LABORATORY CHEMICAL HYGIENE & SAFETY PLAN

[INSERT FACILITY NAME]

[INSERT ADDRESS]

[INSERT DATE]

OFFICE OF ENVIRONMENTAL HEALTH AND SAFETY

LOS ANGELES UNIFIED SCHOOL DISTRICT

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Certification of Program Implementation and Annual Review/Updates

By signing and dating below the Chemical Safety Coordinator and Site Administrator certify that this Laboratory Chemical Hygiene and Safety Plan is accurate and effectively provides guidelines for the safety of employees and students in school science laboratories.

Site Administrator

_____

Signature Printed Name Date

Chemical Safety Coordinator

_____

Signature Printed Name Date

By signing and dating below, the Chemical Safety Coordinator certifies that the required annual review (and update, if needed) of the Laboratory Chemical Hygiene and Safety Plan has been completed, and that this document continues to be accurate and to effectively provide for the chemical safety of employees and students in the school science laboratory.

Sign Name	Print Name	Date	Updated?(Y/N)

I. INTRODUCTION

LAUSD is committed to providing a healthy and safe working environment for the students and staff, free from recognized hazards in accordance with:

- Title 8, CCR, Section 5191, "Occupational Exposure to Hazardous Chemicals in Laboratories," (Appendix A) which became effective October 1, 1991
- California Education Code Sections 49340-49341
- Title 8, CCR, Section 5194, Hazard Communication Standard

The Laboratory Chemical and Hygiene and Safety Plan (CHSP) is a written program for ensuring the safety of the LAUSD educational community from adverse health and safety hazards associated with exposure to potentially hazardous chemicals and must be readily available to all staff members working with hazardous chemicals.

The CHSP manual describes:

- recognition and classification of hazards, including potential effects of physical and health hazards associated with hazardous chemicals in laboratories;
- standard operating work procedures, including safe work practices, safe equipment use, safe handling and storage of chemicals, and posting warning signs and labels;
- minimization and control of hazards by engineering and administrative controls, use of personal protective equipment, environmental monitoring, and appropriate response to accidents;
- proper labeling and disposal of hazardous materials and wastes; and
- recordkeeping requirements of chemical inventories, employee safety training, monitoring results, and medical examinations.

The CHSP represents best practices and provides the information for proper use and handling practices and procedures to reduce and control hazards associated with school laboratories. It is essential that all elements of the CHSP are implemented so that we can provide a healthy and safe learning environment for our students and staff.

For additional information on any chemical safety topic or to report any unsafe working condition, please contact OEHS at **213-241-3199.**

II. RESPONSIBILITIES

A. Principal/Site Administrator

Site Administrators at secondary schools with science or chemistry laboratories are required to appoint a Chemical Safety Coordinator (CSC) from certificated staff. Responsibilities of the CSC include assisting the Site Administrator in complying with hazardous material management, conducting employee training, and implementation of CHSP to ensure laboratory safety protocol. The Principal/Site Administrator is responsible for ensuring implementation of the Chemical Hygiene & Safety Plan (CHSP).

B. Chemical Safety Coordinator

The Chemical Safety Coordinators (CSC) at secondary schools, occupational/skills centers, and facilities are assigned by the principal/site administrator as the designated contact person for the CHSP. The Chemical Safety Coordinator has the responsibility to ensure the following:

1. Employees receive appropriate health and safety training upon initial assignment to a work area where chemicals/ hazardous materials are present and prior to assignments involving new or different exposure situations.
2. Employees have access to the CHSP and other reference materials (e.g. Safety Data Sheets).
3. Employees adhere to safe work procedures which are prescribed in the CHSP.
4. Health and safety inspections are performed and appropriate records are maintained.
5. The school is in compliance with current legal requirements concerning chemicals/hazardous materials and ensures that the school CHSP is in accord with those requirements.

C. Science Teachers

School science teachers (with an assigned work location including a laboratory), have the responsibility to:

1. Plan and conduct each laboratory operation/activity in accordance with the District's CHSP;
2. Maintain an annual inventory of laboratory chemicals and their Safety Data Sheets (SDS);
3. Conduct regular chemical hygiene, safety, and housekeeping inspections, including routine inspections of emergency equipment (i.e. eyewash/shower stations), and maintenance of appropriate records; and
4. Observe and instruct students in proper chemical hygiene and safe work practices and procedures.

D. Office of Environmental Health and Safety

The District's Office of Environmental Health and Safety (OEHS) has the responsibility for developing a program to implement the CHSP requirements.

These responsibilities require the OEHS to:

1. Work with school principals, chemical safety coordinators, and teachers to help implement the school laboratory chemical hygiene & safety plan;
2. Maintain a list of chemical safety coordinators in schools and work with the CSCs to monitor procurement, usage, and disposal of chemicals used in the school laboratory programs;
3. Provide technical assistance to schools and employees on the CHSP;
4. Regulate the use of chemicals for general school laboratories;
5. Determine the need for personal protective equipment beyond what is specified for general laboratory use;
6. Conduct annual review and revision of the CHSP; and
7. Provide training to staff as to the requirements listed in the Chemical Hygiene and Safety Plan.

III. EMPLOYEE INFORMATION AND TRAINING

A. Chemical Hygiene & Safety Training Program

The goals of the District's chemical hygiene and safety training program are to ensure that all individuals at risk are adequately informed of:

1. The physical and health hazards associated with chemicals.
2. The hazardous materials and waste present or generated in the laboratory.
3. The proper procedures to minimize risk of exposure.
4. The proper response to spills.

All school staff whose assigned work locations include a laboratory area shall participate in an ongoing chemical hygiene and safety training program. This includes custodial and maintenance personnel.

The scope of training that an employee receives is determined by the scope of his/her work assignment in the laboratory. For example, training for science teachers would include safe handling of chemicals during experimental procedures. Training for custodians would include procedures for performing necessary cleaning activities in the presence of laboratory chemicals. The training approach will be directed to classes or groups of hazardous chemicals, rather than to the specific characteristics of many individual chemicals.

The general content of the training and information program will include the following:

1. Chemical Hygiene and Safety standards, including the contents of Section 5191 of the General Industry Safety Orders of Title 8, California Code of Regulations.
2. Location and contents of the School's Laboratory Chemical Hygiene and Safety Plan.
3. Safe work practices for handling hazardous materials and transporting them within the school.
4. Hazards of chemicals used in the school laboratory, including permissible exposure limits (PELs) or other exposure limits.
5. Labeling and storage practices including information on interpreting labels, as outlined in the District's Hazard Communication Program.
6. Procedure for requesting a chemical evaluation and authorization to obtain and use chemicals which are not previously approved for school laboratory use.
7. Information on concepts necessary to understand regulatory limits, such as PEL, threshold limit value (TLV), lethal dose (LD) 50, and routes of entry.
8. Location and content of Safety Data Sheets for chemicals at the school site including reference materials related to the chemical/physical properties, safe handling/storage,

and disposal of hazardous materials/waste.

9. Location and proper use of available Personal Protective Equipment.
10. Signs and symptoms associated with an exposure to hazardous chemicals associated with the laboratory.
11. Methods to detect the presence or release of hazardous contaminants (e.g., air monitoring).
12. Proper response and reporting procedures for chemical releases/spills and evacuation.

The training program will be an ongoing process, consisting of an initial orientation for new employees and an annually to the science staff thereafter. The Chemical Safety Coordinator will document and maintain records of the ongoing training received by employees (see Health and Safety Training Form in Appendix B).

B. Safety Data Sheets

The most current Safety Data Sheets (SDS) received for all laboratory chemicals should be kept in the Science Chemical Safety Data Sheets binder and be readily accessible to employees. Appendix C contains a sample SDS.

These SDS's are available electronically on the OEHS website accessible through the LAUSD.net website.

C. Signs/Drawings

Prominent signs/drawings must be clearly posted in all laboratories, as well as in chemical preparation and chemical storage areas. These signs/drawings have to clearly state the following:

1. Exits and evacuation routes.
2. Location of safety showers, eyewash stations, and other safety equipment.
3. Location of fire extinguishers/blankets and first aid kits.
4. Proper identification of used chemical/waste disposal containers.
5. Floor plan drawings of the laboratory.
6. Location of equipment workbenches and storage pattern for all chemicals contained in the storeroom.

IV. LABORATORY HAZARD RECOGNITION AND CLASSIFICATION

Laboratory operations are inherently hazardous and they can be classified as either a physical hazard or a health hazard. Physical hazards include fire, explosion, and dangerous chemical reactions. Health hazards include routes of entry into the human body in sufficient quantity, signs and symptoms of exposure, ranging from minor skin

irritation to death. Substance toxicity depends greatly on its phase (e.g., gas, liquid, or solid), route of entry, duration of exposure and the quantity which is absorbed into the body.

A substance can have acute or chronic health effects. Acute effects produce an immediate symptom, usually from a single dose at high concentration. Chronic effects cause adverse health effects after long-term exposure to the chemical(s).

There are three main routes by which chemical substances can enter the body:

- Inhalation by breathing dusts, fumes, mists or vapors.
- Ingestion by eating or drinking with contaminated hands or in a contaminated laboratory.
- Absorption through the skin or eye by contact with liquid, dusts, fumes, mists or vapors. Absorption by accidental puncture of the skin may occur with sharp objects or needles.

A. Physical (Safety) Hazards

1. **Combustible liquid**: Any pure liquid having a flash point at or above 100 degrees Fahrenheit (100 For 37.8 degrees Celsius), but below 200 F (93.3 C), except when a mixture has components with flashpoints of 200 F (93.3 C), or higher and the sum of the components makes up 99 percent or more of the total volume of the mixture.
2. **Compressed Gas**: (a) A gas or mixture of gases, in a container having an absolute pressure exceeding 40 psi at 70 F (21.1 C); or (b) A gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130 F (54.4 C) regardless of the pressure at 70 F (21.1 C); or (c) A liquid having a vapor pressure exceeding 40 psi at 100 F (37.8 C).
3. **Explosive**: A chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.
4. **Flammable**: A chemical that falls into one of the following categories:
    a. **Aerosol, flammable** means an aerosol that yields a flame projection exceeding 18 inches at full valve opening, or a flashback (a flame extending back to the valve) at any degree of valve opening.
    b. **Gas, flammable** means a gas at ambient temperature and pressure that forms a flammable mixture with air at a concentration of 13 percent by volume or less; or a gas at ambient temperature and pressure that forms a range of flammable mixtures with air greater than 12 percent by volume, regardless of the lower explosive limit.
    c. **Liquid, flammable** means any liquid having a flashpoint below 100°F (37.8 C), except any mixture having components with flashpoints of 100°F (37.8 C) or higher, the total of which make up 99 percent or more of the total volume of the mixture.

d. **Liquid Combustible** are those with flash points at or above 100°F (37.8 C), but below 200°F (93.3C)

e. **Solid, flammable** means a solid (other than a blasting agent or explosive) that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious hazard.

5. **Organic Peroxide**: An organic compound that contains the bivalent 0-0-structure and which may be considered to be a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms has been replaced by an organic radical. All organic peroxides are extremely flammable and sensitive to heat, friction, impact and light as well as to strong oxidizing and reducing agents.
6. **Oxidizer**: A chemical other than a blasting agent or explosive that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases.
7. **Unstable (reactive)**: A chemical which is in the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shock, pressure or temperature.
8. **Water-reactive**: A chemical that reacts with water to release a gas that is either flammable or presents a health hazard.

B. Chemical Health Hazards

1. **Carcinogen:** A chemical is considered to be a carcinogen if it is capable of causing cancer. Carcinogens are listed by the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP), or the Occupational Safety and Health Administration (OSHA). Lists of carcinogens are updated and maintained by OEHS. Currently, the District does not use any chemicals identified in the above referenced lists.
2. **Corrosive**: A chemical that causes visible destruction of, or irreversible alterations in, living tissue by chemical action at the site of contact.
3. **Highly toxic**: A substance with the potential of injury by direct chemical action with body systems falling within any of the following categories:
   a. A chemical that has a median lethal dose (LD50) of 50 milligrams or less per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.
   b. A chemical that has a LD50 of 200 milligrams or less per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between two and three kilograms each.

c. A chemical that has a median lethal concentration (LC50) in air of 200 parts per million by volume or less of gas or vapor, or 2 milligrams per liter or less of mist, fume, or dust, when administered by continuous inhalation for one hour (or less if death occurs within one hour) to albino rats weighing between 200 and 300 grams each.

4. **Toxic**: A substance with the potential of injury by direct chemical action with body systems falling within any of the following categories:

   a. A chemical that has a LD50 of more than 50 milligrams per kilogram but not more than 500 milligrams per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.

   b. A chemical that has a LD50 of more than 200 milligrams per kilogram but not more than 1,000 milligrams per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between two and three kilograms each.

   c. A chemical that has a LD50 in air of more than 200 parts per million but not more than 2,000 parts per million by volume of gas or vapor, or more than two milligrams per liter but not more than 20 milligrams per liter of mist, fume, or dust, when administered by continuous inhalation for one hour (or less if death occurs within one hour) to albino rats weighing between 200 and 300 grams each.

5. I**rritant**: A chemical, which is not corrosive, but which causes a reversible inflammatory effect on living tissue, skin or eyes by chemical action at the site of contact.

6. **Sensitizer**: A chemical that causes a substantial proportion of exposed people or animals to develop an allergic reaction in normal tissue after repeated exposure to the chemical.

C. Chemical Classes and Their Effects

The following are examples of some of the classes of chemical substances and their potential health effects:

1. **Acids**: Acids: Acetic, hydrochloric, nitric, and sulfuric acids are corrosive to skin and mucous membranes.

2. **Alcohols**: Methanol induces blindness via ingestion or prolonged inhalation. Ethyl alcohol depresses central nervous system by ingestion or prolonged inhalation.

3. **Aldehydes and ketones**: Ethanol and acetone are irritants and have narcotic effects via inhalation, absorption, or ingestion.

4. **Aliphatic**: Acetylene, methane and ethane are central nervous system (CNS) depressants and asphyxiants. Some are neurotoxins.

5. **Alkalies**: Sodium and potassium hydroxides, ammonium hydroxide can cause severe tissue burns and bronchial spasms.

6. **Asphyxiants**: Reduces the oxygen carrying capacity of the blood (e.g., carbon monoxide) or displaces atmospheric oxygen (e.g. carbon dioxide).
7. **Compounds of sulfur, phosphorus, and nitrogen**: Sulfur dioxide, sulfuric acid, phosphoric acid and nitrogen oxides are corrosive to the skin and destructive to respiratory tissues.
8. **Halogens**: Compounds of bromine are corrosive and highly irritating to tissues.
9. **Metal fumes/vapors**: Metal fumes and vapors can cause systemic poisoning via ingestion and inhalation. Toxic effects are compounded with prolonged exposure.

It is important to note that while some chemical families have similar toxicological characteristics, the vast majority of chemicals have their own unique toxic properties.

V. STANDARD OPERATING PROCEDURES

A. General Safe Work Practices

1. Know the safety rules and procedures that apply to the work that is being performed. Determine the potential hazards (e.g., physical and/or health) and appropriate safety precautions before beginning any new operation. Students should be familiarized with the potential hazards of various chemical substances.
2. Identify unsafe conditions and actions so that corrective actions can be made as soon as possible.
3. Develop and encourage safe work practices and procedures; avoid unnecessary exposure to chemicals.
4. Thoroughly wash areas of exposed skin before leaving the laboratory. Be familiar with first aid procedures, eye wash stations, and emergency showers.
5. Eating, drinking, smoking, gum chewing, or application of cosmetics in laboratory is prohibited. Food and drinks must not be kept in cabinets, on countertops, or bench tops. Laboratory glassware or utensils must not be used for food or beverages.
6. Do not allow practical jokes or other inappropriate behavior which might confuse, startle, or distract another person and cause an injury.
7. Personal apparel:
    - Confine long hair and loose clothing.
    - Avoid wearing open-toed shoes to protect from chemical spills or broken glass.
    - Wear and apron or lab coat to protect from corrosive or staining chemicals.
    - Students and the instructor in the proximity of an experiment should wear safety goggles. Students should be relocated from seats near the demonstration table even if the possibility of injury is remote.
8. Working alone in the laboratory is not recommended.
9. Never leave an experiment unattended.

10. Do not use mouth to suction for piping or starting a siphon.
11. Caution must be used when smelling the contents of a test tube or other container. Students must be instructed first, to perform this task. If instructed, the students should proceed to wave some of the escaping vapors toward themselves. The container should never be brought up to the nose. Students must be constantly reminded that chemicals should never be tasted, smelled, or touched unless such action is approved by the instructor and conducted in the proper manner.
12. Housekeeping: There is a definite relationship between safety performance and orderliness in the laboratory. When housekeeping standards fail, safety performance inevitably deteriorates. Good housekeeping practices include but are not limited to the following:

    - Coats and books must be kept in designated places. Work areas must be kept clean and free from obstructions.
    - Cleanup must follow the completion of any experiment or at the end of each day.
    - Waste must be deposited in the appropriate receptacles.
    - Minor chemical spills must be cleaned up immediately and disposed of properly. Immediately notify the instructor prior to initiating a cleanup procedure.
    - Floors must be cleaned regularly; accumulated dust and other assorted chemicals pose respiratory hazards.
    - Access to exits, emergency equipment, controls, and such must never be blocked.

A. Safe Equipment Use

1. Safety equipment and supplies (goggles, aprons, face shield, fire blanket, fire extinguisher, eyewash, spill pillow, safety shields, fume hood and, if appropriate, deluge shower) must be available and functional according to manufacturer's guidelines.
2. Care must be taken to give proper instruction and caution regarding the use of polyethylene squeeze bottles and dispensing bottles, especially if the bottles contain flammable liquids. In this case, bottles must not be used around open flames.
3. Equipment and glassware:

    - Use equipment only for its designated purpose.
    - When working with glassware, remove "frozen" stoppers safely. Discard broken or chipped glassware.
    - Use a cork ring with round-bottom flasks.
    - Do not touch heated glass until it has had time to cool.

4. When inserting glass tubing into rubber stopper or tubing, observe the following precautions:

    - Never attempt to insert glass tubing having a jagged edge. Any jagged edge

should be beveled with a file, wire gauze or emery cloth; and if possible fire-polished.
- Use water, soap solution, glycerin, or petroleum jelly as a lubricant and gently insert the tube into the hole with a twisting motion. Always aim the glass tubing away from the palm of the hand which holds the stopper or rubber tubing.
- Expand the rubber stopper, using a cork borer prior to insertion. Lubrication is still necessary.
- Always hold glass tubing as close as possible to the part where it is entering the rubber stopper.
- Decrease the chance of injury resulting from broken tubing through the use of a cloth wrapped around the hand or the tubing at the point of contact with the hand.
- Do not grasp the thistle tube by the bowl when inserting a thistle tube into a rubber stopper. Grasp only by the tubing as close as possible to where the glass tubing enters the stopper. Always lubricate the tube and use a twisting motion when applying pressure.

5. Glass wool and steel wool must be handled carefully to avoid getting splinters in the skin or eyes.
6. Table tops must be protected from extreme heat by using non-asbestos insulation under burners or heated objects.

B. Safe Handling and Storage of Chemicals

Safe chemical storage areas should be established as follows: (See Appendix F for a specific checklist):

1. Ensure all chemicals are correctly and clearly labeled. To avoid contamination, never return used or contaminated reagents to their original containers.
2. Unlabeled containers and chemical waste must be disposed of promptly, by using the appropriate procedures. Materials, including chemicals that are no longer needed, must not accumulate in the laboratory. Contact the Office of Environmental Health and Safety when excess chemicals have accumulated for disposal.
3. Only chemicals that are used should be kept in storage. Chemicals must be appropriately disposed of when their shelf-life has expired or when no longer in use.
4. Do not “stockpile” chemicals. Stock only the amount of chemicals which can be consumed within a year.
5. Review the hazards and personal protective equipment required before using any chemical. Study the precautionary label and review its contents frequently before using any chemical product.
6. Store all chemicals by compatibility groups (see Appendix D, Table 1: Chemical Shelf Storage Identification Chart and Table 2: Storage for Compatibility Categories).
7. Avoid storing chemicals on shelves above eye level and/or on the floor.

8. Ensure neutralizing chemicals, spill kit, absorbent and other spill control materials are readily available.
9. Secure compressed gas cylinders upright to the wall, with valve protection caps in place. Flammable gases should be separated from oxidizing gases by a one hour fire wall or at least 25 feet (7.5m).
10. Appropriately label storage cabinets for corrosive chemicals (separate for acids and for bases).
11. Use an approved storage cabinet for flammables.
12. Secure shelving units/storage cabinets to walls or floor to prevent tipping of entire sections.
13. Equip shelving with lips to prevent products from rolling off the shelves.
14. Label storage areas and cabinets to identify the hazardous nature of the products stored within.
15. Have Class ABC fire extinguishers available in chemical storage areas in working order.
16. Keep sources of ignition away from the chemical storage area.
17. Provide marked exits from a chemical storage area.
18. Assure that chemical storage cabinets are locked when not being accessed for laboratory use.
19. Chemicals should be secured using approved storage units.
20. Transfer chemicals only in approved and secure storage vessels.
21. Do not walk with an open chemical container – cap all containers before moving out of your work area.
22. Transport of chemicals outside the laboratory area must be by an authorized and trained person, and in a spill proof rigid storage container.

C. Working Safely with Flammability Hazards

Flammable materials should be stored in an approved flammables storage cabinet. Flammables outside a cabinet should be in safety cans. Because these materials are used in laboratory operations, the following rules should be observed:

1. Do not use an open flame to heat a flammable liquid or to carry out a distillation under reduced pressure.
2. Use an open flame only when necessary and extinguish it when it is no longer needed.
3. Before lighting a flame, remove all flammable substances from the immediate area. Check all containers of flammable materials in the area to ensure that they are tightly closed.
4. Notify other occupants in the laboratory in advance of lighting a flame.

5. When volatile flammable materials are present, use only non-sparking electrical equipment.
6. Exercise care so that long hose connections between burners and gas outlets are protected from pinching or pulling. Extinguish burners when walking away from the area.
7. Ensure that appropriately rated and charged fire extinguishers are present if flammable chemicals are used.

D. Working Safely with Cryogenic Hazards

The primary hazard of cryogenic materials is their extreme coldness. They and the surfaces they cool can cause severe burns if allowed to contact the skin. Gloves and a face shield may be needed when preparing or using some cold baths.

Never cap or use a solid stopper in a bottle containing dry ice or cryogenic liquids. Always loosely plug with cotton or use a stopper with a hole.

Neither liquid nitrogen nor liquid air should be used to cool a flammable mixture in the presence of air because oxygen can condense from the air, leading to an explosion hazard.

Appropriate dry gloves must be used when handling dry ice, which should be added slowly to the liquid portion of the cooling bath to avoid foaming over. **Personnel should avoid lowering their head into a container with dry ice (i.e. Ice chest) as: carbon dioxide is heavier than air, and suffocation can result.**

Dry ice can be preserved for short periods of time by wrapping the ice in several layers of newspaper to insulate and reduce rate of sublimation. The use of absorbent, styrofoam beads or other particulate insulation material and a styrofoam chest will further extend the preservation of dry ice. Dry ice must be handled by faculty only. Faculty must avoid contact with the skin and eyes.

E. Reactive Chemicals and Explosives

Demonstrations involving reactive substances must be approved in writing by OEHS prior to use and must be arranged to shield both pupils and teachers from any danger. The teacher and students should use goggles, face shields and safety shields for protection. The size of apparatus and quantities of reagents used in demonstrations should be consistent with safety. Explosives are not used in the District curriculum. However, it is prudent to identify and dispose of reactive chemicals which may already exist on storage shelves which will not be immediately used.

The Science Safety Handbook for California Public Schools provides lists of explosive and extremely hazardous chemicals (Chapter 7, Table 7.2 and Table 7.3). During chemical inventory, if any unapproved chemicals are found, the containers should **NOT** be touched or moved by teachers or students. OEHS must be contacted immediately at (213) 241-3199 for safe disposal. **Note: the following examples are provided to**

improve scenarios likely to occur in District laboratories.

1. Water reactive products such as sodium metal must be stored under oil.
2. Water must never be added to concentrated acids. To dilute acids, add the concentrated acid, in conjunction with manufacturer's guidelines, to the water. Stir constantly. Use heat-resistant glassware for this procedure.
3. White phosphorus is very explosive and is not recommended for use. It is recommended that red amorphous phosphorus be used as a substitute. Red amorphous phosphorus should be made available for student use only in small quantities. When phosphorus burns, it produces toxic phosphorus pentoxide. Red phosphorus fires are very difficult to extinguish.
4. CSC's and Science Teachers should review the Science Chemicals Approved list, posted on the OEHS website.

F. Warning Signs and Labels

Signs must be posted to identify the location of safety showers, eyewash stations, exits, fire blankets, and fire extinguishers. Extinguishers must be labeled to show the type of fire for which they are intended.

Labels on chemical containers must contain information on the hazards associated with the use of the chemical, identity of the chemical, and name and address of the chemical manufacturer, importer or supplier.

Unlabeled bottles of chemicals must not be opened or moved. Such materials must be disposed of promptly and will require special handling procedures. Contact the OEHS immediately at (213) 241-3199 for safe disposal.

VI. HAZARD CONTROLS

A. General Principles for Hazard Minimization

1. It is prudent to minimize all chemical exposures because few laboratory chemicals are without hazards. General precautions for handling all laboratory chemicals should be observed. All contact with chemicals either through inhalation, ingestion or skin should be avoided.
2. Avoid underestimation of risk. Even for substances with no known significant hazard, exposure should be minimized. One should assume that any mixture will be more toxic than its most toxic component and that all substances of unknown toxicity are toxic.
3. Provide adequate ventilation. The best way to prevent exposure to airborne substances is to prevent their escape into the classroom atmosphere by the use of fume hoods and other ventilation devices. In the absence of such control devices, experiments which generate chemical fumes, dusts, mists or vapors should only be performed in well ventilated areas (i.e., outside if possible).

4. Follow the Chemical Hygiene and Safety Plan (CHSP): The chemical hygiene and safety plan specifies laboratory practices designed to minimize employee exposure to hazardous chemicals. Due to the large number of chemicals that may be stored and used in district laboratories, employees must follow the practices specified in the CHSP in order to minimize their health and safety risks.
5. Observe Permissible Exposure Limits (PELs) and Threshold Limit Values (TLVs): The PELs and TLVs for some chemicals approved for school laboratory are provided in Appendix E. They are also available to employees in the Safety Data Sheet (SDS) for each chemical, and in publications such as Cal/OSHA General Industry Safety Order, Title 8, Section 5155: "Air Contaminants - Permissible Exposure Limits," and the NIOSH Pocket Guide to Chemical Hazards. In a high school laboratory setting, employee exposure to hazardous chemicals is not expected to exceed these levels. However, OEHS will train employees in using this information to minimize exposure.

B. Engineering Controls

1. General laboratory ventilation: This system should provide a source of air for occupant comfort and for input to local ventilation devices; it should not be relied on for protection from toxic substances released into the laboratory. This system should ensure that laboratory air is continually replaced to prevent an increase of the concentration of airborne toxic substances during the day.
2. Fume hoods: Laboratory fume hoods should be used for students at the discretion of the laboratory instructor. Other local ventilation (i.e., canopy hood) can also be used to minimize student exposure. Laboratory fume hoods are useful in many aspects:
    - For activities which might result in the harmful release of toxic chemical gases, vapors or dust.
    - As local ventilation devices to prevent toxic vapors from entering the general laboratory atmosphere.
    - As a physical barrier between instructor/students and the chemical reaction.
    - As an effective containment device for accidental spills of chemicals.
3. The following factors should be remembered in the daily use of fume hoods:
    - Hoods should be considered as backup safety devices that can contain and exhaust toxic, offensive, or flammable materials when the design of an experiment fails and vapors or dusts escape from the apparatus being used. Hoods should not be regarded as a means for disposing of chemicals.
    - Hoods should be checked to ensure it is operational prior to each use. However, hoods should be evaluated at least annually or more if the manufacturer specifications require it.
    - Except when adjustments of apparatus within the hood are being made, the hood should be kept closed: vertical sashes down and horizontal sashes closed. Sliding sashes should not be removed from horizontal sliding-sash hoods. Keeping the face opening of the hood small will improve the overall performance of the hood.

- The airflow pattern, and thus the performance of a hood, depends on such factors as placement of equipment in the hood. Move equipment 5-10 centimeters back from the front edge into the hood to reduce the vapor concentration at the face.
- Hoods are not intended for storage of chemicals. Materials stored in them should be kept to a minimum, preferably on a temporary basis only. Stored chemicals should not block vents or alter airflow patterns. Whenever practical, chemicals should be moved from hoods to cabinets for storage.
- Solid objects and materials (such as paper) should not be permitted to enter the exhaust ducts of hoods as they can lodge in the ducts or fans and adversely affect their operation.
- An emergency plan should always be prepared in the event of ventilation failure, power failure, fire, explosion or other unexpected occurrence.

C. Personal Protective Equipment

1. Know the types of personal protective equipment available and use appropriately.
    - Aprons, laboratory coats, and gloves, made of chemically inert material, should be readily available and worn whenever hazards exist which could damage clothing, cause an injury, or irritate the skin. It is important to caution that most lab coats and aprons are made of substances that will burn.
    - Wear appropriate gloves when the potential for contact with toxic materials exists. Gloves must provide sufficient arm protection to minimize the chance of spilled chemicals making contact with the skin. Gloves must be inspected before and after each use, washed before removal and replaced periodically (at a minimum per the manufacturer's specifications).
    - Remove contaminated clothing or laboratory coats immediately upon significant contamination. Place them into an appropriate container, label, and then properly dispose of the container.
    - Use any other protective and emergency apparel and equipment as appropriate.
2. Approved eye protection devices must be used by all persons performing science activities, or in the proximity of the activity, involving possible splash hazards to the eyes. The use of proper eye protection is a minimum requirement for everyone who enters a chemical laboratory.
    - There is always a danger of splashing chemicals, therefore, goggles or other forms of eye protection that protect both the front and sides of the eyes are mandatory. Side shields offer some protection from objects that approach from the side, but do not provide adequate protection from chemical splashes, which can drip behind glasses.
    - Face shields and goggles may be appropriate when working with glassware

under reduced or elevated pressure and with glass apparatus used in combustion or other high-temperature operations. Face shields alone are not considered adequate eye protection and must be used in conjunction with other eye protection.

- Goggles should be worn when working with compressed gases.
- It is recommended that contact lenses should not be worn in the chemistry laboratory or workplace due to the possible increased absorption of airborne contaminants across the eye tissues (prescription glasses are preferred). In addition, they are never a substitute for eye protection. **If contact lenses are worn, fitted goggles must also be worn at all times.**
- Assure that appropriate eye protection is worn by all persons, including visitors, where chemicals are stored or handled.

3. It is not anticipated that permissible exposure concentrations will be exceeded in a high school laboratory. Therefore, respiratory equipment is generally not required. However, if airborne contaminant concentrations cannot be sufficiently controlled by existing room ventilation or fume hood, experiments should be modified to lower the emission of contaminants before respiratory protection is sought.

D. Administrative Controls

1. Use only those chemicals in quantities whose chemical concentrations can be controlled by the existing ventilation system. Use the least toxic materials and process available to teach the desired experiment. The OEHS website contains the list of approved science chemicals. The list is periodically reviewed to reflect changes brought forth by new toxicology information. Chemicals not identified in Table 1 have toxic hazards which outweigh their instructional value. Therefore, they may not be ordered, stored, or used in school laboratories. If they are found, arrangements should be made with OEHS for proper disposal (see Appendix E). To obtain and use chemicals which are not on the list of approved chemicals, a request should be addressed to OEHS for evaluation and authorization. Criteria taken into account include but are not limited to the existence of an appropriate substitution, application, available engineering controls and length of use.
2. Procurement: Prior to ordering any chemical, the need should be determined based on the desired use of the chemical. The amounts ordered should not exceed what is expected to be used in one year. Orders should be shipped to a central location to minimize the number of employees handling the containers. Before new chemicals are ordered, employees will be trained by Chemical Safety Coordinators in chemical hazards, storage and handling. No chemical should be accepted without a proper label and safety data sheet.

   Purchasing of large (bulk) quantities of chemicals and dispensing into smaller containers is discouraged. Incoming shipments of chemicals should only be opened and transported by qualified science teachers. If possible, keep certain items in the original shipping package, e.g., acids and bases in the special styrofoam cubes. All

chemicals should be dated upon receipt.

3. Stockrooms/Storerooms: Chemical substances should be segregated in a locked and secure area. Stored chemicals should be examined at least annually for replacement, deterioration and container integrity.

   No unlabeled products should be stored anywhere in the storage room. Chemical products in unlabeled containers are considered unsafe for use. Please inform OEHS of any unlabeled containers at your school.

   Stockrooms/storerooms without proper ventilation should not be used as preparation or repackaging areas.

4. Laboratory Storage: **Laboratory rooms should not be used for storage of chemicals**. However, amounts permitted should be as small as practical, preferably only what will be used within that laboratory procedure. Storage on bench tops and in hoods is not advisable. Exposure to heat or direct sunlight should be avoided. Periodic checks should be conducted and unneeded items should be properly discarded or returned to the storeroom/stockroom.

5. Distribution: Chemicals needed for laboratory use will be obtained from the chemical storage room and transferred to temporary-use (secondary) containers, and then taken to the laboratory. Temporary use containers should also be labeled with the chemical name and its hazard class.

6. Inventory: An annual inventory should be made of all hazardous materials and submitted to OEHS; a SDS should be on file for each chemical that is received and used in the normal course of the school year and accessible to employees (General Industry Safety Orders, Title 8, Section 5194 or refer to your Hazard Communication and Your Right to Know manual).

   There should be a continuous up-to-date inventory of all chemicals, including quantity, location, purchase date, shelf-life, and projected disposal date. The inventory should be maintained throughout the school year.

E. Environmental Monitoring

Because moderately or highly toxic substances are not commonly identified as part of a school laboratory program, regular instrumental monitoring of airborne concentrations is not justified or practical. Nevertheless, it is the policy of the District to investigate in a prompt manner all employee-reported incidents in which there is a reasonable possibility of overexposure to a toxic substance.

Circumstances which indicate the possibility of overexposure include but are not limited to: major leak or spill of a hazardous chemical; prolonged and direct skin or eye contact with a hazardous chemical; manifestation of symptoms (headache, rash, nausea, coughing, tearing, irritation of eye, nose, or throat, dizziness) that disappear upon leaving the exposure area and reappear upon returning to it; diagnosis by a doctor of an illness

that can be directly related to an exposure by a specific contaminant; and more than one person in the same laboratory with similar complaints.

If evidence is sufficient, investigation of an incident may result in the decision to conduct a formal exposure assessment.

Monitoring for specific airborne substances shall be performed by OEHS. If the measured concentration exceeds the permissible exposure limits for the substances, science teachers will be notified of the results of the measurement as required by law.

F. Fire Protection and Prevention

The Science Department staff should be familiar with locations and types of fire safety equipment such as fire blankets and portable fire extinguishers. Firefighting equipment should be inspected monthly and be accessible.

All fire doors and doors leading from classrooms into an open corridor should not be blocked open or closed with any devices.

All automatic, self-closing hardware on all doors must be maintained in good working order to maintain the fire protection integrity.

All combustible waste produced in the laboratory should be kept to a minimum, stored in a closed metal waste container, and disposed of daily.

G. Accident and Spill Responses

While the practices and procedures specified in the CHSP will help to minimize risk of exposure to hazardous chemicals, employees must be knowledgeable about what to do should an accident occur. At a minimum, employees should know the location and proper use of emergency equipment in the laboratory area, the location of exits, and emergency procedures. Types of emergencies that should be anticipated are the following:

- thermal and chemical burns
- chemical splash in the eye
- skin contact and irritation by chemicals
- inhalation, ingestion, or skin absorption of chemicals
- cuts and puncture wounds

If an accident, such as a spill occurs and results in the likelihood of a hazardous exposure, the affected employee or student shall be provided immediate medical attention. In case of an EMERGENCY, such as severe burns, DIAL‘911.’

Copies of the school's fire prevention, biological and chemical release, and emergency evacuation procedures should be included as attachments to the CHSP. Refer to your School's Safe School Plan Volume 2 - Emergency Procedures.

1. General Accident Procedures

In the event of a laboratory accident, the following procedures should be used:

a. Report the type and the location of the emergency to the appropriate fire or medical facility. For severe injuries DIAL '911.' Give your name, telephone number, building, and room number. If individuals are involved, report how many, whether they are unconscious, burned, or trapped, whether an explosion has occurred, and whether there has been a chemical or electrical fire. Notify Site Administrator and School nurse. Do not make any other phone calls unless they directly relate to the control of the emergency.

b. Keep clear of the area of a spill, fire or personal injury unless it is your responsibility to help handle the emergency (expressly documented in the "Safe School Plan Volume 2 - Emergency Procedures"). Curious bystanders interfere with rescue and responding emergency personnel, and may endanger themselves.

c. Notify others in the area about the nature of the emergency.

d. Meet the responding emergency personnel at the indicated location, or send someone to meet them.

e. Do not move any injured person unless they are in further danger. Use general first aid techniques, if appropriate. Always treat the most urgent symptom first:

    1) Cessation of breathing
    2) Cessation of heartbeat
    3) Eye injury
    4) Skin contact
    5) Shock

2. Chemical Accidents

a. Skin: Carefully remove all contaminated clothing immediately and wash the skin with soap and water. Flush the skin for at least fifteen minutes. Contact OEHS for proper disposal of clothing.

b. Eye contact: In the event that a foreign material (solid, liquid) gets in the eye(s)/face, the eye(s)/face must be thoroughly and continuously irrigated for at least 15 minutes. Such irrigation should be with potable clean water from faucet, emergency eye wash, shower, water hose, drinking fountain, or any other nearest available source of water. Following this emergency first aid action, the injured individual should be provided with professional medical treatment.

c. Ingestion: Follow emergency first aid procedures listed on the chemical SDS. Immediately call 911. Be sure to note which chemical(s) is believed

to have been ingested.

3. Chemical Spill Clean-up

a. Promptly clean up minor spills of dilute chemicals using appropriate personal protective equipment such as gloves and aprons. Dispose of properly.

b. If there is no fire hazard and the material is not particularly volatile or toxic, clean it up using procedures listed on the SDS. Wear appropriate gloves and clean the contaminated area with soap and water after removing the spill.

c. If a volatile, flammable and/or concentrated material is spilled, immediately extinguish flames and turn off all electrical apparatuses. Evacuate the area by established routes. Provide any source migration/substance co-mingling through isolation techniques which the employee has received specific training, seal the area, report the spill to school administration and request assistance from OEHS at (213) 241-3199 to clean up the spill.

d. If a nonvolatile, toxic material is spilled, evaluate the area by established routes and isolate the area of the spill. If the quantity or toxicity of the chemical exceeds the employee's ability or training to handle, evacuate the area until OEHS personnel arrive.

e. If an unlabeled material is spilled, isolate the area, including shutting down the ventilation system. Evacuate by established routes and immediately contact OEHS for assistance.

f. Use care in cleaning spills involving multiple chemicals, so that reactive combinations do not occur in waste receptacles. Do not dispose of absorbing material in open trash cans. Contact OEHS if you have disposal questions.

4. Fire

a. If the fire is too large to be suffocated quickly and simply, or if it is believed to produce toxic fumes, evacuate the area following established evacuation routes, sound the fire alarm, and notify the fire department. On arrival, inform fire fighters what chemicals are involved, or may become involved.

b. A fire contained in a small vessel can often be suffocated by covering the vessel with an inverted container. Do not use dry towels, cloths or plastic. Remove nearby flammable materials.

c. In fires that appear controllable, direct the discharge from a carbon dioxide or dry-chemical fire extinguisher at the base of the flames. Do not discharge a fire extinguisher at a pool of burning liquid. Avoid breathing gases and smoke from the fire. Always fight the fire from a position of

escape.

1) Follow the PASS procedure when using a fire extinguisher:

P – Pull the pin
A – Aim at the base of the fire
S – Squeeze the lever
S – Sweep from side to side at the base of the fire until it appears to be Out

If you have the slightest doubt about your ability to fight a fire **EVACUATE IMMEDIATELY!**

d. If a person's clothing is on fire, douse the individual with water or wrap the person in a coat, fire blanket, or other non flammable material that is immediately available. Quickly remove any clothing contaminated with chemicals. Douse with water to remove heat and place clean, wet, ice-packed cloths on burned areas. Call 911 and get medical attention immediately.

VII. CHEMICAL CONTAINER LABELING AND DISPOSAL OF HAZARDOUS MATERIALS AND WASTE

The first priority of the Los Angeles Unified School District Hazardous Waste Management Procedures for Schools is waste minimization. Whenever possible, chemical volumes should be minimized. This is achieved by:

- planning experiments to reduce types of used chemicals generated; reducing the scale of experiments to limit the amounts of used chemicals generated; and
- purchasing chemicals only in the amounts needed.

A. Used Chemical Container Labeling

Leftover reagents and reaction products should be placed in marked containers at the end of each laboratory session. Broken glass should be placed in its own marked container.

Used chemicals shall be classified into the following categories:

-Flammable	-Organic Acid
-Reactive	-Base
-Water Reactive	-Toxic
-Air Reactive	-Oxidizer
-Inorganic Acid	-Other

Containers shall be labeled with the following information:

- used-chemical category
- name of chemical(s) in the container
- approximate percentage of each chemical (if mixed)
- date prepared

- name of teacher or room number

Used chemicals will be maintained in their containers and secured in a storage area until such time that they are either reused in a laboratory procedure or reclassified as waste for disposal. Chemicals stored in each building shall be inventoried at least annually.

B. Chemical Waste Disposal

If used chemicals become reclassified as hazardous waste, their containers will be relabeled as such and segregated into the following classes for disposal (EPA categories):

- Ignitable: Materials capable of causing fire.
- Corrosive: Aqueous solutions with a pH less than or equal to 2 or greater than or equal to 12.5.
- Reactive: Substances that are unstable, explosive, water reactive, or generate toxic gases.
- Toxic: Substances that are harmful to human health such as arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver.
- Other waste not falling into one of the above classes should be identified by chemical names.

All hazardous waste containers must be properly labeled with name and address of school, composition and physical state of the waste, and accumulation date. Since it is unlawful to store hazardous wastes at school sites for longer than 90 days without a permit, a hazardous material/waste pick up form is provided in Appendix F for school personnel to arrange for the pickup of hazardous materials and/or wastes.

For more information, school staff should refer to the Los Angeles Unified School District Hazardous Waste Management Procedures for Schools Manual.

VIII. RECORDKEEPING

A. Chemical Inventory Records

An inventory of all chemicals stored in each school building shall be conducted annually and chemical usage determined. Inventory information shall include at least the following: chemical name, quantity, hazard information, and storage location. Computer software may be used for keeping the inventory, if desired.

Inventory and chemical order records are to be maintained by the Chemical Safety Coordinator, Site Administrator, or Science Chairperson, with a copy sent to OEHS.

B. Chemical Hygiene and Safety Training Records

Records documenting the dates and content of chemical hygiene & safety training sessions must be completed for each employee (see Appendix B). Records should be maintained by the Chemical Safety Coordinator, filed in the main office, and a copy sent to OEHS.

C. Medical Examination and Exposure Records

School science teachers do not regularly handle significant quantities of materials that are acutely or chronically toxic. Therefore, regular medical surveillance is not required.

In the event that an employee is exposed to levels of a hazardous chemical exceeding the established Permissible Exposure Limit (PEL) or Threshold Limit Values (TLV), or should the employee exhibit signs or symptoms of such exposure, then the employee shall have the opportunity to receive a medical consultation to determine the need for medical examination.

All the medical examinations and consultations shall be performed at a reasonable time and location without the cost to the employee. The physician will be provided with:

- identity of the chemical(s) to which the employee may have been exposed;
- exposure conditions; and
- employee's signs and symptoms of possible exposure.

A record of the results of the consultation, including tests performed and conclusions reached will be provided to the employee and school district. California OSHA regulations require that records of air concentration monitoring, exposure assessments, medical consultations, and medical examinations be maintained for at least 30 years after the employee leaves school district employment.

Appendix A

Title 8, California Code of Regulations, Section 5191
Occupational Exposure to Hazardous Chemical in Laboratories

Subchapter 7. General Industry Safety Orders
Group 16. Control of Hazardous Substances
Article 109. Hazardous Substances and Processes

§5191. Occupational Exposure to Hazardous Chemicals in Laboratories.

(a) Scope and application.

(1) This section shall apply to all employers engaged in the laboratory use of hazardous chemicals as defined below.

(2) Where this section applies, it shall supersede, for laboratories, the requirements of Title 8 of the California Code of Regulations Section 5190 and Article 110, Regulated Carcinogens of the General Industry Safety Orders, except as follows:

(A) The requirement to limit employee exposure to the specific exposure limit.

(B) When that particular regulation states otherwise, as in the case of Section 5209(c)(6).

(C) Prohibition or prevention of eye and skin contact where specified by any health regulation shall be observed.

(D) Where the action level (or in the absence of an action level, the exposure limit) is exceeded for a regulated substance with exposure monitoring and medical surveillance requirements.

(E) The "report of use" requirements of Article 110, (Section 5200 et. seq.) Regulated Carcinogens regulations.

(F) Section 5217 shall apply to anatomy, histology and pathology laboratories.

(3) This regulation shall not apply to:

(A) Uses of hazardous chemicals which do not meet the definition of laboratory use, and in such cases, the employer shall comply with the relevant regulations in Title 8, California Code of Regulations, even is such use occurs in a laboratory.

(B) Laboratory uses of hazardous chemicals which provide no potential for employee exposure. Examples of such conditions might include:

1. Procedures using chemically-impregnated test media such as Dip-and-Read tests where a reagent strip is dipped into the specimen to be tested and the results are interpreted by comparing the color reaction to a color chart supplied by the manufacturer of the test strip; and

2. Commercially prepared kits such as those used in performing pregnancy tests in which all of the reagents needed to conduct the test are contained in the kit.

(b) Definitions

Action level. A concentration designated in Title 8, California Code of Regulations for a specific substance, calculated as an eight (8)-hour time weighted average, which initiates certain required activities such as exposure monitoring and medical surveillance.

Carcinogen (see “select carcinogen”).

Chemical Hygiene Officer. An employee who is designated by the employer, and who is qualified by training or experience, to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan. This definition is not intended to place limitations on the position description or job classification that the designated individual shall hold within the employer's organizational structure.

Chemical Hygiene Plan. A written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment and work practices that

(1) are capable of protecting employees from the health hazards presented by hazardous chemicals used in that particular work place and

(2) meets the requirements of subsection 5191(e).

Chief. The Chief of the Division of Occupational Safety and Health.

Combustible liquid. Any liquid having a flashpoint at or above 100oF (37.8oC), but below 200oF (93.3oC) except any mixture having components with flashpoints of 200oF (93.3oC), or higher, the total volume of which make up 99 percent or more of the total volume of the mixture.

Designated area. An area which may be used for work with “select carcinogens,” reproductive toxins or substances which have a high degree of acute toxicity. A designated area may be the entire laboratory, an area of a laboratory or a device such as a laboratory hood.

Emergency. Any occurrence such as, but not limited to, equipment failure, rupture of containers or failure of control equipment which results in an uncontrolled release of a hazardous chemical into the workplace.

Employee. An individual employed in a laboratory workplace who may be exposed to hazardous chemicals in the course of his or her assignments.

Explosive. A chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

Flammable. A chemical that falls into one of the following categories:

(1) “Aerosol, flammable” means an aerosol that, when tested by the method described in 16 CFR 1500.45, yields a flame projection exceeding 18 inches at full valve opening, or a flashback (a flame extending back to the valve) at any degree of valve opening;

(2) “Gas, flammable” means:

(A) A gas that, at ambient temperature and pressure, forms a flammable mixture with air at a concentration of 13 percent by volume or less; or

(B) A gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air greater than 12 percent by volume, regardless of the lower explosive limit.

(3) “Liquid, flammable” means any liquid having a flashpoint below 100oF (37.8oC), except any mixture having components with flashpoints of 100oF (37.8oC) or higher, the total of which make up 99 percent or more of the total volume of the mixture.

(4) “Solid, flammable” means a solid, other than a blasting agent or explosive as defined in 29 CFR 1910.109(a), that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious hazard. A chemical shall be considered to be a flammable solid if, when tested by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a rate greater than one-tenth of an inch per second along its major axis.

Flashpoint. The minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite when tested as follows:

(1) Tagliabue Closed Tester (See American National Standard Method of Test for Flash Point by Tag Closed Tester, Z11.24 - 1979 (ASTM D 56-79) - for liquids with a viscosity of less than 45 Saybolt Universal Seconds (SUS) at 100oF (37.8oC), or that do not contain suspended solids, and do not have a tendency to form a surface film under test; or

(2) Pensky-Martens Closed Tester (see American National Standard Method of Test for Flash Point by Pensky-Martens closed tester), Z11.7 - 1979 (ASTM D 93-79) for liquids with a viscosity equal to or greater than 45 SUS at 100oF (37.8oC), or that contain suspended solids, or that have a tendency to form a surface film under test; or

(3) Setaflash Closed Tester (see American National Standard Method of Test for Flash Point by Setaflash Closed Tester (ASTM D 3278-78)). Organic peroxides, which undergo autoaccelerating thermal decomposition, are excluded from any of the flashpoint determination methods specified above.

Hazardous chemical. Any chemical which is classified as health hazard or simple asphyxiant in accordance with the Hazard Communication Standard (Section 5194).

Health hazard. A chemical that is classified as posing one of the following hazardous effects: Acute toxicity (any route of exposure); skin corrosion or irritation; serious eye damage or eye irritation; respiratory or skin sensitization; germ cell mutagenicity; carcinogenity; reproductive toxicity; specific target organ toxicity (single or repeated exposure); aspiration hazard. The criteria for determining whether a chemical is classified as a health hazard are detailed in Appendix A of the Hazard Communication Standard (Section 5194) and Section 5194(c) (definition of “simple asphyxiant”).

Laboratory. A facility where the “laboratory use of hazardous chemicals” occurs. It is a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis.

Laboratory scale. Work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safety manipulated by one person. “Laboratory scale” excludes those workplaces whose function is to produce commercial quantities of materials.

Laboratory-type hood. A device located in a laboratory, enclosed on five sides with a movable sash or fixed partial enclosure on the remaining side; constructed and maintained to draw air from the laboratory and to prevent or minimize the escape of air contaminants into the laboratory; and allows chemical manipulations to be conducted in the enclosure without insertion of any portion of the employee's body other than hands and arms.

Walk-in hoods with adjustable sashes meet the above definition provided that the sashes are adjusted during use so that the airflow and the exhaust of air contaminants are not compromised and employees do not work inside the enclosure during the release of airborne hazardous chemicals.

Laboratory use of hazardous chemicals. Handling or use of such chemicals in which all of the following conditions are met:

(1) Chemical manipulations are carried out on a “laboratory scale”;

(2) Multiple chemical procedures or chemicals are used;

(3) The procedures involved are not part of a production process, nor in any way simulate a production process; and

(4) “Protective laboratory practices and equipment” are available and in common use industry-wide to minimize the potential for employee exposure to hazardous chemicals.

Medical consultation. A consultation which takes place between an employee and a licensed physician for the purpose of determining what medical examinations or procedures, if any, are appropriate in cases where a significant exposure to a hazardous chemical may have taken place.

Mutagen. Chemicals that cause permanent changes in the amount or structure of the genetic material in a cell. Chemicals classified as mutagens in accordance with the Hazard Communication Standard (Section 5194) shall be considered mutagens for purposes of this section.

Physical hazard. A chemical that is classified as posing one of the following hazardous effects: Explosive; flammable (gases, aerosols, liquids, or solids); combustible liquid; oxidizer (liquid, solid, or gas); self-reactive; pyrophoric (gas, liquid or solid); self-heating; organic peroxide; corrosive to metal; gas under pressure; in contact with water emits flammable gas; water-reactive; or combustible dust. The criteria for determining whether a chemical is classified as a physical hazard are in Appendix B of the Hazard Communication Standard (Section 5194) and Section 5194(c) (definitions of “combustible dust,” “combustible liquid,” “water-reactive” and “pyrophoric gas”).

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

Reproductive toxins. Chemicals which affect the reproductive capabilities including chromosomal damage (mutations), effects on fetuses (teratogenesis), adverse effects on sexual function and fertility in adult males and females, as well as adverse effects on the development of the offspring. Chemicals classified as reproductive toxins in accordance with the Hazard Communication Standard (Section 5194) shall be considered reproductive toxins for purposes of this section.

Select carcinogen. Any substance which meets one of the following criteria:

(1) It is regulated by Cal/OSHA as a carcinogen; or

(2) It is listed under the category, “known to be carcinogens,” in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (1985 edition); or

(3) It is listed under Group 1 (“carcinogenic to humans”) by the International Agency for Research on Cancer Monographs (IARC) (Volumes 1-48 and Supplements 1-8); or

(4) It is listed in either Group 2A or 2B by IARC or under the category, “reasonably anticipated to be carcinogens” by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:

(A) After inhalation exposure of 6-7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m3;

(B) After repeated skin application of less than 300 mg/kg of body weight per week; or

(C) After oral dosages of less than 50 mg/kg of body weight per day.

(c) Exposure limits. For laboratory uses of Cal/OSHA regulated substances, the employer shall ensure that laboratory employees' exposures to such substances do not exceed the exposure limits specified in Title 8, California Code of Regulations, Group 16, Section 5139 et seq., of the General Industry Safety Orders.

(d) Employee exposure determination

(1) Initial monitoring. The employer shall measure the employee's exposure to any substance regulated by a standard which requires monitoring if there is reason to believe that exposure levels for that substance exceed the action level (or in the absence of an action level, the exposure limit). The person supervising, directing or evaluating the monitoring shall be competent in industrial hygiene practice.

(2) Periodic monitoring. If the initial monitoring prescribed by subsection 5191(d)(1) discloses employee exposure over the action level (or in the absence of an action level, the exposure limit), the employer shall immediately comply with the exposure monitoring provisions of the relevant regulation.

(3) Termination of monitoring. Monitoring may be terminated in accordance with the relevant regulation.

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

(e) Chemical hygiene plan.

(1) Where hazardous chemicals as defined by this regulation are used in the workplace, the employer shall develop and carry out the provisions of a written Chemical Hygiene Plan which is:

(A) Capable of protecting employees from health hazards associated with hazardous chemicals in that laboratory and

(B) Capable of keeping exposures below the limits specified in subsection 5191(c).

(2) The Chemical Hygiene Plan shall be readily available to employees. employee representatives and, upon request, to the Chief.

(3) The Chemical Hygiene Plan shall include each of the following elements and shall indicate specific measures that the employer will take to ensure laboratory employee protection;

(A) Standard operating procedures relevant to safety and health considerations to be followed when laboratory work involves the use of hazardous chemicals:

(B) Criteria that the employer will use to determine and implement control measures to reduce employee exposure to hazardous chemicals including engineering controls, the use of personal protective equipment and hygiene practices; particular attention shall be given to the selection of control measures for chemicals that are known to be extremely hazardous;

(C) A requirement that fume hoods comply with Section 5154.1, that all protective equipment shall function properly and that specific measures shall be taken to ensure proper and adequate performance of such equipment;

(D) Provisions for employee information and training as prescribed in subsection 5191(f);

(E) The circumstances under which a particular laboratory operation, procedure or activity shall require prior approval from the employer or the employer's designee before implementation;

(F) Provisions for medical consultation and medical examinations in accordance with subsection 5191(g);

(G) Designation of personnel responsible for implementation of the Chemical Hygiene Plan including the assignment of a Chemical Hygiene officer and, if appropriate, establishment of a Chemical Hygiene Committee; and

(H) Provisions for additional employee protection for work with particularly hazardous substances. These include “select carcinogens,” reproductive toxins and substances which have a high degree of acute toxicity. Specific consideration shall be given to the following provisions which shall be included where appropriate;

1. Establishment of a designated area;

2. Use of containment devices such as fume hoods or glove boxes;

3. Procedures for safe removal of contaminated waste; and

4. Decontamination procedures.

(4) The employer shall review and evaluate the effectiveness of the Chemical Hygiene Plan at least annually and update it as necessary.

Note: Appendix A of this section is non-mandatory but provides guidance to assist employers in the development of the Chemical Hygiene Plan.

(f) Employee information and training.

(1) 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. Information and training may relate to an entire class of hazardous substances to the extent appropriate.

(2) Such information shall be provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present and prior to assignments involving new exposure situations. The frequency of refresher information and training shall be determined by the employer.

(3) Information. Employees shall be informed of:

(A) The contents of this regulation and its appendices which shall be available to employees;

(B) The location and availability of the employer's Chemical Hygiene Plan;

(C) The exposure limits for Cal/OSHA regulated substances or recommended exposure limits for other hazardous chemicals where there is no applicable Cal/OSHA regulation;

(D) Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory; and

(E) The location and availability of known reference material on the hazards, safe handling, storage and disposal of hazardous chemicals found in the laboratory including, but not limited to, Safety Data Sheets received from the chemical supplier.

(4) Training.

(A) Employee training shall include;

1. Methods and observations that may be used to detect the presence or release of a hazardous chemical (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.);

2. The physical and health hazards of chemicals in the work area; and

3. The measures employees can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used.

(B) The employee shall be trained on the applicable details of the employer's written Chemical Hygiene Plan.

(g) Medical consultation and medical examinations.

(1) The employer shall provide all employees who work with hazardous chemicals an opportunity to receive medical attention, including any follow-up examinations which the examining physician determines to be necessary, under the following circumstances;

(A) Whenever an employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory, the employee shall be provided an opportunity to receive an appropriate medical examination.

(B) Where exposure monitoring reveals an exposure level above the action level (or in the absence of an action level, the exposure limit) for a Cal/OSHA regulated substance for which there are exposure monitoring and medical surveillance requirements, medical surveillance shall be established for the affected employee as prescribed by the particular standard.

(C) Whenever an event takes place in the work area such as a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure, the affected employee shall be provided an opportunity for a medical consultation. Such consultation shall be for the purpose of determining the need for a medical examination.

(2) 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.

(3) Information provided to the physician. The employer shall provide the following information to the physician;

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

(B) A description of the conditions under which the exposure occurred including quantitative exposure data, if available; and

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

(4) Physician's written opinion.

(A) For examination or consultation required under this standard, the employer shall obtain a written opinion from the examining physician which shall include the following;

1. Any recommendation for further medical follow-up;

2. The results of the medical examination and any associated tests, if requested by the employee;

3. Any medical condition which may be revealed in the course of the examination which may place the employee at increased risk as a result of exposure to a hazardous chemical found in the workplace; and

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

(B) The written opinion shall not reveal specific findings of diagnoses unrelated to occupational exposure.

(h) Hazard identification.

(1) With respect to labels and material safety data sheets;

(A) Employers shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced.

(B) Employers shall maintain in the workplace any safety data sheets that are received with incoming shipments of hazardous chemicals, and ensure that they are readily accessible to laboratory employees during each work shift when they are in their work area(s).

(2) The following provisions shall apply to chemical substances developed in the laboratory;

(A) If the composition of the chemical substance which is produced exclusively for the laboratory's use is known, the employer shall determine if it is a hazardous chemical as defined in subsection 5191(b). If the chemical is determined to be hazardous, the employer shall provide appropriate training as required under subsection 5191(f).

(B) If the chemical produced is a byproduct whose composition is not known, the employer shall assume that the substance is hazardous and shall implement subsection 5191(e).

(C) If the chemical substance is produced for commercial purposes by another user outside of the laboratory, the employer shall comply with the Hazard Communication Standard (Section 5194) including the requirements for preparation of safety data sheets and labeling.

(i) Use of respirators.

Where the use of respirators is necessary to maintain exposure below permissible exposure limits, the employer shall provide, at no cost to the employee, the proper respiratory equipment. Respirators shall be selected and used in accordance with the requirements of Section 5144.

(j) Recordkeeping.

(1) The employer shall establish and maintain for each employee an accurate record of any measurements taken to monitor employee exposures and any medical consultation and examinations including tests or written opinions required by this regulation.

(2) The employer shall ensure that such records are kept, transferred, and made available in accordance with Section 3204.

(k) Dates

(1) Employers shall have developed and implemented a written Chemical Hygiene Plan no later than October 31, 1991.

(2) Subsection (a) (2) shall not take effect until the employer has developed and implemented a written Chemical Hygiene Plan.

(*l*) Appendices. The information contained in the appendices is not intended, by itself, to create any additional obligations not otherwise imposed or to detract from any existing obligation.

Note: Authority cited: Sections 142.3 and 9020, Labor Code. Reference: Sections 142.3, 9004(d), 9009 and 9020, Labor Code.

Appendix A
Appendix B

HISTORY

1. New section filed 3-25-91; operative 4-24-91 (Register 91, No. 17).

2. Editorial correction of printing errors (Register 92, No. 33).

3. Change without regulatory effect amending Appendix B subsections (b)1. and (c)1. filed 12-28-92 pursuant to section 100, title 1, California Code of Regulations (Register 93, No. 1).

4. Editorial correction of Appendix A subsection D.11.(b) (Register 95, No. 24).

5. Amendment of Appendix A, subsection E.1.(a) filed 1-18-2012; operative 1-18-2012 pursuant to Labor Code section 142.3(a)(4)(C). Submitted to OAL for printing only pursuant to Labor Code section 142.3(a)(3) (Register 2012, No. 3).

6. Amendment of definitions within subsection (b) and amendment of subsections (f)(3)(E), (h)(1)(B) and (h)(2)(C) filed 5-6-2013; operative 5-6-2013 pursuant to Labor Code section 142.3(a)(4)(C). Submitted to OAL for printing only pursuant to Labor Code section 142.3(a)(4) (Register 2013, No. 19).

7. Amendment of definitions within subsection (b) and amendment of subsections (f)(3)(E), (h)(1)(B) and (h)(2)(C) refiled 11-6-2013; operative 11-6-2013 pursuant to Labor Code section 142.3(a)(4)(C). Submitted to OAL for printing only pursuant to Labor Code section 142.3(a)(4) (Register 2013, No. 45).

Appendix B

Health and Safety Training Form

LOS ANGELES UNIFIED SCHOOL DISTRICT
HEALTH AND SAFETY TRAINING FORM

TRAINING LOCATION_____ **DATE** _____

The following employees have been trained in accordance with Title 8 of the California Code of Regulations in: (Please check one of the following.)

[ ] Bloodborne Pathogens Standard Section 5193

[ ] Fire Prevention & Emergency Evacuation Sections 3220-3221

[ ] Hazard Communication Section 5194

[ ] Injury & Illness Prevention Program Section 3203

[ ] Occupational Exposure Hazardous Chemicals in Laboratories Section 5191

[ ] Other (specify agency and applicable codes) _____

PRINT NAME	SIGNATURE	EMPLOYEE #	JOB TITLE	WORK LOCATION

_____

Trainer or Site Administrator's Signature

ATTACH A COPY OF THE AGENDA AND LIST OF TRAINING MATERIALS.

Appendix C

Sample Safety Data Sheet

Section 1: Identification

This section identifies the chemical on the SDS as well as the recommended uses. It also provides the essential contact information of the supplier. The required information consists of:

- Product identifier used on the label and any other common names or synonyms by which the substance is known.
- Name, address, phone number of the manufacturer, importer, or other responsible party, and emergency phone number.
- Recommended use of the chemical (e.g., a brief description of what it actually does, such as flame retardant) and any restrictions on use (including recommendations given by the supplier).

Section 2: Hazard(s) Identification

This section identifies the hazards of the chemical presented on the SDS and the appropriate warning information associated with those hazards. The required information consists of:

- The hazard classification of the chemical (e.g., flammable liquid, category[1]).
- Signal word.
- Hazard statement(s).
- Pictograms (the pictograms or hazard symbols may be presented as graphical reproductions of the symbols in black and white or be a description of the name of the symbol (e.g., skull and crossbones, flame).
- Precautionary statement(s).
- Description of any hazards not otherwise classified.
- For a mixture that contains an ingredient(s) with unknown toxicity, a statement describing how much (percentage) of the mixture consists of ingredient(s) with unknown acute toxicity. Please note that this is a total percentage of the mixture and not tied to the individual ingredient(s).

Section 3: Composition/Information on Ingredients

This section identifies the ingredient(s) contained in the product indicated on the SDS, including impurities and stabilizing additives. This section includes information on substances, mixtures, and all chemicals where a trade secret is claimed. The required information consists of:

Substances

- Chemical name.
- Common name and synonyms.
- Chemical Abstracts Service (CAS) number and other unique identifiers.
- Impurities and stabilizing additives, which are themselves classified and which contribute to the classification of the chemical.

Mixtures

- Same information required for substances.
- The chemical name and concentration (i.e., exact percentage) of all ingredients which are classified as health hazards and are:
  - Present above their cut-off/concentration limits or
  - Present a health risk below the cut-off/concentration limits.
- The concentration (exact percentages) of each ingredient must be specified except concentration ranges may be used in the following situations:
  - A trade secret claim is made,
  - There is batch-to-batch variation, or
  - The SDS is used for a group of substantially similar mixtures.

Chemicals where a trade secret is claimed

- A statement that the specific chemical identity and/or exact percentage (concentration) of composition has been withheld as a trade secret is required.

Section 4: First-Aid Measures

This section describes the initial care that should be given by untrained responders to an individual who has been exposed to the chemical. The required information consists of:

- Necessary first-aid instructions by relevant routes of exposure (inhalation, skin and eye contact, and ingestion).
- Description of the most important symptoms or effects, and any symptoms that are acute or delayed.
- Recommendations for immediate medical care and special treatment needed, when necessary.

Section 5: Fire-Fighting Measures

This section provides recommendations for fighting a fire caused by the chemical. The required information consists of:

- Recommendations of suitable extinguishing equipment, and information about extinguishing equipment that is not appropriate for a particular situation.
- Advice on specific hazards that develop from the chemical during the fire, such as any hazardous combustion products created when the chemical burns.
- Recommendations on special protective equipment or precautions for firefighters.

Section 6: Accidental Release Measures

This section provides recommendations on the appropriate response to spills, leaks, or releases, including containment and cleanup practices to prevent or minimize exposure to people, properties, or the environment. It may also include recommendations distinguishing between responses for large and small spills where the spill volume has a significant impact on the hazard. The required information may consist of recommendations for:

- Use of personal precautions (such as removal of ignition sources or providing sufficient ventilation) and protective equipment to prevent the contamination of skin, eyes, and clothing.
- Emergency procedures, including instructions for evacuations, consulting experts when needed, and appropriate protective clothing.
- Methods and materials used for containment (e.g., covering the drains and capping procedures).
- Cleanup procedures (e.g., appropriate techniques for neutralization, decontamination, cleaning or vacuuming; adsorbent materials; and/or equipment required for containment/clean up).

Section 7: Handling and Storage

This section provides guidance on the safe handling practices and conditions for safe storage of chemicals. The required information consists of:

- Precautions for safe handling, including recommendations for handling incompatible chemicals, minimizing the release of the chemical into the environment, and providing advice on general hygiene practices (e.g., eating, drinking, and smoking in work areas is prohibited).
- Recommendations on the conditions for safe storage, including any incompatibilities. Provide advice on specific storage requirements (e.g., ventilation requirements).

Section 8: Exposure Controls/Personal Protection

This section indicates the exposure limits, engineering controls, and personal protective measures that can be used to minimize worker exposure. The required information consists of:

- OSHA Permissible Exposure Limits (PELs), American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs), and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the safety data sheet, where available.
- Appropriate engineering controls (e.g., use local exhaust ventilation, or use only in an enclosed system).
- Recommendations for personal protective measures to prevent illness or injury from exposure to chemicals, such as personal protective equipment (PPE) (e.g., appropriate types of eye, face, skin or respiratory protection needed based on hazards and potential exposure).
- Any special requirements for PPE, protective clothing or respirators (e.g., type of glove material, such as PVC or nitrile rubber gloves; and breakthrough time of the glove material).

Section 9: Physical and Chemical Properties

This section identifies physical and chemical properties associated with the substance or mixture. The minimum required information consists of:

- Appearance (physical state, color, etc.);
- Odor;
- Odor threshold;
- pH;
- Melting point/freezing point;
- Initial boiling point and boiling range;
- Flash point;
- Evaporation rate;
- Flammability (solid, gas);
- Upper/lower flammability or explosive limits;
- Vapor pressure;
- Vapor density;
- Relative density;
- Solubility(ies);
- Partition coefficient: n-octanol/water;
- Auto-ignition temperature;
- Decomposition temperature; and
- Viscosity.

The SDS may not contain every item on the above list because information may not be relevant or is not available. When this occurs, a notation to that effect must be made for that chemical property. Manufacturers may also add other relevant properties, such as the dust deflagration index (Kst) for combustible dust, used to evaluate a dust's explosive potential.

Section 10: Stability and Reactivity

This section describes the reactivity hazards of the chemical and the chemical stability information. This section is broken into three parts: reactivity, chemical stability, and other. The required information consists of:

Reactivity

- Description of the specific test data for the chemical(s). This data can be for a class or family of the chemical if such data adequately represent the anticipated hazard of the chemical(s), where available.

Chemical stability

- Indication of whether the chemical is stable or unstable under normal ambient temperature and conditions while in storage and being handled.
- Description of any stabilizers that may be needed to maintain chemical stability.
- Indication of any safety issues that may arise should the product change in physical appearance.

Other

- Indication of the possibility of hazardous reactions, including a statement whether the chemical will react or polymerize, which could release excess pressure or heat, or create other hazardous conditions. Also, a description of the conditions under which hazardous reactions may occur.
- List of all conditions that should be avoided (e.g., static discharge, shock, vibrations, or environmental conditions that may lead to hazardous conditions).
- List of all classes of incompatible materials (e.g., classes of chemicals or specific substances) with which the chemical could react to produce a hazardous situation.
- List of any known or anticipated hazardous decomposition products that could be produced because of use, storage, or heating. (Hazardous combustion products should also be included in Section 5 (Fire-Fighting Measures) of the SDS.)

Section 11: Toxicological Information

This section identifies toxicological and health effects information or indicates that such data are not available. The required information consists of:

- Information on the likely routes of exposure (inhalation, ingestion, skin and eye contact). The SDS should indicate if the information is unknown.
- Description of the delayed, immediate, or chronic effects from short- and long-term exposure.
- The numerical measures of toxicity (e.g., acute toxicity estimates such as the LD50 (median lethal dose)) - the estimated amount [of a substance] expected to kill 50% of test animals in a single dose.
- Description of the symptoms. This description includes the symptoms associated with exposure to the chemical including symptoms from the lowest to the most severe exposure.
- Indication of whether the chemical is listed in the National Toxicology Program (NTP) Report on Carcinogens (latest edition) or has been found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) Monographs (latest editions) or found to be a potential carcinogen by OSHA.

Section 12: Ecological Information (non-mandatory)

This section provides information to evaluate the environmental impact of the chemical(s) if it were released to the environment. The information may include:

- Data from toxicity tests performed on aquatic and/or terrestrial organisms, where available (e.g., acute or chronic aquatic toxicity data for fish, algae, crustaceans, and other plants; toxicity data on birds, bees, plants).
- Whether there is a potential for the chemical to persist and degrade in the environment either through biodegradation or other processes, such as oxidation or hydrolysis.
- Results of tests of bioaccumulation potential, making reference to the octanol-water partition coefficient (K_{ow}) and the bioconcentration factor (BCF), where available.
- The potential for a substance to move from the soil to the groundwater (indicate results from adsorption studies or leaching studies).
- Other adverse effects (e.g., environmental fate, ozone layer depletion potential, photochemical ozone creation potential, endocrine disrupting potential, and/or global warming potential).

Section 13: Disposal Considerations (non-mandatory)

This section provides guidance on proper disposal practices, recycling or reclamation of the chemical(s) or its container, and safe handling practices. To minimize exposure, this section should also refer the reader to Section 8 (Exposure Controls/Personal Protection) of the SDS. The information may include:

- Description of appropriate disposal containers to use.
- Recommendations of appropriate disposal methods to employ.
- Description of the physical and chemical properties that may affect disposal activities.
- Language discouraging sewage disposal.
- Any special precautions for landfills or incineration activities.

Section 14: Transport Information (non-mandatory)

This section provides guidance on classification information for shipping and transporting of hazardous chemical(s) by road, air, rail, or sea. The information may include:

- UN number (i.e., four-figure identification number of the substance)[2].
- UN proper shipping name[2].
- Transport hazard class(es)[2].
- Packing group number, if applicable, based on the degree of hazard[2].
- Environmental hazards (e.g., identify if it is a marine pollutant according to the International Maritime Dangerous Goods Code (IMDG Code)).
- Guidance on transport in bulk (according to Annex II of MARPOL 73/78[3] and the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (International Bulk Chemical Code (IBC Code)).
- Any special precautions which an employee should be aware of or needs to comply with, in connection with transport or conveyance either within or outside their premises (indicate when information is not available).

Section 15: Regulatory Information (non-mandatory)

This section identifies the safety, health, and environmental regulations specific for the product that is not indicated anywhere else on the SDS. The information may include:

- Any national and/or regional regulatory information of the chemical or mixtures (including any OSHA, Department of Transportation, Environmental Protection Agency, or Consumer Product Safety Commission regulations).

Section 16: Other Information

This section indicates when the SDS was prepared or when the last known revision was made. The SDS may also state where the changes have been made to the previous version. You may wish to contact the supplier for an explanation of the changes. Other useful information also may be included here.

Appendix D

List of Incompatible Chemicals

Appendix D
List of Incompatible Chemicals[1]

The following list is only a guide; it is not a complete list of all incompatible chemicals. For specific incompatibilities, please consult the Material Safety Data Sheet (MSDS) for each chemical in use. For an extensive listing and discussion of reactivity risks of chemicals alone or in combination, as well as toxicity hazards for unexpected reactions, refer to *Bretherick's Handbook of Reactive Chemical Hazards* (Volumes 1–2), 7th Edition, 2007, published by Elsevier, Inc.

Acetic acid	Oxidizing agents (e.g., chromic acid, nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, permanganates)
Acetone	Nitric acid and sulfuric acid; other oxidizing agents
Acetylene	Chlorine, bromine, copper, fluorine, silver, mercury
Alkali and alkaline earth metals (such as powdered aluminum or magnesium, calcium, lithium, sodium, potassium)	Water, carbon tetrachloride, other chlorinated hydrocarbon compounds, carbon dioxide, halogens
Ammonia (anhydrous)	Mercury (e.g., in manometers), chlorine, calcium hypochlorite, iodine, bromine, hydrofluoric acid
Ammonium nitrate	Acids, powdered metals, flammable liquids, chlorates, nitrites, sulfur, finely divided organic or combustible materials
Aniline	Nitric acid, hydrogen peroxide
Arsenical materials	Reducing agents
Azides	Acids
Bromine	See *chlorine*
Calcium oxide	Water
Carbon (activated)	Calcium hypochlorite, other oxidizing agents

1. Adapted from UC Davis, Environmental Health and Safety, Safety Net #4, 2007. Available at http://safetyservices.ucdavis.edu/safetynets/snml/sn4/SN4pdf [Outside Source] (accessed November 10, 2011).

Chemical	*Incompatible with*
Chlorates	Ammonium salts, acids, powdered metals, sulfur, finely divided organic or combustible materials
Chlorine	Ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), hydrogen, sodium carbide, benzene, finely divided metals, turpentine
Chlorine dioxide	Ammonia, methane, phosphine, hydrogen sulfide
Chromium trioxide (chromic acid)	Acetic acid, naphthalene, camphor, glycerol, alcohol, flammable liquids
Copper	Acetylene, hydrogen peroxide
Cyanides	Acids
Flammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens
Hydrocarbons (e.g., butane, propane, benzene)	Fluorine, chlorine, bromine, chromic acid, sodium peroxide, other oxidizing agents
Hydrocyanic acid (anhydrous)	Alkali
Hydrofluoric acid	Potassium permanganate, sulfuric acid
Hydrogen sulfide	Metal oxides, powdered copper, oxidizing gases
Hypochlorites	Acids, activated carbon, ammonia
Iodine	Acetylene, ammonia (aqueous or anhydrous), hydrogen
Mercury	Acetylene, fulminic acid, ammonia
Nitrates	Powdered metals and nonmetals, metal sulfides, flammable/combustible liquids
Nitric acid	Acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids and gases, copper, brass, heavy metals, alkalis
Nitrites	Ammonium salts, amides, phosphides, reducing agents
Nitroparaffins	Acids, bases, amines, halides
Oxalic acid	Silver, chlorites, urea
Oxygen	Oils, grease, hydrogen, and other reducing agents, including flammable liquids, solids or gases
Perchlorates	See *chlorates*

Chemical	*Incompatible with*
Perchloric acid	Reducing agents such as acetic anhydride, bismuth and its alloys, alcohols, paper, wood, grease, oils
Phosphorous (white)	Air, oxygen, alkalis, halogens, halogen oxides, oxidizing agents
Potassium	Carbon tetrachloride, carbon dioxide, water
Potassium permanganate	Glycerol, ethylene glycol, benzaldehyde, other reducing agents, sulfuric acid
Sodium	Carbon tetrachloride, carbon dioxide, water
Sodium peroxide	Ethyl and methyl alcohol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural
Sulfides	Acids
Sulfuric acid	Permanganates, water, aqueous solutions, reducing agents, chlorates, perchlorates, nitric acid
Water	Acids (Remember to add acid to water, not vice versa.)

Appendix E

Categories of Compatible Chemicals

Table 7.4
Categories of Compatible Chemicals

1. **Metals.** All metals except mercury (see item 8). Phosphorus should also be stored here (red only; white or yellow phosphorus is not recommended for school usage). Flammable solids should be stored in the flammables cabinet. *Location:* Keep separate from oxidizers (including ammonium nitrate), halogens, organic compounds, and moisture.

2. **Oxidizers**. All except ammonium nitrate. Includes nitrates, nitrites, permanganates, chlorates, perchlorates, peroxides, and hydrogen peroxide (30 percent or greater). *Location:* Keep separate from metals, acids, organic materials, and ammonium nitrate. Preferably, isolate oxidizers from the flammable liquids storage cabinet by a minimum of eight meters (25 feet) or by a one-hour fire wall.

3. **Ammonium nitrate.** Store in isolation from all other chemicals, especially acids, powdered metals, flammable liquids, chlorates, nitrites, sulfur, and finely divided organic combustible materials.

4. **Bases.** Strong bases—sodium hydroxide, potassium hydroxide, and other regulated bases—and ammonium hydroxide. Store in a dedicated corrosive-chemicals storage cabinet that has an interior constructed entirely of corrosion-resistant materials.

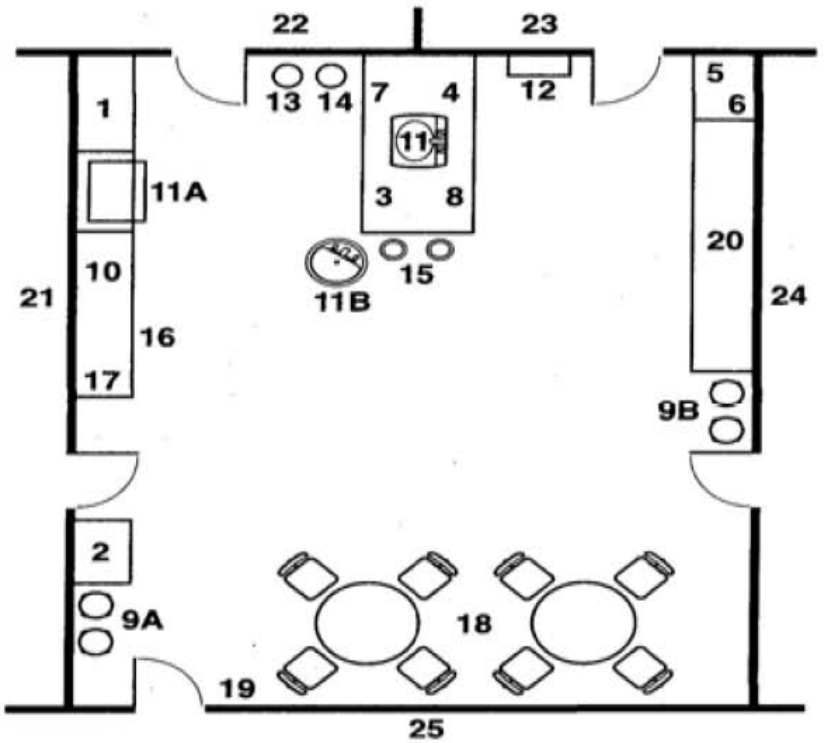
5. **Acids.** Inorganic (except nitric acid) and regulated organic acids. *Location:* Store in a dedicated corrosive-chemicals storage cabinet that has an interior constructed entirely of corrosion-resistant materials.

Table 7.4 *(continued)*

6. **Nitric acid.** Must be stored separately from acetic acid. *Location:* Store either in an isolated compartment in the acids cabinet or in special Styrofoam containers available for that purpose from vendors of chemicals. Fuming nitric acid should never be used.
7. **Flammables.** Preferably, isolated from all oxidizers by a minimum of eight meters (25 feet) or by a one-hour fire wall. *Location:* Store in a dedicated flammables storage cabinet painted with heat- or flame-resistant paint.
8. **Poisons.** Cyanides (no longer recommended for school programs), mercury and mercury compounds, nicotine, and other poisons. *Location:* Use a lockable drawer remote from the acids storage cabinet.
9. **Compressed gases.** Cylinders must be chained or strapped to the wall, with caps on tight. *Location:* (a) keep oxidizing gases remote from flammable liquids, metals, and flammable gases; (b) keep flammable gases remote from oxidizers and oxidizing gases by a distance of eight meters (25 feet) or by a one-hour fire wall.
10. **Low-hazard chemicals.** Many of the salts not otherwise specified (of course, *not* the nitrates), weak bases, oxides, carbonates, sulfides, dyes, indicators, stains, noncorrosive organic acids, amino acids, sugars, and so forth. Store on open shelves that have earthquake barriers.

Figure 7.1
Sample Layout of Preparation/Storage Area

Preparation/Storage Area Diagram



1. Metals storage
2. Oxidizers storage
3. Ammonium nitrate storage
4. Bases cabinet
5. Acids cabinet
6. Isolated nitric acid storage
7. Flammables cabinet
8. Poisons drawer

9A. Compressed gases—nonflammable/ oxidizing; chained/strapped to a wall

9B. Compressed gases—flammable; chained/ strapped to a wall

10. Low-hazard chemicals storage with earthquake lips; secured to walls
11. Sink/counter with hot/cold water, gas, electricity, exhaust hood, cabinet underneath

11A. Refrigerator

11B. Emergency shower and eyewash station

12. First-aid kit
13. ABC fire extinguisher
14. Fire blanket
15. Plastic waste receptacles
16. Chemical spill kit
17. Chemical inventory system, including MSDS
18. Conference/prep area
19. Emergency evacuation procedure
20. Apparatus/glassware storage cabinets with earthquake lips; secured to walls

21–24. Adjacent classroom laboratories

25. Hall or outside exit; all doors self-closing and lockable