of a chemical on which various properties related to the hazardous properties of the chemical are listed.
NAPB	Mutagen Chemical which causes chromosomal damage. National Association for the Prevention of Blindness.
Neoplastigen	Chemicals capable of causing non-cancerous

NFPA
NIOSH

OSHA

PEL

Protective Laboratory

HCS
IARC
Laboratory

Laboratory Scale

Laboratory Use

LC 50

LD 50

Medical Consultation

tumors.

National Fire Protection Association.
National Institute of Occupational Safety and Health. NTP National Toxicology Program
Occupational Safety and Health Act. Also, the
Occupational Safety and Health Administration.
200 Constitution Ave., Washington, DC 20010,
(202-523-6091.

Permissible Exposure Limit. The legally allowed
concentration in the workplace is considered a
safe level of exposure for an 8-hour shift, 40
hours per week.

Those laboratory procedures, practices, and
equipment accepted by laboratory health and
safety experts as and Equipment effective or that
the employer can show to be effective,
in minimizing the potential for employee
exposure to hazardous chemicals.

Hazard Communication Standard, 29 CFR
1910.1200

International Agency for Research on Cancer
A facility (building, room, etc.) where the
"laboratory use of chemicals" occurs. A
workplace where relatively small quantities of
hazardous chemicals *are* used on a non-
production basis.

Work with chemicals in which containers used
can easily and safely be manipulated by one
person, excluding commercial production of
chemicals for sale.

Handling or use of chemicals which satisfy the
following conditions: 1] manipulations are carried
out on a "Laboratory scale"; 2] multiple chemicals
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A consultation which takes place between an
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Chemicals capable of causing non-cancerous tumors.

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National Institute of Occupational Safety and Health. NTP National Toxicology Program Occupational Safety and Health Act. Also, the Occupational Safety and Health Administration. 200 Constitution Ave., Washington, DC 20010, (202-523-6091).

OSHA

PEL

Permissible Exposure Limit. The legally allowed concentration in the workplace is considered a safe level of exposure for an 8-hour shift, 40 hours per week.

Protective Laboratory

Those laboratory procedures, practices, and equipment accepted by laboratory health and safety experts as and Equipment effective or that the employer can show to be effective, in minimizing the potential for employee exposure to hazardous chemicals.

Physical Hazard

A chemical for which there is scientifically valid evidence ~ that it is combustible, flammable, explosive, an oxidizer, unstable, or highly reactive.

Select Carcinogen

Any substance that meets one of the following criteria:
1] Regulated by OSHA as a carcinogen;
2] Listed as a "known carcinogen" in the latest Annual Report on Carcinogens, published by the National Toxicology Program;
3] Listed in Group 1 (Carcinogenic to Humans) by the latest IARC monographs; or
4] Listed in either Group 2A or 2B by IARC, or "reasonably anticipated to be carcinogenic" by NTP, and causes statistically significant tumor incidence in experimental animals through inhalation, skin application or oral dosages (the exact specifications for dosages may be found in IARC publications).

Sensitizer

Chemical capable of creating an allergic reaction in certain individuals after an initial exposure.

Teratogen

Chemical, which affects fetal development.

TIRC

Oak Ridge Toxicology Information Reference

TLV	Center Threshold Limit Value. The amount of exposure allow- able for an employee in an 8-hour day.
Physical Hazard	A chemical for which there is scientifically valid evidence ~ that it is combustible, flammable, explosive, an oxidizer, unstable, or highly reactive.
Select Carcinogen	Any substance that meets one of the following criteria: 1] Regulated by OSHA as a carcinogen; 2] Listed as a "known carcinogen" in the latest Annual Report on Carcinogens, published by the National Toxicology Program; 3] Listed in Group 1 (Carcinogenic to Humans) by the latest IARC monographs; or 4] Listed in either Group 2A or 2B by IARC, or "reasonably anticipated to be carcinogenic" by NTP, and causes statistically significant tumor incidence in experimental animals through inhalation, skin application or oral dosages (the exact specifications for dosages may be found in IARC publications).
Sensitizer	Chemical capable of creating an allergic reaction in cerl ain individuals after an initial exposure.
Teratogen	Chemical, which affects fetal development.
TIRC	Oak Ridge Toxicology Information Reference Center
TLV	Threshold Limit Value. The amount of exposure allow- able for an employee in an 8-hour day.

APPENDIX C: Chemical Purchases

The chemicals listed below may be purchased from local community suppliers such as grocery stores. All other chemicals are to be purchased from commercial chemical suppliers. It is recommended to first check Flinn Sci to purchase chemicals before purchasing from other websites.

Acetone
Antacids
Aluminum
Aluminum Foil
Ammonia
Aspirin
Baking soda
Baking powder
Bleach
Borax (sodium borate)
Chalk- for lab experiments
Cooking oil
Corn syrup
Copper
Corn Starch
Dish detergent
Drano
Epsom Salt
Flour
Food coloring
Gelatin
Glue (white school glue)
Hydrogen peroxide 2 %
Hydrogen peroxide 3 %
Hydrogen peroxide 27-30 %
Honey
Iron
Liquid Bluing
Nail polish remover
Naphthalene
Pancake syrup
Plastic Wrap
Rock Salt
Rubbing Alcohol
Salt- NaCl
Sand
Shampoo/ conditioner
Steel
Sugar- Sucrose
Tea bags
Tie Dye Dyes
Tylenol

Vegetable oil- corn oil, etc.
Vinegar
Windex
Wires (aluminum, copper, ni-chrome)
Woolite
Yeast
Zinc

No chemicals should be purchased or used in science laboratory exercises unless they:
(c) support the Essential Understandings and/or the Essential Knowledge found in the Science Standards of Learning Curriculum Framework, 2003 and
(d) are published in an appropriate laboratory manual with complete instructions.

Chemicals are to be purchased from commercial chemical suppliers (Flinn Scientific). Under no circumstances

are chemicals to be accepted as gifts or otherwise acquired from private individuals, manufacturing companies, government agencies, etc. The teacher should be familiar with any exercise involving chemicals and follow safe procedures for use and storage of those chemicals.

The quantity of chemicals stored should not be excessive. **Quantities should be limited to amounts no greater than what will be consumed over two academic years.** The following list of chemicals was prepared using data from the Commonwealth of Virginia Department of Education, the Council of State Science Supervisors, and the Flinn Chemical Catalog/Reference Manual. Evaluation of these chemicals involved reactivity, toxicity, carcinogenic potential, explosiveness, and flammability. This brief list should be compared to the chemical inventory. Those chemicals preceded by an asterisk (*) should not be purchased, used, or stored. The other chemicals listed should be used or stored only with appropriate cautions. The MSDS should be read before using these or any other chemicals. The Flinn Chemical Catalog/Reference Manual is a good source of information on potential hazards.

Hazards indicated:

C = positive or suspected carcinogen

T = moderately to extremely toxic

R = highly reactive and/or corrosive

F or E = potentially flammable or explosive

Acetamide–C

Acetic acid (glacial)–T, F, R

Acetic acid–R

*Acetic anhydride- F, R, T

Acetone–F, T

Acetyl chloride–F

Acrylonitrile–C

dl- Adrenalin–T

*Aluminum chloride (anhydrous)–R, T

*Ammonium dichromate–T, E, F

Ammonium chromate–T

Ammonium dichromate–T, E, F

Ammonium hydroxide (14M)–T
Ammonium hydroxide (6M)–T
Ammonium nitrate (crystals)–T, E
Ammonium vanadate (ammonium metavanadate)–T
*Aniline–T, C
*Aniline hydrochloride–T
*Anthracene–C
Antimony–T
Antimony oxide–T
Antimony pentachloride–R
Antimony trichloride–T
*Arsenic–T
*Arsenic chloride–T
*Arsenic pentoxide–T
*Arsenic trioxide–C, T
*Asbestos–C
*Arcarite–C
Barium chloride (crystals) T
Barium oxalate–T
Barium peroxide–T, F (High School Only, Demo Supply)
*Benzene–C, T, F
*Benzidine–T
*Benzoin–C, T
Benzoyl chloride–T, R
*Benzoyl peroxide–T, E, R
*Beryllium carbonate–T
Biuret solution–R
*Bromine–T, F
*Bromine water–T (High School Only & fresh supply only)
*Cadmium–C, T
All Cadmium compounds–T
Cadmium bromide–T
Cadmium carbonate–T
*Cadmium chloride–C
Cadmium nitrate–C, T, F
Cadmium sulfate–C, T
*Calcium carbide–F
*Lead acetate (flakes)–T, C
*Lead arsenate–C, T
Lithium–F, R (max. qty.–1 yr. demo supply)
Lithium nitrate crystals–E, R (max. qty.–1 yr. demo supply)
Magnesium–F
Magnesium chlorate–T
Magnesium perchlorate–R
*Mercury (and all compounds) T
Methyl alcohol–F, T
Methyl ethyl ketone–F

Methyl iodide–C
Methyl methacrylate–T, F
*Millon's reagent solution–T
Nickel(ous) Ammonium sulfate crystals–T
Nickel carbonate–C
Nickel(ous) chloride–T, C
Nickel(ous) nitrate–T, C
Nickel oxide–C
Nickel(ous) sulfate–T, C
Nicotine–T
Nitric acid–R
Osmium tetroxide–T
Oxygen tanks–F
Para-dichlorobenzene (1,4 Dichlorobenzene)–T
*Paris green–T
Pentane–F
*Perchloric acid–R, E
Perchloroethylene–C, T
*Petroleum ether–F
*Phenol (Crystals or 88% solution)–C, T
1-Phenyl-2 Thiourea–T
Phenylthiocarbamide powder–T
*Phosphorous, red or white–F
*Phosphorous pentoxide–F, R
*Picric acid
*Potassium metal–E, R (max. qty.–1 yr. demo supply)
*Potassium cyanide–T
*Potassium chlorate–T, E
Potassium chromate–C, T
Potassium dichromate–R, T, C
Potassium ferricyanide–T
Potassium ferrocyanide–T
Potassium hydroxide (solid)–T, R
Potassium nitrate–F, E
Potassium nitrite (crystals)–F, E
Potassium periodate–R
Potassium permanganate–T, F
*Potassium sulfide–F, T
Propionic acid–F
n-Propyl alcohol–F
Pyridine–T, E
Pyrogallol (Pyrogallol acid)–T
Sebacoyl chloride/hexane soln.–F
Silver acetate–T
*Silver cyanide–T
Silver nitrate–T, R
Soda lime–R

Sodium metal–F, R (max. qty.–1 yr. demo supply)
*Sodium arsenate–T, C
*Sodium arsenite–T, C
*Sodium azide–T, E
Sodium chlorate–F
Sodium chromate–T, C
*Sodium cyanide–T
Sodium dichromate–T, C
Sodium fluoride–T
Sodium hydroxide solutions–R (purchase of pre-mixed soln. recommended)
Sodium hydroxide–R
Sodium nitrate–R, E, T
Sodium nitrate (granular)–T, F, E (for A.P. Chemistry only)
Sodium nitrite–C, T, E
*Sodium peroxide–E
Sodium sulfide–T, F
Sodium thiocyanate–T
Stannic chloride–R, T
*Strontium–F
Strontium nitrate–F
Sudan IV–C
Sulfuric acid–R, T
Tannic acid–C, T
Tetrabromoethane–T
Thioacetamide–C, T
Thiourea (thiocarbamide)–C
*Toluene–T, F
Toluidine–C
Trichloroethylene–C, T
Uranyl acetate–C
Uranyl nitrate–C, F, E
Urethane–C
Vinylite–C
Winkler's solution #2–R
Wood's metal–T
Xylene–F, T
Zinc nitrate (flakes–T, F