HENRY COUNTY PUBLIC SCHOOLS

CHEMICAL HYGIENE PLAN

This plan was created for Henry County Public Schools to use when disseminating safety protocols for both chemical use classroom instruction and for facility operations. This document will be updated yearly to reflect current protocols in the division.

CHEMICAL HYGIENE PLAN

SECTION 1 INTRODUCTION

A. **Purpose of this document**

The Chemical Hygiene Plan is a document designed to express the policies and procedures adopted by Henry County Public Schools, 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 test 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 Henry County Public Schools 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 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 Henry County Public Schools 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 Henry County School 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 PELs and TLVs

The Permissible Exposure Limits (PELs) and Threshold Limit Values (TLVs) 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

Henry County Public Schools will not accept a chemical from a supplier unless it is accompanied by the corresponding Safety Data Sheet (SDS).

G. **Be Prepared**

The School Division 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 Henry County Public Schools 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 alone in a laboratory or chemical storage area.

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, be 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. 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 Officer 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 Henry County 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 in the school. The principal should monitor school employees' compliance with the Chemical Hygiene Plan.

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

Henry County Public Schools has fifteen schools covered by this Laboratory Standard, and have elected to have a Division Chemical Hygiene Officer (CHO) and a single Chemical Safety Officer (CSO) for each school.

1. Division Chemical Hygiene Officer (CHO)

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 Safety 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 Safety Officer

The school chemical safety officer will serve in that position for the school. The school Chemical Safety Officer will be designated by the principal. The School CSO will serve as the building's contact person for chemical hygiene programs.

The School CSO 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.
(c) Provide regular, formal chemical hygiene and housekeeping inspections.
(d) 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.

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 is 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.

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

Laboratory employees should be informed of those laboratory procedures and operations which require prior approval from the Chemical Safety Officer to ensure that these activities are carefully monitored for adherence to the Chemical Hygiene Plan. Requests for approval must be made in writing or via email to the Chemical Hygiene Officer.

G. Accident Reports

Each incidence of an accident or injury should be reported to both the local CSO 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), which will be updated periodically. A copy of the CIL will be kept in Google Drive and will be accessible to all. 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 Safety 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 of 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. AHRAE 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 CSO.

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) All chemicals purchased must be approved by the Chemical Safety Officer prior to purchase.
(c) 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.
(d) All chemicals should be contained in tightly closed, sturdy, and appropriate containers.
(e) A chemical should not be accepted without being accompanied by the SDS.
(f) The container should be marked with the date at the time it is received and the date it is opened.
(g) Chemicals should not be accepted if the original container has been broken, opened, or has been compromised in some other way.
h) The Chemical Inventory List should be updated each time a chemical is received.
(i) 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) The classification system used for the storage of chemicals should be displayed in the storage area.
(e) 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.
(f) All shelves on which chemicals are stored should have a lip of approximately ¾" or greater in order to prevent bottles from sliding off the shelf.
(g) 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.
(h) 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.
(i) Those chemicals classified as acute poisons should be kept in a separate, locked location, which has been labeled as to its purpose.
(j) 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.

(k) Chemicals should not be distributed to other persons or to other areas of the school without prior approval of the School Chemical Safety 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.
(d) A printed copy of the most recent inventory should be kept by the School CSO, the principal and Division CHO.
(e) The Chemical Inventory List should be updated on an annual basis.

3. Inventory

(a) A Chemical Inventory List (CIL) received. The CIL should be checked (updated) on at least on an annual basis.
(b) The Chemical Inventory List should contain the following
1. Chemical name
2. Date purchased
3. Amount in storage
4. Hazard Identification and 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, 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), solvent (if in solution), and name or initials of the person responsible for the transfer.
(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.

4. 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.

5. Waste Disposal

The Division Chemical Hygiene Officer and School Chemical Safety 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 ten 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 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 CSO, 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 CSO. 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.

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.

3. Inspection records will be kept by the Principal and School CSO.

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:
(a) Is described as such by Bretherick, the SDS, or the label,
(b) IS ranked by the NFPA as “3” or “4” for reactivity,
(c) IS identified by the Department of Transportation as an oxidizer, organic peroxide or an explosive in

classes A, B, or C.
(d) Fits the EPA definition of reactive in 40 CFR 261.23,
(e) Fits the OSHA definition of unstable in 29 CFR 1910.1450, or
(f) Is known or found to be reactive with other substances.
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 that 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 should provide 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' Safety Data Sheets, 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.

C. Record Keeping

As indicated in the earlier section, the training of laboratory personnel should be documented and kept in the employee's file.

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. Completion of the Flinn Science Safety Course should take place every three years. 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

Henry County Public Schools require 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 procedures 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. There should be a telephone in the laboratory, which can be a cell phone, for the purpose of emergency response.
3. Specialized equipment such as self-contained breathing apparatus (respirators) requires specialized training prior to use.
4. 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.
5. 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.
6. 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.

1. 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 Officer(s) should ensure that adequate emergency equipment is available in the laboratory and inspected periodically to ensure that it 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 of 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 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

- Part Number: 1910
- Part Title: Occupational Safety and Health Standards
- Subpart: Z
- Subpart Title: Toxic and Hazardous Substances
- Standard Number: 1910.1450 App A
- Title: National Research Council Recommendations Concerning Chemical Hygiene in Laboratories (Non-Mandatory)

To assist employers in developing an appropriate laboratory Chemical Hygiene Plan (CHP), the following non-mandatory recommendations were based on the National Research Council's (NRC) 2011 edition of "Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards." This reference, henceforth referred to as "Prudent Practices," is available from the National Academies Press, 500 Fifth Street NW., Washington DC 20001 (www.nap.edu). "Prudent Practices" is cited because of its wide distribution and acceptance and because of its preparation by recognized authorities in the laboratory community through the sponsorship of the NRC. However, these recommendations do not modify any requirements of the OSHA Laboratory standard. This appendix presents pertinent recommendations from "Prudent Practices," organized into a form convenient for quick reference during operation of a laboratory and during development and application of a CHP. For a detailed explanation and justification for each recommendation, consult "Prudent Practices."

"Prudent Practices" deals with both general laboratory safety and many types of chemical hazards, while the Laboratory standard is concerned primarily with chemical health hazards as a result of chemical exposures. The recommendations from "Prudent Practices" have been paraphrased, combined, or otherwise reorganized in order to adapt them for this purpose. However, their sense has not been changed.

Section F contains information from the U.S. Chemical Safety Board's (CSB) Fiscal Year 2011 Annual Performance and Accountability report and Section F contains recommendations extracted from the CSB's 2011 case study, "Texas Tech University Laboratory Explosion," available from: http://www.csb.gov/.

Culture of Safety

With the promulgation of the Occupational Safety and Health Administration (OSHA) Laboratory standard (29 CFR 1910.1450), a culture of safety consciousness, accountability, organization, and education has developed in industrial, governmental, and academic laboratories. Safety and training programs have been implemented to promote the safe handling of chemicals from ordering to disposal, and to train laboratory personnel in safe practices. Laboratory personnel must realize that the welfare and safety of each individual depends on clearly defined attitudes of teamwork and personal responsibility. Learning to participate in this culture of habitual risk assessment, experiment planning, and consideration of worst-case possibilities—for oneself and one’s fellow workers—is as much part of a scientific education as learning the theoretical background of experiments or the step-by-step protocols for doing them in a professional manner. A crucial component of chemical education for all personnel is to nurture basic attitudes and habits of prudent behavior so that safety is a valued and inseparable part of all laboratory activities throughout their career.

Over the years, special techniques have been developed for handling chemicals safely. Local, state, and federal regulations hold institutions that sponsor chemical laboratories accountable for providing safe working environments. Beyond regulation, employers and scientists also hold themselves personally responsible for their own safety, the safety of their colleagues and the safety of the general public. A sound safety organization that is respected by all requires the participation and support of laboratory administrators, workers, and students. A successful health and safety program requires a daily commitment from everyone in the organization. To be most effective, safety and health must be balanced with, and incorporated into, laboratory processes. A strong safety and health culture is the result of positive workplace attitudes—from the chief executive officer to the newest hire; involvement and buy-in of all members of the workforce; mutual, meaningful, and measurable safety and health improvement goals; and policies and procedures that serve as

reference tools, rather than obscure rules.

In order to perform their work in a prudent manner, laboratory personnel must consider the health, physical, and environmental hazards of the chemicals they plan to use in an experiment. However, the ability to accurately identify and assess laboratory hazards must be taught and encouraged through training and ongoing organizational support. This training must be at the core of every good health and safety program. For management to lead, personnel to assess worksite hazards, and hazards to be eliminated or controlled, everyone involved must be trained.

A. General Principles

1. Minimize All Chemical Exposures and Risks

Because few laboratory chemicals are without hazards, general precautions for handling all laboratory chemicals should be adopted. In addition to these general guidelines, specific guidelines for chemicals that are used frequently or are particularly hazardous should be adopted.

Laboratory personnel should conduct their work under conditions that minimize the risks from both known and unknown hazardous substances. Before beginning any laboratory work, the hazards and risks associated with an experiment or activity should be determined and the necessary safety precautions implemented. Every laboratory should develop facility-specific policies and procedures for the highest-risk materials and procedures used in their laboratory. To identify these, consideration should be given to past accidents, process conditions, chemicals used in large volumes, and particularly hazardous chemicals.

Perform Risk Assessments for Hazardous Chemicals and Procedures Prior to Laboratory Work:

(a) Identify chemicals to be used, amounts required, and circumstances of use in the experiment. Consider any special employee or laboratory conditions that could create or increase a hazard. Consult sources of safety and health information and experienced scientists to ensure that those conducting the risk assessment have sufficient expertise.

(b) Evaluate the hazards posed by the chemicals and the experimental conditions. The evaluation should cover toxic, physical, reactive, flammable, explosive, radiation, and biological hazards, as well as any other potential hazards posed by the chemicals.

(c) For a variety of physical and chemical reasons, reaction scale-ups pose special risks, which merit additional prior review and precautions.

(d) Select appropriate controls to minimize risk, including use of engineering controls, administrative controls, and personal protective equipment (PPE) to protect workers from hazards. The controls must ensure that OSHA's Permissible Exposure Limits (PELs) are not exceeded. Prepare for contingencies and be aware of the institutional procedures in the event of emergencies and accidents.

One sample approach to risk assessment is to answer these five questions:

(a) What are the hazards?

(b) What is the worst thing that could happen?

(c) What can be done to prevent this from happening?

(d) What can be done to protect from these hazards?

(e) What should be done if something goes wrong?

2. Avoid Underestimation of Risk

Even for substances of no known significant hazard, exposure should be minimized; when working with substances that present special hazards, special precautions should be taken. Reference should be made to the safety data sheet (SDS) that is provided for each chemical. Unless otherwise known, one should assume that any mixture will be more toxic than its most toxic component and that all substances of unknown toxicity are toxic.

Determine the physical and health hazards associated with chemicals before working with them. This determination may involve consulting literature references, laboratory chemical safety summaries (LCSSs),

SDSs, or other reference materials. Consider how the chemicals will be processed and determine whether the changing states or forms will change the nature of the hazard. Review your plan, operating limits, chemical evaluations and detailed risk assessment with other chemists, especially those with experience with similar materials and protocols.

Before working with chemicals, know your facility's policies and procedures for how to handle an accidental spill or fire. Emergency telephone numbers should be posted in a prominent area. Know the location of all safety equipment and the nearest fire alarm and telephone.

3. Adhere to the Hierarchy of Controls

The hierarchy of controls prioritizes intervention strategies based on the premise that the best way to control a hazard is to systematically remove it from the workplace, rather than relying on employees to reduce their exposure. The types of measures that may be used to protect employees (listed from most effective to least effective) are: engineering controls, administrative controls, work practices, and PPE. Engineering controls, such as chemical hoods, physically separate the employee from the hazard. Administrative controls, such as employee scheduling, are established by management to help minimize the employees' exposure time to hazardous chemicals. Work practice controls are tasks that are performed in a designated way to minimize or eliminate hazards. Personal protective equipment and apparel are additional protection provided under special circumstances and when exposure is unavoidable.

Face and eye protection is necessary to prevent ingestion and skin absorption of hazardous chemicals. At a minimum, safety glasses, with side shields, should be used for all laboratory work. Chemical splash goggles are more appropriate than regular safety glasses to protect against hazards such as projectiles, as well as when working with glassware under reduced or elevated pressures (e.g., sealed tube reactions), when handling potentially explosive compounds (particularly during distillations), and when using glassware in high-temperature operations. Do not allow laboratory chemicals to come in contact with skin. Select gloves carefully to ensure that they are impervious to the chemicals being used and are of correct thickness to allow reasonable dexterity while also ensuring adequate barrier protection.

Lab coats and gloves should be worn when working with hazardous materials in a laboratory. Wear closed-toe shoes and long pants or other clothing that covers the legs when in a laboratory where hazardous chemicals are used. Additional protective clothing should be used when there is significant potential for skin-contact exposure to chemicals. The protective characteristics of this clothing must be matched to the hazard. Never wear gloves or laboratory coats outside the laboratory or into areas where food is stored and consumed.

4. Provide Laboratory Ventilation

The best way to prevent exposure to airborne substances is to prevent their escape into the working atmosphere by the use of hoods and other ventilation devices. To determine the best choice for laboratory ventilation using engineering controls for personal protection, employers are referred to Table 9.3 of the 2011 edition of ''Prudent Practices.'' Laboratory chemical hoods are the most important components used to protect laboratory personnel from exposure to hazardous chemicals.

(a) Toxic or corrosive chemicals that require vented storage should be stored in vented cabinets instead of in a chemical hood.

(b) Chemical waste should not be disposed of by evaporation in a chemical hood.

(c) Keep chemical hood areas clean and free of debris at all times.

(d) Solid objects and materials, such as paper, should be prevented from entering the exhaust ducts as they can reduce the air flow.

(e) Chemical hoods should be maintained, monitored and routinely tested for proper performance.

A laboratory ventilation system should include the following characteristics and practices:

(a) Heating and cooling should be adequate for the comfort of workers and operation of equipment. Before modification of any building HVAC, the impact on laboratory or hood ventilation should be considered, as well as how laboratory ventilation changes may affect the building HVAC.

(b) A negative pressure differential should exist between the amount of air exhausted from the laboratory and the amount supplied to the laboratory to prevent uncontrolled chemical vapors from leaving the laboratory.
(c) Local exhaust ventilation devices should be appropriate to the materials and operations in the laboratory.
(d) The air in chemical laboratories should be continuously replaced so that concentrations of odoriferous or toxic substances do not increase during the workday.
(e) Laboratory air should not be recirculated but exhausted directly outdoors.
(f) Air pressure should be negative with respect to the rest of the building. Local capture equipment and systems should be designed only by an experienced engineer or industrial hygienist.
(g) Ventilation systems should be inspected and maintained on a regular basis. There should be no areas where air remains static or areas that have unusually high airflow velocities.
Before work begins, laboratory workers should be provided with proper training that includes how to use the ventilation equipment, how to ensure that it is functioning properly, the consequences of improper use, what to do in the event of a system failure or power outage, special considerations, and the importance of signage and postings.

5. Institute a Chemical Hygiene Program
A comprehensive chemical hygiene program is required. It should be designed to minimize exposures, injuries, illnesses and incidents. There should be a regular, continuing effort that includes program oversight, safe facilities, chemical hygiene planning, training, emergency preparedness and chemical security. The chemical hygiene program must be reviewed annually and updated as necessary whenever new processes, chemicals, or equipment is implemented. Its recommendations should be followed in all laboratories.

6. Observe the PELs and TLVs
OSHA's Permissible Exposure Limits (PELs) must not be exceeded. The American Conference of Governmental Industrial Hygienists' Threshold Limit Values (TLVs) should also not be exceeded.

Responsibilities
Persons responsible for chemical hygiene include, but are not limited to, the following:
1. Chemical Hygiene Officer
(a) Establishes, maintains, and revises the chemical hygiene plan (CHP).
(b) Creates and revises safety rules and regulations.
(c) Monitors procurement, use, storage, and disposal of chemicals.
(d) Conducts regular inspections of the laboratories, preparations rooms, and chemical storage rooms, and submits detailed laboratory inspection reports to administration.
(e) Maintains inspection, personnel training, and inventory records.
(f) Assists laboratory supervisors in developing and maintaining adequate facilities.
(g) Seeks ways to improve the chemical hygiene program.

2. School Chemical Safety Officer and Principal
(a) Assumes responsibility for personnel engaged in the laboratory use of hazardous chemicals.
(b) Provides the chemical hygiene officer (CHO) with the support necessary to implement and maintain the CHP.
(c) After receipt of laboratory inspection report from the CHO, meets with laboratory supervisors to discuss cited violations and to ensure timely actions to protect trained laboratory personnel and facilities and to ensure that the department remains in compliance with all applicable federal, state, university, local and departmental codes and regulations.
(d) Provides budgetary arrangements to ensure the health and safety of the departmental personnel, visitors, and students.
(e) Reviews accident reports and makes appropriate recommendations to the department chairperson regarding proposed changes in the laboratory procedures.
(f) Ensure that laboratory personnel comply with the departmental CHP and do not operate equipment or

handle hazardous chemicals without proper training and authorization.

3. Laboratory Personnel has overall responsibility for chemical hygiene in the laboratory, including responsibility to:
(a) Read, understand, and follow all safety rules and regulations that apply to the work area;
(b) Plan and conduct each operation in accordance with the institutional chemical hygiene procedures;
(c) Promote good housekeeping practices in the laboratory or work area.
(d) Notify the supervisor of any hazardous conditions or unsafe work practices in the work area.
(e) Use PPE as appropriate for each procedure that involves hazardous chemicals.
(f) Follow all pertinent safety rules when working in the laboratory to set an example.
(g) Review laboratory procedures for potential safety problems before assigning to other laboratory personnel.
(h) Ensure that visitors follow the laboratory rules and assume responsibility for laboratory visitors.
(i) Ensure that PPE is available and properly used by each laboratory employee and visitor.
(j) Maintain and implement safe laboratory practices.
(k) Contact the CSO to report problems with the facilities or the chemical fume hoods.

C. The Laboratory Facility
General Laboratory Design Considerations Wet chemical spaces and those with a higher degree of hazard should be separated from other spaces by a wall or protective barrier wherever possible. If the areas cannot be separated, then workers in lower hazard spaces may require additional protection from the hazards in connected spaces.

1. Laboratory Layout and Furnishing
(a) Work surfaces should be chemically resistant, smooth, and easy to clean.
(b) Hand washing sinks for hazardous materials may require elbow, foot, or electronic controls for safe operation.
(c) Wet laboratory areas should have chemically resistant, impermeable, slip resistant flooring.
(d) Walls should be finished with a material that is easy to clean and maintain.
(e) Doors should have view panels to prevent accidents and should open in the direction of egress.
(f) Operable windows should not be present in laboratories, particularly if there are chemical hoods or other local ventilation systems present.

2. Safety Equipment and Utilities
(a) An adequate number and placement of safety showers, eyewash units, and fire extinguishers should be provided for the laboratory.
(b) Use of water sprinkler systems is resisted by some laboratories because of the presence of electrical equipment or water reactive materials, but it is still generally safer to have sprinkler systems installed. A fire large enough to trigger the sprinkler system would have the potential to cause far more destruction than the local water damage.

D. Chemical Hygiene Plan (CHP)

The OSHA Laboratory standard defines a CHP as ‘‘a written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment and work practices that are capable of protecting employees from the health hazards presented by hazardous chemicals used in that particular workplace.’’ (29 CFR 1910.1450(b)). The Laboratory Standard requires a CHP: ‘‘Where hazardous chemicals as defined by this standard are used in the workplace, the employer shall develop and carry out the provisions of a written Chemical Hygiene Plan.’’ (29 CFR 1910.1450(e)(1)). The CHP is the foundation of the laboratory safety program and must be reviewed and updated, as needed, and at least on an annual basis to reflect changes in policies and personnel. A CHP should be facility specific and can assist in promoting a culture of safety to protect workers from exposure to hazardous materials.

1. The Laboratory's CHP must be readily available to workers and capable of protecting workers from health hazards and minimizing exposure. Include the following topics in the CHP:
(a) Individual chemical hygiene responsibilities;
(b) Standard operating procedures;
(c) Personal protective equipment, engineering controls and apparel;
(d) Laboratory equipment;
(e) Safety equipment;
(f) Chemical management;
(g) Housekeeping;
(h) Emergency procedures for accidents and spills;
(i) Chemical waste;
(j) Training;
(k) Safety rules and regulations;
(l) Laboratory design and ventilation;
(m) Exposure monitoring;
(n) Compressed gas safety;
(o) Medical consultation and examination.
It should be noted that the nature of laboratory work may necessitate addressing biological safety, radiation safety and security issues.

E. Chemical Procurement, Distribution, and Storage

Prudent chemical management includes the following processes:
Chemical Procurement:
(a) Information on proper handling, storage, and disposal should be known to those who will be involved before a substance is received.
(b) Only containers with adequate identifying labels should be accepted.
(c) Ideally, a central location should be used for receiving all chemical shipments.
(d) Shipments with breakage or leakage should be refused or opened in a chemical hood.
(e) Only the minimum amount of the chemical needed to perform the planned work should be ordered.
(f) Purchases of high risk chemicals should be reviewed and approved by the CHO.
(g) Proper protective equipment and handling and storage procedures should be in place before receiving a shipment.

Chemical Storage:
(a) Chemicals should be separated and stored according to hazard category and compatibility.
(b) SDS and label information should be followed for storage requirements.
(c) Maintain existing labels on incoming containers of chemicals and other materials.
(d) Labels on containers used for storing hazardous chemicals must include the chemical identification and appropriate hazard warnings.
(e) The contents of all other chemical containers and transfer vessels, including, but not limited to, beakers, flasks, reaction vessels, and process equipment, should be properly identified.
(f) Chemical shipments should be dated upon receipt and stock rotated.
(g) Peroxide formers should be dated upon receipt, again dated upon opening, and stored away from heat and light with tight fitting, nonmetal lids.
(h) Open shelves used for chemical storage should be secured to the wall and contain 3/4-inch lips. Secondary containment devices should be used as necessary.
(i) Consult the SDS and keep incompatibles separate during transport, storage, use, and disposal.
(j) Oxidizers, reducing agents, and fuels should be stored separately to prevent contact in the event of an accident.

(k) Chemicals should not be stored in the chemical hood, on the floor, in areas of egress, on the benchtop, or in areas near heat or in direct sunlight.
(l) Laboratory-grade, flammable-rated refrigerators and freezers should be used to store sealed chemical containers of flammable liquids that require cool storage. Do not store food or beverages in the laboratory refrigerator.
(m) Highly hazardous chemicals should be stored in a well-ventilated and secure area designated for that purpose.
(n) Flammable chemicals should be stored in a spark-free environment and in approved flammable-liquid containers and storage cabinets. Grounding and bonding should be used to prevent static charge buildups when dispensing solvents.
(o) Chemical storage and handling rooms should be controlled-access areas. They should have proper ventilation, appropriate signage, diked floors, and fire suppression systems.
Chemical Handling:
(a) As described above, a risk assessment should be conducted prior to beginning work with any hazardous chemical for the first time.
(b) All SDS and label information should be read before using a chemical for the first time.
(c) Trained laboratory workers should ensure that proper engineering controls (ventilation) and PPE are in place.

Chemical Inventory:
(a) Prudent management of chemicals in any laboratory is greatly facilitated by keeping an accurate inventory of the chemicals stored.
(b) Unneeded items should be discarded or returned to the storeroom.

Transporting Chemicals:
(a) Secondary containment devices should be used when transporting chemicals.
(b) When transporting chemicals outside of the laboratory or between stockrooms and laboratories, the transport container should be break-resistant.
(c) High-traffic areas should be avoided.

Transferring Chemicals:
(a) Use adequate ventilation (such as a fume hood) when transferring even a small amount of a particularly hazardous substance (PHS).
(b) While drum storage is not appropriate for laboratories, chemical stockrooms may purchase drum quantities of solvents used in high volumes. Ground and bond the drum and receiving vessel when transferring flammable liquids from a drum to prevent static charge buildup.
(c) If chemicals from commercial sources are repackaged into transfer vessels, the new containers should be labeled with all essential information on the original container.
Shipping Chemicals: Outgoing chemical shipments must meet all applicable Department of Transportation (DOT) regulations and should be authorized and handled by the institutional shipper.

F. Waste Management

A waste management plan should be in place before work begins on any laboratory activity. The plan should utilize the following hierarchy of practices:
(a) Reduce waste sources. The best approach to minimize waste generation is by reducing the scale of operations, reducing its formation during operations, and, if possible, substituting less hazardous chemicals for a particular operation.
(b) Reuse surplus materials. Only the amount of material necessary for an experiment should be purchased, and, if possible, materials should be reused.

(c) Recycle waste. If waste cannot be prevented or minimized, the organization should consider recycling chemicals that can be safely recovered or used as fuel.
(d) Dispose of waste properly. Sink disposal may not be appropriate. Proper waste disposal methods include incineration, treatment, and land disposal. The organization's environmental health and safety (EHS) office should be consulted in determining which methods are appropriate for different types of waste.
Collection and Storage of Waste:
(a) Chemical waste should be accumulated at or near the point of generation, under the control of laboratory workers.
(b) Each waste type should be stored in a compatible container pending transfer or disposal. Waste containers should be clearly labeled and kept sealed when not in use.
(c) Incompatible waste types should be kept separate to ensure that heat generation, gas evolution, or another reaction does not occur.
(d) Waste containers should be segregated by how they will be managed. Waste containers should be stored in a designated location that does not interfere with normal laboratory operations. Ventilated storage and secondary containment may be appropriate for certain waste types.
(e) Waste containers should be clearly labeled and kept sealed when not in use. Labels should include the accumulation start date and hazard warnings as appropriate.
(f) Non-explosive electrical systems, grounding and bonding between floors and containers, and non-sparking conductive floors and containers should be used in the central waste accumulation area to minimize fire and explosion hazards. Fire suppression systems, specialized ventilation systems, and dikes should be installed in the central waste accumulation area. Waste management workers should be trained in proper waste handling procedures as well as contingency planning and emergency response. Trained laboratory workers most familiar with the waste should be actively involved in waste management decisions to ensure that the waste is managed safely and efficiently. Engineering controls should be implemented as necessary, and personal protective equipment should be worn by workers involved in waste management.

G. Inspection Program

Maintenance and regular inspection of laboratory equipment are essential parts of the laboratory safety program. Management should participate in the design of a laboratory inspection program to ensure that the facility is safe and healthy, workers are adequately trained, and proper procedures are being followed.
Types of inspections: The program should include an appropriate combination of routine inspections, self-audits, program audits, peer inspections, EHS inspections, and inspections by external entities.
Elements of an inspection:
(a) Inspectors should bring a checklist to ensure that all issues are covered and a camera to document issues that require correction.
(b) Conversations with workers should occur during the inspection, as they can provide valuable information and allow inspectors an opportunity to show workers how to fix problems.
(c) Issues resolved during the inspection should be noted.
(d) An inspection report containing all findings and recommendations should be prepared for management and other appropriate workers.
(e) Management should follow-up on the inspection to ensure that all corrections are implemented.

H. Medical Consultation and Examination
The employer must provide all employees who work with hazardous chemicals an opportunity to receive medical attention, including any follow-up examinations that the examining physician determines to be necessary, whenever an employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory. If an employee encounters a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure, the affected employee must be provided an opportunity for a medical consultation by a licensed physician. All medical examinations and consultations must be performed by or under the direct supervision of a licensed physician and must be provided without

cost to the employee, without loss of pay and at a reasonable time and place. The identity of the hazardous chemical, a description of the incident, and any signs and symptoms that the employee may experience must be relayed to the physician.

I. Records

All accident, fatality, illness, injury, and medical records and exposure monitoring records must be retained by the institution in accordance with the requirements of state and federal regulations (see 29 CFR part 1904 and § 1910.1450(j)). Any exposure monitoring results must be provided to affected laboratory staff within 15 working days after receipt of the results (29 CFR 1910.1450(d)(4)).

J. Signs

Prominent signs of the following types should be posted:
(a) Emergency telephone numbers of emergency personnel/facilities, supervisors, and laboratory workers;
(b) Location signs for safety showers, eyewash stations, other safety and first aid equipment, and exits; and
(c) Warnings at areas or equipment where special or unusual hazards exist.

K. Spills and Accidents

Before beginning an experiment, know your facility's policies and procedures for how to handle an accidental release of a hazardous substance, a spill or a fire. Emergency response planning and training are especially important when working with highly toxic compounds. Emergency telephone numbers should be posted in a prominent area. Know the location of all safety equipment and the nearest fire alarm and telephone. Know who to notify in the event of an emergency. Be prepared to provide basic emergency treatment. Keep your co-workers informed of your activities so they can respond appropriately. Safety equipment, including spill control kits, safety shields, fire safety equipment, PPE, safety showers and eyewash units, and emergency equipment should be available in well marked highly visible locations in all chemical laboratories. The laboratory supervisor or CHO is responsible for ensuring that all personnel are aware of the locations of fire extinguishers and are trained in their use. After an extinguisher has been used, designated personnel must promptly recharge or replace it (29 CFR 1910.157(c)(4)). The laboratory supervisor or CHO is also responsible for ensuring proper training and providing supplementary equipment as needed.
Special care must be used when handling solutions of chemicals in syringes with needles. Do not recap needles, especially when they have been in contact with chemicals. Remove the needle and discard it immediately after use in the appropriate sharps containers. Blunt-tip needles are available from a number of commercial sources and should be used unless a sharp needle is required to puncture rubber septa or for subcutaneous injection.
For unattended operations, laboratory lights should be left on, and signs should be posted to identify the nature of the experiment and the hazardous substances in use. Arrangements should be made, if possible, for other workers to periodically inspect the operation. Information should be clearly posted indicating who to contact in the event of an emergency. Depending on the nature of the hazard, special rules, precautions, and alert systems may be necessary.

L. Training and Information

Personnel training at all levels within the organization is essential. Responsibility and accountability throughout the organization are key elements in a strong safety and health program. The employer is required to provide employees with information and training to ensure that they are apprised of the hazards of chemicals present in their work area (29 CFR 1910.1450(f)). This information must be provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present and prior to assignments involving new exposure situations. The frequency of refresher information and training should be determined by the employer. At a minimum, laboratory personnel should be trained on their facility's specific CHP, methods and observations that may be used to detect the presence or release of a hazardous chemical (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released), the physical and health hazards of chemicals in the work area and means to protect themselves from these hazards. Trained laboratory personnel must know shut-off procedures in case of an

emergency. All SDSs must be made available to the employees.

M. General Procedures for Working with Chemicals

The risk of laboratory injuries can be reduced through adequate training, improved engineering, good housekeeping, safe work practice and personal behavior.

1. General Rules for Laboratory Work With Chemicals

(a) Assigned work schedules should be followed unless a deviation is authorized by the laboratory supervisor.
(b) Unauthorized experiments should not be performed.
(c) Plan safety procedures before beginning any operation.
(d) Follow standard operating procedures at all times.
(e) Always read the SDS and label before using a chemical. (f) Wear appropriate PPE at all times.
(g) To protect your skin from splashes, spills and drips, always wear long pants and closed-toe shoes.
(h) Use appropriate ventilation when working with hazardous chemicals.
(i) Pipetting should never be done by mouth.
(j) Hands should be washed with soap and water immediately after working with any laboratory chemicals, even if gloves have been worn.
(k) Eating, drinking, smoking, gum chewing, applying cosmetics, and taking medicine in laboratories where hazardous chemicals are used or stored should be strictly prohibited.
(l) Food, beverages, cups, and other drinking and eating utensils should not be stored in areas where hazardous chemicals are handled or stored.
(m) Laboratory refrigerators, ice chests, cold rooms, and ovens should not be used for food storage or preparation.
(n) Contact the laboratory supervisor, Principal Investigator, CHO or EHS office with all safety questions or concerns.
(o) Know the location and proper use of safety equipment.
(p) Maintain situational awareness.
(q) Make others aware of special hazards associated with your work.
(r) Notify supervisors of chemical sensitivities or allergies.
(s) Report all injuries, accidents, incidents, and near misses.
(t) Unauthorized persons should not be allowed in the laboratory.
(u) Report unsafe conditions to the laboratory supervisor or CHO.
(v) Properly dispose of chemical wastes.

Working Alone in the Laboratory

Working alone in a laboratory is dangerous and should be strictly avoided. There have been many tragic accidents that illustrate this danger. Accidents are unexpected by definition, which is why coworkers should always be present. Workers should coordinate schedules to avoid working alone.

N. Housekeeping

Housekeeping can help reduce or eliminate a number of laboratory hazards. Proper housekeeping includes appropriate labeling and storage of chemicals, safe and regular cleaning of the facility, and proper arrangement of laboratory equipment.

O. Nanoparticles and Nanomaterials

Nanoparticles and nanomaterials have different reactivities and interactions with biological systems than bulk materials, and understanding and exploiting these differences is an active area of research. However, these differences also mean that the risks and hazards associated with exposure to engineered nanomaterials are not well known. Because this is an area of ongoing research, consult trusted sources for the most up to date information available. Note that the higher reactivity of many nanoscale materials suggests that they should be treated as potential sources of ignition, accelerants, and fuel that could result in fire or explosion. Easily dispersed dry nanomaterials may pose the greatest health hazard because of the risk of inhalation. Operations

involving these nanomaterials deserve more attention and more stringent controls than those where the nanomaterials are embedded in solid or suspended in liquid matrices.
Consideration should be given to all possible routes of exposure to nanomaterials including inhalation, ingestion, injection, and dermal contact (including eye and mucous membranes). Avoid handling nanomaterials in the open air in a freeparticle state. Whenever possible, handle and store dispersible nanomaterials, whether suspended in liquids or in a dry particle form, in closed (tightly-sealed) containers. Unless cutting or grinding occurs, nanomaterials that are not in a free form (encapsulated in a solid or a nanocomposite) typically will not require engineering controls. If a synthesis is being performed to create nanomaterials, it is not enough to only consider the final material in the risk assessment, but consider the hazardous properties of the precursor materials as well.
To minimize laboratory personnel exposure, conduct any work that could generate engineered nanoparticles in an enclosure that operates at a negative pressure differential compared to the laboratory personnel breathing zone. Limited data exist regarding the efficacy of PPE and ventilation systems against exposure to nanoparticles. However, until further information is available, it is prudent to follow standard chemical hygiene practices. Conduct a hazard evaluation to determine PPE appropriate for the level of hazard according to the requirements set forth in OSHA's Personal Protective Equipment standard (29 CFR 1910.132).

P. Highly Toxic and Explosive/Reactive Chemicals/Materials

The use of highly toxic and explosive/ reactive chemicals and materials has been an area of growing concern. The frequency of academic laboratory incidents in the U.S. is an area of significant concern for the Chemical Safety Board (CSB). The CSB issued a case study on an explosion at Texas Tech University in Lubbock, Texas, which severely injured a graduate student handling a high-energy metal compound. Since 2001, the CSB has gathered preliminary information on 120 different university laboratory incidents that resulted in 87 evacuations, 96 injuries, and three deaths.
It is recommended that each facility keep a detailed inventory of highly toxic chemicals and explosive/reactive materials. There should be a record of the date of receipt, amount, location, and responsible individual for all acquisitions, syntheses, and disposal of these chemicals. A physical inventory should be performed annually to verify active inventory records. There should be a procedure in place to report security breaches, inventory discrepancies, losses, diversions, or suspected thefts.
Procedures for disposal of highly toxic materials should be established before any experiments begin, possibly even before the chemicals are ordered. The procedures should address methods for decontamination of any laboratory equipment that comes into contact with highly toxic chemicals. All
waste should be accumulated in clearly labeled impervious containers that are stored in unbreakable secondary containment.
Highly reactive and explosive materials that may be used in the laboratory require appropriate procedures and training. An explosion can occur when a material undergoes a rapid reaction that results in a violent release of energy. Such reactions can happen spontaneously and can produce pressures, gases, and fumes that are hazardous. Some reagents pose a risk on contact with the atmosphere. It is prudent laboratory practice to use a safer alternative whenever possible.
If at all possible, substitutes for highly acute, chronic, explosive, or reactive chemicals should be considered prior to beginning work and used whenever possible.

Q. Compressed Gas

Compressed gases expose laboratory personnel to both chemical and physical hazards. It is essential that these are monitored for leaks and have the proper labeling. By monitoring compressed gas inventories and disposing of or returning gases for which there is no immediate need, the laboratory can substantially reduce these risks. Leaking gas cylinders can cause serious hazards that may require an immediate evacuation of the area and activation of the emergency response system. Only appropriately trained hazmat responders may respond to stop a leaking gas cylinder under this situation.

R. Safety Recommendations—Physical Hazards

Physical hazards in the laboratory include combustible liquids, compressed gases, reactives, explosives and flammable chemicals, as well as high pressure/energy procedures, sharp objects and moving equipment. Injuries can result from bodily contact with rotating or moving objects, including mechanical equipment, parts, and devices. Personnel should not wear loose fitting clothing, jewelry, or unrestrained long hair around machinery with moving parts.

The Chemical Safety Board has identified the following key lessons for laboratories that address both physical and other hazards:

(1) Ensure that research-specific hazards are evaluated and then controlled by developing specific written protocols and training.

(2) Expand existing laboratory safety plans to ensure that all safety hazards, including physical hazards of chemicals, are addressed.

(3) Ensure that the organization's EHS office reports directly to an identified individual/office with organizational authority to implement safety improvements.

(4) Develop a verification program that ensures that the safety provisions of the CHP are communicated, followed, and enforced at all levels within the organization.

(5) Document and communicate all laboratory near-misses and previous incidents to track safety, provide opportunities for education and improvement to drive safety changes at the university.

(6) Manage the hazards unique to laboratory chemical research in the academic environment. Utilize available practice guidance that identifies and describes methodologies to assess and control hazards.

(7) Written safety protocols and training are necessary to manage laboratory risk.

S. Emergency Planning

In addition to laboratory safety issues, laboratory personnel should be familiar with established facility policies and procedures regarding emergency situations. Topics may include, but are not limited to:

(1) Evacuation procedures—when it is appropriate and alternate routes;

(2) Emergency shutdown procedures—equipment shutdown and materials that should be stored safely;

(3) Communications during an emergency—what to expect, how to report, where to call or look for information;

(4) How and when to use a fire extinguisher;

(5) Security issues—preventing tailgating and unauthorized access;

(6) Protocol for absences due to travel restrictions or illness;

(7) Safe practices for power outage;

(8) Shelter in place—when it is appropriate;

(9) Handling suspicious mail or phone calls;

(10) Laboratory-specific protocols relating to emergency planning and response;

(11) Handling violent behavior in the workplace; and

(12) First-aid and CPR training, including automated external defibrillator training if available.

It is prudent that laboratory personnel are also trained in how to respond to short-term, long-term and large-scale emergencies. Laboratory security can play a role in reducing the likelihood of some emergencies and assisting in preparation and response for others. Every institution, department, and individual laboratory should consider having an emergency preparedness plan. The level of detail of the plan will vary depending on the function of the group and institutional planning efforts already in place.

Emergency planning is a dynamic process. As personnel, operations, and events change, plans will need to be updated and modified. To determine the type and level of emergency planning needed, laboratory personnel need to perform a vulnerability assessment. Periodic drills to assist in training and evaluation of the emergency plan are recommended as part of the training program.

T. Emergency Procedures

(1) Fire alarm policy. Most organizations use fire alarms whenever a building needs to be evacuated—for any reason. When a fire alarm sounds in the facility, evacuate immediately after extinguishing all equipment flames. Check on and assist others who may require help evacuating.

(2) Emergency safety equipment. The following safety elements should be met:

a. A written emergency action plan has been provided to workers;

b. Fire extinguishers, eyewash units, and safety showers are available and tested on a regular basis; and

c. Fire blankets, first-aid equipment, fire alarms, and telephones are available and accessible.

(3) Chemical spills. Workers should contact the CHO or EHS office for instructions before cleaning up a chemical spill. All SDS and label instructions should be followed, and appropriate PPE should be worn during spill cleanup.

(4) Accident procedures. In the event of an accident, immediately notify appropriate personnel and local emergency responders. Provide an SDS of any chemical involved to the attending physician. Complete an accident report and submit it to the appropriate office or individual within 24 hours.

(5) Employee safety training program. New workers should attend safety training before they begin any activities. Additional training should be provided when they advance in their duties or are required to perform a task for the first time. Training documents should be recorded and maintained. Training should include hands-on instruction of how to use safety equipment appropriately.

(6) Conduct drills. Practice building evacuations, including the use of alternate routes. Practice shelter-in-place, including plans for extended stays. Walk the fastest route from your work area to the nearest fire alarm, emergency eyewash and emergency shower. Learn how each is activated. In the excitement of an actual emergency, people rely on what they learned from drills, practice and training.

(7) Contingency plans. All laboratories should have long-term contingency plans in place (e.g., for pandemics). Scheduling, workload, utilities and alternate work sites may need to be considered.

U. Laboratory Security

Laboratory security has evolved in the past decade, reducing the likelihood of some emergencies and assisting in preparation and response for others. Most security measures are based on the laboratory's vulnerability. Risks to laboratory security include, but are not limited to:

(1) Theft or diversion of chemicals, biologicals, and radioactive or proprietary materials, mission-critical or high-value equipment;

(2) Threats from activist groups;

(3) Intentional release of, or exposure to, hazardous materials;

(4) Sabotage or vandalism of chemicals or high-value equipment;

(5) Loss or release of sensitive information; and

(6) Rogue work or unauthorized laboratory experimentation. Security systems in the laboratory are used to detect and respond to a security breach, or a potential security breach, as well as to delay criminal activity by imposing multiple layered barriers of increasing stringency. A good laboratory security system will increase overall safety for laboratory personnel and the public, improve emergency preparedness by assisting with preplanning, and lower the organization's liability by incorporating more rigorous planning, staffing, training, and command systems and implementing emergency communications protocols, drills, background checks, card access systems, video surveillance, and other measures. The security plan should clearly delineate response to security issues, including the coordination of institution and laboratory personnel with both internal and external responders.

[76 FR 33609, June 8, 2011; 77 FR 17888, March 26, 2012; 78 FR 4325, Jan. 22, 2013]

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 *Air Conditioning Engineers.*
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 bum. These are liquids with flash point at or above 100oF (37.80C) and below 200oF (93.30C).
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 flash point

	below 100oF
Flash Point	The lowest temperature at which a combustible or flammable material can be made to ignite momentarily in air.
FR	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	International Agency for Research on Cancer
Laboratory Use	Work with chemicals in which containers used can easily and safely be manipulated by one person, excluding commercial production of chemicals for sale.
LC 50	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.
LD 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 ex- posed 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.
	Mutagen Chemical which causes chromosomal damage.
NAPB	National Association for the Prevention of Blindness.

Neoplastigen	Chemical capable of causing non-cancerous tumors.
NFPA	National Fire Protection Association.
NIOSH	National Institute of Occupational Safety and Health. NTP National Toxicology Program
OSHA	Occupational Safety and Health Act. Also, the Occupational Safety and Health Administration. 200 Constitution Ave., Washington, DC 20010, (202-523-6091.
PEL	Permissible Exposure Limit. The legally allowed concentration in the workplace that is considered a safe level of exposure for an 8-hour shift, 40 hours per week.
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 28 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	Chemicals 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 Center
TLV	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 28 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	Chemicals 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 Center
TLV	Threshold Limit Value. The amount of exposure allow- able for an employee in an 8-hour day.

APPENDIX C

Accident Reporting
CALL COMPANY NURSE

Report the injury to the Company Nurse on the day of the injury. If the employee is not able to make the call, the supervisor or site designee may do so on their behalf.

AGAIN—ALL INJURIES MUST BE REPORTED!

APPENDIX D

PERSONAL CLOTHING AND EQUIPMENT

Aprons, rubber or plastic: Should extend to below the knees Laboratory Coat, should have long sleeves
Gloves: The material from which the glove is made must be carefully chosen so that the glove is not permeable to the liquids or vapors anticipated for the experiment.
Goggles: Should meet ANSI Standard 287.1 Should conform to face to prevent splashes.
Face Shield: Should be worn with goggles for some procedures.
Respirator: Respirators should not be used unless the person has been fully trained in their uses and limitations. A better plan is to evacuate the area and leave the clean-up to a trained person.

LABORATORY SAFETY EQUIPMENT

Fire Extinguisher: Should be suitable for Class A, B, and C fire
May be carbon dioxide, halon, or dry powder type.
Fire Blanket, wool: A blanket should be available but not on a roller. The purpose of the blanket is to cover the victim, not encircle.
Fume Hood: Hood should be clean and deliver air
through the face at 60-100 linear feet per minute.
Hood may have vertical or horizontal sash. .
Hood should be vented directly to the outside.
Flammable storage cabinet: May be made of wood or metal
Should be vented directly to the outside.
Eyewash Fountain Should deliver tepid, potable water to both eyes Should provide a steady, *gentle* flow *for* at least 15 minutes Should operate with spring-operated valve.
Drench Shower May be either a flexible body drench design or a ceiling mounted design. Ceiling and wall mounted showers should operate by spring loaded, chain pull valve. Should deliver tepid, potable water for at least 15 minutes
First Aid Kit Any good, general purpose first-aid kit is suitable.
Signs A variety of signs are useful for designating the location of safety equipment, means of ingress and egress, etc. Signs should be chosen to be in conformity with state guidelines and recommendations.
Safety cans Some occasions demand that volatile, flammable or combustible solvents be stored in safety cans. Each can should have a flame arrestor in good working order.

APPENDIX E
LABORATORY SPILL PROTECTION

Acid spills -Best treated with Sodium bisulfate, which may be mixed with kitty litter and/or sand.
Base spills -Best treated with vinegar (dilute acetic acid), which may be mixed with kitty litter and/or sand.
Halogen spills Best treated with Sodium thiosulfate. which may be mixed with kitty Litter and/or sand.
General purpose A general purpose adsorbent, such. As a mixture of kitty litter, sand, and vermiculite suitable for containing many chemical spills.

APPENDIX G
Lab Safety Audit Checklist

1. All personnel know how to obtain SDSs.
2. All personnel have received *Flinn* Lab Safety Training and updated every three years.
3. Lab coats are available.
4. Chemical protective gloves are available.
5. Safety glasses/goggles are available.
6. An eyewash fountain is present (deck, drench, combo, faucet, plumbed, portable).
7. An emergency shower is present (in the room, in the hallway, in the neighboring lab).
8. Food and beverages are not stored or used in the lab.
9. Aisles are uncluttered and without a tripping hazard.
10. Chemical spill kits are available.
11. All exit ways are free and unobstructed.
12. Fire extinguishers are available and unobstructed.
13. Fire extinguishers have a DPPS tag and are sealed.
14. Current inventory of chemicals is available.
15. Gas cylinders are properly secured.
16. No leaking containers are present.
17. All chemical containers are properly labeled.
18. Chemicals are stored according to compatibility.
19. Peroxide forming reagents are dated when opened.
20. Peroxide forming reagents are disposed of or tested after expiration date.
21. Flammable and corrosive storage areas are labeled.
22. Flammables are kept away from sources of heat, ignition, flames, etc.
23. Corrosive materials are stored low to the ground.
24. Chemicals in the open are kept to a minimum.
25. Flammable/Combustible liquids do not exceed NFPA storage limits.
26. Flammable gases are not present.
27. Poisonous gases are not present.
28. Hazardous waste containers are labeled and have closed lids.
29. Hazardous waste tags are complete.
30. Hazardous wastes are not stored beyond 90 days.

Audit conducted by:_____ Date:_____
Items with an X must be corrected by (date): _____

APPENDIX F

Superintendent, Dr. Amy Blake-Lewis

Chemical Safety Committee
Lisa Millner
Ben Boone
Keith Scott
David Jones
Mike Minter
Sherri Helbert
Phyllis Meade

Chemical Hygiene Officer
Keith Scott

Chemical Safety Officers
Mike Minter, Bassett High School
Joshua Bocock, Magna Vista High School
Brittany Bummitt, Career Academy
Garrett Dillard, CCL
Franketta Tatum, Fieldale-Collinsville Middle School
Luke Boone, Laurel Park Middle School
Marty Ingram, Axton Elementary
Kenya Gravely, Campbell Court Elementary
Melissa Broadstreet, Drewry Mason Elementary
Kimberly Foley, G.W. Carver Elementary
Anthony Swann, Meadow View Elementary
Kelsey Gardner, Mount Olivet Elementary
Crystal Dixon, Rich Acres Elementary
Joshua Eanes, Sanville Elementary
Eric Ross, Stanleytown Elementary