**Department of Defense Education Activity (DODEA)**
**Domestic Elementary and Secondary Schools (DDESS)**

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# Chemical Hygiene Plan

Reedited by

_____

Signature _____ Date _____
Superintendent
Signature _____ Date _____
Principal

Signature _____ Date _____
Chemical Hygiene Officer

# ACKNOWLEDGEMENT

The Department of Defense Domestic Dependent Elementary Secondary Schools Chemical Hygiene Plan was developed during December 2007 by members of the DDESS Chemical Hygiene Officer class with the guidance and assistance of Dr. James Kaufman and Dr. W.H. (Jack) Breazeale of The Laboratory Safety Institute.

This chemical hygiene plan is based on a model CHP written by Dr. Brian Wazlaw (on sabbatical from Exeter High School) and Dr. James Kaufman and published by The Laboratory Safety Institute.



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# INTRODUCTION

## PURPOSE

The Department of Defense Education Activity (DODEA) Domestic Dependent Elementary and Secondary Schools (DDESS) has developed a Chemical Hygiene Plan to explain the policies and procedures that will promote the safe operation of the school laboratory. 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 from health hazards associated with hazardous chemicals in the laboratory.

The Occupational Safety and Health Act, 29CFR1910, applies to all private employers and government agencies.

"The Laboratory Standard" is a regulation developed for the protection of employees. Since students are not employees, they are not officially covered by provisions of the "Laboratory Standard". However, DDESS extends the provisions of the Chemical Hygiene Plan to our students in addition to our employees. "What is good for teachers is good for students!"

Many policies and practices may not be part of the Chemical Hygiene Plan, but the policies and practices may be crucial to the planning process for maintaining a safe environment for employees and students. The amount of physical space per student is an example of a policy that affects the establishment of a safe environment but is not required by the "Laboratory Standard" to be included in the Chemical Hygiene Plan.

## GENERAL PRINCIPLES

A. The Chemical Hygiene Plan provides specific laboratory practices designed to minimize the exposure of employees 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. 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.

C. Employees are cautioned against the underestimation of risk; 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 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 chemical. Employee exposure to hazardous chemicals should not exceed these limits.

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. DDESS schools will not accept a chemical from a supplier unless it is accompanied by the corresponding MSDS. All MSDSs should be accessible to employees at all times, and employees should be trained to read and use the information provided on the MSDSs.

_____ _____

Director Date

* Insert signature block for other personnel

# DDESS CHEMICAL HYGIENE PLAN

I. Standard Operating Procedures

A. General

1. The design of the laboratory facility will provide sufficient space for safe work by the number of persons to be in the laboratory. Exit doors will be clearly marked and free of obstructions to permit quick, safe escape in an emergency. (KY)

2. Laboratory facilities will be used only by persons with proper qualifications and training. The number of students assigned to the laboratory shall not exceed the number of laboratory stations available. The maximum number of students shall not exceed the lesser of: 24 students per teacher, the design capacity of the room, or at least 50 $ft^2$/student for lab only rooms and at least 60 $ft^2$/student for combo rooms. (KY, CA, MD, NSTA, LSI)

3. In order to permit a quick, safe escape in an emergency, exit doors will be clearly marked and free of obstructions (Prudent)

4. Staff and students should follow the Chemical Hygiene Plan to minimize their health and safety risks. (ACS)

5. 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 MSDSs, will also be followed. (ACS, KY)

6. Employees should not underestimate the 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 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, then the experiment, procedure, or chemical should be eliminated. (ACS, KY)

7. 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 should be accessible to employees at all times. Employees should be trained to read and use the information found on MSDSs. (ACS, Prudent, Appendix A)

8. Generally, textbooks, laboratory manuals, and other instructional materials designate the safety precautions needed for a particular laboratory 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. (ACS, KY)

B. Laboratory Procedures

1. Individuals in laboratories:

a. Eating, drinking, gum chewing, application of cosmetics, manipulation of contact lenses, or other such activities are not to be done in the laboratory. (KY)

b. Conduct yourself in a responsible manner at all times in the laboratory. This means that horseplay, throwing items, and pranks are prohibited. (Prudent)

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. (ACS, Prudent)

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 should never be tasted. (ACS)

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. (Prudent)

g. Proper Bunsen burner procedures shall be followed. Never leave a flame unattended. (EHS)

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 laboratory. (EHS, ACS, Prudent)

i. Should a fire drill or any other evacuation occur during a lab activity, turn off all Bunsen burners and electrical equipment. Leave the room as directed. (EHS, Prudent)

j. Remember hot glass looks like cold glass, and glass remains hot for a long time. Determine if an object is hot by bringing the back of your hand close to the object but do not touch the object. (EHS)

k. Careful storage and handling procedures should be used to avoid glassware breakage. In the event of breakage, protection for the hands should be worn 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. (ACS)

l. The quantities of flammable liquids brought in to used in the laboratory shall not exceed the amount that can be consumed in one day. (JK, BW)

m. Hands should be washed thoroughly before leaving the laboratory. (SIACL)

2. Students in the laboratory:

a. Must read lab directions ahead of time and follow all verbal and written instructions. (EHS)

b. Shall only perform only authorized experiments. (EHS)

c. Shall report all accidents or injuries to the instructor at once, no matter how trivial it may seem. The student must go to the nurse for the treatment of cuts, burns, accidental ingestion of chemicals, or inhalation of fumes. (EHS)

d. Shall only work in a laboratory or chemical storage area under the direct supervision of a science teacher. (JK, BW)

C. Housekeeping Practices

1. Individuals in the laboratory:

a. All laboratory areas must be kept clean and contain only those items needed for the task at hand. (ACS)

b. Place all wastes in appropriate, segregated receptacles that are properly labeled. (ACS)

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. (EHS)

d. Tabletops are to be swept clean and washed at the end of the lab activity.

e. Clean up all chemical spills as soon as they occur. Chemicals and cleanup materials should be disposed of correctly. (ACS)

f. Never block access to emergency equipment, showers, eyewashes, or exits (ACS).

g. Store chemicals and equipment properly. Chemicals should not be stored in aisles, on the floor, in stairwells, on desks, or laboratory tables. (ACS)

h. Before leaving the laboratory, turn off services (gas, electricity, water). (KY)

i. Keep all cabinets and drawers closed when not in use to avoid catching and bumping hazards. (ACS)

j. Floors should be cleaned daily. (Standard)

2. Students in the laboratory:

a. Bring only your lab instructions, calculators, and writing instruments to the laboratory area. (EHS)

b. Leave backpacks, excess clothing, and other books/ materials in the classroom area. (EHS)

D. Chemical Procurement (ACS)

1. The purchasing of chemicals should be guided by the maxim that less is better. The lower 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. (ACS)

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. (ACS)

3. All chemicals should be in tightly closed, sturdy, and appropriate containers. (ACS)

4. Chemicals should only be accepted with an adequate identifying label and should be quarantined if the current material safety data sheet is not on file. (Standard)

5. When a chemical is received, proper handling, storage, and disposal should be known. (Standard)

6. The container should be marked with the full level and date(s) it is received and opened. (JK)

7. The chemical inventory list should be updated each time a chemical is received. (ACS, Prudent)

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. (ACS)

E. Storage and Distribution (ACS)

1. All chemicals should be in tightly closed, sturdy, and appropriate containers.

2. If the chemical has been transferred 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.

4. Large containers and containers with reactive chemicals, such as acids and bases, should be on low shelves.

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

6. Flammable chemicals shall be stored in approved storage containers and in approved flammable chemical storage cabinets.

7. Combustible packaging material should not be stored near flammable chemical storage cabinets.

8. 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.

9. 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)

10. 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.

11. During the annual review of stored chemicals, the condition of those chemical should be examined and a determination made as to whether the chemical should be retained or disposed of.

12. Household refrigerators are not to be used to store flammable chemicals.

13. Refrigerators used to store flammable chemicals shall be labeled and shall be of explosion proof or of lab safe design. (NFPA 45)

14. OSHA standards and NFPA Guidelines or local fire regulations should be consulted on the proper use of flammable chemicals in the laboratory. (ACS)

15. All Chemicals should be transported using the container-within-a-container concept. (SACL)

16. 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/in 2) at 21 °C, or an absolute pressure greater than 717 kPa (104 lb/in 2) at 54 °C or both, or any liquid flammable material having a Reid vapor pressure greater than 276 kPa (40 lb/in 2) at 38 °C. (Prudent, Mercier)

    b. Gas cylinders should only be moved from one location to another with the protective cap securely in place. (ACS)

c. Both full and empty cylinders should only be stored where they may be securely restrained by straps, chains, or a suitable stand. (ACS)

d. A cylinder should be considered empty when there is still a slight positive pressure. (ACS)

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. (ACS)

f. Cylinders should not be exposed to temperatures above 50 °C. (ACS)

g. Store flammable gases separately from oxidizer gases. (JK)

F. Waste Disposal

1. The Chemical Hygiene Officer will ensure that the disposal of all laboratory chemicals is in compliance with all military installation, local, state, and federal regulations.

2. Guidelines for waste minimization: (JK)

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.

d. Prior to ordering new chemicals, using existing chemicals, or creating products from reactions, employees shall determine if the material will need to be treated as hazardous waste.

3. Guidelines for hazardous waste disposal: (ACS, Prudent)

   a. Flammable, combustible, water-immiscible materials, or water soluble solutions of toxic substances shall not be poured down the drain.

   b. Separate waste containers should be provided for heavy metal compounds, chlorinated hydrocarbons, nonchlorinated hydrocarbons, and any other categories recommended by the School District's hazardous waste transporter company. Separation of wastes in this manner will make disposal less costly.

   c. Waste chemicals should be stored in appropriately labeled containers, inside secondary containment.

   d. Hazardous wastes should never be placed in the common solid trash container.

   e. All waste containers should have an up-to-date log of the material that is in the container. When any material is added to the container, the chemical name, the amount of the chemical, the date, and the initials of the individual adding the hazardous chemical, shall be recorded in the log for that container. (JK, BW)

   f. Upon completion of the laboratory activity, the waste containers shall be returned to the preparation room. Waste materials should not be stored in the laboratory. (JK)

   g. When the waste containers become full, the containers shall be transferred to a designated waste storage area within three (3) days. (JK)

   h. Make sure an MSDS is available at the time of disposal.

## G. Spills

1. If the chemical involved in the spill is judged to present an immediate hazard, evacuation is to be absolute, and the area should be isolated until a HAZMAT team arrives. (ACS)

2. If hazardous vapors are present, the area should be isolated. Only persons trained in the use of respirators may enter the area. This will frequently mean waiting for the arrival of a HAZMAT team. (ACS)

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. (KY)

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. (ACS)

5. If there is no immediate danger, cleanup procedures listed on the MSDS should be followed. Appropriate personal protective equipment shall be used. (KY)

6. A spill kit should be accessible for each science laboratory. The kit might include: (MD)

    a. Spill control pillows

    b. Inert absorbents such as vermiculite, clay, sand, or kitty litter

    c. Neutralizing agents for acid spills such as sodium carbonate and sodium hydrogen carbonate

    d. Neutralizing agents for alkali spills such as sodium hydrogen sulfate and citric acid

    e. Quantities of cleanup materials sufficient for the largest anticipated spill. (JK)

    f. Large plastic scoops and other equipment such as brooms, pails, bags, and dust pans.

    g. 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. (ACS)

8. If a major spill occurs (cannot be cleaned-up safely by yourself), cleanup shall only be undertaken by individuals who are trained in HAZMAT procedures. (ACS)

9. If you can clean it up without hurting yourself or anyone else and it is not an emergency and not likely to become an emergency, then clean it up. Otherwise, call a hazmat team.

## II. Control Measures

A. Personal Protective Equipment

1. It is the responsibility of the school district to provide appropriate safety and emergency equipment for employees and students. (Prudent)

2. Personal Protective Equipment (PPE) shall be compatible with the required degree of protection for the substances being handled. (Standard)

3. PPE, including aprons or coats, eye protection, and non-permeable gloves, is considered standard equipment for school laboratory and other school programs and should be readily available to employees, teachers, students and visitors. (ACS, KY)

4. All eye protection devices should conform to ANSI Standard Z87.1-2003. Eyeglasses, even with side shields, are not acceptable protection against chemical splashes. (ACS)

5. Appropriately sized chemical splash safety goggles should be used as the standard protective eyewear (see ANSI Z-87.1 1989 and 2003 “protective device H”). Such goggles should fit the face surrounding the eyes snuggly to protect the eyes from a variety of hazards. (MD)

6. Any experiment that involves heating or the use of chemicals, or glassware shall require the use of chemical splash safety goggles. The goggles also serve to reduce dust and fumes from reaching the eye. (CA, EHS)

7. Contact lenses are not necessarily prohibited in the laboratory. If contact lenses are permitted, chemical splash goggles must be worn at all times. (ACS)

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. (Hall, Lab Safety Pocket Handbook, JK, BW)

9. Standing shields should be used either by individuals or for group protection when there is a potential for explosions, implosions, or splashes, or when corrosive liquids are used. Goggles and, if appropriate, a face shield should be worn whenever using a standing shield. (ACS)

10. Lab coats or aprons worn in the laboratory should offer protection from splashes and spills, and should be easy to remove in case of an accident, and should be fire resistant. (ACS)

11. 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.

B. Administrative Controls

1. Inventory Control

a. A chemical inventory should be updated each time a chemical is received or consumed. The list should be audited for accuracy on at least an annual basis. (ACS)

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. (ACS)

c. Every area in which chemicals are used or stored should have an up-to-date inventory. (ACS)

d. A printed copy of the most recent inventory should be kept by the principal and by the chemical hygiene officer.

e. See Appendix A for the DDESS chemical inventory software instructions.

2. Hazard Identification and Labels

a. Labels on incoming containers of hazardous chemicals are not to be removed or defaced. (Standard)

b. All chemicals should be properly labeled to identify any hazards associated with them for the employee's information and protection. (ACS)

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 on the chemical who opened the container. (ACS)

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, date of transfer, and name or initials of the person responsible for the transfer. (ACS)

e. Unlabeled bottles should not be opened, and such materials should be disposed of promptly, as outlined in the section on disposal procedures. (ACS)

3. Signs and Posters

   a. Emergency telephone numbers shall be posted in all areas containing hazardous materials. (Standard)

   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. (KY)

   c. Warnings at areas or equipment where special or unusual hazards exist. (Standard)

   d. Posters to reinforce laboratory safety procedures should be displayed in the laboratory and the classroom. (EHS)

4. Material Safety Data Sheets

   a. Each MSDS received with incoming shipments of chemicals should be maintained and made readily available to employees, students, and visitors. (ACS) (Standard)

   b. The material safety data sheets for each chemical in the laboratory usually give recommended limits or OSHA - mandated limits, or both, as guidelines to exposure limits. Typical limits are expressed as threshold limit values (TLVs), permissible exposure limits (PELs), or action levels. When such limits are stated, that limit, along with any other information about the hazardous characteristics of the chemical, should be used to set guidelines. These guidelines may be used in determining the safety precautions, control measures, and personal protective equipment that apply when working with the toxic chemical. (ACS)

   c. A material safety data sheet for each compound on the chemical inventory should be available in the department. Material safety data sheets can often be obtained by requesting them from companies that currently sell the chemicals. 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. (ACS)

5. Records

a. Chemical Inventory Records (KY)

i) An inventory of al chemicals shall be conducted annually and chemical usage determined.

ii) The chemical hygiene officer shall retain a copy of the chemical inventory.

b. Inspection Records (KY)

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.

iii) Records indicating the dates of repairs and regular maintenance of safety equipment should be maintained.

c. Training Records (ACS)
The district should maintain records of employee training for at least 30 years, and they should be made available to employees.

d. Incident Report (KY)
Accident reports must be completed for any incident. Copies are to be retained by the chemical hygiene officer and the school principal.

e. Medical and Exposure Records
Records of air concentration monitoring, exposure assessments, medical consultations, and medical examinations must be kept for at least 30 years after the employee ceases employment with the district.

f. Waste Disposal Records (ACS, NH)
The school district shall retain records of disposal of hazardous waste. The records shall conform to the requirements of the New Hampshire Department of Environmental Services Hazardous Waste Rules.

g. MSDSs (ACS)
The district should maintain a file of MSDSs 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 that the employee or student exposure to that substance is measured. (ACS)

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

i. The manner in which the chemical procedures or operations involving the particular substances are conducted.

ii. The existence of historical monitoring data that shows elevated exposures to the particular substance for similar operations.

iii. The use of a procedure that involves significant quantities or is performed over an extended period of time.

iv. There is reason to believe that an exposure limit may be exceeded.

v. Signs or symptoms of exposure (e.g., skin or eye irritation, shortness of breath, nausea, or headache), which are experienced by employees or students. (Some of these symptoms are very general and can be due to many other causes including emotional stress or hysteria.)

c. If the substance in question does not have exposure monitoring or a medical surveillance requirement, exposure monitoring and medical surveillance shall be continued until exposure levels are determined to be below the action level or 50% of the PEL. In the absence of PELs, the ACGIH TLVs should be referenced. (JK, BW)

d. If a substance has an exposure monitoring requirement and if there is reason to believe that exposure levels for that substance routinely exceed the action level or in the absence of the action level, the PEL, the employer shall measure the employee or student exposure to the substance. (Standard)

e. If the initial monitoring (described in d. above) discloses employee exposure over the action level or in the absence of an action level, the PEL, the employer shall immediately comply with the exposure monitoring provisions of the relevant standard for that substance. (Standard)

f. The employer shall, within 15 working days after the receipt of any monitoring results notify the employee or student of these results in writing either individually or by posting the results in an appropriate location that is accessible to employees. (Standard)

g. The following substances are regulated by OSHA standards and require monitoring: lead, benzene, 1,2-dibromo-3-chloropropane, acrylonitrile, ethylene oxide, formaldehyde, asbestos, vinyl chloride, and inorganic arsenic. (JK)

## III. SAFETY / EMERGENCY FACILITIES AND EQUIPMENT

A. Equipment

1. The school district must ensure that adequate emergency equipment is available in the laboratory and inspected periodically to ensure that it is functioning properly. All employees must be properly trained in the use of each item. (ACS)

2. Emergency equipment items that should be readily available include but are not limited to: eyewash station, fire extinguisher of the appropriate type, safety shower, two- way radio or telephone for emergencies, fire blanket, identification signs, spill kit, broken glass disposal container, and appropriate PPE for students and staff. Evacuation routes and emergency procedures must be clearly posted. (ACS)

3. Each laboratory should have a standard first aid kit and appropriate PPE available for students and staff.

4. Multipurpose fire extinguisher(s) must be available in the laboratory. A multipurpose, ABC, fire extinguisher (ten pound minimum) can be used on all fires EXCEPT for Class D fires. Extinguishers should be visually checked monthly and inspected and tested annually. (DODEA)

    a. Mandatory training in the use of fire extinguishers should take place at time of employment and as determined necessary by administration thereafter.

    b. Student training may be given as appropriate.

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. The eye wash station must be flushed 1x weekly and recorded. (ANSI Z358.1-1998) (ACS) (DDESS)

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. Safety showers must be tested 1x monthly and recorded. (DoD 4800.1) ANSI recommends that safety showers be activated weekly and inspected annually. (ANSI Z358.1-1998) (ACS, Prudent)

7. Eye wash stations and safety shower stations shall be located so they will be accessible within 10 seconds and unobstructed. (ANSI Z358.1-1998) (JK)

8. Safety equipment will be tagged following an inspection, showing the date, inspector, and results.

9. Laboratories 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. (ACS, Prudent)

10. Each storeroom shall be equipped with a smoke and heat sensor/fire alarm. These detectors should be integrated into the school alarm system.

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. (Prudent)

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. (ACS)

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. (KY, CA)

d. In most cases, the recommended face velocity is between 80 and 100 feet per minute (fpm). (Prudent)

e. Fume hoods should be positioned in the laboratory so that air currents do not draw fumes from the hood into the room. (CA)

f. The exhaust stack from a fume hood shall be in a vertical-up direction at a minimum of 10 feet above the adjacent roof line and so located with respect to openings and air intakes of the laboratory or adjacent buildings to avoid reentry of the exhaust into the building. (ANSI/AIHA Z9.5 – 1992)

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)

h. All biosafety cabinets and chemical fume hoods shall be inspected annually and certified by _____ (i.e. maintenance/industrial hygiene). Any hood not passing inspection must be taken out of service immediately and not be used until such time as the hood has passed inspection. It is the responsibility of the employer to purchase the parts and replace the unit in a timely fashion so as not to endanger the health and well being of the employee or place the facility at risk. (NH Chem. Hygiene Model)

i. Fume hood air velocity should be tested at least 1 time(s) per year by the _____. The lab instructor is responsible for maintaining the fume hoods and must notify appropriate personnel if repairs are needed. (J K, BW)

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. (ACS, Standard)

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. (Standard)

c. Exhaust from the fume hoods should be vented directly to the outside. (JK)

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. (ACS)

b. All fire hazard chemicals must be stored in a flammable solvent storage area, safety cans, or in storage cabinets designed for flammable materials. (ACS)

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 must have a grounding connection accommodating a three prong plug. (ACS)

b. All laboratories should have circuit breakers readily accessible. Employees must know how to cut-off electricity to the laboratory in case of emergency. (ACS)

c. Laboratory lighting should be on a separate circuit from electrical outlets. (ACS)

d. All electrical outlets should be checked for continuity after initial occupancy or whenever electrical maintenance or changes occur. (ACS)

e. If electrical equipment shows evidence of undue heating, it should be immediately unplugged and reported to the appropriate personnel. (ACS)

f. Install ground-fault circuit interrupters (GFCIs) as required by code to protect users from electrical shock, particularly if an electrical device is hand held during a laboratory operation. (Prudent)

## 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. (Standard)

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. (Standard)

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. (KY)

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. (ACS)

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. (ACS)

5. Employees using hazardous chemicals 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. (ACS)

6. The training an employee receives should be determined by the nature of the work assignment …. (KY)

7. 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 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. (ACS)

8. All employees using hazardous chemicals will be trained to read and understand MSDSs. (ACS)

9. All employees shall be trained in labeling and storage practices as outlined in the chemical hygiene plan. (KY)

10. All employees should be trained in the methods and observations that may be used to detect the presence or release of hazardous chemicals. (Standard)

11. All training will be documented and kept on file according to the standard.

B. Training for Students

1. Instruction in laboratory safety shall be provided to all students involved in laboratory activities. (ACS)

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. (ACS)

3. Safety training should include the importance and the content of the label and of material safety data sheets. As appropriate, the student should also be introduced to other sources of chemical safety information. (ACS)

4. At the beginning of the school year and prior to laboratory activities, class time shall be devoted to safe laboratory practices and to the student safety agreement. (EHS)

5. A yearly signed safety agreement will be kept on file for a period of seven (7) years following the student's departure from the school.

C. Information

1. Employees shall be informed of the content of the "Laboratory Standard", 29 CFR Part 1910. (Standard)

2. Employees using hazardous chemicals will be provided a copy of the chemical hygiene plan.

3. Employees shall be informed of the permissible exposure limits for OSHA regulated substances on site or recommended exposure limits for other hazardous chemicals on site where there is no applicable OSHA standard. (ACS, Standard)

4. 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. (ACS)

5. Employees shall be informed of the location of material safety data sheets. (ACS)

6. Employees shall be informed of the location of personal protective equipment and of emergency equipment as outlined in the chemical hygiene plan. (KY)

7. Employees shall be informed of the signs and symptoms associated with exposures to hazardous chemicals used in the laboratory. (Standard, KY)

## V. Prior Approval

1. Prior approval should be obtained from the chemical hygiene officer whenever a new 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. (ACS)

2. Prior approval before doing any procedure should be obtained where one or more of the following conditions exist:

   a. Potential for a rapid rise in temperature

   b. Potential for a rapid increase in pressure

c. Use of a flammable solvent

d. Potential for a chemical explosion

e. Potential for spontaneous combustion

f. Potential for the emission of toxic gasses that could produce concentrations in the air that exceed toxic limits.

g. Change in a procedure, even if the change is quite small. (ACS)

h. Involves the use of highly toxic substances.

3. 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.

4. Donated chemicals should be accepted only after approval is obtained from the District 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.

5. A list of acceptable reagents 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. (MD, ACS)

a. Use of the chemical is pedagogically sound.

b. Use of the substance is an effective method to illustrate an important process, property, or concept.

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. (JK, BW)

7. Staff members will only be allowed to work with hazardous chemicals when there is a second informed person available. (Consider the use of walkie/talkie or life alert systems.)

## VI. Medical Consultation and Medical Examinations

A. In the event that an employee is exposed to levels of a hazardous chemical exceeding the established PEL or TLV, or should the employee exhibit signs or symptoms of such exposure, the employee shall be provided an opportunity to receive an appropriate medical examination. (KY, Standard)

B. All medical examinations and consultations shall be performed by or under the direct supervision of a licensed physician and shall be provided without cost to the employee, without loss of pay, and at a reasonable time and place. (Standard)

C. Each school shall provide the following information to the physician conducting the examination.

1. The identity of the hazardous chemical(s) to which the employee may have been exposed.

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

3. A description of the signs and symptoms of exposure that the employee is experiencing

4. A copy of the MSDSs for the chemicals(s) involved. (NH)

D. A written opinion from the examining physician for any consultations or examinations performed under this standard should include:

1. Any recommendation for further medical attention.

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

3. 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

4. A statement that the employee has been informed by the physician of the results of the consultation or examination and any medical condition that may require further examination or treatment.

5. A copy of the physician's report to be retained by the employer. (ACS, Standard)

6. The written opinion from the physician should not reveal specific diagnoses unrelated to the occupational exposure. (ACS, Standard)

## VII. Responsibilities

A. Superintendent

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

B. Principal

The Principal of the school is responsible for enforcement of all federal, state, and local health, safety, and environmental

regulations and policies including the chemical hygiene plan.

C. Chemical Hygiene Officer

1. The Chemical Hygiene Officer is appointed and designated in writing by the Principal.

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 program.

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.

e. Provide technical assistance to schools and employees on the chemical hygiene plan.

f. Assure that the chemical hygiene plan is reviewed annually and revised as needed, so that it 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.

D. Department Chair

The Department Chair is responsible for chemical hygiene programs within their departments. The Department Chair shall monitor compliance with the chemical hygiene plan. The Department Chair is also responsible for enforcement of all federal state, and local health, safety, and environmental regulations and policies as applicable to their department. (JK, BW)

E. School District Employees

1. School district employees, who normally work with hazardous chemicals are responsible for: (ACS)

a. Participating in training programs provided by the school district.

b. Maintain 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 MSDS's, related to chemical safety where appropriate.

e. Using and modeling good personal chemical hygiene habits.

f. Reporting accidents, injuries, unsafe practices, and unsafe conditions.

F. Students

Students should practice good personal hygiene habits. They should report accidents and maintain an awareness of health and safety hazards. Students should conduct all activities according to the chemical hygiene plan procedures. (JK, BW)

## 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. (BW, JK)

2. PHSs include highly toxic chemicals, reproductive toxins, and select carcinogens. In addition, our school district includes highly flammable chemicals, highly reactive chemicals, and highly corrosive chemicals.

3. The use of these substances requires prior written approval from the Chemical Hygiene Officer and designated authorities. (see section V)

4. PHSs shall be used in designated areas and in fume hoods.

5. The use of PHSs shall require removal of contaminated waste and the decontamination of contaminated areas with help from the Chemical Hygiene Officer and base Hazmat. (Prudent) Documentation should be retained by the CHO and copies to appropriated authorities.

B. Highly Toxic Chemicals

1. When a PEL or TLV 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 is available, no work should be performed using the chemical. (ACS)

2. If a PEL, TLV, or comparable value is not available, the animal or human median inhalation lethal concentration information, LC 50, should be used as a guideline. If that value is less than 200 ppm or 2000 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 other device equipped with appropriate traps. If none are available, no work should be performed using that chemical. (ACS)

3. Examples of highly toxic chemicals (acute or chronic) that were commonly used in the past are benzene, chloroform, formaldehyde, bromine, carbon disulfide, carbon tetrachloride, cyanide salts, and hydrofluoric acid. (ACS)

C. Highly Flammable Chemicals

1. Our school district will define 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. (JK, BW)

2. Examples of highly flammable chemicals are diethyl ether, acetone, pentane, petroleum ether, acetaldehyde, and ligroines. (JK,BW)

D. Highly Reactive Chemicals

1. Reactivity information may be given in a manufacturers' MSDSs and on labels. The most complete and reliable reference on chemical reactivity is the current edition of Bretherick's Handbook of Reactive Chemical Hazards. (ACS, Prudent)

2. A reactive chemical is one that: (ACS)

   a. Is described as such on the label, in the MSDS, or by Bretherick.

   b. Is ranked by the 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.

3. 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. (ACS)

4. Examples of commonly encountered highly reactive chemicals are ammonium dichromate, nitric acid, perchloric acid, hydrogen peroxide, and potassium chlorate, azides, organic nitrates, and acetylides. (ACS, Prudent)

E. Highly Corrosive Chemicals and Contact Hazard Chemicals

1. Corrosivity, allergen, and sensitizer information is provided in manufacturers' MSDSs and on labels. (ACS)

2. A corrosive chemical is one that: (ACS)

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: (ACS)

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. (ACS)

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). (ACS)

F. Reproductive Toxins

1. A reproductive toxin refers to chemicals which affect reproductive capabilities including chromosomal damage (mutations) and which effect fetuses (teratogenesis). (Standard)

2. A reproductive toxin is a compound that: (ACS)

   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, (ACS)

   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 (ACS, Standard, Prudent)

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

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 Monograms (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 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.

7. Examples of select carcinogens are benzene, nickel metal dust, vinyl chloride, and formaldehyde.

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# APPENDICES

## I. APPENDIX A – ChemTrack Instructions

# ChemTrack-

a chemical inventory data base for Microsoft Office V4.2*


V3.02

- Written for IBM** and MS-DOS* compatible computers -

Distributed by:
Laboratory Safety Institute
192 Worcester Road
Natick, MA 01760
1-508-647-1900
FAX: 1-508-647-0062

**ChemTrack** - a chemical inventory/organization database
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by Roger Postley
V3.02

***[These directions may be printed out or viewed on your monitor. It is suggested that you print them out. as it is likely that they will be a valuble reference.]***

This Word v6.0* and Excel v5.0* set of documents and data base was designed to be a highly adaptable and useful tool for science department chairmen or the person in charge of the chemical stock room. It contains approximately 1200 entries of `standard' chemicals, usually in several grades of purity.

The documentation (“INSTRUCT.DOC”) and chemical entry format (“ALLCHEM.EXL”, are on the 3 1/2" diskette. The disk also holds a very brief “README.DOC” file for those who want to get started and are too impatient to read further AT THIS TIME and a “NOTES.DOC” file which contains any last minute updates. As it is unlikely that these chemicals will match your inventory, the data base can be customized. After customizing, the “ALLCHEM.EXL” data base can be separated into smaller files, such as “INORGanics”, “ORGANICS”, and “STAINS/indicators” if you desire.

In conjunction with Excel*, you can:

1. organize and systemize your inventory;
2. print locator lists all chemicals (very useful for non-chemists trying to find supplies in the stock room);
3. print inventory blanks and replacement stock container labels;
4. add alternate or common chemical names;
5. analyze your stock room safety requirements;
6. keep track of Chemical Abstract Services (CAS) registry numbers;
7. have access to Natational Fire Protection Association (NFPA) hazard codes;
8. generate some of the many OSHA-required reports;
9. print labels for solutions and laboratory stock bottles;
10. many other functions, limited only by your needs.

**MINIMUM SYSTEM:**

The MINIMUM system that will allow this data base to be used includes an IBM** or compatible computer with two megabytes of memory, a hard drive, one 3 1/2" drive, AND a printer with multiple font and type size capabilities. To print stockroom lists, it is nice to have bold face or enhanced mode capability on your printer. In addition, you must be using MS-DOS* 3.1 (or newer) and MS-Windows*

**INITIAL INSTRUCTIONS**:

**PLEASE COPY YOUR ORIGINAL DISK** to another disk and/or your hard drive. Make as many copies as your **INDIVIDUAL SCHOOL** needs. Do **NOT** distribute this program outside your individual school **UNLESS** your school system has purchased site licenses for additional schools within the system. Almost any copy program will do this or use the DOS or Windows "copy" commands.

**MAKE ALL CUSTOMIZING CHANGES ON YOUR COPY. LEAVE THE ORIGINAL INTACT**. You will have to develop an Inventory Report form that is compatible with your printer and type fonts. Please refer to the report section of these instructions for further suggestions. Print this report format which should be titled "Inventory" for the entire data base "ALLCHEM.EXL". Use the print-out to complete a thorough chemical inventory of your department (including the chemicals 'squirreled' away in various teachers' rooms). Upon completion of the inventory, cross off the chemicals that you do not have, from the list. Finally, write in the few additional chemicals that you found that were not on the list.

Now return to the computer, and **ON YOUR COPY**, delete all of the entries that you crossed off on the print-out. Insert the few additions you found. You may now wish to split "ALLCHEM.EXL" into three smaller separate files ("INORG(anics)", "ORGANICS", and "STAINS(indicators)") with the EDIT and SELECT features of Excel*. This can easily be done as the data in the "REQUIRED" field indicates in which of these three files the record belongs! (It may be preferable to keep two or three separate inventories if organics or stains/indicators are routinely stored in different areas from inorganics.)

Although it is tedious, enter the amounts-on-hand from your inventory. This is a prerequisite for an organized chemical stockroom. By now, the data base(s) will contain far fewer entries, and will probably show the presence of several chemicals you were unaware you had.

**CHEMICAL SAFETY**:

One feature of this data base is that it contains a wealth of chemical safety and chemical stock organization information. This information has been culled from many sources. Some of it has been elaborated on and, if anything, errors are made on the side of excessive conservatism.

For those wishing more information about the safety categories, it is suggested you obtain and study the publications listed in the bibliography. The hazard color codes were developed by the Fisher Scientific. The main purpose of the color codes is to act as a visual warning to teachers and students and indicate the major safety factor of each chemical. The codes are also a grouping designation for setting up a chemically-safe layout for your stockroom.

It is suggested that every chemical container in your stockroom be color coded. This can be easily and inexpensively done with self-adhesive colored paper labels which are available in any office supply store. This can also be done by wrapping a band of colored tape around the circumference of the container if you have a source for the required five colors. The color codes, as used in this data base are as follows:

**RED**.....flammability and/or potential explosive hazard. These chemicals should be stored in a safety cabinet.

**YELLOW**.....reactivity/oxidizing hazard. These chemicals are either highly reactive in the presence of certain other chemical or are strong oxidizers. They should be stored separately from other chemicals.

**WHITE**.....contact/corrosion hazard. These chemicals are corrosive, either to objects near them or to human flesh. They should be stored in ventilated corrosion-proof locations.

**BLUE**.....health hazard. This color code is a catch-all for any chemical that does not fall in the above categories, yet carcinogens, suspected carcinogens, strong irritants, and even chemicals with noxious odors. The color does not infer any degree of danger, but just that a danger does exist. These chemicals should be stored in an area securable by lock and key.

**GREEN**.....relatively non-harmful. These chemicals are not believed to be particularly dangerous. This is not to imply that they could not be misused, and therefore, cause harm. None is characterized by the above groups.

**DATA BASE CATEGORIES**:

**REQUIRED**...This category is where you can enter either an "X" for chemicals that are required for your science programs, or leave the category empty for supplemental chemicals. You could also code this entry to indicate which course requires the chemical (ie. "B" for biology or "C" for chemistry.) These entries can be very useful as a guide to which chemicals must be ordered first, before your tight budget allotment runs out. (At the moment, this category, in the "ALLCHEM.EXL" file, contains an "i", "o", or "s" to help subdivide it into three smaller files for inorganics, organics, and stains/indicators, as mentioned above.

**NAME**...although the contents of this category are obvious, the actual entry system may not be. The Stock naming system has been used, as it seems to be the system of choice in most modern textbooks. For those wishing to use the older system (ie. ferric for Iron(III)), or perhaps include both systems as a cross-reference, it is an easy matter to copy those records, change the names, and re-sort the data base. (A category field for SYNONYMS could easily be added, if you desire. It can be used for this or to enter common names.)

**GRADE**...in general, this category contains abbreviated purity grades. However, in some cases, the actual content of this category has been stretched, in the interest of clarity. In some instances, degree of purity is of no importance in a school laboratory, and this category can be deleted from any reports. In most cases, only one grade (usually the purest) is included. If this does not match what you have then change the entry.

**FORM**...this is a convenience category for use by the non-chemist, to distinguish between different forms of the same chemical (ie. aluminum in stock as a sheet, wire, powder, etc.). It is necessary for inventory and ordering purposes. In many cases, one chemical is included in several forms or sizes.

**HAZARD**...the safety color codes mentioned in the safety section are already entered. For any additional chemicals you enter, if you cannot find reliable safety information, either leave this category blank, or make an entry, erring on the side of excessive caution. Again, the references in the safety section will be invaluable in choosing the proper color code.

**GROUP** (I or O)...this is used to subdivide all the chemicals into inorganic and organic categories, if additional separation is desired within the color divisions. Within these divisions, the chemicals can be alphabetized. You may wish to use small self-adhesive white labels and label each chemical container "INORGANIC" or "ORGANIC", if desired. Definitely use a permanent non-water-soluble ink.

There are some special groupings, however:

1. Ammonium nitrate must be stored separate from other chemicals.

2. Liquid acids should be stored in a dedicated acid cabinet.

**NOTE**: nitric acid should be separated from the other acids.

3. Flammables should only be stored in flammable storage cabinet.

**LOCATION**...most school's chemical stockroom contain a combination of stock shelves, dedicated acid cabinet(s), flammables safety cabinet(s), drawers, and perhaps even lockable cabinets for the storage of second (or more) bottles of chemicals already open on the shelves. This leads to the obvious categories of "SHELVES", "ACID CAB., "FLAMMABLES", "DRAWER", and "OVERFLOW". These categories (or equivalents) will fit your stockroom storage locations. (Only have one bottle of each chemical per grade/form open and available for use at a time. Keep duplicates locked up!)

**SUGG. AMT**...most science textbook publishers include a listing of the required materials and the suggested amounts per class in the teacher's edition of the text. Multiplying those amounts by the number of classes using the textbook will yield a crude approximation of the amount of each item that you are likely to consume each year. This can be a very helpful figure to have on hand, as you plan your beginning-of-the-year chemical order, using your previous end-of-the-year inventory amounts.

**AMT. O/H**...enter your current inventory amounts here. You have the option of letting this category always be the current year's inventory, and renaming the field to include the year. You can also add more fields after the AMOUNTS-ON-HAND column for additional years. This will be useful in showing trends in your ordering (if you need such information) and chemical usage in the department. Upon re-inventorying (you do inventory at least once each year??...the inventory report print-out eases much of the 'pain'), simply enter the current figures in the data base.

**INVENTORY**...this category has a standard default value of an empty line. The category is used in the INVENTORY report format to allow you to enter the actual amount you find on hand, as you run your inventory. It also provides the printed line on the LABEL report format.

**CAS NUMBER**...the American Chemical Society, through its Chemical Abstracts Service has developed a precise and unique identifying number for most chemicals that are likely to be found in a secondary chemistry laboratory. This CAS number has no chemical significance and is strictly for identification. The number CAN be used to identify chemicals to meet the requirements of OSHA. Some school systems require that all chemicals used be identified, so the CAS number has been included. Many substances, such as plant and animal extracts have not yet been given registry numbers.

The following three categories are copied verbatim from the National Fire Protection Association three part coding system for health, flammability, and reactivity. The definitions of these categories have been paraphrased from the "Fire Protection Guide to Hazardous Materials", 9th (1986) edition, and the "National Fire Codes - 1985, Sections 49 and 325M". IT MUST BE NOTED that the coding system is only accurate under FIRE CONDITIONS, and thus may NOT portray realistic hazards in a chemistry laboratory! However, the coding is essential for firefighters and safety officials if an emergency occurs. Many of the chemicals in a typical school have not yet been assigned NFPA ratings, or only have partial ratings, and thus many of the chemicals are shown with no NFPA ratings.

**HEALTH**..."In general, the health hazard in fire fighting is that of a single exposure which may vary from a few seconds up to an hour. The physical exertion demanded in fire fighting or other emergency conditions may be expected to intensify the effects of exposure."

**H0**...under fire conditions no hazard beyond ordinary combustibility.

**H1**...upon exposure will cause irritation but no lasting injury.

**H2**...could cause temporary incapacitation or residual injury unless prompt medical treatment is given.

**H3**...short exposure couldcause serious temporary injury even though prompt medical treatment were given.

**H4**...short exposure could cause death or major injury even though prompt medical treatment were given.

**FLAMMABILITY**..."Susceptibility to burning is the basis for assigning degrees within this category. The method for attacking the fire is influenced by this susceptibility factor."

**F0**...materials that will not burn.

**F1**...materials that must be preheated before ignition can occur.

**F2**...materials that must be moderately heated before ignition can occur. The material can be cooled below its flash point.

**F3**...materials which can be ignited under almost all ambient temperature conditions.

**F4**...very flammable gases or volatile flammable liquids.

**REACTIVITY (STABILITY)**..."The assignment of degrees in the reactivity category is based upon the susceptibility of materials to release energy either by themselves or in combination with water. Fire exposure was one of the factors considered along with conditions of shock and pressure."

**R0**...materials which (in themselves) are normally stable.

**R1**...materials which may become unstable at elevated temperatures and pressures or which may nonviolently react with water.

**R2**...materials which (in themselves) are unstable and readily undergo violent chemical change and/or rapid release of energy but do not detonate. They may also react violently with water.

**R3**...materials which(in themselves) are capable of detonation or of explosive decomposition but which require a strong initiating energy source or elevated temperature confinement.

**R4**...materials which (in themselves) are readily capable of detonation or of explosive decomposition or explosive reaction at normal temperatures and pressures.

**FORMULA**...as chemists, you understand this one. Notice the distinction between different hydrated states!

Obviously, many other fields may be added, as needed for your own stock room(s). These fields might include: ROOM #, SHELF #, EXTRA O/H, DISPOSAL INFO, SYNONYYMS, or any other category for which you have a need.

**OTHER REPORTS**:
The printing capabilities of Microsoft Office* are controlled by your printer, the fonts you have available, and your wishes. It is not possible for the report formats suggested below to meet the capabilities of every possible printer that may be in your school! You may have to alter the width, layout, font, or size of of printed fields of the report to fit the

capabilities of your printer. This is not difficult, and is clearly described in the Microsoft Office* manuals and in other publishers' generic Word* or Excel* instruction books. This will allow customized reports that may indeed better fit your needs!

The variety of reports you can generate from the "ALLCHEM.EXL" data base (or any of its sub-files) is limited only by your needs or imagination. The report formats that we suggest that you create and the fields that you should include are:

a. a listing of all fields with entries ("ALL CHEMICALS"). To fit on a printed page, you will have to use a small font. Minimum included categories should be: NAME; GRADE; FORM; HAZARD; FORMULA; CAS #; HEALTH; FLAMMABILITY; REACTIVITY.

b. a form for your initial/annual inventory ("INVENTORY FORM"). Minimum included categories should be: NAME; FORMULA; GRADE; FORM; LOCATION; AMT. O/H; INVENTORY (which generates a blank line to write in your data).

c. a stock room chemical locator report intended to assist the non-chemist who needs supplies ("LOCATOR LIST"). Minimum included categories should be: NAME; FORMULA; GRADE; FORM; LOCATION.

Some other suggested reports might include listings of chemicals sorted by their potential hazard or a second inventory sheet sorted not only alphabetically, but also by group and/or location. This has proved to be a very helpful report while conducting an inventory.

Should you encounter difficulty is setting up these report formats (or have any problem using Word* or Excel*) you can receive outstanding assistance from Microsoft Corp. The Product Support service for Word is 1-(206) 462-9673 and the Fast Tips number for Word is 1-(800) 936-4100. The corresponding numbers for Excel are 1-(206) 635-7070 and 1-(206) 635-7071. Both services are open M-F, 6:00 AM to 6:00 PM Pacific Standard Time.

**LABELS:**

There are two files that it is suggested that you set up on your disk or hard drive. These will be Word files needed to print either replacement labels or inventory labels for your chemical containers. The label on a chemical bottle will frequently become obliterated, stained, torn, or fall off. Word has the capability to mailmerge Excel data into a self-adhesive label. The program already contains the data on all Avery labels. If you follow the on-line help on Labels and on Mail merge, you should have no problem preparing the labels suggested below.

There are two label sizes that have been found to be most helpful. A large 2" x 4" label is perfect for replacement bottle labels (Avery #5163) and a small 1" x 2 5/8" label (Avery #2160) is convenient for suplemental or inventory labeling on each bottle.

(Obviously, you can design a format to fit any label that you might have.) If you pick an appropriate type size, both labels have room for the vital information (name, formula, CAS and NFPA codes, group, and hazard color). Additional information might also include date-of-purchase, location, or even shelf number.

The easiest way to print labels is to set up a new Excel* workbook called “LABELS”. Copy the “ALLCHEM” record for each item that you need a label to this new workbook. Open a new Word document and choose “Envelopes and labels” from the Tool menu. Set up a Mail Merge format for the label. Read your manuals or use the on-line help on both Labels and Mail Merge to find specific tips. If you do not care for the default optioh font, Choose New Document instead of Print and choose your own choice of font and point size.

**ERRATA, ETC.**:
As with any large data base, there are bound to be a minimal number of errors, despite the fact that all entries have been diligently checked. The author would appreciate hearing from any users that have discovered errors. In exchange for this information, the author will supply the first submitted of each error, with a full list of all corrections, discovered as of that date. Submit any discovered errors in writing to Laboratory Safety Workshop and they will be forwarded to the author. All other users can receive this information upon receipt of a self-addressed stamped envelope and a request for the "ChemTrack" errata report. (The "NOTES.DOC" file will include the date that all corrections reported to me were made in your files!)

**DISCLAIMER**:
The materials contained in this data base have been carefully compiled from Material Safety Data Sheets (MSDS) and other sources believed to be reliable. It is believed the safety information represents the best opinions on the subjects covered as it relates to use in elementary or secondary schools. The safety information in this data base is intended only to supplement safe practices in a school laboratory, and does not purport to specify any legal standards or to represent the policy of any regulatory body or professional association. No warrantee, guarantee, or representation is made by the author or Laboratory Safety Workshop as to the accuracy or sufficiency of the information contained herein, and we assume no responsibility in connection therewith. The safety information in this data base is intended to provide some basic guidelines for the safer use and storage of laboratory chemicals in a school setting. It cannot be assumed that all necessary warnings and precautionary measures are contained in this data base. Additional sources should be consulted. These include Material Safety Data Sheets (MSDS) or standard texts. Other measures may be required. Users of this data base should consult local, state, and federal laws and regulations and their legal counsel prior to initiating any safety activities.

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