

Chemical Hygiene Plan Safety First! in Science Labs and Art Rooms

Rhode Island School for the Deaf



TABLE OF CONTENTS

TABLE OF CONTENTS	2
INTRODUCTION	
Purpose	4
General Principles	4
I. STANDARD OPERATING PROCEDURES	
A. General	5
B. Laboratory Procedures	6
C. Housekeeping Practices	8
D. Chemical Procurement	9
E. Storage and Distribution	9
F. Waste Disposal	11
G. Spills	12
II. CONTROL MEASURES	
A. Personal Protective Equipment (PPE)	13
B. Administrative Controls	14
1. Inventory Control	14
2. Hazard and Identification Labels	15
3. Signs and Posters	15
4. Material Safety Data Sheets	15
5. Records	16
6. Exposure Monitoring	17
III. SAFETY / EMERGENCY FACILITIES AND EQUIPMENT	
A. Equipment	17
B. Facilities	18
1. Fume Hoods	18
2. Ventilation	19
3. Flammable Storage	19
4. Electrical	19
IV. TRAINING AND INFORMATION	

A. Training for Employees	20
B. Training for Students	21
C. Safety Information for Employees	22
V. PRIOR APPROVAL	22
VI. MEDICAL CONSULTATIONS AND EXAMINATIONS	23
VII. RESPONSIBILITIES	
A. Superintendent/ Director/ Head of School	23
B. Principal	23
C. Chemical Hygiene Officer	24
E. School District Employees/ Teachers	25
F. Students	25
VIII. PARTICULARLY HAZARDOUS SUBSTANCES (PHS)	
A. General	26
B. Highly Toxic Chemicals	26
C. Highly Flammable Chemicals	36
D. Highly Reactive Chemicals	27
E. Highly Corrosive and Contact Hazard Chemicals	27
F. Reproductive Toxins	28
G. Select Carcinogens	29
IX: STUDENT APPENDIX SECTION	30

INTRODUCTION

Rhode Island School for the Deaf has developed a Chemical Hygiene Plan to explain the policies and procedures that will promote the safe operation of the school laboratory and art rooms or anywhere where chemicals and compounds may be used for instruction.

In addition, the Chemical Hygiene Plan satisfies the requirements of the U.S. Department of Labor, Occupational Safety and Health Administration, 29 CFR Part 1910.1450, *Occupational Exposures to Hazardous Chemicals in Laboratories*. This regulation is known as the "Laboratory Standard"; the objective of the "Laboratory Standard" is to protect employees and students from health hazards associated with hazardous chemicals in school activities.

All employees are expected to follow this plan when working in the areas of the School that apply.

GENERAL PRINCIPLES

A. The Chemical Hygiene Plan provides specific laboratory and classroom practices designed to minimize the exposure of employees and students to hazardous substances. Employees should follow the practices specified in the Chemical Hygiene Plan to minimize their health and safety risks.

B. It is prudent to minimize all chemical exposures because most laboratory chemicals present hazards of one type or another. Exposure may result in an acute adverse health reaction; however, some chemicals are bio-accumulative and may present a chronic or long-term health hazard. Employees will follow general precautions for handling all laboratory chemicals.

Specific guidelines for some chemicals, such as those found in the appropriate Material Safety Data Sheets (MSDS), will also be followed.

A **Material Safety Data Sheet (MSDS)** is an important document that contains information on the potential hazards (health, fire, reactivity and environmental) and how to work safely with the chemical product. It is an essential starting point for the development of a complete health and safety program.

C. Employees are cautioned against under -estimating risk; Exposure to hazardous substances always should be minimized. The decision to use particular substance will be based on the best available knowledge of each chemical's particular hazard and the availability of proper handling facilities and equipment. Substitutions, either of chemicals, demonstrations, 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, demonstration, procedure, or chemical should be eliminated.

D. The permissible exposure limit (PEL) and threshold limit value (TLV) of a typical chemical used in the laboratory are available on the MSDS for that specific chemical.

E. The best way to prevent exposure to airborne substances is to prevent their escape into the laboratory by using hoods or other ventilation devices. These devices should be kept in good working order to provide employees with a safe working area.

F. The school should not accept a chemical from a supplier unless it is accompanied by the corresponding MSDS. All MSDS sheets should be accessible to employees at all times, and employees should be trained to read and use the information provided on the MSDS. At RISDeaf, the MSDS binder is located in the Maintenance Office.

The Safety Officer is Chris Suchmann.

CHEMICAL HYGIENE PLAN

I. Standard Operating Procedures

A. General

1. The design of the laboratory/art facility will provide sufficient space for safe work by the number of persons to be in the laboratory.
2. In order to permit a quick, safe escape in an emergency, exit doors will be clearly marked and free of obstructions.
3. Staff and students must follow the Chemical Hygiene Plan to minimize their health and safety risks.
4. It is prudent to minimize all chemical exposures, because most 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 MSDSs, will also be followed.

5. The decision to use a particular substance will be based on the best available knowledge of each chemical's particular hazard and 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, the experiment, procedure, or chemical should be eliminated.

6. Chemicals should not be accepted from a supplier unless it is accompanied by the corresponding MSDS, or an MSDS from that supplier for that chemical is already on file. All MSDSs sheets should be accessible to employees at all times. Employees should be trained to read and use the information found on MSDSs. The MSDS binder is located in the Maintenance Office.
7. Generally, textbooks, laboratory manuals, and other instructional materials designate the safety precautions needed for a particular laboratory or art activity. However, total reliance on such publications to provide complete and accurate information is not advisable. Employees should consult additional references, including Material Safety Data Sheets, before undertaking an unfamiliar activity.

B. Laboratory Procedures

1. Individuals in laboratories or art rooms using chemicals, please note:
 - a. Eating, drinking, gum chewing, application of cosmetics, manipulation of contact lenses, using phones, or other such activities are not to allowed. This prohibition applies even when the laboratory is being used as a classroom, since residual chemicals may be present on surfaces.
 - b. Conduct yourself in a responsible manner at all times in the laboratory. This means that horseplay, throwing items, and pranks are prohibited.
 - c. Employees should not work alone in the lab or chemical storage area unless other employees are in the vicinity and are aware that someone is in the laboratory.
 - d. "Wafting" to test chemical odors should only be done with extreme caution and when only specifically directed to do so in the written experimental procedure. Also, chemicals and art supplies should never be tasted.
 - e. Never pipette by mouth. Always use a bulb or other device for suction.
 - f. Do not force glass tubing into rubber stoppers. Lubricate the glass and hold the tubing with a cloth towel as the tubing is inserted into the stopper.

- g. Proper Bunsen burner procedures shall be followed. Never leave a flame unattended.
- h. Dress appropriately for laboratory work. Avoid loose or baggy clothing and dangling jewelry. Confine or tie back long hair. Sandals or any open-toed shoes are not permitted in the science laboratory.
- i. Should a fire drill or any other evacuation occur during a lab or use of chemical activity, turn off all Bunsen burners and electrical equipment. The high school is equipped with an emergency gas shut-off valve. Engage this shut-off valve and leave the room as directed.
- j. Remember that hot glass looks like cold glass, and glass remains hot for a long time. Determine if an object is hot by bringing your hand close to the object to sense for heat, but do not touch the object.
- k. Careful storage and handling procedures should be used to avoid glassware breakage. In the event of breakage, call Maintenance for help!

Protection for the hands should be worn by Maintenance when picking up the broken pieces. Small pieces should be swept up with a brush and pan. Broken glass should be separated from other waste by placing it in a special container marked Broken Glass. Broken glass contaminated with chemicals must be treated as hazardous waste.

- l. The quantities of flammable liquids used in the laboratory or art room shall not exceed the amount that can be consumed in one day.

2. Students in the science laboratory:

- a. Must read lab directions ahead of time and follow all verbal, signed, and written instructions.
- b. Shall only perform authorized experiments.
- c. Shall report all accidents or injuries to the instructor at once, no matter how small it may seem.
- d. Shall only work in a laboratory or chemical storage area under the direct supervision of a science teacher.

C. Housekeeping Practices

1. Individuals in the laboratory/ art room:

- a. All laboratory or art areas must be kept clean and contain only those items needed for the task at hand.

- b. Place all wastes in appropriate, segregated receptacles that are properly labeled.
 - c. Sinks are to be used only for disposal of water and those solutions designated by the instructor. Other solutions must be placed in the appropriate labeled waste container.
 - d. Table tops are to be swept clean and washed at the end of the activity.
 - e. Clean up all chemical spills as soon as they occur. Chemicals and cleanup materials should be disposed of correctly.
 - f. Never block access to emergency equipment, showers, eyewashes, or exits.
 - g. Store chemicals and equipment properly. Chemicals should not be stored in the long-term (beyond 24 hours) in aisles, on the floor, in stairwells, on desks, or laboratory tables.
 - h. Before leaving the laboratory, turn off services (gas, electricity, water).
 - i. Keep all cabinets and drawers closed and, when possible, locked, when not in use to avoid catching and bumping hazards.
 - j. Ensure floors are cleaned daily by the maintenance staff.
2. Students in the laboratory:
- a. Bring only your lab instructions, calculators, and writing instruments to the laboratory area.
 - b. Leave backpacks, phones, and other books in another area.

D. Chemical Procurement

1. The Chemical Hygiene Officer is responsible for approving all chemicals used in the classroom. The purchasing of chemicals should be guided by the motto that purchasing less is better. The smaller the chemical inventory, the fewer the problems associated with storage, and the less likely that the school district will face excessive costs to dispose of outdated or surplus chemicals.
2. Chemicals should be ordered in quantities that are likely to be consumed in one year and should be purchased only in the quantity sufficient for the declared use.
3. All chemicals should be in tightly closed, sturdy, and appropriate containers.

4. A chemical should not be accepted without the material safety data sheet (MSDS) and an adequate identifying label. (OSHA Standard)
5. When a chemical is received, proper handling, storage, and disposal should be known. (OSHA Standard)
6. The container should be marked with the full level and date(s) it is received and opened.
7. The chemical inventory list should be updated each time a chemical is received or eliminated.
8. Donated chemicals should be accepted only after approval is obtained from the Chemical Hygiene Officer. It should be established that the donated chemical is in excellent condition, that an appropriate MSDS is available, and that there is a specific use for the donated material.
9. The Chemical Hygiene Officer shall ensure that all chemicals on site have a current MSDS. He/she must also ensure that all MSDS's are collected in a clearly marked binder and is kept in a location that is readily accessible to school and emergency personnel.

E. Storage and Distribution

1. All chemicals should be in tightly closed, sturdy, and appropriate Containers, with clear and visible labels using dark permanent markers. Labels should indicate:

Chemical name
Necessary Handling
Hazard Information
Date received/ opened
Expiration
2. If the chemical has been transferred or decanted to a secondary container, the new container should be appropriately labeled, including **all** of the hazard information.
3. Chemicals should be stored based on the reactive nature, and compatibility group, of the chemical, and NOT by alphabetical order. Acids and oxidizers **must always** be stored apart from each other. The classification system used for the storage of chemicals should be displayed in the main storage area. Chemicals **should never** be stored alphabetically.
4. Large containers and containers with reactive chemicals, such as acids and bases, should be on low shelves so that falling items from above are avoided. Wherever possible, chemicals or heavy liquids should be stored at or just below eye level, labeled, on storage shelves that have a "lip" to prevent spills.
5. Flammable chemicals must be stored in approved storage containers and in approved flammable chemical storage cabinets. A common household refrigerator **is not** considered to be an approved storage cabinet. (For further

directions regarding the storage of flammables, please refer to Section III, (B)(3), *Flammable Storage*).

6. Combustible packaging material should not be stored near flammable chemical storage cabinets.
7. All storage areas should be securely locked when not in use. Storage and preparation areas should be accessible only to those persons authorized to use the chemicals.
8. Glass bottles containing highly flammable liquids (Class 1A) shall not exceed 500 ml. For larger volumes, metal or approved plastic may not exceed 1 gallon, and safety cans shall not exceed 2 gallons. (NFPA 45)
9. Chemicals should not be distributed to other persons or to other areas of the school without the prior approval of the Chemical Hygiene Officer. Chemicals should not be transferred to another location without the simultaneous transfer of a copy of the appropriate material data safety sheet, (MSDS), nor should they be transferred without the person receiving the chemicals having had an appropriate training in their use, storage, and disposal.
10. OSHA standards and National Fire Prevention Association Guidelines or local fire regulations should be consulted on the proper use of flammable chemicals in the laboratory.
11. Instructors should note, if applicable, chemical expiration dates, and dispose of expired chemicals on time.
13. **Compressed Gases:**
 - a. A compressed gas is defined as any material or mixture having in the container either an absolute pressure greater than 276 kPa (40 lb/in²) at 21 °C, or an absolute pressure greater than 717 kPa (104 lb/in²) at 54 °C or both, or any liquid flammable material having a Reid vapor pressure greater than 276 kPa (40 lb/in²) at 38 °C.
 - b. Gas cylinders should only be moved from one location to another with the protective cap securely in place.
 - c. Both full and empty cylinders should only be stored where they may be securely restrained by straps, chains, or a suitable stand, and the protective cap must be securely in place.
 - d. Remember that a cylinder is never completely empty; there is always a slight positive pressure due to residual gas.
 - e. An empty cylinder should be returned to the supplier as soon as possible after having been emptied or when it is no longer needed.
 - f. Cylinders should not be exposed to temperatures above 50 °C.

- g. Flammable gases must be stored at least 20 feet away from oxidizing gases, or stored with an acceptable barrier between them.

F. Waste Disposal

1. The School and the Chemical Hygiene Officer shall ensure that disposal of laboratory chemicals follows all applicable local, state, and federal regulations.
2. The School District and the Chemical Hygiene Officer shall ensure that drain disposal of laboratory chemicals follows City Sewer District rules and regulations.
3. A School, such as this one is considered a Small Quantity Generator (SQG) of hazardous waste.
4. Guidelines for waste minimization:
 - a. Employees shall minimize generation of hazardous wastes (microscale labs, selecting less hazardous materials, etc.).
 - b. Chemicals should be ordered in quantities that are likely to be consumed in one year or less.
- c. Avoid the inadvertent accumulation of hazardous waste. Potential waste materials are surplus, old, and/or unnecessary chemicals. Every attempt must be made to avoid accumulating such chemicals as this accumulation is dangerous.
5. Guidelines for hazardous waste disposal:
 - a. Flammable, combustible, water immiscible materials, or water-soluble solutions of toxic substances shall not be poured down the drain.
 - b. Waste chemicals should be stored in appropriately labeled containers, inside secondary containment. All federal, state, and local regulations regarding proper disposal shall be followed at all times.
 - c. Hazardous wastes should never be placed in the common solid trash container.
 - d. When the waste containers become full, the containers shall be transferred to a designated waste storage area within three (3) days.
 - e. Planning for lab experiments should include a discussion regarding proper methods for disposing of the generated waste. **Questions regarding hazardous waste disposal should be directed to School Safety Officer, Chris Suchmann.**

G. Spills

1. If the chemical involved in the spill is judged to present an immediate hazard, **call 911 immediately and say "HAZMAT emergency"**. The area should be isolated until a HAZMAT team arrives, and evacuation must occur.
2. If hazardous vapors are present, **call 911 immediately** and isolate the area. Only persons trained in the use of respirators may enter the area. This will frequently mean waiting outside for the arrival of a HAZMAT team.
3. If a volatile, flammable material is spilled, immediately extinguish flames, turn off all electrical apparatus, and evacuate the area. Consult the MSDS for appropriate cleanup procedures. If the quantity exceeds the employee's ability or training to handle the spill, seal the area until appropriately trained personnel arrive.
4. If there is no immediate danger (flammability, toxicity, reactivity, corrosivity) to personnel, containment should be accomplished by use of spill pillows, towels, rolls, or other devices that will keep the spill from spreading.
5. If there is no immediate danger, cleanup procedures listed on the MSDS should be followed. Appropriate personal protective equipment shall be used.
6. A spill kit should be centrally located, accessible, and for the exclusive use of the Science Department.

The kit must include:
 - a. Inert absorbents such as vermiculite, clay, sand, or kitty litter
 - b. Neutralizing agents for acid spills such as sodium carbonate and sodium hydrogen carbonate
 - c. Neutralizing agents for alkali spills such as sodium hydrogen sulfate and citric acid
 - d. Quantities of cleanup materials sufficient for the largest anticipated spill.
 - e. Large plastic scoops and other equipment such as brooms, pails, bags, and dust pans.
 - f. Appropriate personal protective equipment
7. If the spill material was a hazardous chemical, all of the materials involved in the cleanup will usually be considered to be hazardous waste and must be disposed of as such.
8. If a spill occurs which cannot be cleaned-up safely by yourself, notify your Principal or Administrator-in-Charge immediately. C

Cleanup shall only be undertaken by individuals who are trained in HAZMAT procedures.

II. Control Measures

A. Personal Protective Equipment (PPE)

1. It is the responsibility of the school district to provide appropriate safety and emergency equipment for employees and students. This is often referred to as PPE.
2. Protective apparel shall be compatible with the required degree of protection for the substances being handled.
3. 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.
4. All eye protection devices should conform to ANSI Standard Z87.1-1989. Eyeglasses, even with side shields, are not acceptable protection against chemical splashes.
5. Chemical splash safety goggles should be used as the standard protective eyewear. Such goggles should fit the face surrounding the eyes snugly to protect the eyes from a variety of hazards.
6. Any experiment that involves heating, the use of chemicals, the use of glassware, or the use of a sharp bladed instrument shall require the use of chemical splash safety goggles. The goggles also protect the eyes from debris, splashing, and flying objects.
7. The use of contact lenses should be avoided in the laboratory. If contact lenses are necessary, chemical splash goggles must be worn at all times.
8. Full face shields protect the face and throat. They must be worn for protection when there is a greater risk of injury from flying particles and harmful chemical splashes. A full-face shield should also be worn when an operation involves a pressurized system that may explode or an evacuated system that may implode. For full protection, safety goggles must be worn with the face shield.
9. Standing shields should be used when there is a potential for explosions, implosions, or splashes, or when corrosive liquids are used. Goggles should be worn whenever using a standing shield.
10. A standing shield should be used for group protection from chemical splash and impact. The standing safety shield should be used with safety goggles and, if appropriate, with a face shield.
11. Lab coats or smocks/aprons worn in the laboratory or art rooms should offer protection from splashes and spills, and should be easy to remove in case of an accident, and should be fire resistant.

12. When gloves are required, it should be remembered that no one kind of glove is suitable for all situations. The MSDS should be consulted for information regarding the proper type of gloves to be used.

Under no circumstances are latex gloves to be purchased or used.

B. Administrative Controls

1. Inventory Control

- a. The Chemical Hygiene Officer must ensure that the chemical inventory be updated each time a chemical is received or consumed. The list should be audited at least on an annual basis.
- b. The chemical inventory list should contain the following information about each chemical found in storage: the chemical name, location, the date purchased, the amount present, the CAS number, and the examination date for possible disposal.
- c. Every area in which chemicals are used or stored should have an up-to-date inventory.
- d. A printed copy of the most recent inventory should be kept by the principal and by the chemical hygiene officer.

2. Hazard Identification and Labels

- a. Labels on incoming containers of hazardous chemicals are not to be removed or defaced.
- b. Laboratory chemicals should be properly labeled to identify any hazards associated with them for the employee's information and protection.
- c. If a chemical is stored in its original bottle, it should have the manufacturer's original label identifying potential hazards, and the date of purchase, the date opened, and the initials of the person who opened the container.
- d. 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), hazard warnings, and name or initials of the person responsible for the transfer. This includes pre-made solutions for classroom experiments.
- e. Unlabeled bottles should not be opened, and such materials should be disposed of promptly, as outlined in the section on disposal procedures.

3. Signs and Posters

- a. Emergency telephone numbers shall be posted in all laboratory areas.
 - b. Signs shall be used to indicate the location of exits, evacuation routes, safety showers, eyewash stations, fire extinguishers, fire blankets, first aid kits, fume hoods, and other safety equipment.
 - c. Warnings at areas or equipment where special or unusual hazards exist.
 - d. Posters to reinforce laboratory safety procedures should be displayed in the laboratory and the classroom.
4. Material Safety Data Sheets (MSDS)
- a. If not already on file, each MSDS received with incoming shipments of chemicals should be maintained and made readily available to laboratory employees and to students.
 - b. A material safety data sheet for each compound on the chemical inventory should be available in the department, except for those chemicals that predate the laboratory standard. Material safety data sheets can often be obtained by requesting them from _____ companies that currently sell the chemicals.
 - b. Chemical manufacturers and suppliers are required to supply one copy of a material safety data sheet the first time the chemical is purchased by the school or institution. It should be on file at the school.
5. Records
- a. Chemical Inventory Records
 - i) Annually, by the end of the school year, an inventory of all chemicals shall be conducted and chemical usage determined.
 - ii) The chemical hygiene officer shall retain a copy of the chemical inventory.
 - b. Inspection Records
 - i) Reports must be completed and retained by the chemical hygiene officer.
 - ii) Safety equipment should be tagged to indicate the date and the results of the last inspection.
 - c. Training Records - The district should maintain records of employee safety training, and they should be made available to employees if requested.
 - d. Incident Reports – A report must be completed for any incident involving student or staff injuries or overexposure to chemicals.
 - e. Medical and Exposure Records

Records of air concentration monitoring, exposure assessments, medical consultations, and medical examinations must be kept for at least 20 years after the employee ceases employment with the district.

f. Waste Disposal Records

The school district shall retain records of disposal of hazardous waste. The records shall conform to the requirements of the Rhode Island Department of Natural Resources.

g. MSDS

The school shall maintain a file of MSDS sheets and should make them accessible to employees. If an MSDS is not available when a new chemical is received, that chemical should not be used until a MSDS is obtained.

6. Exposure Monitoring

a. If there is reason to believe that exposure levels for a regulated substance have exceeded the action level or permissible exposure limit, the chemical hygiene officer should ensure the safety of all students and staff, and contact Environmental Services.

b. If there is reason to believe that an exposure limit may have been exceeded, the circumstances regarding the over-exposure must be documented, and Environmental Services contacted.

c. Signs or symptoms of exposure include skin or eye irritation, shortness of breath, nausea, or headache. Some of these symptoms are generic, and can be due to many other causes including emotional stress, flu, a viral infection, or a head cold.

III. SAFETY / EMERGENCY FACILITIES AND EQUIPMENT

A. Equipment

1. The school must ensure that adequate emergency equipment is available in the laboratory and inspected periodically to ensure that it is functioning properly. All employees who work in the lab should be trained in the use of each item.

2. Emergency equipment items that should be available include: eyewash station, fire extinguisher of the appropriate type, safety shower, telephone for emergencies, fire blanket, and identification signs.

3. Each laboratory should have a standard first aid kit stocked according to school policy and the recommendations of the school nurse.

4. Multipurpose fire extinguishers should be available in the laboratory. A multipurpose, ABC, fire extinguisher, can be used on all fires EXCEPT for Class D fires. Extinguishers should be visually checked monthly and inspected and tested annually.

5. Every eye wash station will be capable of supplying a continuous flow of aerated, tepid, potable water to both eyes for at least 15 minutes. The valve should remain in the open position without the need to hold the valve.
6. Safety showers should be capable of supplying a continuous flow of tepid potable water for at least 15 minutes. The shower should have a quick - opening valve requiring manual closing. This is located in the nurse's office.
7. Eye wash stations and safety shower stations shall be located so they will be easily accessible.
8. Safety equipment must be inspected and checked annually. All equipment will be tagged following an inspection, showing the date of the inspection, the name of the inspector, and results noted.
9. Areas in which hazardous substances are being used should have spill control kits tailored to deal with the potential risk associated with the materials being used. If there is no immediate danger to employees or students, containment should be accomplished by spill pillows, towels, rolls, inert absorbents, neutralizing agents, or other devices.

B. Facilities

1. Fume hoods

- a. Laboratory fume hoods are the most important components used to protect laboratory employees and students from exposure to hazardous chemicals and agents used in the laboratory. Functionally, a standard fume hood is a fire and chemical resistant enclosure with one opening (face) in the front with a movable window (sash) to allow user access into interior. Large volumes of air are drawn through the face and out the top to contain and remove contaminants from the laboratory.
- b. 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 example, it must not be used for laboratory experiments or transfer of chemicals. In that event, it must be used only for storage.
- c. Laboratory activities that may release airborne contaminants above the Permissible Exposure Limit (PEL) or Thresholds Limit Value (TLV) concentrations must be carried out in the fume hood. Also, if laboratory activities produce potentially hazardous vapors or gaseous substances, the laboratory activities should be conducted in the fume hood.
- d. In most cases, the recommended face velocity is between 80 and 100 feet per minute (fpm)
- e. Fume hoods should be positioned in the laboratory so that air currents do not draw fumes from the hood into the room.
- f. The exhaust stack from a fume hood shall be in a vertical-up from

adjacent buildings to avoid reentry of the exhaust into the building.

- g. Fume hoods or other local ventilation devices should be used when working with any appreciably volatile substance with a TLV of less than 50 ppm. (Standard).
 - **A Work Order shall be generated annually by the Safety Officer and issued to check the fume hoods for safe operation that meets all state and federal guidelines.**

2. Ventilation

- a. General laboratory ventilation should not be relied on for protection from exposure to hazardous chemicals. A rate of 4 - 12 room air exchanges 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.

- b. Any alteration of the ventilation system should be made only if thorough testing indicates that employee and student protection from airborne toxic substances will continue to be adequate.
- c. Exhaust from the fume hoods should be vented directly to the outside.

3. Flammable Storage

- a. Chemicals with a flash point below 93.3 ° C (200 ° F) should be considered "fire hazard chemicals". Any chemical whose MSDS or label states "Flammable" is in this category.
- b. Fire hazard chemicals in excess of 500 mL should be stored in a flammable solvent storage area, safety cans, or in storage cabinets designed for flammable materials.
- c. Flammable materials should be stored in a flammable liquid storage cabinet or other appropriate location. When transferring significant quantities of flammable liquids from one container to another, it is particularly important that they be properly grounded to prevent accidental ignition of flammable vapors and liquids from static electricity or other sources of ignition. Large quantities of flammable chemicals stored outside cabinets should be in flame-proof storage cans which conform to NFPA guidelines. NFPA 30, Flammable and Combustible Liquids code, and NFPA 45, Fire protection for Laboratories Using Chemicals, and/or the applicable local fire codes should be followed.

4. Electrical
 - a. All electrical outlets should have a grounding connection accommodating a three-prong plug.
 - b. All laboratories should have circuit breakers readily accessible. Employees should know how to cut-off electricity to the laboratory in case of emergency.
 - c. All electrical outlets should be checked for continuity after initial occupancy or whenever electrical maintenance or changes occur.
 - d. If electrical equipment shows evidence of undue heating, it should be immediately unplugged.
 - e. Install ground-fault circuit interrupters (GFCIs) when required by code to protect users from electrical shock, particularly if an electrical device is hand held during a laboratory operation.
 - f. Science instructors and/or departments must have access to circuit breaker panels that control the electrical output to their laboratories and areas of responsibility.

IV. Training and Information

A. Training for Employees

1. General
 - a. The employer shall provide employees with information and training to ensure that they are apprised of the hazards of chemicals present in their work area.
 - b. Such information shall be provided at the time of the employee's initial assignment to a work area where hazardous chemicals are present and prior to assignments involving to exposure situations. The frequency of refresher information and training shall be determined by the employer.
2. The objective of the employee training and information program is to assure that all individuals at risk are adequately informed about: the physical and health hazards associated with hazardous chemicals present in the laboratory; the proper procedures to minimize risk of exposure; and the proper response to accidents.
3. The school district shall provide training opportunities for all individuals at risk. These training opportunities should include information about the hazards of chemicals present in the laboratory and sources of information concerning hazards in the laboratory. In particular, the training program

should cover the laboratory standard, material safety data sheets, the chemical hygiene plan, and the responsibilities of the district and the employee.

4. Employees should be trained on the potential chemical hazards in the employees' work areas and on appropriate sections of the chemical hygiene plan. 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.

5. Laboratory employees should be trained on the applicable details of the chemical hygiene plan, including a review of the general rules of laboratory safety. The training program should describe appropriate sections of the standard operating procedures, particularly those procedures that require prior approval of the chemical hygiene officer.
6. The training an employee receives should be determined by the nature of the work assignment in the laboratory.
7. Employees and students should be trained in measures they may take to protect themselves from exposure to hazardous chemicals, including the location and proper use of protective equipment and emergency equipment. In addition, the training must also include a discussion of inventory procedures to be followed, proper storage and ordering rules, and district hazardous waste disposal procedures.
8. All laboratory employees will be trained to read and understand MSDS sheets.
9. All employees shall be trained in labeling and storage practices as outlined in the chemical hygiene plan.
10. All employees should be trained in the methods and observations that may be used to detect the presence or release of hazardous chemicals.

B. Training for Students

1. Instruction in laboratory safety shall be provided by teachers to all students involved in laboratory activities.
2. The extent of student training should be based on their grade level, course of study, the laboratory facility, school policies, the chemical hygiene plan, and the level of chemical handling and potential exposure to hazardous chemicals.
3. Safety training should include the importance and the content of the label

and of material safety data sheets (MSDS). As appropriate, the student should also be introduced to other sources of chemical safety information.

4. At the beginning of the school year and prior to laboratory activities, class time shall be devoted to learning safe laboratory practices and to the student safety agreement. A signed copy of each student's safety agreement must be kept on file. No student may participate in lab experiments without an executed student safety agreement.

C. Information

1. Employees shall be informed of the location and availability of the chemical hygiene plan.
2. Employees shall be informed of the location and availability of known reference material on the hazards, safe handling, storage and disposal of hazardous chemicals where there is no applicable OSHA standard.
3. Employees shall be informed of the location of material safety data sheets (MSDS).
4. Employees shall be informed of the location of personal protective equipment and have emergency equipment as outlined in the chemical hygiene plan.
5. Employees shall be informed of the signs and symptoms associated with exposures to hazardous chemicals used in the laboratory.

V. Prior Approval

1. Prior approval should be obtained from the chemical hygiene officer whenever a new or not previously reviewed laboratory experiment or test is to be carried out. This prior approval should also be sought for experiments that have not been performed recently or for which the potential for harm is present. The potential for harm may be affected by a change in the amounts of materials being used, the conditions under which the experiment is to be conducted, or the substitution, deletion, or addition of a chemical.
2. Chemicals should not be distributed to other persons or to other areas of the school without the prior approval of the chemical hygiene officer. Chemicals should not be transferred to another location without the simultaneous transfer of a copy of the appropriate material data safety sheet, nor should they be transferred without the person receiving the chemicals having had an appropriate training in their use, storage, and disposal.
3. Donated chemicals should be accepted only after approval is obtained from the Chemical Hygiene Officer. It should be established that the donated chemical is in excellent condition, that an appropriate MSDS is available, and that there is a specific curriculum use for the donated material.

4. A list of chemicals that are acceptable should be developed for use in the classroom. An employee who desires to use a substance that is not on the acceptable list must seek the permission of the chemical hygiene officer. The decision to use the chemical will be based on the best available knowledge of the hazards of the substance and the availability of proper handling facilities and equipment. The written request should include the following information.
 - a. Use of the chemical is pedagogically sound and appropriate.
 - b. Use of the substance is an effective method to illustrate an important process, property, or concept that students will learn.
 - c. Adequate safeguards are in place to assure proper use of the substance
 - d. Exposure time of the employees and students to the substance
 - e. Permissible exposure limit and threshold limit value of the substance
6. Students shall only work in a laboratory or chemical storage area under the direct supervision of a science teacher.

Medical Consultation and Medical Examinations

- A. School laboratory employees do not regularly handle significant quantities of materials that are acutely or chronically toxic. Therefore, regular medical surveillance is not justified.
- B. In the event that an employee is over-exposed to a hazardous chemical, or otherwise injured, or they exhibit signs and symptoms of an over-exposure, they must report the incident immediately to their school Principal, the school Nurse, or other school Administrator, and seek medical attention.
- C. A copy of the MSDSs for the chemicals(s) involved incident must accompany the employee to the clinic or hospital.

VII. Responsibilities

- A. Superintendent/ Director

The Head of School, as executive officer, has the ultimate responsibility for chemical hygiene within the district. The Head of School should, with other administrators, provide continuing support for district wide chemical hygiene programs, including development and enforcement of the chemical hygiene plan.

The Head of School is responsible for enforcement of all federal, state, and local health, safety, and environmental regulations and policies.

C. Chemical Hygiene Officer

1. The Chemical Hygiene Officer is appointed by the Director annually.
2. The Chemical Hygiene Officer should be qualified by training and experience to provide technical guidance in the development and implementation of the Chemical Hygiene Plan.
3. **The Chemical Hygiene Officer has the responsibility to:**
 - a. Develop and implement the chemical hygiene plan and the safety plan for the school district, including training, reporting, and other functions.
 - b. Work with administrators and teachers to develop and implement the safety programs.
 - c. Assure that inspections in the laboratory are performed when appropriate and that records of inspections are maintained.
 - d. Monitor the procurement, use, and disposal of chemicals used in the school's laboratory programs.
 - c. Provide technical assistance to employees on the chemical hygiene plan.
 - f. Assure that the chemical hygiene plan is reviewed regularly, so that the school site is always in compliance with current legal requirements.
 - g. Make decisions regarding requests to use chemicals identified as explosive, carcinogenic, mutagenic, highly toxic, or otherwise unsuitable for general school laboratories.
 - h. Determine the need for personal equipment beyond that specified for general laboratory use.
 - i. Implement appropriate training with regard to chemical hygiene for all district employees whose normal work locations include laboratory areas.
 - j. Ensure that employees have received appropriate training.
 - k. Ensure that employees have access to the chemical hygiene plan MSDSs, and other suitable reference materials.

E. School District Employees/ Science Teachers

1. **School district employees (teachers) have an obligation to instruct students in the basic safety practices required in a science laboratory. This includes the basic principles of health hazard precaution.**

These teachers who normally work in the laboratory, are responsible for:

- a. Participating in training programs provided by the school district.
- b. Maintaining an awareness of health and safety hazards.
- c. Planning and conducting each operation in accordance with school district's chemical hygiene plan procedures.
- d. Consulting reference materials, including MSDSs, related to chemical safety where appropriate.
- e. Using and modeling good personal chemical hygiene habits.
- f. Reporting accidents, injuries, unsafe practices, and unsafe conditions.
- g. Review all lab experiments periodically to ensure compliance with the overall intent of the Chemical Hygiene Plan; to minimize or eliminate safety hazards and risks, to minimize waste generation, and to ensure proper disposal of hazardous wastes.
- h. Teachers must provide safety information and training to students for every stage of the experiment and planning for the activity. Teachers must be present to actively observe, supervise and monitor the experimentation for safety.

F. Students

Students should practice good personal hygiene habits. They must behave safely in the lab areas. They must follow all safety rules and guidelines, and maintain an awareness of health and safety hazards. They must execute and adhere to the Student Safety Agreement. Students must conduct all activities according to the procedures outlined in the Chemical Hygiene Plan, and should report incidents immediately. Students must wear personal protective gear when engaging in a science lab activity.

VIII. Particularly Hazardous Substances (PHS)

A. General

1. This section of our plan describes the specific and general control measures which are designed to reduce the exposure of instructors, aides,

students, and other employees to especially hazardous substances.

Employees should read and understand these practices before commencing a procedure using particularly hazardous substances.

2. PHSs include highly toxic chemicals, reproductive toxins, and select carcinogens. In addition, our school may include highly flammable chemicals, highly reactive chemicals, and highly corrosive chemicals.
3. The use of these substances requires prior approval of the Chemical Hygiene Officer (CHO) and close monitoring.
4. PHSs shall be used in designated areas only and in fume hoods.
5. The use of PHSs shall require thorough removal of contaminated waste and the decontamination of contaminated areas.

B. Highly Toxic Chemicals

Highly toxic chemicals have a Permissible Exposure Limit (PEL) or Threshold Limit Value (TLV) less than 50ppm or 100 mg/m³. This information is available on the MSDS. Examples of highly toxic chemicals that are commonly used in the classroom are benzene, chloroform, formaldehyde, bromine, carbon disulfide, carbon tetrachloride, cyanide salts, and hydrofluoric acid. These chemicals should only be used with appropriate safety equipment.

C. Highly Flammable Chemicals

1. RI School for the Deaf has defined Class 1A liquids as highly flammable chemicals. Class 1A liquids have a flashpoint of less than 73 ° C and a boiling point of less than 100 ° C.
2. Examples of highly flammable chemicals are diethyl ether, acetone, pentane, petroleum ether, acetaldehyde, and ligroines. (*Ligroine is a complex combination of hydrocarbons obtained by the distillation of petroleum and has a boiling point range of 60 to 110 deg C. Ligroine's production and use as a paint thinner, varnish component, solvent, and dry-cleaning agent make it a common chemical.*)

D. Highly Reactive Chemicals

1. Reactivity information may be given on an MSDS and on the container labels. A reactive chemical is one that:
 - a. Is described as such on the label, in the MSDS,
 - b. Is ranked by the National Fire Protection Association (NFPA) as 3 or 4 for reactivity.
 - c. Is identified by the Department of Transportation (DOT) as an oxidizer, an organic peroxide, or an explosive (Class A, B, or C).

- d. Fits the Environmental Protection Agency definition of reactive in 40 CFR 261.23.
 - e. Is known or found to be reactive with other substances.
- 2. 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.
 - 3. Examples of commonly encountered highly reactive chemicals are ammonium dichromate, nitric acid, perchloric acid, hydrogen peroxide, and potassium chlorate, azides, organic nitrates, and acetylides.

E. Highly Corrosive Chemicals and Contact Hazard Chemicals

- 1. Corrosivity, allergen, and sensitizer information is provided in manufacturers' MSDSs and on container labels.
- 2. A corrosive chemical is one that:
 - a. Fits the OSHA definition of corrosive in 29 CFR 1910.1200
 - b. Fits the EPA definition of corrosive in 40 CFR 262.22 (has a pH greater than 12 or a pH less than 2.5)
 - c. Is known to be reactive to living tissue, causing visible destruction, or irreversible alterations of the tissue at the site of contact.
- 3. A contact - hazard chemical is an allergen or sensitizer that:
 - a. Is so identified or described in the MSDS or on the label.
 - b. Is so identified or described in medical or industrial hygiene literature.
 - c. Is known to be an allergen or sensitizer.
- 4. Corrosive and contact hazard chemicals will be handled with all proper safety precautions, including wearing safety goggles, using gloves tested for the absence of pinholes and known to be resistant to permeation or penetration by the chemical, and wearing a laboratory apron or laboratory coat.

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

F. Reproductive Toxins

1. A reproductive toxin refers to chemicals which affect reproductive capabilities including chromosomal damage (mutations) and which effect fetuses (teratogenesis).
2. A reproductive toxin is a compound that:
 - a. Is described as such in the applicable MSDS or label.
 - b. Is identified as such by the Oak Ridge Toxicology Information Resource Center (TIRC), (615) 576-1746.
3. No reproductive toxins should be allowed in middle or high school laboratories without written authorization from the chemical hygiene officer.
4. If such chemicals are used,
 - a. They should be handled only in a hood and when satisfactory performance of the hood has been confirmed.
 - b. Skin contact should be avoided by using gloves and wearing protective apparel.
 - c. Persons using such substances should always wash hands and arms immediately after working with these materials.
 - d. Unbreakable containers of these substances should be stored in a well ventilated area and will be labeled properly.
5. Examples of reproductive toxins are organomercurial compounds and ethidium bromide, carbon disulfide, xylene, toluene, benzene, mercury, lead compounds, ethyl ethers, vinyl chloride. (Prudent)

G. Select Carcinogens

1. Select carcinogen means any substance which meets one of the following criteria:

- a. It is regulated by OSHA as a carcinogen
 - b. It is listed under the category, “known to be carcinogens,” in the National Toxicology Program (NTP) Annual Reports on Carcinogens.
 - c. It is listed under Group 1 “carcinogenic to humans” by the International Agency for Research on Cancer Monographs (IARC).
 - d. It is listed in either Group 2 A or 2 B by IARC or under the category “reasonably anticipated to be carcinogens” and causes statistically significant tumor incident in experimental animals under set criteria of exposure.
2. All work with these substances should be conducted in a designated area, such as a fume hood, glove box, or a portion of a laboratory designated for use of chronically toxic substances. Such a designated area should be clearly marked with warning and restricted access signs.
 3. Any procedure that may result in a generation of aerosols or vapors should be performed in a hood whose performance is known to be satisfactory.
 4. Skin contact should be avoided by using gloves and other protective apparel as appropriate. Any protective clothing should be removed before leaving the designated area and placed in a labeled container. Hands, arms, and neck should be thoroughly washed after working with these materials.
 5. Select carcinogens should be stored in unbreakable containers in a ventilated area with controlled access. All containers should be labeled with the identity and hazard of the substance. Immediately upon completion of the project, all unused reproductive toxin should be disposed of following standard hazardous waste disposal procedures.
 6. No select carcinogens are allowed in middle or high school laboratories without written authorization from the Chemical Hygiene Officer and the Director. Specific purpose to the educational goals must be clearly explained.
 7. **Examples of select carcinogens are benzene, nickel metal dust, vinyl chloride, and formaldehyde.**

STUDENT APPENDIX A

What Are the Teacher's Responsibilities?

Teachers and teacher-aides should lead by example and wear personal protective equipment; follow and enforce safety rules, procedures, and practices; and demonstrate safety behavior and promote a culture of safety. They should be proactive in every aspect of laboratory safety, making safety a priority. The following is a checklist for teachers highlighting essential information for working in the high school laboratory. This is a general safety checklist and should be periodically re-evaluated for updates.

Upkeep of Laboratory and Equipment

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

Recordkeeping

- ◆ Keep organized records on safety training of staff for as long as required by the school system.
- ◆ Keep records of all laboratory incidents for as long as required by the school system.

Safety and Emergency Procedures

- ◆ Educate students on the location and use of all safety and emergency equipment prior to laboratory activity.
- ◆ Identify safety procedures to follow in the event of an emergency/ accident.
- ◆ Provide students with verbal and written safety procedures to follow in the event of an emergency/accident.
- ◆ Know the location of and how to use the cut-off switches and valves for the water, gas, and electricity in the laboratory.
- ◆ Know the location of and how to use all safety and emergency equipment (i.e., safety shower, eyewash, first-aid kit, fire blanket, fire extinguishers and mercury spill kits).

- ◆ Keep a list of emergency phone numbers near the phone.
- ◆ Conduct appropriate safety and evacuation drills on a regular basis.
- ◆ Explain in detail to students the consequences of violating safety rules and procedures.

Maintenance of Chemicals

- ◆ Perform regular inventory inspections of chemicals.
- ◆ Update the chemical inventory at least annually, or as requested by the administration.
- ◆ Provide a copy of the chemical inventory to the local emergency responders (i.e., fire department).
- ◆ Do not store food and drink with any chemicals.
- ◆ If possible, keep all chemicals in their original containers.
- ◆ Make sure all chemicals and reagents are labeled.
- ◆ Do not store chemicals on the lab bench, on the floor, or in the laboratory chemical hood.
- ◆ Ensure chemicals not in use are stored in a locked facility with limited access.
- ◆ Know the storage, handling, and disposal requirements for each chemical used.
- ◆ Make certain chemicals are disposed of properly. Consult the label and the Material Safety Data Sheet for disposal information and always follow appropriate chemical disposal regulations.

Preparing for Laboratory Activities

- ◆ Before each activity in the laboratory, weigh the potential risk factors against the educational value.
- ◆ Have an understanding of all the potential hazards of the materials, the process, and the equipment involved in every laboratory activity.
- ◆ Inspect all equipment/apparatus in the laboratory before use.
- ◆ Before entering the laboratory, instruct students on all laboratory procedures that will be conducted.

- ◆ Discuss all safety concerns and potential hazards related to the laboratory work that students will be performing before starting the work. Document in lesson plan book.

Ensuring Appropriate Laboratory Conduct

- ◆ Be a model for good safety conduct for students to follow.
- ◆ Make sure students are wearing the appropriate personal protective equipment (i.e., chemical splash goggles, laboratory aprons or coats, and gloves).
- ◆ Enforce all safety rules and procedures at all times.
- ◆ Never leave students unsupervised in the laboratory.
- ◆ Never allow unauthorized visitors to enter the laboratory.
- ◆ Never allow students to take chemicals out of the laboratory.
- ◆ Never permit smoking, food, beverages, or gum in the laboratory.

STUDENT APPENDIX B

Safety Do's and Don'ts for Students

Life threatening injuries can happen in the laboratory. For that reason, students need to be informed of the correct way to act and things to do in the laboratory. The following is a safety checklist that can be used as a handout to students to acquaint them with the safety do's and don'ts in the laboratory.

Conduct

- ◆ Do not engage in practical jokes or boisterous conduct in the laboratory.
- ◆ Never run in the laboratory.
- ◆ The use of personal audio or video equipment is prohibited in the laboratory.
- ◆ The performance of unauthorized experiments is strictly forbidden.
- ◆ Do not sit on laboratory counters.

General Work Procedure

- ◆ Know emergency procedures.
- ◆ Never work in the laboratory without the supervision of a teacher.
- ◆ Always perform the experiments or work precisely as directed by the teacher.
- ◆ Immediately report any spills, accidents, or injuries to a teacher.
- ◆ Never leave experiments while in progress.
- ◆ Never attempt to catch a falling object.
- ◆ Be careful when handling hot glassware and apparatus in the laboratory.
Hot glassware looks just like cold glassware.
- ◆ Never point the open end of a test tube containing a substance at yourself or others.
- ◆ Never fill a pipette using mouth suction. Always use a pipetting device.
- ◆ Make sure no flammable solvents are in the surrounding area when lighting a flame.
- ◆ Do not leave lit Bunsen burners unattended.
- ◆ Turn off all heating apparatus, gas valves, and water faucets when not in use.
- ◆ Do not remove any equipment or chemicals from the laboratory.
- ◆ Coats, bags, and other personal items must be stored in designated areas, not on the bench tops or in the aisle ways.
- ◆ Notify your teacher of any sensitivities that you may have to particular chemicals if known.
- ◆ Keep the floor clear of all objects (e.g., ice, small objects, spilled liquids).

Housekeeping

- ◆ Keep work area neat and free of any unnecessary objects.
- ◆ Thoroughly clean your laboratory work space at the end of the laboratory

session.

- ◆ Do not block the sink drains with debris.
- ◆ Never block access to exits or emergency equipment.
- ◆ Inspect all equipment for damage (cracks, defects, etc.) prior to use; do not use damaged equipment.
- ◆ Never pour chemical waste into the sink drains or wastebaskets.
- ◆ Place chemical waste in appropriately labeled waste containers.
- ◆ Properly dispose of broken glassware and other sharp objects (e.g., syringe needles) immediately in designated containers.
- ◆ Properly dispose of weigh boats, gloves, filter paper, and paper towels in the laboratory.

Apparel in the Laboratory

- ◆ Always wear appropriate eye protection (i.e., chemical splash goggles) in the laboratory.
- ◆ Wear disposable gloves, as provided in the laboratory, when handling hazardous materials. Remove the gloves before exiting the laboratory.
- ◆ Wear a full-length, long-sleeved laboratory coat or chemical-resistant apron.
- ◆ Wear shoes that adequately cover the whole foot; low-heeled shoes with non-slip soles are preferable. Do not wear sandals, open-toed shoes, open-backed shoes, or high-heeled shoes in the laboratory.
- ◆ Avoid wearing shirts exposing the torso, shorts, or short skirts; long pants that completely cover the legs are preferable.
- ◆ Secure long hair and loose clothing (especially loose long sleeves, neck ties, or scarves).
- ◆ Remove jewelry (especially dangling jewelry).
- ◆ Synthetic finger nails are not recommended in the laboratory; they are made of extremely flammable polymers that can burn to completion and are not easily extinguished.

Hygiene Practices

- ◆ Keep your hands away from your face, eyes, mouth, and body while using chemicals.
- ◆ Food and drink, open or closed, should never be brought into the laboratory or chemical storage area.
- ◆ Never use laboratory glassware for eating or drinking purposes.
- ◆ Do not apply cosmetics while in the laboratory or storage area.
- ◆ Wash hands after removing gloves, and before leaving the laboratory.
- ◆ Remove any protective equipment (i.e., gloves, lab coat or apron, chemical splash goggles) before leaving the laboratory.

Emergency Procedure

- ◆ Know the location of all the exits in the laboratory and building.
- ◆ Know the location of the emergency phone.
- ◆ Know the location of and know how to operate the following:

Fire extinguishers
Alarm systems with pull stations
Fire blankets
Eyewashes First-aid kits
Deluge safety showers

◆ In case of an emergency or accident, follow the established emergency plan as explained by the teacher and evacuate the building via the nearest exit.

Chemical Handling

- ◆ Check the label to verify it is the correct substance before using it.
- ◆ Wear appropriate chemical resistant gloves before handling chemicals. Gloves are not universally protective against all chemicals.
- ◆ If you transfer chemicals from their original containers, label chemical containers as to the contents, concentration, hazard, date, and your initials.
- ◆ Always use a spatula or scoopula to remove a solid reagent from a container.
- ◆ Do not directly touch any chemical with your hands.
- ◆ Never use a metal spatula when working with peroxides. Metals will decompose explosively with peroxides.
- ◆ Hold containers away from the body when transferring a chemical or solution from one container to another.
- ◆ Use a hot water bath to heat flammable liquids. Never heat directly with a flame.
- ◆ Add concentrated acid to water slowly. Never add water to a concentrated acid.
- ◆ Weigh out or remove only the amount of chemical you will need. Do not return the excess to its original container, but properly dispose of it in the appropriate waste container.
- ◆ Never touch, taste, or smell any reagents. (a substance or mixture for use in chemical analysis or other reactions)
- ◆ Never place the container directly under your nose and inhale the vapors.
- ◆ Never mix or use chemicals not called for in the laboratory exercise.

- ◆ Use the laboratory chemical hood, if available, when there is a possibility of release of toxic chemical vapors, dust, or gases. When using a hood, the sash opening should be kept at a minimum to protect the user and to ensure efficient operation of the hood. Keep your head and body outside of the hood face. Chemicals and equipment should be placed at least six inches within the hood to ensure proper air flow.
- ◆ Clean up all spills properly and promptly as instructed by the teacher.
- ◆ Dispose of chemicals as instructed by the teacher.
- ◆ When transporting chemicals (especially 250 mL or more), place the immediate container in a secondary container or bucket (rubber, metal or plastic) designed to be carried and large enough to hold the entire contents of the chemical.
- ◆ Never handle bottles that are wet or too heavy for you.
- ◆ Use equipment (glassware, Bunsen burner, etc.) in the correct way, as indicated by the teacher.



A STUDENT SAFE LAB

SUPERVISION

**Never work in the lab
without the supervision of a teacher**

ATTENTION	Always pay attention to the work-don't fool around in the lab
FOLLOW INSTRUCTIONS	Always perform experiments precisely as directed by the teacher
EMERGENCY PREPAREDNESS	Know what to do in the event of emergency
LABELING	Check labels to verify substances before using them. Label Containers
APPAREL	Always wear appropriate protective equipment and apparel
Your BRAINS	Use them!

Safety begins with YOU

APPENDIX C

Recommended Safety and Emergency Equipment for the Lab

The following are checklists for safety and emergency equipment for the laboratory:

Personal Protective Equipment

- Chemical splash goggles
- Face shields
- Lab coat
- Lab apron
- Gloves (selected based on the material being handled and the particular hazard involved)

Safety and Emergency Equipment

- Hand-free eye-wash stations (not eye-wash bottles) that conform to ANSI Z358.1 -2004
- Deluge safety showers that conform to ANSI Z358.1-2004
- Safety shields with heavy base
- Fire extinguishers (dry chemical and carbon dioxide extinguishers)
- Sand bucket
- Fire blankets

- Emergency lights
- Emergency signs and placards
- Fire detection or alarm system with pull stations
- First-aid kits
- Spill control kit (absorbent and neutralizing agents)
- Chemical storage cabinets (preferably with an explosion proof ventilation system)
- Gallon-size carrying buckets for chemical bottles
- Laboratory chemical hood (60-100 ft/minute capture velocity; vented outside)
- Ground-fault interrupter electrical outlets
- Container for broken glass and sharps
- Material Safety Data Sheets (MSDSs)
- Emergency Action Plan for the institution

APPENDIX D

How Should Chemicals Be Stored

First, identify any specific requirements regarding the storage of chemicals from
(1) local, State, and Federal regulations and
(2) insurance carriers.

General Rules for Chemical Storage- *Criteria for Storage Area*

- ◆ Store chemicals inside a closeable cabinet or on a sturdy shelf with a front-edge lip to prevent accidents and chemical spills; a $\frac{3}{4}$ -inch front edge lip is recommended.
- ◆ Secure shelving to the wall or floor.
- ◆ Ensure that all storage areas have doors with locks.
- ◆ Keep chemical storage areas off limits to all students.
- ◆ Ventilate storage areas adequately.

Organization

- ◆ Organize chemicals first by COMPATIBILITY-not alphabetic succession
- ◆ Store alphabetically within compatible groups.

Chemical Segregation

- ◆ Store acids in a dedicated acid cabinet. Nitric acid should be stored alone unless the cabinet provides a separate compartment for nitric acid storage.
- ◆ Store highly toxic chemicals in a dedicated, lockable poison cabinet that has been labeled with a highly visible sign.
- ◆ Store volatile and odoriferous chemicals in a ventilated cabinet.
- ◆ Store flammables in an approved flammable liquid storage cabinet (refer to section titled Suggested Shelf Storage Pattern).
- ◆ Store water sensitive chemicals in a water-tight cabinet in a cool and dry location segregated from all other chemicals in the laboratory.

Storage Don'ts

- ◆ Do not place heavy materials, liquid chemicals, and large containers on high shelves.
- ◆ Do not store chemicals on tops of cabinets.
- ◆ Do not store chemicals on the floor, even temporarily.
- ◆ Do not store items on bench tops and in laboratory chemical hoods, except when in use.
- ◆ Do not store chemicals on shelves above eye level.
- ◆ Do not store chemicals with food and drink.
- ◆ Do not store chemicals in personal staff refrigerators, even temporarily.
- ◆ Do not expose stored chemicals to direct heat or sunlight, or highly variable temperatures.

Proper Use of Chemical Storage Containers

- ◆ Never use food containers for chemical storage.
- ◆ Make sure all containers are properly closed.
- ◆ After each use, carefully wipe down the outside of the container with a paper towel before returning it to the storage area. Properly dispose of the paper towel after use.

APPENDIX E

Ways to Reduce Amount of Toxicity or Chemical Waste

Table I. Possible substitutions

<u>Toxic chemicals/equipment</u>	<u>Possible substitution(s)</u>
Mercury thermometers	Digital and alcohol thermometers
Mercury barometer	Aneroid or digital pressure sensors
Methyl orange or methyl red	Bromophenol blue, bromothymol blue
Lead chromate	Copper carbonate
p-Dichlorobenzene	Lauric acid
Dichromate/sulfuric acid mixture	Ordinary detergents, enzymatic cleaners
Alcoholic potassium hydroxide	Ordinary detergents, enzymatic cleaners



Flammable



Poison



Explosive



Radioactive



Corrosive



Compressed Gas

The above safety symbols may be replaced by the following symbols that are internationally accepted*:



Flammable



Oxidizer



Explosive



Low Level Hazard



Corrosive



Severe Chronic Hazard



Poison



Environmental Hazard

APPENDIX F COMMON SAFETY SYMBOLS

APPENDIX G

National Fire Protection Association Hazard Labels

The National Fire Protection Association (NFPA) has developed a visual guide (right) for a number of chemicals pertinent to the MSDS. The ANSI/NFPA 704 Hazard Identification system, the NFPA diamond, is a quick visual review of the health hazard, flammability, reactivity, and special hazards a chemical may present.

The diamond is broken into four sections (blue, red, yellow, and white). The symbols and numbers in the four sections indicate the degree of hazard associated with a particular chemical or material.



Health Hazard (Blue)

4	Danger	May be fatal on short exposure. Specialized protective equipment required
3	Warning	Corrosive or toxic. Avoid skin contact or inhalation
2	Warning	May be harmful if inhaled or absorbed
1	Caution	May be irritating
0		No unusual hazard

Flammability (Red)

4	Danger	Flammable gas or extremely flammable liquid
3	Warning	Combustible liquid flash point below 100 °F
2	Caution	Combustible liquid flash point of 100 to 200 °F
1		Combustible if heated
0		Not combustible

Reactivity (Yellow)

4	Danger	Explosive material at room temperature
3	Danger	May be explosive if shocked, heated under confinement, or mixed with water
2	Warning	Unstable or may react violently if mixed with water
1	Caution	May react if heated or mixed with water but not violently
0	Stable	Not reactive when mixed with water

Special Notice Key (White)

W Water Reactive
OX Oxidizing Agent

APPENDIX G

General Guidelines to Follow in the Event of a Chemical Spill

- ◆ Assess the overall situation.
- ◆ Determine the appropriate action to resolve the situation.
- ◆ Follow the pre-existing, approved local emergency plan.
- ◆ Act swiftly and decisively.

Below are some recommended actions for specific emergencies:

Chemical in the Eye

- ◆ Flush the eye immediately with water while holding the eye open with fingers.
- ◆ If wearing contact lens, remove and continue to rinse the eye with water.
- ◆ Continue to flush the eye and seek immediate medical attention.

Acid/Base Spill

For a spill not directly on human skin, do the following:

Neutralize acids with powdered sodium hydrogen carbonate (sodium bi- carbonate /baking soda), or bases with vinegar (5% acetic acid solution).

- ◆ Avoid inhaling vapors.
- ◆ Spread diatomaceous earth to absorb the neutralized chemical.
- ◆ Sweep up and dispose of as hazardous waste.

For spills directly on human skin, do the following:

- ◆ Flush area with copious amounts of cold water from the faucet or drench shower for at least 5 minutes.

- ◆ If spill is on clothing, first remove clothing from the skin and soak the area with water as soon as possible.
- ◆ Arrange treatment by medical personnel.

Mercury Spill

- ◆ Evacuate the affected area.
- ◆ Close off interior doors and windows, and heating and air conditioning vents in the incident room.
- ◆ Open exterior doors and windows to move the inside air outside.
- ◆ Follow specific cleanup instructions detailed by the EPA (www.epa.gov/epaoswer/hazwaste/mercury/spills.htm) or by your state.

All Appendix from School Chemistry Lab Safety Guide CDC – NIOSH – Department of Health & Human Service – US Consumer Product Safety Commission

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Approved: