

SCHOOL SCIENCE LABORATORIES A GUIDE TO SOME HAZARDOUS SUBSTANCES

A supplement to the National Institute for Occupational Safety and Health
Manual of Safety and Health Hazards in the School Science Laboratory

Prepared by the

COUNCIL OF STATE SCIENCE SUPERVISORS

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PREFACE

The purpose of this supplement to the NIOSH **Manual of Safety and Health Hazards in the School Science Laboratory** is to identify certain potentially hazardous substances that may be in use in many school laboratories and to provide an inventory of these substances so that science instructors may take the initiative in providing for the proper storage, handling, use, and, if warranted, removal of hazardous materials.

This document provides lists of explosives, carcinogens, highly toxic, and/or corrosive or irritant chemicals. These lists are not all-inclusive, nor do they address all of the hazards associated with handling chemicals. For example, effects such as central nervous system depression, behavioral modifications, cardiovascular alterations, or allergic reactions which may be associated with exposure to various chemicals have not been addressed. Information on hazards associated with chemicals which have not been addressed, or on chemicals not identified in this document should be obtained from the manufacturer, supplier, local American Chemical Society section members, qualified consultants, or the appropriate government agency.

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Section 1
TOTAL SCIENCE SAFETY PROGRAM

The goal of the Council of State Science Supervisors is to aid in the development of a complete science safety program. The Council advocates the use of chemical substances in the teaching of science courses and believes that student laboratory experiences are essential to a meaningful science curriculum. The Council also recognizes that not all schools can provide conditions necessary for the safe use of all chemicals in their laboratories. The purpose of this document, therefore, is to alert science instructors to the hazards associated with the use of various chemicals found in schools.

Qualified science instructors, teachers who have been trained in laboratory procedures and who have knowledge of potential laboratory hazards, are the foundation of any total school science safety program. There is no substitute for qualified professionals, and only they should be assigned to teach science courses.

Some level of risk is inherent in almost all science activities. Determination of an acceptable level of risk for all planned activities in the science curriculum is the challenge. It is imperative that students learn to identify laboratory risks and follow safe procedures in handling potentially dangerous substances.

The potential hazards of certain substances outweigh their usefulness. In some cases, hazardous substances have come into the schools through governmental surplus property, industrial and college "give-aways," or special purchases for student projects. Often a hazardous reagent has been stored in quantities for a long period of time with only the antique packaging serving as a clue to its age.

The decision to use certain substances in the school laboratory should be based on the best available knowledge of each chemical's particular hazard and the availability of proper handling facilities. Substitutions, either of chemicals or experiments, often can be made to reduce hazards without sacrificing instructional objectives. When the risk outweighs the benefit and no substitute chemical is available, then the experiment should be eliminated.

Section 2
LIMITATIONS OF THIS GUIDE

The list of potentially hazardous substances under discussion here is not all-inclusive, nor does it address all of the hazards which can be encountered when handling chemicals. The substances listed herein were identified by the National Institute for Occupational Safety and Health (NIOSH) in the **Manual of Safety and Health Hazards in the School Science Laboratory** from an examination of the secondary school biology, chemistry, earth science, and physics textbooks, current school supply catalogs, and by the U.S. Consumer Product Safety Commission's (CPSC) Directorate for Health Sciences from an examination of several school science inventories. The Safety Committee of the Council of State Science Supervisors, with the assistance of several toxicologists from state departments of health, the CPSC Health Sciences staff, and other organizations, conducted a literature search to gather information on the hazard associated with exposure to these substances.

Terms used herein are defined as follows:

- CARCINOGEN** — A substance capable of causing cancer or cancerous growths in mammals.
- “Known” labels indicate that sufficient information exists which shows a definite relationship between exposure to a substance and cancer in humans.
 - “Probable” labels indicate there is limited evidence in humans and/or sufficient evidence in experimental animals.
- MUTAGEN** — A substance capable of causing changes in the genetic material of a cell, which can be transmitted during cell division.
- HIGHLY TOXIC** — Agents or substances that when inhaled, absorbed or ingested in small amounts can cause death, disablement, or severe illness.
- EXPLOSIVE** — An unstable substance capable of rapid and violent energy release.
- CORROSIVE** — A substance that causes destruction of tissue by chemical action on contact.
- IRRITANT** — A substance that on immediate, prolonged, or repeated contact with normal tissue will induce a local inflammatory reaction.

As new information on chemicals used in school laboratories becomes available, this inventory may be modified to include those chemicals.

TEACHER'S NOTES

Section 3
INSTRUCTIONS FOR USE OF HEALTH AND SAFETY TABLES

Adverse health effects depend upon both the inherent hazard of the substance and the degree of exposure. Therefore, to reduce the risk of adverse health effects, exposure to hazardous substances should be reduced to the lowest possible level, which may in some instances require removal.

Two categories of potentially hazardous substances have been identified for the purpose of this report:

(1) Substances with hazards that may be greater than their potential usefulness are found in Tables 1 and 2. Table 1 contains chemicals which are explosive, and Table 2 contains chemicals which have been identified as known or probable human carcinogens. It is recommended that these substances **NOT** be used or stored in schools. If it is determined that the use of these substances is vital to the course, special precautions to prevent exposure and/or injury should be employed. Material Safety Data Sheets should be obtained on each chemical delineating particular hazards or handling procedures. In addition, for carcinogens, handling guidelines published by the Federal government should be followed. Those guidelines are published in

- (a) **Carcinogens — Regulation and Control**, U.S. Department of Health, Education and Welfare, NIOSH, Publication No. (NIOSH) 77-205, Cincinnati, OH 45226, 1977
- (b) **Carcinogens — Working with Carcinogens**, U.S. Department of Health, Education and Welfare, NIOSH, Publication NO. (NIOSH) 77-206, Cincinnati, OH 45226, 1977

(2) Based on current knowledge of the hazards associated with chemicals contained in Tables 3, 4 and 5, their potential usefulness may be outweighed by their associated risks, even when handled with caution and approved safety procedures designed to minimize exposure. Table 3 is a list of substances reported to be animal carcinogens and/or mutagens. Table 4 is a list of substances with a high degree of toxicity. Table 5 is a list of substances that are corrosive or irritating. Storage information is contained in the Science Inventory with special attention given to fire hazards and special storage problems.

The tables are designed to give the chemical name of the substance, a registry identification number, the classified hazard — although not the only hazard which the substance may present — and space for the instructor to enter the amount presently being stored. The Chemical Abstract Service (CAS) Registry Number has been employed in the tables because synonyms and/or trade names frequently make identification complex. When requesting information about a chemical, the CAS number is a convenient reference.

In order to evaluate the usefulness of this document, WE REQUEST THAT AFTER COMPLETING AN INVENTORY OF CHEMICALS STORED IN THE SCHOOL, THE INSTRUCTOR FILL OUT THE HAZARDOUS SUBSTANCE REMOVAL FORM (p. 55) AND MAIL A COPY TO THE U.S. CONSUMER PRODUCT SAFETY COMMISSION WITH AN EVALUATION OF THIS PUBLICATION (p. 57).

TEACHER'S NOTES

Section 4
HEALTH AND SAFETY TABLES

Table 1
EXPLOSIVES

CAUTION: This is not a comprehensive list of all possible explosive chemicals.

The substances in this table are **NOT** recommended for use or storage in schools, except as indicated, unless an absolute need is determined and appropriate safety procedures are instituted.

REMOVAL: Explosives should be removed by trained fire or police bomb squads, or other qualified officials. Limit movement of containers of such chemicals in order to minimize the chance of detonation.

| SUBSTANCE | CAS NO. | RECORD OF REMOVAL | WHO, WHERE TAKEN, DATE |
|--------------------------------|-----------|-------------------|------------------------|
| Benzoyl Peroxide | 94-36-0 | | |
| Carbon Disulfide ¹ | 75-15-0 | | |
| Diisopropyl Ether ² | 108-20-3 | | |
| Ethyl Ether ² | 60-29-7 | | |
| Picric Acid ³ | 88-89-1 | | |
| Perchloric Acid ⁴ | 7601-90-3 | | |
| Potassium metal ² | 7440-09-7 | | |

¹The flashpoint of carbon disulfide (-22°F) is well below room temperature and small amounts of the vapor in air can be explosive.

²These chemicals become dangerous upon aging. Ethers and potassium metal can both form explosive peroxides upon exposure to air. Old opened containers of ether should be treated with great caution as should potassium metal not stored under kerosene.

³Picric acid should always contain 10-20% water and bottles should be disposed of after two years. Dry picric acid is explosive.

⁴Although the 70% acid/water mixture is not explosive by itself, the use of perchloric acid often leads to the formation of perchlorates which are very explosive.

Table 2
SUBSTANCES IDENTIFIED* AS KNOWN OR PROBABLE HUMAN CARCINOGENS

CAUTION: This is not a comprehensive listing of all chemicals having substantial evidence of carcinogenicity. Further, each substance listed here may have additional health hazards.

These substances are **NOT** recommended for use or storage in schools unless an absolute need is determined and appropriate use and storage safety procedures are instituted. If it is determined that there is a definite need to use one of these carcinogenic chemicals, obtain additional information on the risk involved. Information on many carcinogenic chemicals can be obtained from NIOSH or CPSC. Ask for the NIOSH criteria document on the chemical of interest by writing to NIOSH, Publications Dissemination DSDTT, 4676 Columbia Parkway, Cincinnati, OH 45226, or write for additional information to CPSC, Directorate for Health Sciences, Washington, D.C. 20207. (For more information, contact the groups listed in Section 9 of this document.) REMEMBER — Some carcinogens are more potent than others and risk increases with **level** and **duration** of exposure.

REMOVAL: These substances should be removed by health authorities or a licensed commercial company. All state, local and federal regulations must be adhered to in the removal process. Once removed, the substances should not reenter the school. Instructions should be added to the procedures for ordering chemicals to make sure that, once removed, these chemicals are not reordered.

| KNOWN CARCINOGENS | CAS NO. | AMOUNT |
|----------------------|------------|--------|
| Arsenic Powder** | 7440-28-2 | |
| Arsenic Pentoxide | 1303-28-2 | |
| Arsenic Trichloride | 7784-34-1 | |
| Arsenic Trioxide | 1327-53-3 | |
| Asbestos | 1332-21-4 | |
| Benzene | 71-43-2 | |
| Benzidine | 92-87-5 | |
| Chromium Powder** | 7440-47-3 | |
| Chromium (VI) Oxide | 1333-82-0 | |
| Lead Arsenate | 7784-40-9 | |
| Sodium Arsenate | 7631-89-2 | |
| Sodium Arsenite | 7784-46-5 | |
| PROBABLE CARCINOGENS | CAS NO. | AMOUNT |
| Acrylonitrile | 107-13-1 | |
| Cadmium Powder** | 7440-43-9 | |
| Cadmium Chloride | 10108-64-2 | |
| Cadmium Sulfate | 10124-36-4 | |
| Carbon Tetrachloride | 56-23-5 | |
| Chloroform | 67-66-3 | |
| Ethylene Oxide | 75-21-8 | |
| Nickel Powder** | 7440-02-0 | |
| o-Toluidine | 95-53-4 | |

*Based on the International Agency for Research on Cancer (IARC) classification. "Known" carcinogens are IARC Group 1; "Probable" carcinogens are IARC Groups 2A and 2B.

**Evidence for the carcinogenicity of these metals is derived from occupational exposure studies. Although it is uncertain whether the metal or a metal compound(s) is responsible, only respirable particulates are thought to be of concern.

Table 3
SUBSTANCES REPORTED AS ANIMAL CARCINOGENS* OR MUTAGENS**

ANIMAL CARCINOGENS: Reports on the extent of the hazard to humans are not complete as of this edition. Substances that are animal carcinogens should be regarded as posing a carcinogenic risk to humans and should be used with appropriate caution.

MUTAGENS: The extent of the hazard to humans associated with exposure to mutagens is less clear than it is with carcinogens. However, it is recommended that similar (to that exercised in handling carcinogens) caution should be exercised in handling substances which are mutagenic.

Substances are identified as **KNOWN ANIMAL CARCINOGENS** or **MUTAGENS**

| SUBSTANCE | CAS NO. | ANIMAL CARCINOGENS | MUTAGENS | AMOUNT |
|---|------------|--------------------|----------|--------|
| Acetamide | 60-35-5 | ● | ● | |
| Acridine Orange | 494-38-2 | | ● | |
| Ammonium Chromate | 7788-98-9 | | ● | |
| Ammonium Dichromate Ammonium Bichromate | 7789-09-5 | | ● | |
| Aniline (or any of its salts) | 142-04-1 | ● | | |
| Anthracene | 120-12-7 | | ● | |
| Antimony Oxide | 4327-33-9 | | ● | |
| Beryllium Carbonate | 66104-24-3 | ● | ● | |
| Cobalt Powder | 7740-48-4 | | ● | |
| Colchicine | 64-86-8 | | ● | |
| 1,2-Dichloroethane (Ethylene Dichloride) | 107-06-2 | ● | ● | |
| 1,4-Dioxane (p-Dioxane) | 123-91-1 | ● | | |
| Formaldehyde | 50-00-0 | ● | ● | |
| Hydroquinone | 123-31-9 | | ● | |
| Indigo Carmine | 860-22-0 | | ● | |
| Lead Diacetate | 301-04-2 | ● | ● | |
| Nickel (II) Acetate | 373-02-4 | ● | | |
| Osmium Tetraoxide | 20816-12-0 | | ● | |
| Potassium Chromate | 7789-00-6 | | ● | |
| Potassium Permanganate | 7722-64-7 | | ● | |
| Pyrogalllic Acid | 87-66-1 | | ● | |
| Silver (I) Nitrate | 7761-88-8 | | ● | |
| Sodium Azide | 26628-22-8 | | ● | |
| Sodium Dichromate Dihydrate | 7789-12-0 | | ● | |
| Sodium Nitrate | 7631-99-4 | | ● | |
| Sodium Nitrite | 7632-88-3 | | ● | |
| Thioacetamide | 62-55-5 | ● | ● | |
| Toluene | 108-88-3 | | ● | |
| Urethane (Ethyl Carbamate) | 51-79-6 | ● | ● | |

*Based on IARC classification or the National Toxicology Program testing classifications.

**Based on IARC classification, the National Toxicology Program testing classification, or the Registry of Toxic Effects of Chemical Substances (following review of citations by CPSC).

Table 4
HIGHLY TOXIC SUBSTANCES THAT SHOULD ONLY BE USED WITH CAUTION
AND APPROVED SAFETY PROCEDURES

Substances in Table 4 are highly toxic as defined by the Federal Hazardous Substances Act (FHSA). Very small amounts of these chemicals may cause immediate, acutely toxic reactions. All necessary precautions should be taken to limit exposure to these highly toxic chemicals and substitutes for such chemicals should be used whenever possible.

The FHSA uses the LD₅₀ and LC₅₀ as a measure of the acute toxicity of a substance. The FHSA defines a highly toxic substance as one where the LD₅₀ is 50 mg/kg or less when orally administered or where the LC₅₀ is 200 ppm or less when a gas or vapor is inhaled. The LD₅₀ is the dose of a substance that produces death in 50% of a group of laboratory animals. The LC₅₀ is the vapor concentration of a substance that produces death in 50% of the animals. Although these measures of lethality can be influenced by a variety of factors, historically they have provided a measure of toxicity which can be used in estimating the comparative safety of substances. The LD₅₀ values in this table are determined for the most part following oral administration of the chemical to rats and are expressed in milligrams per kilogram (mg/kg). The LC₅₀ is expressed in parts per million (ppm). The lowest LD₅₀ or LC₅₀ reported in the literature is shown for each substance.

| SUBSTANCE | CAS NO. | LD ₅₀ (mg/kg) or LC ₅₀ (ppm) | AMOUNT |
|----------------------|------------|---|--------|
| Adrenaline | 51-43-4 | 50 mg/kg | |
| Barium Hydroxide | 17194-00-2 | 5 to 50 mg/kg | |
| Chlorine | 7782-50-5 | 137 ppm | |
| Colchicine | 64-86-8 | 50 mg/kg | |
| Mercury | 7439-97-6 | Mercury presents a special type of hazard. Due to acute and chronic neurotoxicity of mercury vapors, the Occupational Safety and Health Administration has set the Acceptable Ceiling Concentration* at 100 micrograms per cubic meter. | |
| Mercuric Chloride | 7487-94-7 | 10 mg/kg | |
| Mercuric Iodide | 7774-29-0 | 40 mg/kg | |
| Mercuric Nitrate | 7783-34-8 | ** | |
| Mercuric Oxide | 21908-53-2 | 18 mg/kg | |
| Mercuric Sulfate | 13766-44-4 | ** | |
| Nicotine | 54-11-5 | 24 mg/kg | |
| Osmium Tetraoxide | 20816-12-0 | 14 mg/kg | |
| Phosphorus (White) | 7723-14-0 | 4.8 mg/kg | |
| Phosphorus Pentoxide | 1314-56-3 | 9.7 ppm | |
| Potassium Cyanide | 151-50-8 | *** | |
| Potassium Periodate | 7790-21-8 | 48 mg/kg | |
| Silver Cyanide | 506-64-9 | *** | |
| Sodium Cyanide | 143-33-9 | 4 mg/kg | |

*Acceptable Ceiling Concentration is the level which cannot be exceeded at anytime during an eight hour work shift.

**Toxicity is expected to be similar to other mercuric salts.

***Toxicity is expected to be similar to Sodium Cyanide.

Table 5
SUBSTANCES IDENTIFIED* AS CORROSIVE OR IRRITATING
THAT CAN BE USED WITH CAUTION AND APPROVED SAFETY PROCEDURES

For those substances labeled corrosive, great care should be taken to prevent contact with the skin and especially with the eyes, since blindness or impaired vision could result. For those chemicals labeled as irritants, care should be taken to avoid skin and eye contact; for volatile substances, additional care should be exercised to avoid inhalation of vapors.

| SUBSTANCE | CAS NO. | CORROSIVE | IRRITANT | AMOUNT |
|-------------------------|------------|-----------|----------|--------|
| Acetaldehyde | 75-07-0 | | ● | |
| Acetic Acid | 64-19-7 | ● | | |
| Acetic Anhydride | 108-24-7 | | ● | |
| Aluminum Chloride | 7446-70-0 | ● | | |
| Ammonia | 1336-21-6 | | ● | |
| Ammonium Dichromate | 7789-09-5 | ● | | |
| Ammonium Oxalate | 14258-49-2 | ● | | |
| Antimony Pentachloride | 7647-18-9 | ● | | |
| Antimony Oxide | 1309-64-4 | | ● | |
| Antimony Trichloride | 10025-91-9 | ● | | |
| Bismuth Trichloride | 7787-60-2 | ● | | |
| Bromine | 7726-95-6 | ● | | |
| Calcium Carbide | 75-20-7 | ● | | |
| Calcium Fluoride | 7789-75-5 | | ● | |
| Calcium Oxide | 1305-78-8 | ● | | |
| Catechol (pyrocatechol) | 120-80-9 | | ● | |
| Chlorine** | 7782-50-5 | ● | | |
| Cupric Bromide | 7789-45-9 | ● | | |
| Cupric Chloride | 1344-67-8 | | ● | |
| Cupric Nitrate | 10031-43-3 | | ● | |
| Cupric Sulfate | 7758-98-7 | | ● | |
| p-Dichlorobenzene | 106-46-7 | | ● | |
| Diethyl Phthalate | 84-66-2 | | ● | |
| Ethyl Methacrylate | 97-63-2 | | ● | |
| Ferric Chloride | 7705-08-0 | | ● | |
| Hexachlorophene | 70-30-4 | | ● | |
| Hydrochloric Acid | 7647-01-0 | ● | | |
| Hydrofluoric Acid | 7664-39-3 | ● | | |
| Hydrogen Peroxide (30%) | 7722-84-1 | | ● | |
| Hydrogen Sulfide | 7783-06-4 | | ● | |
| Hydroquinone | 123-31-9 | ● | | |
| Iodine (crystals) | 7553-56-2 | | ● | |
| Lead Carbonate | 598-63-0 | | ● | |

*According to NFPA and RTECS

**Highly toxic substances included here for their corrosive or irritant characteristics.

Table 5, continued — Substances identified* as CORROSIVE or IRRITANT

| SUBSTANCE | CAS NO. | CORROSIVE | IRRITANT | AMOUNT |
|--|------------|-----------|----------|--------|
| Lithium | 7439-93-2 | ● | | |
| Methyl Ethyl Ketone | 78-93-3 | | ● | |
| Methyl Methacrylate | 80-62-6 | | ● | |
| Methyl Salicylate | 119-36-8 | | ● | |
| Naphthalene | 91-20-3 | | ● | |
| Nitric Acid | 7697-37-2 | ● | | |
| Oxalic Acid | 144-62-7 | ● | | |
| Phosphorus (White)** | 7723-14-0 | ● | | |
| Phosphorus Pentoxide** | 1314-56-3 | ● | | |
| Phthalic Anhydride | 85-44-9 | | ● | |
| Potassium Chromate | 7789-00-6 | ● | | |
| Potassium Cyanide** | 151-50-8 | ● | | |
| Potassium Fluoride | 7789-23-3 | ● | | |
| Potassium Metal | 7740-09-7 | ● | | |
| Potassium Hydroxide | 1310-58-3 | ● | | |
| Potassium Permanganate | 7722-64-7 | | ● | |
| Sodium Metal | 7440-23-5 | ● | | |
| Sodium Cyanide** | 143-33-9 | ● | | |
| Sodium Ferrocyanide | 13601-19-9 | ● | | |
| Sodium Hydroxide | 1310-73-2 | ● | | |
| Sodium Sulfide | 1313-84-4 | | ● | |
| Disodium Hexafluorosilicate (Sodium Silicofluoride) | 16893-85-9 | ● | | |
| Stannic Chloride | 7646-78-8 | ● | | |
| Sulfuric Acid | 7664-93-9 | ● | | |
| Sulfuric Acid Fuming | 8014-95-9 | ● | | |
| Titanium Trichloride | 7705-07-9 | | ● | |
| Toluene | 108-88-3 | | ● | |
| Trichlorotrifluoroethane | 76-13-1 | | ● | |
| Turpentine | 8006-64-2 | | ● | |

*According to NFPA and RTECS

**Highly toxic substances included here for their corrosive or irritant characteristics.

Section 5 SAFETY RECOMMENDATIONS

WORK HABITS

- Never work alone in a science laboratory or storage area.
- Never eat, drink, smoke, chew gum or tobacco in a science laboratory or storage area. Do not store food or beverages in the laboratory environment.
- Never pipette by mouth.
- Wash hands before and after work in a science laboratory, and after spill cleanups.
- Restrain loose clothing (e.g. sleeves, full cut blouses, neckties etc.), long hair and dangling jewelry.
- Tape all Dewar flasks.
- Never leave heat sources unattended (e.g. gas burners, hot plates, heating mantles, sand baths, etc.).
- Do not store reagents and/or apparatus on lab bench, and keep lab shelves organized.
- Never place reactive chemicals (in bottles, beakers/flasks, wash bottles, etc.) near the edges of a lab bench.
- Use a fume hood when working with volatile substances.
- Never lean into the fume hood.
- Do not use the fume hood as a storage area.
- Obtain and read the Material Safety Data Sheets (MSDS) for each chemical before beginning any experiment.
- Analyze new lab procedures in advance to pinpoint hazardous areas.
- Analyze accidents to prevent repeat performances.
- Protection should be provided for not only the lab worker but also the lab partner working nearby.
- Do not mix chemicals in the sink drain.
- Always inform co-workers of plans to carry out hazardous work.
- Record who worked with what, when, and how long in order to allow meaningful retrospective contamination studies.
- Conduct regular in-house safety and health inspections with an emphasis on improvement rather than guilt.
- Inform lab occupants about the alarm bell and what to do if it sounds.
- Carry out regular fire or emergency drills with critical reviews of the results.
- Have actions pre-planned in case of an emergency (e.g. what devices should be turned off, which escape route to use, a personnel meeting place outside the building, a person designated to authorize re-entry into the building).
- Lab personnel should have recent training in first aid, CPR etc.

SAFETY WEAR

- ANSI (or equivalent standard) approved eye or face protection should be worn continuously.
- Gloves should be worn which will resist penetration by the chemical being handled and which have been checked for pin holes, tears, or rips.
- Wear a laboratory coat or apron to protect skin and clothing from chemicals.
- Footwear should cover feet completely; no open-toe shoes.

FACILITIES AND EQUIPMENT

- Have separate containers for trash and broken glass.
- Never block any escape routes, and plan alternate escape routes.
- Never block a fire door open.
- Never store materials in lab or storage area aisles.
- All moving belts and pulleys should have safety guards.
- Instruct lab personnel in the proper use of the eye-wash fountain, emphasizing rolling of the eye-balls, and turning eyelids "inside-out".
- Ensure that eye-wash fountains will supply at least 15 minutes of water flow.
- Sample breathing air space for measurement of possible contaminants, and keep good records.

SAFETY RECOMMENDATIONS, continued

- Regularly inspect fire blankets for rips and holes and keep good records of the inspections.
- Regularly inspect safety showers and eye-wash fountains and keep records of inspections.
- Keep up-to-date emergency phone numbers posted next to the phone.
- Place fire extinguishers near an escape route, not in a “dead end”.
- Regularly maintain fire extinguishers, maintain records, and train personnel in the proper use of extinguishers through actual fire situations.
- Acquaint personnel with the meaning of “Class A fire”, “Class B fire”, etc., and how they relate to fire extinguisher use.
- Regularly check hood for proper draft; also check that exhaust air from an external hood vent is not redrawn into room air.
- Secure all compressed gas cylinders when in use and transport them secured on a hand truck.
- Install chemical storage shelves with lips, and never use stacked boxes in lieu of shelves.
- Only use an explosion-proof refrigerator for lab storage.
- Have appropriate equipment and materials available for spill control; replace when it becomes dated.

PURCHASING, USE, AND DISPOSAL

- If possible, purchase chemicals in class-size quantities only.
- Label all chemicals accurately with date of receipt, or preparation, initialed by the person responsible, and pertinent precautionary information on handling.
- Generally, bottles of chemicals should not remain unused on shelves in the lab for more than one week, in the store room near the lab unused for more than one month, or in the main stockroom unused for more than one year.
- Follow all directions for disposing of residues and unused portions of reagents.
- Properly store flammable liquids in small quantities in containers with a provision for bonding to receiving vessels when the liquid is transferred.
- Never open a reagent package until the label has been read and completely understood.
- Have a Material Safety Data Sheet on hand before using a chemical.
- Prepare a complete list of chemicals of which you wish to dispose.
- Classify each of the chemicals on the disposal list into a hazardous or non-hazardous waste chemical. (Check with the local environmental agency office for details.)
- Unlabeled bottles (a special problem) must be identified to the extent that they can then be classified as hazardous or non-hazardous wastes. (Some landfills will analyze a mystery bottle for a fee, if it is shipped to the landfill in a separate package, labeled as a sample, and accompanied by a letter also identifying it as a sample, with instructions to analyze the contents sufficiently to allow proper disposal).

SUBSTITUTIONS

- Reduce risks by diluting substances instead of using concentrates.
- Use micro/semi-micro techniques instead of macro-techniques.
- Use films, videotapes, and other methods rather than experiments involving hazardous substances.
- Undertake all substitutions with extreme caution.

CLASSES

- All science teachers should complete a science safety course such as "Safety in the School Science Laboratory." It has been developed cooperatively by the Council of State Science Supervisors (CS³) and the National Institute for Occupational Safety and Health (NIOSH). For information concerning this course, please contact the local state science supervisor or Mrs. Glenda White, Division of Training and Manpower Development, NIOSH, 4674 Columbia Parkway, Cincinnati, OH 45226.
- Other chemical safety training courses are offered by commercial organizations, universities, professional societies and trade associations.
- All science teachers should complete a first aid and CPR course offered by the American Red Cross.

EMERGENCY TELEPHONE NUMBERS

Post these numbers in a conspicuous place near the telephone:

Fire _____

Police _____

Rescue Squad _____

Hospital _____

Poison Control Center _____

The local fire department should be regularly informed of current hazardous situations in the lab, and yearly visits by the fire chief are recommended. Nearby hospitals should be aware of current specifics of hazardous chemicals used in the lab. Local physicians should be aware of proper treatments for exposures to chemicals used in the lab.

OFFICIAL INSPECTIONS

Although few schools have the necessary test instruments and personnel trained to conduct a thorough inspection, local health authorities will be able to determine whether or not science laboratory facilities, equipment and storage areas are safe for the substances being used in the program. In the event local authorities are unable to perform this service, consultants from commercial companies are available to make inspections and prepare written reports on their findings.

DAILY INSPECTIONS

Official inspections do not relieve the science instructor of the responsibility of daily and other periodic inspections necessary to maintain a high standard of health and safety for the protection of students and school property.

REFERENCES

Many helpful suggestions may be found in the NIOSH publication **Safety in the School Science Laboratory**.

TEACHER'S NOTES

Section 6

CHEMICAL AND BIOLOGICAL STORAGE ROOMS AND SUGGESTED CHEMICAL STORAGE PATTERNS

One chemical/biological storage room under the supervision of a qualified person is essential for each school. The storage room should have adequate security. Safety facilities should include the following:

- Fire extinguishers of the approved type, including sand and soda positioned near an escape route.
- Spill control and clean-up materials.
- Master control shut-off valves for gas, water and electricity.
- Approved eye/face wash.
- Shower
- Smoke detector.
- Forced ventilation from floor to ceiling with exhaust above roof level.
- Lip-edged shelving secured to wall with top shelf below eye level.
- Safety cabinets for specific groups of compatible substances.
- A communication system to the main office or emergency center.

The alphabetical method of storing chemicals presents hazards because chemicals which react violently with each other may be stored in close proximity. The J. T. Baker Chemical Company has devised a simple color coding scheme to address this problem. The code includes both solid and striped colors which are used to designate specific hazards as follows:

- | | |
|---------------|--|
| Red | — Flammability hazard: Store in a flammable chemical storage area. |
| Red Stripe | — Flammability hazard: Do not store in the same area as other flammable substances. |
| Yellow | — Reactivity hazard: Store separately from other chemicals. |
| Yellow Stripe | — Reactivity hazard: Do not store with other yellow coded chemicals; store separately. |
| White | — Contact hazard: Store separately in a corrosion-proof location. |
| White Stripe | — Contact hazard: Not compatible with chemicals in solid white category. |
| Blue | — Health hazard: Store in a secure poison area. |
| Orange | — Not suitably characterized by any of the foregoing categories. |

Once the chemicals are sorted according to their color codes, sorting into organic and inorganic classes within a color should occur. The Flinn Chemical Catalog Reference Manual suggests organic and inorganic groupings which are further sorted into compatible families. The compatible families suggested* are:

INORGANIC

1. Metals, hydrides
2. Halides, sulfates, sulfites, thiosulfates, Phosphates, halogens
3. Amides, nitrates** (except ammonium nitrate), nitrites**, azides**, nitric acid
4. Hydroxides, oxides, silicates, carbonates, carbon
5. Sulfides, selenides, phosphides, carbides, nitrides
6. Chlorates, perchlorates**, perchloric acid**, chlorites, hypochlorites, peroxides**, hydrogen peroxide
7. Arsenates, cyanides, cyanates
8. Borates, chromates, manganates, permanganates
9. Acids (except nitric)
10. Sulfur, phosphorus**, arsenic, phosphorus pentoxide**

ORGANIC

1. Acids, Anhydrides, peracids
2. Alcohols, glycols, amines, amides, imines, imides
3. Hydrocarbons, esters, aldehydes
4. Ethers**, ketones, ketenes, halogenated hydrocarbons, ethylene oxide
5. Epoxy compounds, isocyanates
6. Peroxides, hydroperoxides, azides**
7. Sulfides, polysulfides, sulfoxides, nitriles
8. Phenols, cresols

Using a combination of the J. T. Baker and Flinn Scientific storage schemes should eliminate chemical incompatibilities in the chemical storage room.

On the opposite page is a suggested arrangement of the compatible chemical families on the shelf areas of a chemical storage room. This suggested arrangement is taken from the Flinn Chemical Catalog Reference Manual.* It should be remembered that storage shelves should not be above eye level and the chemicals marked with a double asterisk (**) deserve special attention due to their potential instability. Additional information on chemical incompatibilities can be found on p. 45.

Be sure to follow local fire codes when storing flammable chemicals in separate cabinets.

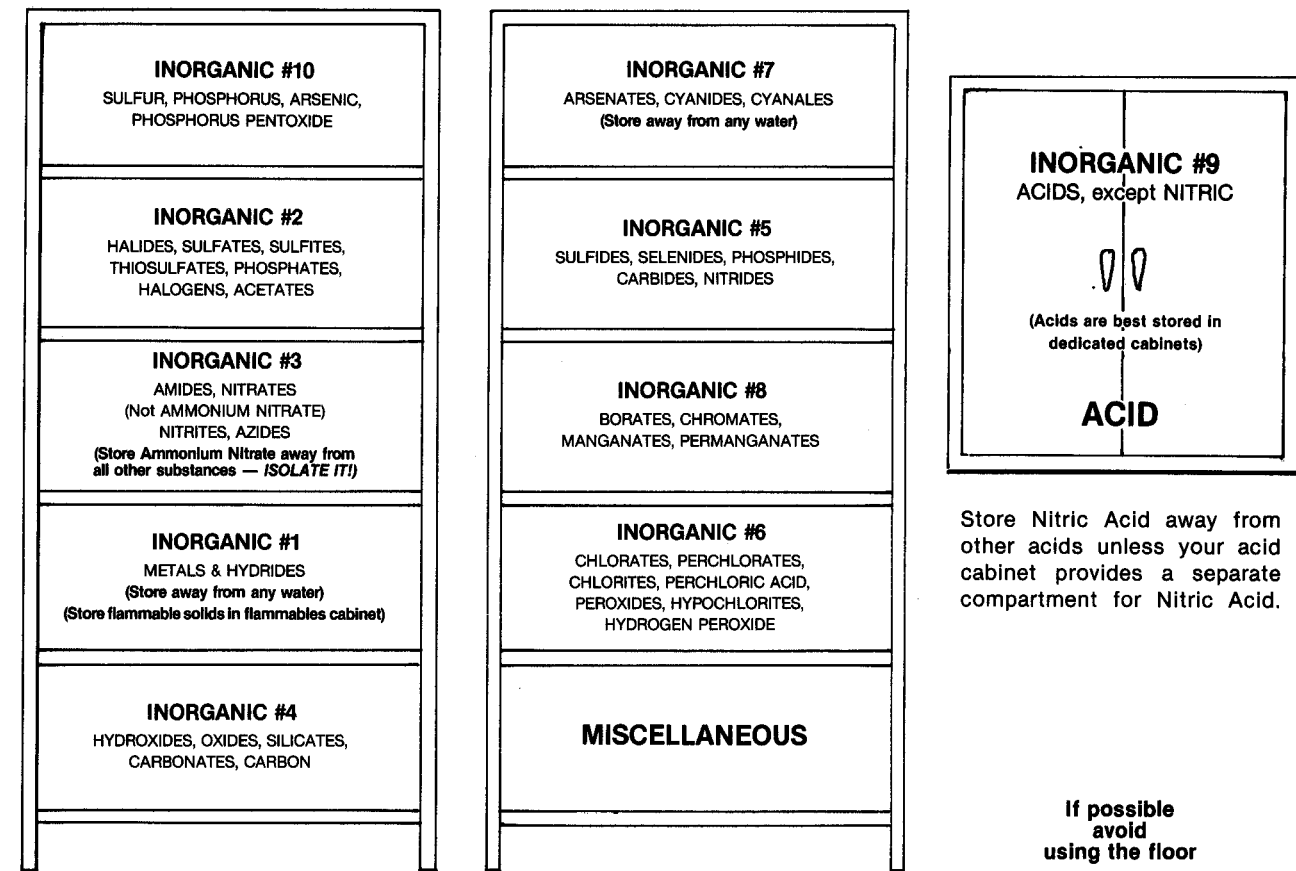
STORAGE SUGGESTIONS

1. Avoid floor chemical storage (even temporary)
2. No top shelf chemical storage
3. No chemicals stored above eye level
4. Shelf assemblies are firmly secured to walls. Avoid island shelf assemblies.
5. Provide anti-roll lips on all shelves
6. Ideally shelving assemblies would be of wood construction
7. Avoid metal, adjustable shelf supports and clips. Better fixed, wooden supports.
8. Store acids in dedicated acid cabinet. Store nitric acid in that same cabinet **only** if isolated from other acids. Store both inorganic and some organic acids in the acid cabinet.
9. Store flammables in a dedicated flammables cabinet.
10. Store severe poisons in a dedicated poisons cabinet.

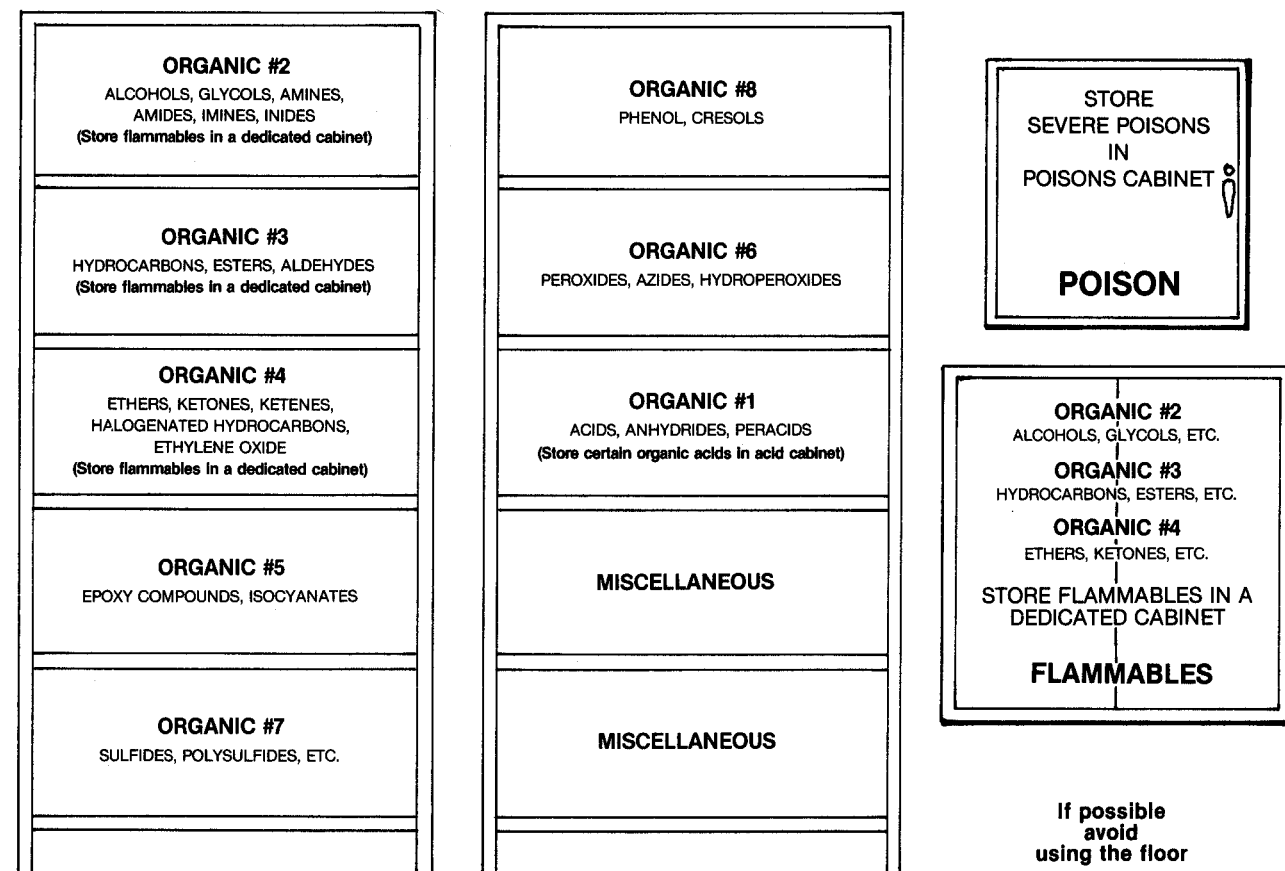
*Reprinted with permission of Flinn Scientific, Inc., P.O. Box 231, Batavia, IL 60510 U.S.A.

**These chemicals deserve special attention due to their potential instability.

SUGGESTED SHELF STORAGE PATTERN — INORGANIC



SUGGESTED SHELF STORAGE PATTERN — ORGANIC



TEACHER'S NOTES

Section 7

SCIENCE INVENTORY AND STORAGE HAZARDS

This list is derived from a current school supply catalog as well as from chemicals identified as being in high school laboratories. The two complementary organization schemes are included under the "Organization" heading of this list. The colors refer to the J. T. Baker system (page 21) and the numbered inorganic and organic categories are derived from the Flinn Scientific scheme (page 22). The suggested joint use of these two systems is as follows: (1) Divide the chemicals within their color coding; (2) Separate chemicals within their color according to the inorganic and organic classifications; (3) Separate acids from bases, and oxidizers from reducing agents; and (4) store all compressed gases separately.

Substances listed in Tables 1—5 are also identified in this list. The National Fire Protection Association flammability classifications have been used to designate the "Storage Hazard." They are based on the flashpoints of materials and are the following: if the flashpoint is less than 73 °F. the material is highly flammable; between 73 °F. and 100 °F. the material is flammable; and between 100 °F. and 200 °F. the material is combustible. TABULATED BELOW ARE STORAGE AND USE HAZARDS FOR EACH CHEMICAL. THE ABSENCE OF A HAZARD OR TOXICITY DESIGNATION IS NOT MEANT TO IMPLY SAFETY. Chemical carcinogens (Tables 2 and 3) should be clearly designated.

| SUBSTANCES | ORGANIZATION | STORAGE HAZARDS | AMOUNT |
|--|------------------------|--|--------|
| Acetaldehyde (Table 5) | Organic #3, Red | Oxidizes readily in air to form unstable peroxides | |
| Acetamide (Table 3) | Organic #2, Orange | | |
| Acetanilide | Organic #2, Orange | | |
| Acetic Acid (Table 5) | Organic #1, Red | Combustible, above 103 °F. Explosive vapor air mixture (fireproof storage) | |
| Acetic Anhydride (Table 5) | Organic #1, Red Stripe | Combustible, above 120 °F. explosive potential (fireproof storage) | |
| Aceto Carmine (Natural Red 4) | Miscellaneous, Dye | | |
| Acetone | Organic #4, Red | Highly flammable, vapor air mixture explosive (fireproof, cool storage) | |
| Aceto-orcein (Orcinol) | Miscellaneous, Orange | | |
| Acetylcholine (as bromide or chloride) | Organic #3 | | |
| Acridine Orange (Table 3) | Miscellaneous, Dye | | |
| Acrylonitrile (Inhibited) (Table 2) | Organic #2, Red | Flammable, explosive (fireproof storage) | |
| Adenine | Organic #2, Orange | | |
| Adrenaline (Table 4) | Organic #2, Orange | | |
| Agar | Miscellaneous, Orange | | |
| Alanine | Organic #2, Orange | | |
| Albumin | Miscellaneous, Orange | | |
| Alizarin Yellow | Miscellaneous, Dye | | |
| Alizarin Red (Red #1) | Miscellaneous, Dye | | |
| Alum | Inorganic #2, Orange | See aluminum ammonium sulfate, aluminum potassium sulfate | |
| Aluminum Ammonium Sulfate | Inorganic #2, Orange | | |
| Aluminum Chloride, hydrate (Table 5) | Inorganic #2, Orange | | |
| Aluminum Chloride, anhydrous (Table 5) | Inorganic #2, Yellow | Store separately from strong bases, reacts violently with water | |

Section 7, continued — Science Inventory and Storage Hazards

| SUBSTANCE | ORGANIZATION | STORAGE HAZARD | AMOUNT |
|----------------------------------|--------------------------|--|--------|
| Aluminum Hydroxide | Inorganic #4, Orange | | |
| Aluminum, metal | Inorganic #1, Red | | |
| Aluminum Nitrate | Inorganic #3, Yellow | Enhances combustion of other materials (avoid contamination) | |
| Aluminum Oxide | Inorganic #2, Orange | | |
| Aluminum Potassium Sulfate | Inorganic #2, Orange | | |
| Aluminum Sodium Sulfate | Inorganic #2, Orange | | |
| Aluminum Sulfate | Inorganic #2, Orange | | |
| Ammonia, liquid (Table 5) | Inorg. #4, White stripe | | |
| Ammonium Acetate | Inorganic, #2, Orange | | |
| Ammonium Bicarbonate | Inorganic #4, Orange | | |
| Ammonium Bichromate (Table 3, 5) | Inorganic #8, Yellow | Many reactions may cause fire and explosion (fireproof storage) | |
| Ammonium Bromide | Inorganic #2, Orange | | |
| Ammonium Carbonate | Inorganic #4, Orange | | |
| Ammonium Chloride | Inorganic #2, Orange | | |
| Ammonium Chromate (Table 3) | Inorganic #8, Blue | | |
| Ammonium Citrate | Inorganic #8, Orange | | |
| Ammonium Dichromate (Table 3, 5) | Inorganic #8, Yellow | See Ammonium Bichromate | |
| Ammonium Hydroxide | Inorg. #4, White stripe | | |
| Ammonium Iodide | Inorganic #2, Orange | | |
| Ammonium Metavanadate | Inorganic #2, Blue | | |
| Ammonium Molybdate | Inorganic #8, Orange | | |
| Ammonium Nitrate | Yellow, store separately | Enhances combustion of other substances, strong oxidant (fireproof storage) | |
| Ammonium Oxalate (Table 5) | Inorganic # 2, White | | |
| Ammonium Persulfate | Inorganic #6, Yellow | Enhances combustion of other substances; explosive reaction with reducing agents, metals | |
| Ammonium Phosphate | Inorganic #2, Orange | | |
| Ammonium Sulfate | Inorganic #2, Orange | | |
| Ammonium Sulfide | Inorganic #5, Red | | |
| Ammonium Sulfite | Inorganic #2, Orange | | |
| Ammonium Tartrate | Inorganic #2, Orange | | |
| Ammonium Thiocyanate | Inorganic #7, Orange | | |
| Amyl Acetate | Organic #3, Red | Flammable, explosive (fireproof storage) | |
| N-Amyl Alcohol | Organic #2, Red | Combustible | |
| Aniline (Table 3) | Organic #2, Red | Combustible; above 160 °F. explosive air vapor mixtures (fireproof storage, away from acids, oxidants) | |

Section 7, continued — Science Inventory and Storage Hazards

| SUBSTANCE | ORGANIZATION | STORAGE HAZARD | AMOUNT |
|--|-----------------------|---|--------|
| Aniline Blue | Miscellaneous, Dye | | |
| Aniline Hydrochloride (Table 3) | Organic #2, Orange | | |
| Aniline Violet | Miscellaneous, Dye | | |
| Anthracene (Table 3) | Organic #3, Orange | | |
| Antimony | Inorganic #1, Blue | | |
| Antimony Oxide (Trioxide) (Table 3, 5) | Inorganic #4, Blue | | |
| Antimony Pentachloride (Table 5) | Inorganic #2, White | | |
| Antimony Potassium Tartrate | Inorganic #2, White | | |
| Antimony Trichloride (Table 5) | Inorganic #2, White | | |
| Antimony Trisulfide | Inorganic #5, Blue | May enhance combustion of other substances | |
| Arabinose | Organic #2, Orange | | |
| Arsenic (Table 2) | Inorganic #10, Blue | | |
| Arsenic Chloride (Trichloride) (Table 2) | Inorganic #10, Blue | | |
| Arsenic Pentoxide (Table 2) | Inorganic #10, Blue | | |
| Arsenic Trioxide (Arsenous Acid) (Table 2) | Inorganic #7, Blue | | |
| Asbestos (Table 2) | Inorganic #4, Blue | | |
| Ascorbic Acid | Organic #1, Orange | | |
| Balsam | Organic #2, Orange | | |
| Barford Reagent | Organic #1, Orange | Contains cupric acetate, acetic acid and water | |
| Barium Acetate | Inorganic #2, Blue | | |
| Barium Carbonate | Inorganic #4, Orange | | |
| Barium Chlorate | Inorganic #6, Yellow | Enhances combustion of other substances; explosive, oxidant | |
| Barium Chloride | Inorganic #2, Blue | | |
| Barium Hydroxide (Table 4) | Inorganic #4, Blue | | |
| Barium Nitrate | Inorganic #3, Yellow | Enhances combustion of other substances; explosive, oxidant | |
| Barium Oxalate | Inorganic #2, Blue | | |
| Barium Oxide | Inorganic #4, Blue | Oxidant | |
| Barium Peroxide | Inorganic #6, Yellow | Enhances the combustion of other substances; many reactions cause fire or explosion | |
| Barium Sulfate | Inorganic #2, Orange | | |
| Barium Sulfide | Inorganic #5, Blue | | |
| Beal Orcinol Reagent | Organic #2, Red | Contains resorcinol, ethyl alcohol, and ferric chloride | |
| Beeswax | Miscellaneous, Orange | | |
| Benedict's Solution | Inorganic #2, Orange | | |

Section 7, continued — Science Inventory and Storage Hazards

| SUBSTANCE | ORGANIZATION | STORAGE HAZARD | AMOUNT |
|-------------------------------|---------------------------|---|--------|
| Benzaldehyde | Organic #3, Red | Combustible; above 145 °F. explosive air vapor mixtures (fireproof storage) | |
| Benzene (Table 2) | Organic #3, Red stripe | Highly flammable (fireproof storage) | |
| Benzidine (Table 2) | Organic #2, Blue | | |
| Benzoic Acid | Organic #1, Orange | | |
| Benzoyl Peroxide (Table 1) | Organic #6, Yellow stripe | Contamination or heating can cause violent decomposition | |
| Beryllium Carbonate (Table 3) | Inorganic #4, Blue | | |
| Biphenyl (Diphenyl) | Organic #3, Red | | |
| Bismuth Nitrate | Inorganic #3, Yellow | Oxidant | |
| Bismuth Trichloride (Table 5) | Inorganic #2 | | |
| Boric Acid | Inorganic #9, Orange | | |
| Bouin's Fluid | Organic #1, White | Saturated picric acid solution, formalin and acetic acid | |
| Brilliant Green | Organic #3, Dye | | |
| Bromine (Table 5) | Inorganic #2, Yellow | Many reactions may cause fire and explosion; oxidant | |
| Bromine Water | Inorganic #2, Yellow | Oxidant | |
| Bromocresol Green | Miscellaneous, Dye | | |
| Bromocresol Purple | Miscellaneous, Dye | | |
| Bromophenol Blue | Miscellaneous, Dye | | |
| Bromothymol Blue | Miscellaneous, Dye | | |
| Butanol (n-Butyl Alcohol) | Organic #2, Red | Flammable, explosive (fireproof storage) | |
| Butyric Acid | Organic #1, White | Explosive in above 161 °F. air vapor mixtures (fireproof storage) | |
| Cadmium Acetate | Inorganic #2, Blue | | |
| Cadmium Carbonate | Inorganic #4, Blue | | |
| Cadmium Chloride (Table 2) | Inorganic #2, Blue | | |
| Cadmium, metal (Table 2) | Inorganic #1, Blue | | |
| Cadmium Nitrate | Inorg. #3, Yellow stripe | Oxidant | |
| Cadmium Oxide | Inorganic #4, Blue | | |
| Cadmium Sulfate (Table 2) | Inorganic #2, White | | |
| Calcium | Inorganic #1, Red | Many reactions may cause fire or explosion | |
| Calcium Acetate | Inorganic #2, Orange | | |
| Calcium Bromide | Inorganic #2, Orange | | |
| Calcium Carbide (Table 5) | Inorganic #5, Red | Reaction with water may cause fire and explosion | |
| Calcium Carbonate | Inorganic #4, Orange | | |
| Calcium Chloride | Inorganic #2, Orange | | |
| Calcium Dioxide | Inorganic #4, Yellow | | |
| Calcium Fluoride (Table 5) | Inorganic #2, Orange | | |

Section 7, continued — Science Inventory and Storage Hazards

| SUBSTANCE | ORGANIZATION | STORAGE HAZARD | AMOUNT |
|--|---------------------------|---|--------|
| Calcium Hydroxide | Inorganic #4, Orange | | |
| Calcium Hypochlorite | Inorganic #6, Yellow | Enhances combustion of other substances; oxidant | |
| Calcium Nitrate | Inorganic #3, Yellow | Enhances combustion of other substances; oxidant | |
| Calcium Oxide (Table 5) | Inorganic #4, Orange | | |
| Calcium Phosphate | Inorganic #2, Orange | | |
| Calcium Sulfate | Inorganic #2, Orange | | |
| Camphor | Organic #4, Red | Combustible; above 150°F. explosive vapor air mixtures | |
| Carbolfuchsin (Ziehl's Stain) | Organic #2 | | |
| Carbolic Acid (Phenol) | Organic #8, Blue | | |
| Carbon | Inorganic #10, Orange | | |
| Carbon Dioxide | Miscellaneous | Solid can cause frostbite | |
| Carbon Disulfide (Table 1) | Organic #7, Red | Highly flammable, explosive (fireproof storage under water or inert gas) | |
| Carbon Tetrachloride (Table 2) | Organic #4, Blue | | |
| Carborundum | Inorganic #4, Blue | | |
| Carmine | Miscellaneous, Dye | | |
| Carnoy Fixative (mixture of alcohol, acetic acid and chloroform) | Organic #2, Red | Flammable | |
| Casein | Miscellaneous, Orange | | |
| Catechol (1,2-dihydroxybenzene) (Table 5) | Organic #8, Red | Combustible | |
| Ceric Sulfate | Inorganic #2, Yellow | Fire risk in presence of organic substances | |
| Charcoal | Inorganic #10, Red | | |
| Chloral Hydrate | Controlled Substance Blue | Should not be stored on school premises | |
| Chloretone (Chlorobutanol) | Organic #2, Blue | | |
| Chlorine (Tables 4,5) | Bottled gas, Yellow | Many reactions may cause fire and explosion | |
| Chlorine Water | Inorganic #2, Yellow | | |
| Chlorobenzene | Organic #4, Red | Combustible; above 84°F. explosive vapor air mixtures (fireproof storage) | |
| Chloroform (Table 2) | Organic #4, Blue | | |
| Chorionic Gonadatropin | Miscellaneous, Orange | | |
| Chromium (Table 2) | Inorganic #1, Blue | | |
| Chromium Acetate | Inorganic #2, Blue | | |
| Chromium Chloride | Inorganic #2, Orange | | |
| Chromium Nitrate | Inorganic #3, Yellow | Strong Oxidant | |
| Chromium VI Oxide (Table 2) | Inorganic #4, Blue | Oxidant | |

Section 7, continued — Science Inventory and Storage Hazards

| SUBSTANCE | ORGANIZATION | STORAGE HAZARD | AMOUNT |
|-----------------------------------|-----------------------|--|--------|
| Chromium (III) Potassium Sulfate | Inorganic #2, Orange | | |
| Chromium Trioxide (Table 2) | Inorganic #4, Yellow | Many reactions may cause fire and explosion; strong oxidant | |
| Cobalt (Table 3) | Inorganic #1, Orange | Dust is flammable | |
| Cobalt Chloride | Inorganic #2, Blue | | |
| Cobalt Nitrate | Inorganic #3, Yellow | Enhances the combustion of other substances; oxidant | |
| Cobalt Sulfate | Inorganic #2, Orange | | |
| Colchicine (Tables 3, 4) | Organic #8, Blue | | |
| Cupric Acetate | Inorganic #2, Orange | | |
| Cupric Bromide (Table 5) | Inorganic #2, Orange | | |
| Cupric Carbonate | Inorganic #4, Orange | | |
| Cupric Chloride (Table 5) | Inorganic #2, Orange | | |
| Cupric Nitrate (Table 5) | Inorganic #3, Yellow | Strong oxidant | |
| Cupric Oxide | Inorganic #4, Orange | | |
| Cupric Sulfate (Table 5) | Inorganic #2, Orange | | |
| Cyclohexane | Organic #3, Red | Highly flammable (fireproof storage) | |
| Cyclohexene | Organic #3, Red | Highly flammable (fireproof storage, add inhibitor) | |
| Deoxyribonucleic Acid | Organic #1, Orange | | |
| Dextrin Starch | Miscellaneous, Orange | | |
| Dextrose | Miscellaneous, Orange | | |
| Diastase of Malt | Miscellaneous, Orange | | |
| P-Dichlorobenzene (Table 5) | Organic #4, Red | Combustible; above 150°F. explosive air vapor mixtures (fireproof storage) | |
| Dichloroethane (Table 3) | Organic #4, Red | See ethylene dichloride | |
| Dichloroindophenol Sodium Salt | Organic #8 | | |
| Dichloromethane | Organic #4, Blue | See methylene chloride | |
| Dichlorophenol (Table 5) | Organic #8, Blue | | |
| Diethyl Phthalate | Organic #4, Red | Combustible | |
| Digitonin | Organic #3 | | |
| Diisopropyl ether (Table 1) | Organic #4, Red | Explosive | |
| N,N Dimethylaniline | Organic #2, Red | Combustible; above 145°F. explosive vapor air mixtures (fireproof storage) | |
| Dimethylglyoxime | Organic #2 | | |
| 1,4-Dioxane (P-Dioxane) (Table 3) | Organic #4, Red | Flammable; may develop explosive peroxides (fireproof storage) | |
| Diphenylamine | Organic #2, Orange | | |
| Dipotassium Chromate | Inorganic #8, Yellow | Oxidant | |
| EDTA | Organic #1, Orange | | |

Section 7, continued — Science Inventory and Storage Hazards

| SUBSTANCE | ORGANIZATION | STORAGE HAZARD | AMOUNT |
|-------------------------------|-----------------------|--|--------|
| Eosin | Miscellaneous, | | |
| Epinephrine | Organic #2, Orange | See adrenaline | |
| Epsom Salt | Inorganic #2, Orange | See magnesium sulfate | |
| Erythrosine | Miscellaneous, Dye | | |
| Ether, Ethyl (Table 1) | Organic #4, Red | Highly flammable, explosive, forms peroxides | |
| Ethyl Acetate | Organic #4, Red | Flammable, explosive (fireproof storage) | |
| Ethyl Alcohol | Organic #2, Red | Flammable | |
| Ethylene Dichloride (Table 3) | Organic #4, Red | Flammable | |
| Ethylene Glycol | Organic #2, Orange | | |
| Ethylene Oxide (Table 2) | Organic #5, Red | Highly flammable (fireproof storage) | |
| Ethyl Methacrylate (Table 5) | Organic #3, Red | Flammable | |
| F.A.A. Solution | Organic #2, Red | Contains formaldehyde, ethyl alcohol and acetic acid | |
| Fehling's Solution A | Inorganic #2, Orange | | |
| Fehling's Solution B | Inorganic #4 | | |
| Ferric Acetate | Inorganic #2, Orange | Combustible | |
| Ferric Ammonium Acetate | Inorganic #2, Orange | | |
| Ferric Ammonium Citrate | Inorganic #2, Orange | | |
| Ferric Ammonium Sulfate | Inorganic #2, Orange | | |
| Ferric Chloride (Table 5) | Inorganic #2, Orange | | |
| Ferric Nitrate | Inorganic #3, Yellow | Oxidant | |
| Ferric Oxide | Inorganic, #4, Orange | | |
| Ferric Phosphate | Inorganic, #2, Orange | | |
| Ferric Sulfate | Inorganic #2, Orange | | |
| Ferrous Ammonium Sulfate | Inorganic #2, Orange | | |
| Ferrous Chloride | Inorganic #2, Orange | | |
| Ferrous Nitrate | Inorganic #3, Orange | | |
| Ferrous Oxide | Inorganic #4, Orange | | |
| Ferrous Sulfate | Inorganic #2, Orange | | |
| Ferrous Sulfide | Inorganic #5, Orange | | |
| Feulgen Stain | Miscellaneous, Dye | See Schiff Reagent | |
| Flagella Stain | Miscellaneous, Dye | See Loeffler's Stain | |
| Fluorescein | Organic #8 | | |
| Formaldehyde (Table 3) | Organic #3, Red | | |
| Formalin (Table 3) | Organic #3 | 37%-50% solution of formaldehyde | |
| Formic Acid | Organic #1, Red | Above 156 °F. explosive vapor air mixtures | |
| Fructose | Miscellaneous, Orange | | |
| Fuchsin | Miscellaneous, Orange | | |

Section 7, continued — Science Inventory and Storage Hazards

| SUBSTANCE | ORGANIZATION | STORAGE HAZARD | AMOUNT |
|---|-----------------------|---|--------|
| Fumaric Acid | Organic #1 | Combustible | |
| Gasoline | Organic #3, Red | Highly flammable | |
| Gelatin | Miscellaneous, Orange | | |
| Gentian Violet | Miscellaneous, Orange | See Methyl Violet | |
| Gibberellic Acid | Organic #1, Orange | | |
| Giemsa Stain | Organic #2, Dye | | |
| Gilson Fluid | Organic #2 | Contains acetic acid, nitric acid, ethyl alcohol, and zinc chloride | |
| Glucose | Organic #2, Orange | | |
| Glycerine | Organic #2, Orange | See Glycerol | |
| Glycerol | Organic #2, Orange | | |
| Gold Foil | Inorganic #1, Orange | | |
| Gram's Iodine Stain | Miscellaneous, Dye | | |
| Graphite | Inorganic #1, Red | | |
| Gum Arabic | Organic #1, Orange | | |
| Gum Tragacanth | Organic #2, Orange | | |
| Gypsum | Inorganic #2, Orange | See Calcium Sulfate | |
| Hayem's Solution | Inorganic #2, Blue | Contains mercuric chloride, sodium chloride, and sodium sulfate | |
| Helium | Bottled Gas | | |
| Hematoxylin | Organic #2, Blue | | |
| Heptane | Organic #3, Red | Flammable; explosive vapor air mixtures | |
| Hexachlorophene [2,2-Methylenebis (3,4,6 trichlorophenol)] (Table 5) | Organic #8, Blue | | |
| Hexane | Organic #3, Red | | |
| Holtfreter's Solution | Inorganic #2, Orange | Contains sodium chloride, potassium chloride, calcium chloride, sodium bicarbonate | |
| Hydroiodic Acid | Inorganic #9, White | | |
| Hydrochloric Acid (Table 5) | Inorganic #9, White | | |
| Hydrofluoric Acid (Table 5) | Inorganic #9, White | | |
| Hydrogen | Bottled Gas, Red | Highly flammable, explosive | |
| Hydrogen Peroxide, 30% (Table 5) | Inorganic #6, Yellow | Enhances combustion of other substances, possible explosive mixed with other substances | |
| Hydrogen Sulfide (Table 5) | Inorganic #5, Red | Highly flammable, explosive gas | |
| Hydroquinone (Tables 3, 5) | Organic #3, Red | | |
| Indigo | Miscellaneous, Dye | | |
| Indigo Carmine (Table 3) | Miscellaneous, Dye | | |
| Indolacetic Acid (Table 3) | Organic #1 | | |
| Indolphenol Sodium Salt | Inorganic #8 | | |

Section 7, continued — Science Inventory and Storage Hazards

| SUBSTANCE | ORGANIZATION | STORAGE HAZARD | AMOUNT |
|--------------------------|--------------------------|--|--------|
| Iodine (Table 5) | Inorganic #2, White | | |
| Iron Acetate | Inorganic #2, Orange | See Ferric Acetate | |
| Iron, metal | Inorganic #1, Orange | | |
| Iron Pyrite | Inorganic #2, Orange | See Ferrous Sulfide | |
| Isoamyl Alcohol | Organic #2, Red | Combustible | |
| Isobutyl Alcohol | Organic #2, Red | Combustible, explosive above 82°F. | |
| Isopentyl Alcohol | Organic #2, Red | See Isoamyl Alcohol | |
| Isopropyl Alcohol | Organic #2, Red | Flammable | |
| Janus Green B | Miscellaneous, Dye | | |
| Kaolin | Inorganic #4, Orange | | |
| Kerosene | Organic #3, Red | Combustible; above 110°F. vapor air mixtures are explosive | |
| Lactic Acid | Organic #1, White | | |
| Lactose | Miscellaneous, Orange | | |
| Lauric Acid | Organic #1 | Combustible | |
| Lead Acetate (Table 3) | Inorganic #2, Blue | | |
| Lead Arsenate (Table 2) | Inorganic #7, Blue | | |
| Lead Carbonate (Table 5) | Inorganic #4, Blue | | |
| Lead Chloride | Inorganic #2, Blue | Oxidant | |
| Lead Dioxide | Inorganic #4, Yellow | Enhances the combustion of other substances; oxidant; reacts violently | |
| Lead Iodide | Inorganic #2, Blue | | |
| Lead, metal | Inorganic #1, Orange | | |
| Lead Monoxide (Litharge) | Inorganic #4, Blue | | |
| Lead Nitrate | Inorganic #3, Yellow | Enhances combustion of other substances; oxidant | |
| Lead Oxide | Inorganic #4, Blue | Oxidant; strong reactant | |
| Lead Peroxide | Inorganic #4, Yellow | See Lead Dioxide | |
| Lead Sulfate | Inorganic #2, White | | |
| Lead Sulfide (Galena) | Inorganic #5, Blue | | |
| Lead Tetraoxide | Inorganic #4, Blue | See Lead Oxide | |
| Lime Water | Inorganic #4, Orange | See Calcium Hydroxide | |
| Linseed Oil | Organic #2, Red | | |
| Lithium Carbonate | Inorganic #4, White | | |
| Lithium Chloride | Inorganic #2, Orange | | |
| Lithium Hydroxide | Inorganic #4, White | Reacts violently with acids | |
| Lithium, metal (Table 5) | Inorganic #1, Red stripe | Flammable; reacts violently with water, oxidants (fireproof storage) | |
| Lithium Nitrate | Inorganic #3, Yellow | Oxidant | |
| Lithium Sulfate | Inorganic #2, Orange | | |
| Litmus | Miscellaneous | | |

Section 7, continued — Science Inventory and Storage Hazards

| SUBSTANCE | ORGANIZATION | STORAGE HAZARD | AMOUNT |
|---|--------------------------|--|--------|
| Loeffler's Flagella Stain | Organic #2 | Contains fuchsin, ethyl alcohol and aniline | |
| Logwood Extract (Hematin) | Organic #2 | | |
| Luminol | Miscellaneous | | |
| Lugol's Iodine | Inorganic #2, Blue | | |
| Lycopodium Powder | Miscellaneous | Explosive as dust | |
| Lye | Inorg. #4, White stripe | See Sodium Hydroxide | |
| Magnesium Acetate | Inorganic #2, Orange | | |
| Magnesium Bromide | Inorganic #2, Orange | | |
| Magnesium Carbonate | Inorganic #4, Orange | | |
| Magnesium Chloride | Inorganic #2, Orange | | |
| Magnesium, metal | Inorganic #1, Red | Highly flammable in powder form; explosive | |
| Magnesium Nitrate | Inorganic #3, Yellow | Enhances combustion of other substances; oxidant | |
| Magnesium Oxide | Inorganic #4, Orange | | |
| Magnesium Sulfate | Inorganic #2, Orange | | |
| Magnesium Trisilicate | Inorganic #4, Orange | | |
| Malachite Green | Miscellaneous | | |
| Maleic Acid | Organic #1, Red | Combustible | |
| Malonic Acid | Organic #1, White | | |
| Maltose | Miscellaneous, Orange | | |
| Manganese Bromide (Manganous Bromide) | Inorganic #2, Orange | | |
| Manganese Chloride (Manganous Chloride) | Inorganic #2, Orange | | |
| Manganese Carbonate | Inorganic #4, Orange | | |
| Manganese Dioxide | Inorganic #4, Yellow | Enhances combustion of other substances; many reactions may cause fire and explosion | |
| Manganese, metal | Inorganic #1, Red stripe | Dust is flammable | |
| Manganese Nitrate (Manganous Nitrate) | Inorganic #3, Yellow | Oxidant | |
| Manganese Oxide (Manganous Oxide) | Inorganic #4, Orange | | |
| Manganese Sulfate (Manganous Sulfate) | Inorganic #2, Orange | | |
| Mayer's Fluid | Inorganic #2 | Contains potassium phosphate, magnesium sulfate, ammonium nitrate, calcium phosphate | |
| Mercuric Chloride (Table 4) | Inorganic #2, Blue | | |
| Mercuric Iodide (Table 4) | Inorganic #2, Blue | | |
| Mercuric Nitrate (Table 4) | Inorg. #3, Yellow stripe | Enhances combustion of other substances; strong oxidant | |

Section 7, continued — Science Inventory and Storage Hazards

| SUBSTANCE | ORGANIZATION | STORAGE HAZARD | AMOUNT |
|---|--------------------------|--|--------|
| Mercuric Oxide (Table 4) | Inorganic #4, Blue | | |
| Mercuric Sulfate (Table 4) | Inorganic #2, Blue | Decomposes on exposure to light | |
| Mercuric Sulfide | Inorganic #5 | | |
| Mercurous Chloride | Inorganic #2, Blue | | |
| Mercurous Nitrate | Inorg. #3, Yellow stripe | | |
| Mercurous Oxide | Inorganic #4, Yellow | Oxidant | |
| Mercury Bichloride | Inorganic #2, Blue | See Mercuric Chloride | |
| Mercury, metal (Table 4) | Inorganic #1, Blue | Toxic Vapors | |
| Methanol, Methyl Alcohol | Organic #2, Red | Flammable; vapor air mixture explosive (fireproof storage, separate from oxidants) | |
| Methyl Cellulose | Miscellaneous, Blue | | |
| Methylene Blue | Miscellaneous, Orange | | |
| Methylene Chloride (Table 3) | Organic #4, Blue | | |
| Methyl Ethyl Ketone (Table 5) | Organic #2, Red | Highly flammable; vapor air mixtures explosive (fireproof storage, separate from oxidants) | |
| Methyl Iodide | Organic #4, Blue | | |
| Methyl Methacrylate (Inhibited) (Table 5) | Organic #3, Red stripe | Flammable; vapor air mixture explosive (fireproof storage, cool) | |
| Methyl Orange | Miscellaneous | | |
| Methyl Red | Miscellaneous, Orange | | |
| Methyl Salicylate (Table 5) | Organic #3, Orange | | |
| Methyl Sulfoxide (Dimethyl Sulfoxide) | Organic #4, Orange | | |
| Methyl Violet | Miscellaneous | | |
| Mineral Oil | Organic #3, Red | | |
| Molasses | Miscellaneous, Orange | | |
| Monochloroacetic Acid | Organic #1, White | | |
| Naphthalene (Table 5) | Organic #2, Red stripe | | |
| 2-Naphthol (B-Naphthol) | Organic #2 | Combustible | |
| Nessler's Reagent | Inorganic #2, Blue | | |
| Nickel (II) Acetate (Table 3) | Inorganic #2, Blue | | |
| Nickel (II) Ammonium Sulfate | Inorganic #2, Blue | | |
| Nickel (II) Carbonate | Inorganic #6, Blue | | |
| Nickel Chloride | Inorganic #2, Blue | | |
| Nickel Hydroxide | Inorganic #4, Blue | | |
| Nickel, metal (Table 2) | Inorganic #1, Orange | | |
| Nickel Nitrate | Inorg. #3, Yellow stripe | Oxidant | |
| Nickel Oxide | Inorganic #4, Blue | | |
| Nickel Sulfate | Inorganic #2, Blue | | |
| Nicotine Sulfate (Table 4) | Organic #2, Blue | | |

Section 7, continued — Scientific Inventory and Storage I

| SUBSTANCE | ORGANIZATION | STORAGE HAZARD | AMOUNT |
|-----------------------------------|------------------------|--|--------|
| Nicotinic Acid (Niacin) | Organic #1, Blue | | |
| Nigrosine Black | Miscellaneous | | |
| Ninhydrin | Organic #2, Blue | | |
| Nitric Acid (Table 5) | Inorganic #3, Yellow | Many reactions may cause explosion; oxidant | |
| Nitrobenzene | Inorganic #4, Red | | |
| Nitrobenzeneazoresorcinol | Organic #8 | Combustible | |
| Nitrogen | Bottled Gas | | |
| P-Nitrophenol (Table 4) | Organic #8, Yellow | Strong oxidant | |
| Nucleic Acid | Organic #1, Orange | | |
| Oleic Acid | Organic #1, Orange | | |
| Olive Oil | Miscellaneous, Orange | | |
| Orange IV (Torpeolin 00) | Miscellaneous | | |
| Orcein Staining Solution | Miscellaneous | Contains orcein, hydrochloric acid and ethylanol. Flammable liquid | |
| Osmium Tetroxide (Table 3) | Inorganic #4, Blue | Vapors are highly irritant | |
| Oxalic Acid (Table 5) | Organic #1, White | Separate from oxidants and strong bases | |
| Oxygen | Bottled gas | Fire and explosion risk | |
| Pancreatin | Miscellaneous, Orange | | |
| Paraffin | Miscellaneous, Orange | | |
| Peanut Oil | Miscellaneous, Orange | | |
| Pentane | Organic #3, Red | Highly flammable; vapor air mixture explosive (fireproof storage) | |
| Perchloric Acid (Table 5) | Inorganic #6, Yellow | | |
| Petroleum Ether | Organic #4, Red | Highly flammable | |
| Phenolphthalein | Miscellaneous, Orange | | |
| Phenyl Salicylate (Salol) | Organic #3 | Combustible | |
| Phosphoric Acid | Organic #1, White | | |
| Phosphorus (Red) | Inorg. #10, Red stripe | Separate from oxidants | |
| Phosphorus (White) (Tables 4,5) | Inorg. #10, Red stripe | Flammable; ignites upon contact with air | |
| Phosphorus Pentoxide (Tables 4,5) | Inorganic #10, Yellow | Many reactions may cause fire or explosion | |
| Phthalic Anhydride (Table 5) | Organic #1, White | | |
| Picric Acid (Table 1) | Organic #8, Red | Explosive, if dry | |
| Potassium Bicarbonate | Inorganic #4, Orange | | |
| Potassium Bisulfate | Inorganic #2, Orange | | |
| Potassium Bitartrate | Inorganic #2, Orange | | |
| Potassium Bromate | Inorganic #2, Yellow | | |
| Potassium Bromide | Inorganic #2, Orange | | |
| Potassium Carbonate | Inorganic #4, Orange | | |

Section 7, continued — Science Inventory and Storage Hazards

| SUBSTANCE | ORGANIZATION | STORAGE HAZARD | AMOUNT |
|-------------------------------------|--------------------------|--|--------|
| Potassium Chlorate | Inorganic #6, Yellow | Enhances combustion of other substances; if contaminated may explode from shock or mechanical friction | |
| Potassium Chloride | Inorganic #2, Orange | | |
| Potassium Chromate (Tables 3,5) | Inorganic #8, Blue | | |
| Potassium Cyanide (Tables 4,5) | Inorg. #7, White stripe | | |
| Potassium Dichromate | Inorganic #8, Yellow | Strong oxidant | |
| Potassium Ferricyanide | Inorganic #7, Orange | | |
| Potassium Ferrocyanide | Inorganic #7, Orange | | |
| Potassium Fluoride (Table 5) | Inorganic #2, Blue | | |
| Potassium Hydroxide (Table 5) | Inorg. #4, White stripe | Reacts violently with acids | |
| Potassium Iodate | Inorganic #8, Yellow | Enhances combustion of other substances; strong oxidant | |
| Potassium Iodide | Inorganic #2, Orange | | |
| Potassium, metal (Tables 1,5) | Inorg. #1, Red stripe | Combustible; many reactions may cause fire and explosion; reacts violently with water (fireproof storage separately under paraffin or oil) | |
| Potassium Nitrate | Inorganic #3, Yellow | Enhances combustion of other substances; oxidant; violent reactant | |
| Potassium Oxalate | Inorganic #2, Blue | | |
| Potassium Oxide | Inorganic #4, White | | |
| Potassium Periodate, meta (Table 4) | Inorganic #6, Yellow | Enhances combustion of other substances; many reactions may cause fire or explosion | |
| Potassium Permanganate (Tables 3,5) | Inorganic #8, Yellow | Enhances combustion of other substances; many reactions may cause fire and explosion; powerful oxidant; violent reactant | |
| Potassium Phosphate | Inorganic #2, Orange | | |
| Potassium Pyrosulfate | Inorganic #2, Orange | | |
| Potassium Sodium Tartrate | Inorganic #2, Orange | | |
| Potassium Sulfate | Inorganic #2, Orange | | |
| Potassium Sulfide | Inorganic #5, Red | May ignite spontaneously on contact with air; flammable; explosive on heating (fireproof storage) | |
| Potassium Tartrate | Inorganic #2, Orange | | |
| Potassium Thiocyanate | Inorg. #2, Yellow stripe | | |
| Propane | Bottled gas, Red | Highly flammable; explosive air vapor mixtures | |
| Propionic Acid | Organic #1, Red | Combustible | |
| Propyl Alcohol | Organic #2, Red | Flammable; vapor-air mixtures explosive | |
| Pyridine | Organic #2, Red | Flammable; vapor-air mixtures explosive (fireproof storage separate from oxidants) | |

Section 7, continued — Science Inventory and Storage Hazards

| SUBSTANCE | ORGANIZATION | STORAGE HAZARD | AMOUNT |
|---------------------------|-----------------------|---|--------|
| Pyrogallic Acid (Table 3) | Organic #4, Blue | | |
| Quinine Sulfate | Organic #2 | | |
| Resorcinol | Organic #2, Red | | |
| Ringer's Solution | Miscellaneous | | |
| Rosin | Miscellaneous, Red | | |
| Safranine | Miscellaneous, Dye | | |
| Salicylic Acid (Table 3) | Organic #1, Orange | Dust explosive | |
| Sand | Miscellaneous, Orange | | |
| Schiff Reagent | Organic #2 | Contains fuchsin, sodium bisulfite and hydrochloric acid | |
| Selenium | Inorganic #1, Orange | | |
| Sesame Oil | Organic #4, Orange | | |
| Silicic Acid | Inorganic #9, Orange | | |
| Silica Gel | Miscellaneous, Orange | | |
| Silicon, metal | Inorganic #1, Orange | | |
| Silver Acetate | Inorganic #2, Blue | | |
| Silver Chloride | Inorganic #2, Blue | | |
| Silver Cyanide (Table 4) | Inorganic #7, Blue | | |
| Silver Iodide | Inorganic #2, Blue | | |
| Silver, metal | Inorganic #1, Blue | | |
| Silver Nitrate (Table 3) | Inorganic #3, Yellow | Many reactions may cause fire and explosion; violent reaction with organic substances | |
| Silver Oxide | Inorganic #4, Orange | Oxidant | |
| Silver Sulfate | Inorganic #2, Blue | | |
| Sodium Acetate | Inorganic #2, Orange | | |
| Sodium Arsenate (Table 2) | Inorganic #7, Blue | | |
| Sodium Arsenite (Table 2) | Inorganic #7, Blue | | |
| Sodium Azide (Table 3) | Inorganic #3, Blue | Explosion possible from concussion, friction (fireproof storage, mix with water, 20%) | |
| Sodium Bicarbonate | Inorganic #4, Orange | | |
| Sodium Bismuthate | Inorganic #7, Orange | | |
| Sodium Bisulfate | Inorganic #2, Orange | | |
| Sodium Bisulfite | Inorganic #2, Orange | | |
| Sodium Borate | Inorganic #8, Orange | | |
| Sodium Bromide | Inorganic #2, Orange | | |
| Sodium Carbonate | Inorganic #4, Orange | | |
| Sodium Chlorate | Inorganic #6, Yellow | Many reactions may cause fire and explosion; strong oxidant | |
| Sodium Chloride | Inorganic #2, Orange | | |
| Sodium Chromate | Inorganic #8, Yellow | Oxidant | |

Section 7, continued — Science Inventory and Storage Hazards

| SUBSTANCE | ORGANIZATION | STORAGE HAZARD | AMOUNT |
|---|--------------------------|--|--------|
| Sodium Citrate | Inorganic #8, Orange | | |
| Sodium Cyanide (Tables 4,5) | Inorganic #7, Blue | | |
| Sodium Dichromate (Table 3) | Inorganic #8, Yellow | Many reactions may cause fire and explosion; oxidant | |
| Sodium Dithionite | Inorganic #2, Red stripe | Oxidant | |
| Sodium Ferrocyanide (Table 5) | Inorganic #7, Orange | | |
| Sodium Fluoride | Inorganic #2, Blue | | |
| Sodium Hydroxide (Table 5) | Inorg. #4, White stripe | Reacts violently with acid | |
| Sodium Hydrosulfite | Inorganic #2, Red stripe | See Sodium Dithionite | |
| Sodium Hypochlorite | Inorganic #6, Orange | Reacts violently with acids; forms toxic fumes in presence of ammonia | |
| Sodium Hyposulfate | Inorganic #2, Orange | See Sodium Dithionite | |
| Sodium Iodate | Inorganic #2, Yellow | | |
| Sodium Iodide | Inorganic #2, Orange | | |
| Sodium Lauryl Sulfate | Inorganic #2 | | |
| Sodium Metabisulfite | Inorganic #2, Orange | | |
| Sodium, metal (Table 5) | Inorganic #1, Red stripe | Combustible; many reactions may cause fire and explosion; violent reaction with water (fireproof storage; separate under paraffin oil or kerosene from all substances) | |
| Sodium Metaphosphate | Inorganic #2, Orange | | |
| Sodium Molybdate | Inorganic #2, Orange | | |
| Sodium Nitrate (Table 3) | Inorganic #3, Yellow | Enhances the combustion of other substances; oxidant | |
| Sodium Nitrite (Table 3) | Inorganic #3, Yellow | Many reactions may cause fire and explosion | |
| Sodium Oxalate | Inorganic #2, Blue | | |
| Sodium Perborate | Inorganic #8, Orange | Oxidant | |
| Sodium Permanganate | Inorganic #8, Yellow | Oxidant | |
| Sodium Peroxide | Inorg. #6, Yellow stripe | Many reactions may cause fire and explosion; reacts violently with water | |
| Sodium Phosphate | Inorganic #2, Orange | | |
| Sodium Pyrophosphate | Inorganic #2, Orange | | |
| Sodium Salicylate | Organic #1, Orange | | |
| Sodium Silicate | Inorganic #2, Orange | | |
| Sodium Silicofluoride (Disodium Hexafluorosilicate) (Table 5) | Inorganic #4 | | |
| Sodium Sulfate | Inorganic #2, Orange | | |
| Sodium Sulfide (Anhydrous) (Table 5) | Inorganic #5, Red | Store separately from acids, oxidants, dry | |
| Sodium Sulfite | Inorganic #2, Orange | | |
| Sodium Tartrate | Inorganic #2, Orange | | |

Section 7, continued — Science Inventory and Storage Hazards

| SUBSTANCE | ORGANIZATION | STORAGE HAZARD | AMOUNT |
|--|--------------------------|---|--------|
| Sodium Tetraborate | Inorganic #8, Orange | See sodium borate | |
| Sodium Thiocyanate | Inorganic #7, Orange | | |
| Sodium Thiosulfate | Inorganic #2, Orange | | |
| Sodium Tungstate | Inorganic #2, Orange | | |
| Stannic Chloride (Table 5) | Inorganic #2, White | | |
| Stannic Oxide | Inorganic #2, Orange | | |
| Stannous Chloride | Inorganic #2, Orange | | |
| Starch | Miscellaneous, Orange | | |
| Stearic Acid | Organic #1, Orange | | |
| Strontium | Inorganic #1, Red stripe | | |
| Strontium Bromide | Inorganic #2, Orange | | |
| Strontium Chloride | Inorganic #2, Orange | | |
| Strontium Nitrate | Inorganic #3, Yellow | | |
| Succinic Acid | Organic #1, Orange | | |
| Sucrose | Miscellaneous, Orange | | |
| Sudan Black B | Miscellaneous, Dye | | |
| Sudan III | Miscellaneous, Dye | | |
| Sudan IV | Organic #2, Dye | | |
| Sugar | Miscellaneous, Orange | | |
| Sulfamic Acid | Organic #1, White | Separate from strong bases | |
| Sulfanilic Acid | Organic #1, White | | |
| Sulfur | Inorganic #10, Orange | | |
| Sulfur Black Dye | Inorganic #10, Dye | | |
| Sulfur Blue Dye | Inorganic #10, Dye | | |
| Sulfur Yellow Dye (Naphthol yellow, citronin) | Inorganic #10, Dye | | |
| Sulfuric Acid (Table 5) | Inorganic #9, White | Many reactions may cause fire and explosion; water reactive | |
| Talc | Miscellaneous, Orange | | |
| Tannic Acid | Organic #1, Orange | | |
| Tartaric Acid | Organic #1, Orange | | |
| Terpineol | Organic #2, Orange | | |
| Testosterone | Miscellaneous, Blue | | |
| Tetrahydrofuran | Organic #4, Red | Highly flammable, vapor air mixtures are explosive; also forms explosive peroxides | |
| Thermite Igniting Mixture | Inorganic #4, Red | Contains Fe ₂ O ₃ and Al; Flammable Burning difficult to stop once started (fireproof storage) | |
| Thioacetamide (Table 3) | Organic #2, Blue | | |
| Thiourea | Organic #2, Blue | | |

Section 7, continued — Science Inventory and Storage Hazards

| SUBSTANCE | ORGANIZATION | STORAGE HAZARD | AMOUNT |
|------------------------------------|--------------------------|--|--------|
| Thymol Blue | Miscellaneous | | |
| Thyroxine | Miscellaneous, Orange | | |
| Tin, metal | Inorganic #1, Orange | Combustible as dust | |
| Titanium, metal (Table 5) | Inorganic #1, Red | Combustible as dust | |
| Titanium Dioxide (Titanium Oxide) | Inorganic #4, Orange | Combustible; many reactions may cause fire and explosion; store under inert gas | |
| Titanium Trichloride (Table 5) | Inorganic #2, Red | | |
| Toluene (Tables 3,5) | Inorganic #3, Red | Flammable; vapor-air mixtures explosive (fireproof storage, separate from H ₂ SO ₄) | |
| O-Toluidine (Table 2) | Organic #2, Blue | Separate from Acids | |
| Tricane Methane Sulfonate | Organic #2 | | |
| Trichloroacetic Acid | Organic #1, White | | |
| Trichlorotrifluoroethane (Table 5) | Organic #4, Orange | | |
| Triethanolamine | Organic #2, Orange | | |
| Trimethylpentane | Organic #3, Red | Flammable | |
| Triphenyl Tetrazolium Chloride | Miscellaneous | | |
| Trisodium Phosphate | Inorganic #2, White | Separate from strong acids | |
| Tumeric Powder | Organic #2, Orange | | |
| Tungsten, metal | Inorganic #1, Orange | Dust is flammable | |
| Turpentine (Table 5) | Organic #2, Red | Combustible (fireproof storage, separate from oxidants) | |
| Ultramarine Blue | Miscellaneous | | |
| Uranyl Nitrate | Inorganic #3, Yellow | Strong oxidant | |
| Urea | Organic #2, Orange | | |
| Urethane (Table 3) | Organic #2, Orange | | |
| Vegetable Oil | Organic #2, Orange | | |
| Wood's metal | Inorganic #1, Orange | Contains bismuth, lead, tin, cadmium | |
| Wright's Stain Solution | Miscellaneous, Red | Flammable | |
| Xylene | Organic #3, Red | Combustible; above 81 °F. explosive vapor-air mixtures (fireproof storage) | |
| Yeast | Miscellaneous, Orange | | |
| Zenker's Fluid | Inorganic #2, Blue | Contains mercuric chloride, potassium dichromate, sodium sulfate and acetic acid | |
| Zeolite | Inorganic #4, Orange | | |
| Zinc Acetate | Inorganic #2, Orange | | |
| Zinc Carbonate | Inorganic #2 | | |
| Zinc Chloride | Inorganic #2, White | | |
| Zinc, metal | Inorganic #1, Red stripe | Combustible as dust (fireproof storage separated from oxidants) | |

Section 7, continued — Science Inventory and Storage Hazards

| SUBSTANCE | ORGANIZATION | STORAGE HAZARD | AMOUNT |
|-------------------|----------------------|---|--------|
| Zinc Nitrate | Inorganic #3, Yellow | Enhances combustion of other substances | |
| Zinc Oxide | Inorganic #4, Orange | | |
| Zinc Stearate | Inorganic #2, Orange | | |
| Zinc Sulfate | Inorganic #2, Orange | | |
| Zinc Sulfide | Inorganic #5, Orange | | |
| Zirconium Nitrate | Inorganic #3, Yellow | | |

This form is available to Science Teachers if they choose to use it.

SCIENCE INVENTORY FORM

(To be filled out upon completion of an inventory of all chemicals in the school.)

The Science Inventory of _____ School

Address _____

This is to certify that the science inventory (attached) of this school has been completed as of _____ day of _____,

19____. Time: _____

(Signature of Science Teacher)

TEACHER'S NOTES

In general, chemicals with the following functional groups are prone to instability:

| | | |
|---------------------------|--------------------------|------------------------------------|
| O – O (peroxide) | – N = (imino) | – ONO ₂ (nitrate ester) |
| – NO ₂ (nitro) | – N ₃ (azide) | – NHNO ₂ (nitramine) |
| – N = N – (Azo) | – N = O (nitroso) | – N – NO ₂ (nitroamine) |

These reagents should be dated, handled according to prescribed storage conditions, and disposed of after use.

The following list provides some additional information dealing with specific chemical incompatibilities. It is not all-inclusive. The list is reprinted by permission from **Better Science Through Safety** by Jack A. Gerlovich and Gary E. Downs, ©1981 by the Iowa State University Press, 2121 South State Ave., Ames, IA 50010.

| CHEMICAL | CHEMICALS INCOMPATIBLE WITH |
|--|--|
| Acetic Acid | Nitric acid, peroxides, permanganates, ethylene glycol, hydroxyl compounds, perchloric acid, or chromic acid |
| Acetone | concentrated sulfuric and nitric acid |
| Acetylene | Bromine, chlorine, fluorine, copper, silver, mercury and their compounds |
| Alkali metals | Carbon tetrachloride*, carbon dioxide, water, halogens |
| Alkaline metals (powdered aluminum or magnesium) | Carbon tetrachloride*, or other chlorinated hydrocarbons, halogens, carbon dioxide |
| Ammonia, anhydrous | Mercury, hydrogen fluoride, calcium hypochlorite, chlorine, bromine |
| Ammonium Nitrate | Acids, flammable liquids, metal powders, sulfur, chlorates, any finely divided organic or combustible substance |
| Aniline | Nitric acid and hydrogen peroxide |
| Bromine, Chlorine | Ammonia, petroleum gases, hydrogen, sodium, benzene, finely divided metals |
| Carbon, activated | Calcium hypochlorite and all oxidizing agents |
| Chlorates | Ammonium salts, acids, metal powders, sulfur, and finely divided organic or combustible substance |
| Chromic Acid | Glacial acetic acid, camphor, glycerin, naphthalene, turpentine, lower molecular weight alcohols, and many flammable liquids |
| Copper | Acetylene and hydrogen peroxide |
| Flammable liquids | Ammonium nitrate, chromic acid, hydrogen peroxide, sodium peroxide, nitric acid, and the halogens |
| Hydrocarbons (propane, benzene, gasoline) | Fluorine, chlorine, bromine, sodium peroxide and chromic acid |
| Hydrofluoric Acid | Ammonia (aqueous or anhydrous) |
| Hydrogen Peroxide | Most metals and their salts, alcohols, organic substances, any flammable substances |
| Hydrogen Sulfide | Oxidizing gases, fuming nitric acid |
| Iodine | Acetylene, ammonia, hydrogen |
| Mercury | Acetylene, ammonia |
| Nitric Acid (concentrated) | Acetic acid, hydrogen sulfide, flammable liquids and gases, chromic acid, aniline |
| Oxygen | Oils, grease, hydrogen, flammable liquids, solids and gases |

*It is recommended that carbon tetrachloride be removed from high school labs. It is a probable human carcinogen.

Chemical Incompatibilities, continued

| CHEMICAL | CHEMICALS INCOMPATIBLE WITH |
|------------------------|--|
| Perchloric Acid | Acetic anhydride, bismuth and its alloys, alcohols, paper, wood, and other organic materials |
| Phosphorus Pentoxide | Water |
| Potassium Chlorate | Sulfuric and other acids, any organic material |
| Potassium Permanganate | Sulfuric acid, glycerine, ethylene glycol |
| Silver | Acetylene, ammonia compounds, oxalic acid, tartaric acid |
| Sodium Peroxide | Ethyl or methyl alcohol, glacial acetic acid, carbon disulfide, glycerine, ethylene glycol, ethyl acetate |
| Sulfuric Acid | Potassium chlorate, potassium perchlorate, potassium permanganate, similar compounds of other light metals |

WORKSHEET FOR HAZARDOUS PROPERTIES OF A SUBSTANCE

(To assist science teachers in researching the properties of a chemical and deciding how to use, store, or dispose of it.)

Date: _____

Chemical Name: _____ Formula _____

CAS Registry No. _____ Amount stored in school _____

Synonyms: _____

PHYSICAL PROPERTIES:

Gas _____ Liquid _____ Solid _____ Color _____ Odor _____ Solubility _____

Boiling Point _____ Melting Point _____ Flash Point _____

Cup open _____ Cup Closed _____ Others: _____

CHEMICAL PROPERTIES:

Reactive with substances _____

Carcinogen _____ Human _____ Animal _____ Explosive _____ Flammable _____

Severe Poison _____ Oxidizer _____ Other: _____

Storage Instructions: _____

Quantity Restrictions: _____

Disposal and Spill Procedures _____

Site Approved for Disposal _____

Publications Recommending Use of Substance in the School Science Program:

Safety Facilities Necessary to Use and Store this Substance: _____

Recommendations of Health Authorities: Continue to use _____

Purchase _____

Discontinue using _____

Dispose of by Health Agency or

Licensed Commercial Company _____

TEACHER'S NOTES

Section 8
RECOMMENDATIONS FOR TEXTBOOK PUBLISHERS AND SCIENCE SUPPLY COMPANIES

To enable science teachers to provide a safe program of instruction with reduced exposure to hazardous substances authors and science textbook publishers should be encouraged to do the following:

1. Give safety instructions to the student at the beginning of each laboratory experiment.
2. Conclude each student laboratory experiment with instructions for cleanup and disposal of substances left over.
3. Provide instructions for labeling all containers of substances used or produced in the experiment.

Science supply companies should be encouraged to do the following:

1. Supply the smallest quantity required if a hazardous substance is needed for class use, shipped to arrive at the school shortly before the experiment is to be performed.
2. Provide a safety data sheet with each hazardous substance shipped to the school.
3. Advise the school if an ordered substance is restricted or extremely hazardous and suggest a substitute experiment.

TEACHER'S NOTES

Section 9 RESOURCES

Several resources exist to help science teachers deal with chemicals in the school laboratory:

— **American Chemical Society Health and Safety Referral Service.**

This service will refer inquirers to appropriate resources to help find answers to questions about health and safety. The resources used include books, periodical articles, films, educational programs, and government agencies and other organizations oriented to health and safety.

The Health and Safety Referral Service may be reached through:

Barbara Gallagher (Librarian)
American Chemical Society
1155 Sixteenth St., N.W.
Washington, D.C. 20036
(202) 872-4511

— **Toxicologists in the State Departments of Health.**

Most State Departments of Health have toxicologists who can help answer questions about chemical safety. You may find these toxicologists by contacting your State Department of Health.

— **State Science Supervisors in the State Departments of Education.**

Most State Departments of Education have a State Science Supervisor who is responsible for safety in the school science laboratory. The Council of State Science Supervisors (which participated in the development of this publication) may be reached through:

Council of State Science Supervisors
Rt. 2, Box 637
Lancaster, VA 22503
(804) 462-7371

Individual State Science Supervisors may be contacted through your State Department of Education.

- Information similar to the "Chemical Fact Sheet" prepared by the New York State Department of Health, Bureau of Toxic Substance Assessment (Empire State Plaza, Tower Building, Albany, NY 12237) may be obtained from the local state department of health. Although this information applies to workplace exposure resulting from processing, manufacturing, storing or handling rather than for the public at large, it is useful to the secondary school science teacher.
- State health authorities may offer consultation as new evidence becomes available on substances, which may justify classifying a substance as too hazardous to store or use.
- Current references on science laboratory safety topics are available in the libraries of health agencies, colleges, and/or industries.
- Disposal procedures for substances are available from regional offices of the U.S. Environmental Protection Agency.
- Material Safety Data Sheets may be obtained from chemical supply companies on request. They are federally mandated for use by manufacturers and contain relevant product and health and safety information for those who handle and use chemicals.
- Other possible contacts might include the State Department of Labor, insurance companies with a strong industrial hygiene department, local colleges and universities which include a school of Public Health with a toxicology department, local American Chemical Society chapters, and independent consultants.
- Additional copies of this document are available from the offices of the U.S. Consumer Product Safety Commission.

— **Regional Offices of the U.S. Environmental Protection Agency.**

The Regional Offices of the Environmental Protection Agency (EPA) may have information about the disposal procedures recommended when hazardous chemicals must be removed from the school laboratory. You may contact the Regional Office of EPA in your area, using the following list:

U.S. Environmental Protection Agency
Regional Offices

Environmental Protection Agency
Region 1
John F. Kennedy Federal Building
Boston, MA 02203
(617) 223-7210

Environmental Protection Agency
Region 6
1201 Elm Street
Dallas, TX 75270
(214) 767-2600

Environmental Protection Agency
Region 2
26 Federal Plaza
New York, NY 10278
(212) 264-2525

Environmental Protection Agency
Region 7
324 East 11th St.
Kansas City, MO 64106
(816) 926-3720

Environmental Protection Agency
Region 3
Curtis Building
6th and Walnut St.
Philadelphia, PA 19106
(215) 597-9814

Environmental Protection Agency
Region 8
1860 Lincoln St.
Denver, CO 80295
(303) 837-3895

Environmental Protection Agency
Region 4
345 Courtland St., NE
Atlanta, GA 30365
(404) 881-4727

Environmental Protection Agency
Region 9
215 Fremont St.
San Francisco, CA 94105
(415) 974 8153

Environmental Protection Agency
Region 5
230 South Dearborn St.
Chicago, IL 60604
(312) 353-2000

Environmental Protection Agency
Region 10
1200 Sixth Avenue
Seattle, WA 98101
(206) 442-5810

Section 10
SOURCES CONSULTED

1. American Chemical Society Committee on Chemical Safety. **Safety in Academic Chemistry Laboratories**, 3rd Edition, author published, 1979.
2. American Chemical Society's Office of Federal Regulatory Programs. **RCRA and Laboratories**. Department of Public Affairs, American Chemical Society, 1155 Sixteenth St., N.W., Washington, D.C. 20036
2. American Conference Governmental and Industrial Hygienists. **Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment with Intended Changes for 1983-84**. Cincinnati, OH: ACGIH, 1983
3. Armour, N. A., Browne, L. M., Weir, G. L. **Hazardous Chemicals (Information and Disposal Guide)**, Department of Chemistry, University of Alberta, Edmonton, Alberta T6G-2G2.
5. Bretherick, L. **Hazards in the Chemical Laboratory**, 3rd ed., London Chemical Society, Royal Society of Chemistry Publishers, London, 1981.
6. **Catalog Handbook of Fine Chemicals**. Milwaukee, WI: Aldrich Chemical Co., 1982-83.
7. **Chemical Catalog Reference Manual**. Batavia, IL: Flinn Scientific, Inc., 1983.
8. Committee on Hazardous Substances in the Laboratory, Assembly of Mathematical and Physical Sciences, National Research Council. **Prudent Practices for Handling Chemicals in Laboratories**, National Academy Press, Washington, D.C., 1981.
9. Committee on Hazardous Substances in the Laboratory, Commission on Physical Sciences, Mathematics and Resources, National Research Council. **Prudent Practices for Disposal of Chemicals from Laboratories**, National Academy Press, Washington, D.C., 1983
10. **Concise Chemical and Technical Dictionary**. New York: Chemical Publishing Co., Inc., 1974
11. Cralley, L. J. and Cralley, L. V. (Ed.) **Patty's Industrial Hygiene and Toxicology**. New York: John Wiley & Sons, 1979.
12. Dutch Association of Safety Experts, Dutch Chemical Industry Association, Dutch Safety Institute. **Handling Chemicals Safely**. Amsterdam: Amro Bank, 1980.
13. Fawcett, Howard H. and Wood, William S. **Safety and Accident Prevention in Chemical Operations**. 2nd ed., New York: John Wiley & Sons, 1982.
14. Green, Michael E. and Turk, Amos. **Safety in Working with Chemicals**. New York: MacMillan, 1978.
15. **A Handbook of Laboratory Solutions**. New York: Chemical Publishing Co., 1968.
16. Hawley, G. **The Condensed Chemical Dictionary**. 10th ed. New York: Van Nostrand Reinhold Co., 1981.
17. International Agency for Research on Cancer, World Health Organization. **Evaluation of the Carcinogenic Risk of Chemicals to Humans**. Lyon, France: IARC, 1982
18. The International Technical Information Institute. **Toxic and Hazardous Industrial Chemicals Safety Manual for Handling and Disposal with Toxicity and Hazard Data**. Japan: ITII, 1978.
19. Manufacturing Chemists Association. **Guide for Safety in Chemical Laboratories**. 2nd ed., New York: Van Nostrand Reinhold, 1972.
20. **The Merck Index**. 9th ed., Rahway, New Jersey: Merck & Co., 1976.
21. National Fire Protection Association. **Manual of Hazardous Chemical Reactions**. Boston, MA, 1980.
22. National Institute for Occupational Safety and Health. **Manual of Safety and Health Hazards in the School Science Laboratory**. Washington, D.C.: U.S. Department of Health and Human Services, 1980.
23. National Institute for Occupational Safety and Health. **Carcinogens: Regulation and Control**. Cincinnati, OH, 1977.

24. National Institute for Occupational Safety and Health. **Occupational Health Guidelines for Chemical Hazards**. Publ. No. 81-123, Washington, D.C.: U.S. Department of Health and Human Services, January 1981.
25. National Institute for Occupational Safety and Health. **Pocket Guide to Chemical Hazards**. 4th Printing, Publ. No. 78-210, Washington, D.C.: U.S. Department of Health and Human Services, 1981.
26. National Institute for Occupational Safety and Health. **1981-82 Registry of Toxic Effects of Chemical Substances**. Vols. I and II, Publ. No. 81-116: Washington, D.C.: U.S. Department of Health and Human Services, June, 1983.
27. National Institute for Occupational Safety and Health. **Safety in the School Science Laboratory**. Cincinnati, OH, November, 1980.
28. Oliver and Boyd, **Hazardous Chemicals: A Manual for Schools and Colleges**. Edinburgh: Scottish Schools Science Equipment Research Center, 1981.
29. "Safety in the Chemical Laboratory" Volumes 1, 2, 3, 4, **Journal of Chemical Education**, American Chemical Society, Division of Chemical Education, Easton, PA 18042.
30. U.S. Consumer Product Safety Commission. **System for Tracking the Inventory of Chemicals**. Washington, D.C.: USCPSC, 1983.
31. U.S. Public Health Service, Department of Health and Human Services. **First and Second Annual Report on Carcinogens**. Vol. I and II, National Toxicology Program, 1981-82.
32. U.S. Public Health Service, Department of Health and Human Services. Review of Current DHHS, DOE, and EPA Research Related to Toxicology. Washington, D.C.: National Toxicology Program, 1983.
33. Young, J. A., Safety Tips "Academic Laboratory Waste Disposal: Yes, You Can Get Rid of That Stuff Legally!" **Journal of Chemical Education**, vol. 60, no. 6, June, 1983.
34. DATA RETRIEVAL SERVICES:
 Hazard Line.
 Occupational Health Services, Inc.
 Toxicology Data Base (TDB)
35. FILMS:
 Laboratory Safety, Part I, Richmond, VA: Virginia Department of Education, 1969.
 School Lab Safety, West Hollywood, CA: Handel Film Corporation, 1979.
 Eye and Face Protection, Cleveland, OH: Edward Fiel Production
 Flash Point, Chicago, IL, International Film Bureau
 Using a Fire Extinguisher, Boston, MA: NFPA

This information collection is authorized under 15 USC 2051.
This form has been approved by OMB (3041-0052), and its submission to the CPSC
is entirely voluntary.

HAZARDOUS SUBSTANCES REMOVED FROM THE SCHOOL

Identify only your State: _____

| SUBSTANCE | CAS NO. | AMOUNT | REMOVED BY | DATE | DISPOSAL LOCATION |
|-----------|---------|--------|------------|------|-------------------|
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Send a copy of this completed form to:
U.S. Consumer Product Safety Commission
Rm. 412-EX-O
Washington, D.C. 20207

This information collection is authorized under 15 USC 2051.
This form has been approved by OMB (3041-0052), and its submission to the CPSC
is entirely voluntary.

**Section 11
EVALUATION**

Identify only by State _____

In order to help us evaluate this publication, please respond to the following questions and return to:

U.S. Consumer Product Safety Commission
Rm. 412 — EX-O
Washington, D.C. 20207

PLEASE RESPOND TO EACH ITEM BY CIRCLING THE APPROPRIATE NUMBER ON EACH OF THE FOLLOWING SCALES:

1. Did this document give you new information about the hazards associated with commonly-used school laboratory chemicals?

| | | | |
|--------------------|--------|------|----------------------|
| 1 | 2 | 3 | 4 |
| No new information | Little | Some | Much new information |

2. What porportion of the chemicals in your laboratory were addressed by this document?

| | | | |
|--------------------|------|------------|-----------------------|
| 1 | 2 | 3 | 4 |
| Very few chemicals | Some | About half | Most of the chemicals |

3. Please rate the utility of the design of this document.

| | | | |
|------------|-----------------|--------|-------------|
| 1 | 2 | 3 | 4 |
| Not useful | Somewhat useful | Useful | Very useful |

4. Please rate the utility of the references in this document in helping you obtain additional information.

| | | | |
|------------|-----------------|--------|-------------|
| 1 | 2 | 3 | 4 |
| Not useful | Somewhat useful | Useful | Very useful |

5. How much do you think this document will help improve the safe teaching of science?

| | | | |
|------|--------|------|--------------|
| 1 | 2 | 3 | 4 |
| None | Little | Some | A great deal |

6. Will this document cause some teachers to restrict the use of certain chemicals in their science lab activities?

| | | | |
|-----------------|-------|------|-----------------------------------|
| 1 | 2 | 3 | 4 |
| No restrictions | A few | Some | Many chemicals will be restricted |

7. Did this document improve your understanding of what makes specific substances hazardous?

| | | | |
|----------------|--------|------|--------------------------|
| 1 | 2 | 3 | 4 |
| No improvement | Little | Some | Considerable improvement |

8. Will the information provided in this document improve your ability to use these chemical substances in a safer manner?

| | | | |
|----------------|--------|------|--------------------------|
| 1 | 2 | 3 | 4 |
| No improvement | Little | Some | Considerable improvement |

(Over)

9. Is the information provided in this document sufficient for you to decide whether or not to use certain chemicals?

| | | | |
|----------------|--------|----------|-----------------------|
| 1 | 2 | 3 | 4 |
| Not sufficient | Barely | Somewhat | Completely sufficient |

10. Do you believe that special "inservice" training sessions are necessary to get maximum value from this document?

| | | | |
|---------------|--------|----------|----------------|
| 1 | 2 | 3 | 4 |
| Not necessary | Little | Somewhat | Very necessary |

11. Would you recommend this document to other science teachers?

| | | | |
|----|---------|----------|-----|
| 1 | 2 | 3 | 4 |
| No | Perhaps | Probably | Yes |

12. This document will be of greatest value to the following teachers:
(Please circle the most appropriate response/s)

| | | | |
|------------|--------------|------------------|---------------|
| BIOLOGY | CHEMISTRY | PHYSICS | EARTH SCIENCE |
| ELEMENTARY | LIFE SCIENCE | PHYSICAL SCIENCE | |

Comments: _____

When mailing this evaluation form, please be sure to include a list of "Hazardous Substances Removed from the School." (p. 55)

TEACHER'S NOTES

For further information, write:
U.S. Consumer Product Safety Commission
Washington, D.C. 20207

Toll Free Hotline: 800-638-CPSC or 800-638-2772
TTY (including Alaska and Hawaii) 800-638-8270
TTY Maryland only 800-492-8104

Regional Office Addresses

MIDWESTERN REGIONAL OFFICE
230 South Dearborn Street, Rm. 2945
Chicago, Illinois 60604
312-353-8260

SOUTHWESTERN REGIONAL OFFICE
1100 Commerce Street, Rm. 1C10
Dallas, Texas 75242
214-767-0841

SOUTHEASTERN REGIONAL OFFICE
800 Peachtree Street, N.E., Suite 210
Atlanta, Georgia 30308
404-881-2231

WESTERN REGIONAL OFFICE
555 Battery Street, Rm. 416
San Francisco, California 94111
415-556-1816

NORTHEASTERN REGIONAL OFFICE
6 World Trade Center
Vesey Street, 6th Floor
New York, New York 10048
212-264-1125

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The U.S. Consumer Product Safety Commission (CPSC) is an independent regulatory agency charged with reducing unreasonable risks of injury associated with consumer products. The U.S. Consumer Product Safety Commission is headed by five Commissioners appointed by the President with the advice and consent of the Senate.

Nancy Harvey Steorts, Chairman

Sandra Brown Armstrong, Commissioner
Terrence M. Scanlon, Commissioner
Stuart M. Statler, Commissioner

