Menomonie Area School District

Chemical Hygiene Plan (CHP)

October 17, 2018

Menomonie Area School District

Chemical Hygiene Plan
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APPENDICES

Part I
Introduction

A. Policy

It is the policy of the School District of the Menomonie Area (SDMA) to provide a safe and healthy workplace for all students and employees according to 29 CFR 1910.1200 Hazard Communications Standard "Right to Know" regulations. In addition, this document meets the requirement of the Code of Federal Regulations (CFR) part 1910 of Title 29 section 1450 of subpart Z Occupational Exposures to Hazardous Chemicals in Laboratories known as the "Laboratory Standard" (Appendix 1 for 29 CFR 1910.1450 subpart Z) designed for the protection of workers in the laboratory setting.

B. Purpose

The Laboratory Standard ensures that employees are protected from any chemical exposure that exceeds permissible exposure limits and that staff will be educated regarding the hazardous nature of the chemicals used in the classroom/workplace. This document constitutes the required Chemical Hygiene Plan (CHP) that is to be a reference document of SDMA for ensuring the proper chemical hygiene of teachers, support personnel and students.

C. Personnel Covered by This Plan

The CHP applies to all the standard operating procedures involving chemicals in the classrooms, laboratories and work environment of the SDMA employees. It is the responsibility of the administration, teachers and support staff to know and follow the provisions of the CHP.

D. Review

The provisions of the CHP will be reviewed and updated annually by the Chemical Hygiene Officer. All SDMA employees are invited to communicate suggestions and comments to the Chemical Hygiene Officer (CHO) or the Human Resources Department at ASC.

E. Distribution of the CHP

Copies have been distributed to:
All members of the High School Science Department
High School Library and Principal's office
Right-to-Know Center of Elementary Buildings and Middle School (usually found in the staff workroom/lounge)
Principal's Office of Elementary Buildings and Middle School
Office of the Superintendent

The CHP is available for examination by the public during normal business hours. SDMA policies relating to the public examination of SDMA documents will apply. It is also available through the SDMA web site / Buildings & Grounds / Chemical Hygiene-Risk Control Report

Part II
Responsibility and Authority

A. District Administrator/SDMA (Appendix 3)
The District Administrator and the School Board have the ultimate responsibility for chemical hygiene within the District. The District Administrator, with the other administrators, must provide continuing support for district-wide chemical hygiene. The District Administrator appoints the Chemical Hygiene Officer (CHO). (Appendix 2) The Human Resources Department will do the pre-service training in consultation with CESA 11 or another environmental engineering firm.

B. Chemical Hygiene Officer (CHO) (Appendix 3)
The CHO acts as the representative of the District Administrator relative to chemical hygiene and attends the Risk Control committee meetings.

C. Principals (Appendix 3)
Principals are responsible for chemical hygiene in their building(s).

D. Teachers/Support staff
It is the responsibility of teachers and support personnel to follow all standard operating procedures developed under this plan. These include:

1. Participate in initial and annual trainings coordinated by The Human Resources Department and in subsequent triennial Chemical Hygiene /Hazard Communication reviews;
2. Understand the function and proper use of all personal protective equipment;
3. Wear personal protective equipment when mandated or necessary;
4. Report, in writing to your supervisor and/or CHO, any problems arising from the implementation of the standard operating procedures;
5. Report to your supervisor and CHO all facts pertaining to every incident that results in exposure to hazardous chemicals;
6. Report any action or condition that may exist that could result in an incident; (Appendix 13 Teacher's/Support staff CHP Accident/Incident Report Form) (Appendix 19 Request for Correction of Classroom/Workplace Safety Concern)
7. Contact your supervisor or CHO if any of the above procedures are not clearly understood.

Chemical Hygiene Plan Part II Responsibility &Authority Date this section revised 09-24-15

Part III
Information and Training

A. Initial Training

All new employees in the areas of custodial maintenance, food service, technical education, science education and art education are to have Hazard Communication and Safety training which must include the district CHP as coordinated by The Human Resources Department in consultation with CESA 11 or another environmental engineering firm.

When there are changes in assignments, long term substitutes(teaching/support staff), interns, student teachers, starting later in the year; the building principals and/or supervisors are to notify The Human Resources Department so that appropriate training may be provided in consultation with CESA 11 or another environmental engineering firm.

Likewise in the lab or classroom there is to be chemical hygiene and safety training before each student activity with documentation on file (lesson plans or student notes etc).

B. Refresher Training

The Human Resources Department will coordinate documented triennial refresher training in consultation with CESA 11.

C. Training/Information Curriculum

The training/information sessions shall include:

1. Availability of 29 CFR 1910.1200 Hazard Communications Standard “Right to Know” regulations and 29 CFR 1910.1450 and its appendices (Appendix 1);
2. The availability/location of the written CHP;
3. Information of PELs (Permissible Exposure Limits) where they exist, and other recommended exposure limits (Appendix 18 Odor as an Aid to Chemical Safety);
4. Signs, symptoms, health hazards associated with exposure to hazardous chemicals in the laboratory, classroom or workplace (Appendix 17 Exposure Evaluation);
5. Location of reference materials (including all SDMA) concerning the workplace/classroom chemicals.
6. Instruction regarding the safe handling of these chemicals; (Part V)
7. Measures to protect support staff, teachers and students from these hazards, including:
   a. Standard safety procedures when using chemicals; (Part V)
   b. Correct storage; (Appendix 6 High School Chemical Storage system)
   c. Emergency procedures; (Appendix 14 Accident Procedure Plan) (Appendix 15 Student Witness Accident/incident Report)
   d. Personal protective equipment; (see Part V.,E. and Appendix 5 Eye Safety)
8. Substitutes for hazardous chemicals where available.

D. Delivery of Training/Information to Students

Each teacher will provide training/information to students during the initial laboratory sessions. Additional training/information may be presented at any time. (Appendix 10 High School Chemistry Lab Training and Citation Forms) (Appendix 11 Middle School Laboratory Rules) (Appendix 12 Safe Science in the Elementary Grades)

E. Documentation
Documentation of the initial Hazard Communication/Lab Standard training and the triennial update for all employees are to be kept on file with The Human Resources Department.

F. Safety Library
The Library of Laboratory Safety references is located in the chemical storage room 207A of Menomonie Senior High. (Appendix 4)

G. Safety Data Sheets (SDS)
Before chemicals are used in the classroom or work environment, the SDS (Appendix 7) should be used to determine the appropriate personal protective equipment, chemical hygiene procedures and disposal method. Contact the CHO if there is any doubt about the safety of the procedure or disposal of chemical(s).

Copies of SDS for new instructional chemicals and archival copies (chemicals no longer used kept for 30 yrs) are to be monitored monthly by:
1. The custodial building representative (elementary & middle school)
2. CHO for the High School Science dept
3. Art Dept chair is responsible High School Art
4. Technology Dept chair is responsible for High School Technology
5. Food service and Buildings and Grounds supervisors for their respective work environments district wide.

Chemical Hygiene Plan Part III Information and Training Date this section revised 09-24-15

Part IV
Activities Requiring Prior Approval

Our laboratories do not, at this time, use any chemicals, which are sufficiently hazardous to require prior approval before they are used. Prior approval of such activities is made by the CHO.

Chemical Hygiene Plan Part IV Activities Requiring Prior Approval Date this section revised 8-3-98

Part V
Standard Operating Procedures

A. General Principles

In general it is prudent to :

1. ***Minimize all chemical exposures***...
   Few laboratory chemicals are without hazards; general precautions for handling all chemicals should be adopted. Skin contact with chemicals should be avoided as a cardinal rule.
2. ***Avoid underestimation of risk***...
   Even for substances of no known significant hazard, exposure should be minimized; for work with substances which present special hazards, special precautions should be taken. One should assume that any mixture will be more toxic than its most toxic component and that all substances of unknown toxicity are toxic.
3. ***Provide adequate ventilation***....
   The best way to prevent exposure to airborne substances is to prevent their escape into the classroom or **workplace** by use of hoods or other ventilation devices such as a purge fan. Take into consideration the number of children in the room and its size even when nontoxic "smelly" odors are produced. If the odor cannot quickly be eliminated with open windows, fans and doors; perhaps it would be better to take the class outdoors.
4. ***Encourage routine chemical hygiene practices***...
   To provide a healthy and safe environment for all **employee**s and students, it is imperative that the implementation of the CHP be a regular, continuing day-to-day effort. K-12 cross-curricular chemical hygiene training will impress upon student (and teacher) the importance of appropriate precautions regarding exposure to chemicals in their professional and personal lives.
5. ***Observe PELs and the TLVs***...
   Where hazardous chemicals might be used it is important to be cognizant of Permissible Exposure Limits (PEL) of OSHA and the Threshold Limit Values (TLV) of the American Conference of Governmental Industrial Hygienists.

The following standard operating procedures will be followed by all **employee**s of the SDMA. Each teacher or **work supervisor** may need to develop specific procedures appropriate to the class or work assignment to minimize the potential hazards involved.

B. PERSONNEL EXPOSURE (eye, skin, ingestion, inhalation)

Skin and eye contact will be treated according to the recommendations noted in the appropriate MSDS, or by flushing with water for at least 15 minutes, followed by medical attention if necessary. **Emergency phone numbers given below. Know where your closest eye/face wash station or body shower is located. Each building will have an inventory of eye/face wash stations for that building posted in the office, lounge and a copy in the MSDS/SDS binder.**

Ingestion and inhalation will be treated according to the recommendations noted in the appropriate MSDS/SDS, or by the procedures noted by the Poison Control Center. In the case of ingestion; if conscious, encourage the victim to rinse the mouth out with a

small amount of water. Attempt to learn exactly what substances were ingested and/or inhaled and how much. **Emergency phone numbers given below.**

- **Chemicals on the Skin in a Confined Area**

Immediately flush with cold water and wash by using a mild detergent or soap (preferred) and water. If there is no visible burn, scrub with warm water and soap, removing any jewelry in the affected area. If a delayed action [the physiological effects of some chemicals (e.g., methyl and ethyl bromides) may be delayed as much as 48 hours] is noted, obtain medical attention promptly and explain carefully what chemicals were involved.

- **Chemicals Spilled on the Body over a Large Are**a

Quickly remove all contaminated clothing while using the safety shower (high school Biology Rooms 202 & 204; Physics Room 206 and pool filter room); seconds count and no time should be wasted because of modesty. Immediately flood the affected body area with cold water for at least 15 minutes; resume if pain returns. Wash off chemicals by using a mild detergent or soap (preferred) and water; do not use neutralizing chemicals, ointments, or salves. **Emergency numbers given above.**

C. Handling Spills

There should always be supplies and equipment on hand to deal with the biggest possible spill in your room or **workplace**, consistent with the hazards of the spilled substance. These cleanup supplies may include neutralizing agents (such as sodium carbonate and sodium bisulfate) and absorbents (such as vermiculite, sand, oil dry or kitty litter). Paper towels and sponges may also be used as an absorbent; however, this should be done cautiously because paper towels used to clean up a spilled oxidizer may later ignite. Appropriate gloves should be worn when wiping up highly toxic materials with paper towels. Also, when a spilled flammable solvent is absorbed in vermiculite or sand, the resultant solid is highly flammable and gives off flammable vapors and, thus, must be properly contained or removed to a safe place. **Commercial spill kits** are available that have instructions, adsorbents, reactants, and protective equipment. If a spill does occur, the following general procedures may be used but should be tailored to individual needs:

1. Attend to any person who may have been contaminated.
2. Notify persons in the immediate area about the spill.
3. Evacuate all nonessential personnel from the spill area.
4. If the spilled material is flammable, turn off ignition and heat sources.
5. Avoid breathing vapors of the spilled material; if necessary, use a respirator.
6. Leave on or establish exhaust ventilation if it is safe to do so.
7. Obtain supplies to effect cleanup.
8. During cleanup, wear appropriate apparel.
9. Notify the RISK coordinator if a regulated substance is involved.
10. **If emergency medical help is needed or if you are not equipped to effectively deal with the situation call:**
    - **Notify building principal or work supervisor (High School call Health Officer, ext. 40105 for Medical help)**
    - **911 for Emergency Medical and/or HAZMAT team to handle the spill**
    - **Madison poison control center: 1-800-815-8855**
    - **American Assoc. of Poison Control Centers 1-800-222-1222**
    - **MASD nurse: Ramie McMahon Cell 715-440-0213**
    - **Fill out written report form and send a copy to CHO and RISK Committee (Appendix 13)**

Handling of Spilled Liquids

1. Confine or contain the spill to a small area. Do not let it spread.
2. For small quantities of inorganic acids or bases, use a neutralizing agent or an absorbent mixture (e.g., diatomaceous earth or kitty litter). For small quantities of other materials, absorb the spill with a non-reactive material (such as vermiculite, dry sand, or towels).
3. For larger amounts of inorganic acids and bases, flush with large amounts of water (provided that the water will not cause additional damage). Flooding is not recommended in storerooms where violent spattering may cause additional hazards or in areas where water-reactive chemicals may be present.
4. Mop up the spill, wringing out the mop in a sink or a pail equipped with rollers.
5. Carefully pick up and clean any cartons or bottles that have been splashed or immersed.
6. Vacuum the area with a vacuum cleaner approved for the material involved, remembering that the exhaust of a vacuum cleaner can create aerosols and, thus, should be vented to a hood or through a filter.
7. If the spilled material is extremely volatile, let it evaporate and be exhausted by the mechanical ventilation system (provided that the hood and associated mechanical system is spark-proof).
8. Dispose of residues according to safe disposal procedures.

Handling of Spilled Solids

Generally, sweep spilled solids of low toxicity into a dustpan and place them in a solid-waste container for disposal. Additional precautions such as the use of a vacuum cleaner equipped with a HEPA filter may be necessary when cleaning up spills of more highly toxic solids.

D. REPORTING

Incidents must be reported on the appropriate form(s) ASAP (Appendix 13 Teacher's CHP Accident/Incident Report and/or Appendix 15 Student Witness Accident/incident Report). Copies must be provided to the CHO and SDMA human resources. Incidents will be reviewed by the CHO and/or SDMA RISK committee so that actions may be taken to prevent future similar incidents.

E. AVOIDANCE OF ROUTINE EXPOSURE

As a career teacher or **support staff**, many years of repeated exposure to chemicals such as might be found in hair spray, chalk dust or spray adhesive without adequate ventilation should be avoided. Proper chemical hygiene involves developing 'chemical smart' personal hygiene habits such as when to use the wafting technique for checking the odors and when to avoid all possible contact whether at home or at work.

F. PERSONAL HYGIENE

1. Wash promptly whenever a chemical has contacted the skin;
2. Avoid inhalation of chemicals;
3. Do not use mouth suction to pipette anything; use suction bulbs;
4. Wash well with soap and water before leaving the laboratory or **work area**. Wear protective gloves so you do not need to wash your hands with solvents like gasoline or paint thinner to remove grease etc;

5. Do not eat, drink, smoke, or apply cosmetics in the laboratory;
6. Do not bring food, beverages, tobacco, or cosmetic products into chemical storage or use areas.
7. Do not wear soft contacts without vapor proof goggles in a confined area when using organic solvents such as in some furniture stripping products or degreasing auto parts solvents.

G. PROTECTIVE EQUIPMENT

1. Eye protection will be used in accordance with the guidelines of the Wisconsin Department of Public Instruction; i.e., whenever glass, chemical or fire hazards are present. (Appendix 5)
2. Protective apparel compatible with the required degree of protection for the substance present shall be used. The SDMA shall provide aprons, goggles, gloves and most other personal protective equipment required for the work assignment. Shoes must be worn in the laboratory. Sandals, open shoes, and high-heeled shoes are not acceptable where there might be broken glass, spilled chemicals or slippery floor due to a spill.
3. Long hair and loose clothing must be confined when in the laboratory to keep them out of chemicals and fire.
4. Safety showers and eyewash stations shall be inspected and tested weekly (Appendix 9 Eye Wash test record tag). Filled test record tags are kept in the MSDS binder for that building or service area.
5. Fume hoods will be inspected and tested on a yearly basis by a contractor selected by the SDMA. Inspection reports and data relating to measurement of airflow will be maintained at each site. Copies will be forwarded to the Buildings & Grounds **work supervisor**, CHO and superintendent's office.
6. Teachers, students and **support staff** will be instructed on the location and use of eye wash stations and safety showers where available.
7. Location and use of fire extinguishers and other fire protection systems should be reviewed.

H. CHOICE OF CHEMICALS

When using chemicals, teachers (students) and **support staff** should be aware of:

1. The chemicals' hazards, as determined from the SDS and other appropriate references;
2. Appropriate safeguards for using the chemicals, including personal protective equipment;
3. The location and proper use of emergency equipment;
4. How and where to properly store the chemicals when they are not in use;
5. Proper personal hygiene practices;
6. The proper methods of transporting the chemicals within the facility;
7. Appropriate procedures for emergencies, including evacuation routes, spill cleanup procedures, and proper waste disposal.

I. CHEMICAL PURCHASING

Chemicals are to be purchased in quantities appropriate to the needs of the annual curriculum work assignment needs. Review existing inventory before purchasing; do not over purchase. (Appendix 16 MASD Lab/Classroom Chemical Inventory) Substances

noted in Appendix 8 have a short shelf life and should be purchased on an anticipated six-month use basis.

QUESTIONS TO ASK BEFORE PURCHASING CHEMICALS

1. Is it available from another building, lab or classroom in the MASD?
2. What is the minimum quantity that will suffice for current use? Chemical purchases should not be determine by the cheaper unit price basis of large quantities, but rather by the amount needed for the year. Large quantities purchased may result in the material becoming obsolete due to a change in procedure; then we are confronted with a storage hazard and added expense for proper disposal.
3. What is the maximum size container allowed in the use and storage area?
4. Is the chemical unstable?
5. Can waste be managed satisfactorily?

J. HOUSEKEEPING

1. Access to emergency equipment, showers, eyewashes, and exits should never be blocked by anything, not even a temporarily parked chemical cart.
2. All chemical containers must be labeled with at least the identity of the contents and the hazards those contents present to users. Also include date and name of the person preparing the solution.
3. Keep all **work area**s, especially laboratory benches, clear of clutter.
4. Keep all aisles, hallways, and stairs clear of all chemicals.
5. All chemicals should be placed in their proper/secure storage areas at the end of each workday.
6. Wastes should be properly labeled and kept in appropriate containers.
7. Promptly clean up all spills; properly dispose of the spilled chemical and cleanup materials.
8. All working surfaces and floors should be cleaned regularly.
9. Storage of chemicals will be in appropriate storage areas and according to an accepted plan. (See Appendix 6).

K. PLANNING

Before working with any chemical it is the responsibility of the teacher or **workplace** supervisor to determine the physical and chemical hazards associated with the substance. SDS and other literature are available for review. Each activity and work assignment will be planned with an effective waste disposal, and conservation/environment considerations.

L. UNATTENDED OPERATIONS AND WORKING ALONE

Students will not conduct laboratory activities unless a teacher is present in the laboratory. It is recommended for liability reasons that the students do not perform lab work when a substitute teacher is in charge.

Teachers/**support staff** should avoid working alone with hazardous materials. When working alone, arrange with co-workers or other personnel to check on you periodically.

Operations involving hazardous substances are sometimes carried out continuously or overnight. It is the responsibility of those involved to design these procedures with

provisions to prevent the release of hazardous substances in the event of interruptions in utility services such as electricity, cooling water, and gases. Lights should be left on and appropriate signs should be placed identifying the nature of the experiment/procedure and the hazardous substances in use. In some cases arrangements should be made for periodic inspection of the operation by other personnel. Information should be left indicating how to contact the experimenter in the event of an emergency.

M. VIGILANCE

Every teacher and **support staff employee** should observe the following rules:

1. Know the safety rules and procedures that apply to the work that are being done. Determine the potential hazards (e.g., physical, chemical, and biological) and appropriate safety precautions before beginning any new operation.
2. Know the location of and how to use the emergency equipment in your area, as well as how to obtain additional help in an emergency, and be familiar with emergency procedures.
3. Know the types of protective equipment available and use the proper type for each activity.
4. Be alert to unsafe conditions and actions and call attention to them so that corrections can be made as soon as possible.
5. Avoid consuming food or beverages or smoking in areas where chemicals are being used or stored.
6. Avoid hazards to the environment by following accepted waste disposal procedures. Chemical reactions may require traps or scrubbing devices to prevent the escape of toxic substances.
7. Be certain all chemicals are correctly and clearly labeled. Post warning signs when or other special problems exist.
8. Remain out of the area of a fire or personal injury unless it is your responsibility to help meet the emergency. Curious bystanders interfere with rescue and emergency personnel and endanger themselves.
9. Avoid distracting or startling any other teacher/student/fellow worker. Practical jokes or horseplay cannot be tolerated at any time.
10. Use equipment only for its designed purpose.
11. Think, act, and encourage safety until it becomes a habit for your students/fellow workers to emulate.

N. WASTE DISPOSAL

Each classroom activity, lab, demonstration or work assignment should be planned with an effective waste reduction, waste disposal, and conservation component. Instructional laboratory waste disposal guidelines can be found in the Suggested Disposal Procedures in a current FLINN CATALOG AND REFERENCE MANUAL or in “PRUDENT PRACTICES” in the CHC library in the high school Room 207A.

If there are chemcials that cannot be disposed of safely by one of the Flinn suggested methods at the school, contact the Chemical Hygiene Officer who will dispose of those hazardous chemicals at an approved Clean Sweep collection. If those chemicals are not accepted at a Clean Sweep, alternate disposal will be sought by a licensed contractor.

O. HANDLING OF LEAKING COMPRESSED GAS CYLINDERS

Occasionally, a cylinder or one of its component parts develops a leak. Most such leaks occur at the top of the cylinder in areas such as the valve threads, safety device, valve stem, and valve outlet.

If a leak is suspected, do not use a flame for detection; rather, a flammable-gas leak detector or soapy water or other suitable solution should be used. If the leak cannot be remedied by tightening a valve gland or a packing nut, emergency action procedures should be effected and the supplier should be notified. Laboratory workers should never attempt to repair a leak at the valve threads or safety device; rather, they should consult with the supplier for instructions.

The following general procedures can be used for leaks of minimum size where the indicated action can be taken without serious exposure of personnel.

If it is necessary to move a leaking cylinder through populated portions of the building, place a plastic bag, rubber shroud, or similar device over the top and tape it (duct tape preferred) to the cylinder to confine the leaking gas.

1. Flammable, inert, or oxidizing gases:
   Move the cylinder to an isolated area (away from combustible material if the gas is flammable or an oxidizing agent) and post signs that describe the hazards and state warnings.

2. **Corrosive gases may increase the size of the leak as they are released and some corrosives are also oxidants or are flammable:**
   Move the cylinder to an isolated, well-ventilated area and use suitable means to direct the gas into an appropriate chemical neutralizer. Post signs that describe the hazards and state warnings.

3. Toxic gases:
   Follow the same procedure as for corrosive gases. Move the cylinder to an isolated, well-ventilated area and use suitable means to direct the gas into an appropriate chemical neutralizer. Post signs that describe the hazards and state the warnings.

   When the nature of the leaking gas or the size of the leak constitutes a more serious hazard, self-contained breathing apparatus or protective apparel, or both, may be required. Basic action for large or uncontrolled leaks may include any of the following steps:
   1. Evacuation of personnel,
   2. Call **911** for Dunn County HazMat team (Menomonie Fire Dept)
   2. Rescue of injured personnel by crews equipped with adequate personal protective apparel and breathing apparatus,
   3. Fire fighting action,
   4. Emergency repair, and
   5. Decontamination.

Chemical Hygiene Plan Part V Standard Operating Procedures Date this section revised 09-24-15.

Part VI
Medical Consultation and Examination

The purpose of a medical consultation is to determine whether a medical examination is warranted. When, from the results of an exposure assessment, it is suspected or known that an **employee** was overexposed to a hazardous chemical or chemicals, the **employee** should obtain medical consultation from or under the direct supervision of a licensed physician.

When warranted, **employee**s also should receive a medical examination from or under the direct supervision of a licensed physician who is experience in treating victims of chemical overexposure. The medical professional should also be knowledgeable about which test or procedures are appropriate to determine if there has been an overexposure; these diagnostic techniques are called" differential diagnoses".

These provisions apply to medical consultations and examinations:

1. The MASD shall provide all **employee**s who work with hazardous chemicals an opportunity to receive medical attention, including any follow up examinations which the examining physician determines necessary, under the following circumstances:
   a. the **employee** develops signs or symptoms associated with a hazardous chemical to which the **employee** may have been exposed in the **workplace**, laboratory or classroom.
   b. exposure monitoring, routine or otherwise, suggests that there could have been an exposure above the action level, or PEL if there is no action level, for a chemical for which a substance-specific standard has been established.
   c. whenever an event takes place in the **work area** such as a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure, the affected **staff** shall be provided an opportunity for a medical consultation. Such consultation shall be for the purpose of determining the need for a medical examination.

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

3. Information provided to the physician. The employer shall provide the following information to the physician:
   a. The identity of the hazardous chemical(s) to which the **employee** may have been exposed;
   b. A description of the conditions under which the exposure occurred including quantitative exposure data, if available; and
   c. A description of the signs and symptoms of exposure that the **employee** is experiencing, if any.

4. Physician's written opinion.

a. For examination or consultation required under this standard, the MASD shall obtain a written opinion from the examining physician which shall include the following:
    - Any recommendation for further medical follow-up;
    - The results of the medical examination and any associated tests;
    - Any medical condition which may be revealed in the course of the examination which may place the **employee** at increased risk as a result of exposure to a hazardous **workplace**; and
    - A statement that the **employee** has been informed by the physician of the results of the consultation or medical examination and any medical condition that may require further examination or treatment.
b. The written opinion shall not reveal specific findings of diagnoses unrelated to occupational exposure.

Chemical Hygiene Plan Part VI Medical Consultation and Examination Date this section revised 3-22-02

APPENDIX 1

29 CFR 1910.1450 subpart Z
Occupational Exposures to Hazardous Chemicals
in Laboratories known as the
"Laboratory Standard"

Reprint of the Laboratory Standard

- **Standard Number:** 1910.1450
- **Standard Title:** Occupational exposure to hazardous chemicals in laboratories.
- **SubPart Number:** Z
- **SubPart Title:** Toxic and Hazardous Substances
-

(a) Scope and application.

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

(a)(2) Where this section applies, it shall supersede, for laboratories, the requirements of all other OSHA health standards in 29 CFR part 1910, subpart Z, except as follows:

(a)(2)(i) For any OSHA health standard, only the requirement to limit **employee** exposure to the specific permissible exposure limit shall apply for laboratories, unless that particular standard states otherwise or unless the conditions of paragraph (a)(2)(iii) of this section apply.

(a)(2)(ii) Prohibition of eye and skin contact where specified by any OSHA health standard shall be observed.
(a)(2)(iii)
Where the action level (or in the absence of an action level, the permissible exposure limit) is routinely exceeded for an OSHA regulated substance with exposure monitoring and medical surveillance requirements paragraphs (d) and (g)(1)(ii) of this section shall apply.

(a)(3) This section shall not apply to:
..1910.1450(a)(3)(I)

(a)(3)(i) Uses of hazardous chemicals which do not meet the definition of laboratory use, and in such cases, the employer shall comply with the relevant standard in 29 CFR part 1910, subpart 2, even if such use occurs in a laboratory.

(a)(3)(ii) Laboratory uses of hazardous chemicals which provide no potential for **employee** exposure. Examples of such conditions might include:

(a)(3)(ii)(A) Procedures using chemically-impregnated test media such as Dip-and-Read tests where a reagent strip is dipped into the specimen to be tested and the results are interpreted by comparing the color reaction to a color chart supplied by the manufacturer of the test strip; and

(a)(3)(ii)(B) Commercially prepared kits such as those used in performing pregnancy tests in which all of the reagents needed to conduct the test are contained in the kit.

(b) Definitions -
"**Action level**" means a concentration designated in 29 CFR part 1910 for a specific substance, calculated as an eight (8)-hour time-weighted average, which initiates certain required activities such as exposure monitoring and medical surveillance.
"**Assistant Secretary**" means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.
"**Carcinogen**" (see "select carcinogen").
"**Chemical Hygiene Officer**" means an **employee** who is designated by the employer, and who is qualified by training or experience, to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan. This definition is not intended to place limitations on the position description or job classification that the designated individual shall hold within the employer's organizational structure.
"**Chemical Hygiene Plan**" means a written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment and work practices that (i) are capable of protecting **employee**s from the health hazards presented by hazardous chemicals used in that particular **workplace** and (ii) meets the requirements of paragraph (e) of this section.
"**Combustible liquid**" means any liquid having a flashpoint at or above 100 deg. F (37.8 deg. C), but below 200 deg. F (93.3 deg. C), except any mixture having components with flashpoints of 200 deg. F (93.3 deg. C), or higher, the total volume of which make up 99 percent or more of the total volume of the mixture.
"**Compressed gas**" means:
(i) A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70 deg. F (21.1 deg. C); or
(ii) A gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130 deg. F (54.4 deg C) regardless of the pressure at 70 deg. F (21.1 deg. C); or
(iii) A liquid having a vapor pressure exceeding 40 psi at 100 deg. F (37.8 C) as determined by ASTM D-323-72.
"**Designated area**" means an area which may be used for work with "**select carcinogens**," reproductive toxins or substances which have a high degree of acute toxicity. A designated area may be the entire laboratory, an area of a laboratory or a device such as a laboratory hood.
"**Emergency**" means any occurrence such as, but not limited to, equipment failure, rupture of containers or failure of control equipment which results in an uncontrolled release of a hazardous chemical into the **workplace**.
"**Employee**" means an individual employed in a laboratory **workplace** who may be exposed to hazardous chemicals in the course of his or her assignments.
"**Explosive**" means a chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.
"**Flammable**" means a chemical that falls into one of the following categories:

(i) "**Aerosol, flammable**" means an aerosol that, when tested by the method described in 16 CFR 1500.45, yields a flame protection exceeding 18 inches at full valve opening, or a flashback (a flame extending back to the valve) at any degree of valve opening;
(ii) "**Gas, flammable**" means:
(A) A gas that, at ambient temperature and pressure, forms a flammable mixture with air at a concentration of 13 percent by volume or less; or
(B) A gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air wider than 12 percent by volume, regardless of the lower limit.
(iii) "**Liquid, flammable**" means any liquid having a flashpoint below 100 deg F (37.8 deg. C), except any mixture having components with flashpoints of 100 deg. C) or higher, the total of which make up 99 percent or more of the total volume of the mixture.
(iv) "**Solid, flammable**" means a solid, other than a blasting agent or explosive as defined in 1910.109(a), that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious hazard. A chemical shall be considered to be a flammable solid if, when tested by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a rate greater than one-tenth of an inch per second along its major axis.
"**Flashpoint**" means the minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite when tested as follows:
(i) Tagliabue Closed Tester (See American National Standard Method of Test for Flash Point by Tag Closed Tester, Z11.24 – 1979 (ASTM D 56-79)) - for liquids with a viscosity of less than 45 Saybolt Universal Seconds (SUS) at 100 deg. F (37.8 deg. C), that do not contain suspended solids and do not have a tendency to form a surface film under test; or
(ii) Pensky-Martens Closed Tester (See American National Standard Method of Test for Flashpoint by Pensky-Martens Closed Tester, Z11.7 - 1979 (ASTM D 93-79)) - for liquids with a viscosity equal to or greater than 45 SUS at 100 deg. F (37.8 deg. C), or that contain suspended solids, or that have a tendency to form a surface film under test; or
(iii) Setaflash Closed Tester (see American National Standard Method of test for Flash Point by Setaflash Closed Tester (ASTM D 3278-78)).
Organic peroxides, which undergo autoaccelerating thermal decomposition, are excluded from any of the flashpoint determination methods specified above.
"**Hazardous chemical**" means a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed **employee**s. The term "health hazard" includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic systems, and agents which damage the lungs, skin, eyes, or mucous membranes.
Appendices A and B of the Hazard Communication Standard (29 CFR 1910.1200) provide further guidance in defining the scope of health hazards and determining whether or not a chemical is to be considered hazardous for purposes of this standard.
"**Laboratory**" means a facility where the "laboratory use of hazardous chemicals" occurs. It is a **workplace** where relatively small quantities of hazardous chemicals are used on a non-production basis.
"**Laboratory scale**" means work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safety manipulated by one person. "Laboratory scale" excludes those workplaces whose function is to produce commercial quantities of materials.
"**Laboratory-type hood**" means a device located in a laboratory, enclosure on five sides with a movable sash or fixed partial enclosed on the remaining side; constructed and maintained to draw air from the laboratory and to prevent or minimize the escape of air contaminants into the laboratory; and allows chemical manipulations to be conducted in the enclosure without insertion of any portion of the **employee**'s body other than hands and arms.
Walk-in hoods with adjustable sashes meet the above definition provided that the sashes are adjusted during use so that the airflow and the exhaust of air contaminants are not compromised and **employee**s do not work inside the enclosure during the release of airborne hazardous chemicals.
"**Laboratory use of hazardous chemicals**" means handling or use of such chemicals in which all of the following conditions are met:
(i) Chemical manipulations are carried out on a "laboratory scale;"
(ii) Multiple chemical procedures or chemicals are used;
(iii) The procedures involved are not part of a production process, nor in any way simulate a production process; and
(iv) "**Protective laboratory practices and equipment**" are available and in common use to minimize the potential for **employee** exposure to hazardous chemicals.
"**Medical consultation**" means a consultation which takes place between an **employee** and a licensed physician for the purpose of determining what medical examinations or procedures, if any, are appropriate in cases where a significant exposure to a hazardous chemical may have taken place.
"**Organic peroxide**" means an organic compound that contains the bivalent -O-O- structure and which may be considered to be a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms has been replaced by an organic radical.
"**Oxidizer**" means a chemical other than a blasting agent or explosive as defined in 1910.109(a), that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen

or other gases.
"**Physical hazard**" means a chemical for which there is scientifically valid evidence tat it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer pyrophoric, unstable (reactive) or water-reactive.
"**Protective laboratory practices and equipment**" means those laboratory procedures, practices and equipment accepted by laboratory health and safety experts as effective, or that the employer can show to be effective, in minimizing the potential for **employee** exposure to hazardous chemicals.
"**Reproductive toxins**" means chemicals which affect the reproductive chemicals which affect the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogenesis).
"**Select carcinogen**" means any substance which meets one of the following criteria:
(i) It is regulated by OSHA as a carcinogen; or
(ii) It is listed under the category, "known to be carcinogens," in the Annual Report on Carcinogens published by the National Toxicology Program (NTP)(latest edition); or
(iii) It is listed under Group 1 ("**carcinogenic to humans**") by the International Agency for research on Cancer Monographs (IARC)(latest editions); or
(iv) It is listed in either Group 2A or 2B by IARC or under the category, "**reasonably anticipated to be carcinogens**" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:
(A) After inhalation exposure of 6-7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m(3);
(B) After repeated skin application of less than 300 (mg/kg of body weight) per week; or
(C) After oral dosages of less than 50 mg/kg of body weight per day.
"**Unstable (reactive)**" means a chemical which is the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure or temperature.
"**Water-reactive**" means a chemical that reacts with water to release a gas that is either flammable or presents a health hazard.

(c) Permissible exposure limits. For laboratory uses of OSHA regulated substances, the employer shall assure that laboratory **employee**s' exposures to such substances do not exceed the permissible exposure limits specified in 29 CFR part 1910, subpart Z.

..1910.1450(d)
(d) Employee exposure determination

(d)(1) Initial monitoring. The employer shall measure the **employee**'s exposure to any substance regulated by a standard which requires monitoring if there is reason to believe that exposure levels for that substance routinely exceed the action level (or in the absence of an action level, the PEL).

(d)(2) Periodic monitoring. If the initial monitoring prescribed by paragraph (d)(1) of this section discloses **employee** exposure over the action level (or in the absence of an action level, the PEL), the employer shall immediately comply with the exposure monitoring provisions of the relevant standard.

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

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

(e) Chemical hygiene plan - General. (Appendix A of this section is non-mandatory but provides guidance to assist employers in the development of the Chemical Hygiene Plan).

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

(e)(1)(i) Capable of protecting **employee**s from health hazards associated with hazardous chemicals in that laboratory and

..1910.1450(e)(1)(ii)

(e)(1)(ii)
Capable of keeping exposures below the limits specified in paragraph (c) of this section.

(e)(2) The Chemical Hygiene Plan shall be readily available to **employee**s, **employee** representatives and, upon request, to the Assistant Secretary.

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

(e)(3)(i) Standard operating procedures relevant to safety and health considerations to be followed when laboratory work involves the use of hazardous chemicals;

(e)(3)(ii) Criteria that the employer will use to determine and implement control measures to reduce **employee** exposure to hazardous chemicals including engineering controls, the use of personal protective equipment and hygiene practices; particular attention shall be given to the selection of control measures for chemicals that are known to be extremely hazardous;

(e)(3)(iii) A requirement that fume hoods and other protective equipment are functioning properly and specific measures that shall be taken to ensure proper and adequate performance of such equipment;

..1910.1450(e)(3)(iv)
(e)(3)(iv)

Provisions for **employee** information and training as prescribed in paragraph (f) of this section;

(e)(3)(v) The circumstances under which a particular laboratory operation, procedure or activity shall require prior approval from the employer or the employer's designee before implementation;

(e)(3)(vi) Provisions for medical consultation and medical examinations in accordance with paragraph (g) of this section;

(e)(3)(vii) Designation of personnel responsible for implementation of the Chemical Hygiene Plan including the assignment of a Chemical Hygiene Officer, and, if appropriate, establishment of a Chemical Hygiene Committee; and

(e)(3)(viii) Provisions for additional **employee** protection for work with particularly hazardous substances. These include "select carcinogens," reproductive toxins and substances which have a high degree of acute toxicity. Specific consideration shall be given to the following provisions which shall be included where appropriate:

(e)(3)(viii)(A) Establishment of a designated area;

(e)(3)(viii)(B) Use of containment devices such as fume hoods or glove boxes;

(e)(3)(viii)(C) Procedures for safe removal of contaminated waste; and

..1910.1450(e)(3)(viii)(D)
(e)(3)(viii)(D)
Decontamination procedures.

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

(f) Employee information and training.

(f)(1) The employer shall provide **employee**s with information and training to ensure that they are apprised of the hazards of chemicals present in their **work area**.

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

(f)(3) Information. **Employee**s shall be informed of:

(f)(3)(i) The contents of this standard and its appendices which shall be made available to **employee**s;

(f)(3)(ii)
the location and availability of the employer's Chemical Hygiene Plan;

..1910.1450(f)(3)(iii)
(f)(3)(iii)
The permissible exposure limits for OSHA regulated substances or recommended exposure limits for other hazardous chemicals where there is no applicable OSHA standard;

(f)(3)(iv) Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory; and

(f)(3)(v) The location and availability of known reference material on the hazards, safe handling, storage and disposal of hazardous chemicals found in the laboratory including, but not limited to, Material Safety Data Sheets received from the chemical supplier.

(f)(4) Training.

(f)(4)(i) Employee training shall include:

(f)(4)(i)(A) Methods and observations that may be used to detect the presence or release of a hazardous chemical (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.);

(f)(4)(i)(B) The physical and health hazards of chemicals in the **work area**; and

(f)(4)(i)(C) The measures **employee**s can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect **employee**s from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used.

..1910.1450(f)(4)(ii)
(f)(4)(ii)
The **employee** shall be trained on the applicable details of the employer's written Chemical Hygiene Plan.

(g) Medical consultation and medical examinations.

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

(g)(1)(i) Whenever an **employee** develops signs or symptoms associated with a hazardous chemical to which the **employee** may have been exposed in the laboratory, the **employee** shall be provided an opportunity to receive an appropriate medical examination.

(g)(1)(ii) Where exposure monitoring reveals an exposure level routinely above the action level (or in the absence of an action level, the PEL) for an OSHA regulated substance for which there are exposure monitoring and medical surveillance requirements, medical surveillance shall be established for the affected **employee** as prescribed by the particular standard.

(g)(1)(iii) Whenever an event takes place in the **work area** such as a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure, the affected

employee shall be provided an opportunity for a medical consultation. Such consultation shall be for the purpose of determining the need for a medical examination.

..1910.1450(g)(2)
(g)(2) All medical examinations and consultations shall be performed by or under the direct supervision of a licensed physician and shall be provided without cost to the **employee**, without loss of pay and at a reasonable time and place.

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

(g)(3)(i) The identity of the hazardous chemical(s) to which the **employee** may have been exposed;

(g)(3)(ii) A description of the conditions under which the exposure occurred including quantitative exposure data, if available; and

(g)(3)(iii) A description of the signs and symptoms of exposure that the **employee** is experiencing, if any.

(g)(4) Physician's written opinion.

(g)(4)(i) For examination or consultation required under this standard, the employer shall obtain a written opinion from the examining physician which shall include the following:

(g)(4)(i)(A) Any recommendation for further medical follow-up;

(g)(4)(i)(B) The results of the medical examination and any associated tests;

..1910.1450(g)(4)(I)(C)
(g)(4)(i)(C)

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

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

(g)(4)(ii) The written opinion shall not reveal specific findings of diagnoses unrelated to occupational exposure.

(h) Hazard identification.

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

(h)(1)(i) Employers shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced.

(h)(1)(ii) Employers shall maintain any material safety data sheets that are received with incoming shipments of hazardous chemicals, and ensure that they are readily accessible to laboratory **employee**s.

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

..1910.1450(h)(2)(i)
(h)(2)(i) If the composition of the chemical substance which is produced exclusively for the laboratory's use is known, the employer shall determine if it is a hazardous chemical as defined in paragraph (b) of this section. If the chemical is determined to be hazardous, the employer shall provide appropriate training as required under paragraph (f) of this section.

(h)(2)(ii) If the chemical produced is a byproduct whose composition is not known, the employer shall assume that the substance is hazardous and shall implement paragraph (e) of this section.

(h)(2)(iii) If the chemical substance is produced for another user outside of the laboratory, the employer shall comply with the Hazard Communication Standard (29 CFR 1910.1200) including the requirements for preparation of material safety data sheets and labeling.

(i) Use of respirators. Where the use of respirators is necessary to maintain exposure below permissible exposure limits, the employer shall provide, at no cost to the **employee**, the proper respiratory equipment. Respirators shall be selected and used in accordance with the requirements of 29 CFR 1910.134.

(j) Recordkeeping.

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

..1910.1450(j)(2)
(j)(2) The employer shall assure that such records are kept, transferred, and made available in accordance with 29 CFR 1910.1020.

(k) Dates -

(k)(1) Effective date. This section shall become effective May 1, 1990.

(k)(2) Start-up dates.

(k)(2)(i)
Employers shall have developed and implemented a written Chemical Hygiene Plan no later than January 31, 1991.

(k)(2)(ii) Paragraph (a)(2) of this section shall not take effect until the employer has developed and implemented a written Chemical Hygiene Plan.

(l) Appendices. The information contained in the appendices is not intended, by itself, to create any additional obligations not otherwise imposed or to detract from any existing obligation.
[61 FR 5507, Feb. 13, 1996]

- **Appendix A to 1910.1450**
- **Standard Title: National Research Council Recommendations Concerning Chemical Hygiene in Laboratories (Non-Mandatory)**
- **SubPart Number: Z**
- **SubPart Title: Toxic and Hazardous Substances**

Table of Contents

Foreword

As guidance for each employer's development of an appropriate laboratory Chemical Hygiene Plan, the following non-mandatory recommendations are provided. They were extracted form "Prudent Practices" for Handling Hazardous Chemicals in Laboratories" (referred to below as "Prudent Practices"), which was published in 1981 by the National Research Council and is available from the National Academy Press, 2101 Constitution Ave., NW,. Washington DC 20418.

"Prudent Practices" is cited because of its wide distribution and acceptance and because of its preparation by members of the laboratory community through the sponsorship of the National Research Council. However, none of the recommendations given here will modify any requirements of the laboratory standard. This Appendix merely presents pertinent recommendations from "Prudent Practices", organized into a form convenient for quick reference during operation of a laboratory facility and during development and application of a Chemical Hygiene Plan. Users of this appendix should consult "Prudent Practices" for a more extended presentation and justification for each recommendation.

"Prudent Practices" deal with both safety and chemical hazards while the laboratory standard is concerned primarily with chemical hazards. Therefore, only those recommendations directed primarily toward control of toxic exposures are cited in this appendix, with the term "chemical Hygiene" being substituted for the word "safety". However, since conditions producing or threatening physical injury often pose toxic risks as well, page references concerning major categories of safety hazards in the laboratory are given in section F.

The recommendations from "Prudent Practices" have been paraphrased, combined, or otherwise reorganized, and headings have been added. However, their sense has not been changed.

Corresponding Sections of the Standard and this Appendix

The following table is given for the convenience of those who are developing a Chemical Hygiene Plan which will satisfy the requirements of paragraph (e) of the standard. It indicates those sections of this appendix which are most pertinent to each of the sections of paragraph (e) and related paragraphs.

Paragraph and topic in laboratory standard	Relevant appendix section
(e)(3)(i) Standard operating procedures for handling toxic chemicals.	C, D, E
(e)(3)(ii) Criteria to be used for implementation of measures to reduce exposures.	D
(e)(3)(iii) Fume hood performance	C4b
(e)(3)(iv) **Employee** information and training(including emergency procedures).	D10, D9
(e)(3)(v) Requirements for prior approval of laboratory activities.	E2b, E4b

(e)(3)(vi) Medical consultation and medical examinations.
D5, E4f

(e)(3)(vii) Chemical hygiene responsibilities.
B

e)(3)(viii) Special precautions for work with particularly hazardous substances.
E2, E3, E4

In this appendix, those recommendations directed primarily at administrators and supervisors are given in sections A-D. Those recommendations of primary concern to **employee**s who are actually handling laboratory chemicals are given in section E. (Reference to page numbers in "Prudent Practices" are given in parentheses.)
A. General Principles for Work with Laboratory Chemicals
In addition to the more detailed recommendations listed below in sections B-E, "Prudent Practices" expresses certain general principles, including the following:
1. It is prudent to minimize all chemical exposures. Because few laboratory chemicals are without hazards, general precautions for handling all laboratory chemicals should be adopted, rather than specific guidelines for particular chemicals (2,10). Skin contact with chemicals should be avoided as a cardinal rule (198).
2. Avoid underestimation of risk. Even for substances of no known significant hazard, exposure should be minimized; for work with substances which present special hazards, special precautions should be taken (10, 37, 38). One should assume that any mixture will be more toxic than its most toxic component (30, 103) and that all substances of unknown toxicity are toxic (3, 34).
3. Provide adequate ventilation. The best way to prevent exposure to airborne substances is to prevent their escape into the working atmosphere by use of hoods and other ventilation devices (32, 198).
4. Institute a chemical hygiene program. A mandatory chemical hygiene program designed to minimize exposures is needed; it should be a regular, continuing effort, not merely a standby or short-term activity (6,11). Its recommendations should be followed in academic teaching laboratories as well as by full-time laboratory workers (13).
5. Observe the PELs, TLVs. The Permissible Exposure Limits of OSHA and the Threshold Limit Values of the American Conference of Governmental Industrial Hygienists should not be exceeded (13).
B. Chemical Hygiene Responsibilities
Responsibility for chemical hygiene rests at all levels (6, 11, 21) including the:
1. Chief executive officer, who has ultimate responsibility for chemical hygiene within the institution and must, with other administrators, provide continuing support for institutional chemical hygiene (7, 11).
2. Supervisor of the department or other administrative unit, who is responsible for chemical hygiene in that unit (7).
3. chemical hygiene officer(s), whose appointment is essential (7) and who must:
(a) Work with administrators and other **employee**s to develop and implement appropriate chemical hygiene policies and practices (7);
(b) Monitor procurement, use, and disposal of chemicals used in the lab (8);
(c) See that appropriate audits are maintained (8);
(d) Help project directors develop precautions and adequate facilities (10);
(e) Know the current legal requirements concerning regulated substances (50); and
(f) Seek ways to improve the chemical hygiene program (8, 11).
4. Laboratory supervisor, who has overall responsibility for chemical hygiene in the laboratory (21) including responsibility to:
(a) Ensure that workers know and follow the chemical hygiene rules, that protective equipment is available and in working order, and that appropriate training has been provided (21, 22);
(b) Provide regular, formal chemical hygiene and housekeeping inspections including routine inspections of emergency equipment (21, 171);
(c) Know the current legal requirements concerning regulated substances (50, 231);
(d) Determine the required levels of protective apparel and equipment (156, 160, 162); and
(e) Ensure that facilities and training for use of any material being ordered are adequate (215).
5. Project director or director of other specific operation, who has primary responsibility for chemical hygiene procedures for that operation (7).
6. Laboratory worker, who is responsible for:
(a) Planning and conducting each operation in accordance with the institutional chemical hygiene procedures (7, 21, 22, 230); and
(b) Developing good personal chemical hygiene habits (22).
C. The Laboratory Facility
1. Design. The laboratory facility should have:
(a) An appropriate general ventilation system (see C4 below) with air intakes and exhausts located so as to avoid intake of contaminated air (194);
(b) Adequate, well-ventilated stockrooms/storerooms (218, 219).
(c) Laboratory hoods and sinks (12, 162);
(d) Other safety equipment including eyewash fountains and drench showers (162, 169); and
(e) Arrangements for waste disposal (12, 240).
2. Maintenance. Chemical-hygiene-related equipment (hoods, incinerator, etc.) should undergo continual appraisal and be modified if inadequate (11, 12).
3. Usage. The work conducted (10) and its scale (12) must be appropriate to the physical facilities available and, especially, to the quality of ventilation (13).
4. Ventilation - (a) General laboratory ventilation. This system should: Provide a source of air for breathing and for input to local ventilation devices (199); it should not be relied on for protection from toxic substances released into the laboratory (198); ensure that laboratory air is continually replaced, preventing increase of air concentrations of toxic substances during the working day (194); direct air flow into the laboratory

from non-laboratory areas and out to the exterior of the building (194).
(b) Hoods. A laboratory hood with 2.5 linear feet of hood space per person should be provided for every 2 workers if they spend most of their time working with chemicals (199); each hood should have a continuous monitoring device to allow convenient confirmation of adequate hood performance before use (200, 209). If this is not possible, work with substances of unknown toxicity should be avoided (13) or other types of local ventilation devices should be provided (199). See pp. 201-206 for a discussion of hood design, construction, and evaluation.
(c) Other local ventilation devices. Ventilated storage cabinets, canopy hoods, snorkels, etc. should be provided as needed (199). Each canopy hood and snorkel should have a separate exhaust duct (207).
(d) Special ventilation areas. Exhaust air from glove boxes and isolation rooms should be passed through scrubbers or other treatment before release into the regular exhaust system (208). Cold rooms and warm rooms should have provisions for rapid escape and for escape in the event of electrical failure (209).
(e) Modifications. Any alteration of the ventilation system should be made only if thorough testing indicates that worker protection from airborne toxic substances will continue to be adequate (12, 193, 204).
(f) Performance. Rate: 4-12 room air changes/hour is normally adequate general ventilation if local exhaust systems such as hoods are used as the primary method of control (194).
(g) Quality. General air flow should not be turbulent and should be relatively uniform throughout the laboratory, with no high velocity or static areas (194, 195); airflow into and within the hood should not be excessively turbulent (200); hood face velocity should be adequate (typically 60-100 lfm) (200, 204).
(h) Evaluation. Quality and quantity of ventilation should be evaluated on installation (202), regularly monitored (at least every 3 months) (6, 12, 14, 195), and reevaluated whenever a change in local ventilation devices is made (12, 195, 207). See pp 195-198 for methods of evaluation and for calculation of estimated airborne contaminant concentrations.
D. Components of the Chemical Hygiene Plan
1. Basic Rules and Procedures (Recommendations for these are given in section E, below)
2. Chemical Procurement, Distribution, and Storage
(a) Procurement. Before a substance is received, information on proper handling, storage, and disposal should be known to those who will be involved (215, 216). No container should be accepted without an adequate identifying label (216). Preferably, all substances should be received in a central location (216).
(b) Stockrooms/storerooms. Toxic substances should be segregated in a well-identified area with local exhaust ventilation (221). Chemicals which are highly toxic (227) or other chemicals whose containers have been opened should be in unbreakable secondary containers (219). Stored chemicals should be examined periodically (at least annually) for replacement, deterioration, and container integrity (218-19).
Stockrooms/storerooms should not be used as preparation or repackaging areas, should be open during normal working hours, and should be controlled by one person (219).
(c) Distribution. When chemicals are hand carried, the container should be placed in an outside container or bucket. Freight-only elevators should be used if possible (223).
(d) Laboratory storage. Amounts permitted should be as small as practical. Storage on bench tops and in hoods is inadvisable. Exposure to heat or direct sunlight should be avoided. Periodic inventories should be conducted, with unneeded items being discarded or returned to the storeroom/stockroom (225-6, 229).
3. Environmental Monitoring
Regular instrumental monitoring of airborne concentrations is not usually justified or practical in laboratories but may be appropriate when testing or redesigning hoods or other ventilation devices (12) or when a highly toxic substance is stored or used regularly (e.g., 3 times/week) (13).
4. Housekeeping, Maintenance, and Inspections
(a) Cleaning. Floors should be cleaned regularly (24).
(b) Inspections. Formal housekeeping and chemical hygiene inspections should be held at least quarterly (6, 21) for units which have frequent personnel changes and semiannually for others; informal inspections should be continual (21).
(c) Maintenance. Eye wash fountains should be inspected at intervals of not less than 3 months (6). Respirators for routine use should be inspected periodically by the laboratory supervisor (169). Other safety equipment should be inspected regularly. (e.g., every 3-6 months) (6, 24, 171). Procedures to prevent restarting of out-of-service equipment should be established (25).
(d) Passageways. Stairways and hallways should not be used as storage areas (24). Access to exits, emergency equipment, and utility controls should never be blocked (24).
5. Medical Program
(a) Compliance with regulations. Regular medical surveillance should be established to the extent required by regulations (12).
(b) Routine surveillance. Anyone whose work involves regular and frequent handling of toxicologically significant quantities of a chemical should consult a qualified physician to determine on an individual basis whether a regular schedule of medical surveillance is desirable (11, 50).
(c) First aid. Personnel trained in first aid should be available during working hours and an emergency room with medical personnel should be nearby (173). See pp. 176-178 for description of some emergency first aid procedures.
6. Protective Apparel and Equipment
These should include for each laboratory:
(a) Protective apparel compatible with the required degree of protection for substances being handled (158-161);
(b) An easily accessible drench-type safety shower (162, 169);
(c) An eyewash fountain (162)
(d) A fire extinguisher (162-164);

(e) Respiratory protection (164-9), fire alarm and telephone for emergency use (162) should be available nearby; and
(f) Other items designated by the laboratory supervisor (156, 160).
7. Records
(a) Accident records should be written and retained (174).
(b) Chemical Hygiene Plan records should document that the facilities and precautions were compatible with current knowledge and regulations (7).
(c) Inventory and usage records for high-risk substances should be kept as specified in sections E3e below.
(d) Medical records should be retained by the institution in accordance with the requirements of state and federal regulations (12).
8. Signs and Labels
Prominent signs and labels of the following types should be posted:
(a) Emergency telephone numbers of emergency personnel/facilities, supervisors, and laboratory workers (28);
(b) Identity labels, showing contents of containers (including waste receptacles) and associated hazards (27, 48);
(c) Location signs for safety showers, eyewash stations, other safety and first aid equipment, exits (27) and areas where food and beverage consumption and storage are permitted (24); and
(d) Warnings at areas or equipment where special or unusual hazards exist (27).
9. Spills and Accidents
(a) A written emergency plan should be established and communicated to all personnel; it should include procedures for ventilation failure (200), evacuation, medical care, reporting, and drills (172).
(b) There should be an alarm system to alert people in all parts of the facility including isolation areas such as cold rooms (172).
(c) A spill control policy should be developed and should include consideration of prevention, containment, cleanup, and reporting (175).
(d) All accidents or near accidents should be carefully analyzed with the results distributed to all who might benefit (8, 28).
10. Information and Training Program
(a) Aim: To assure that all individuals at risk are adequately informed about the work in the laboratory, its risks, and what to do if an accident occurs (5, 15).
(b) Emergency and Personal Protection Training: Every laboratory worker should know the location and proper use of available protective apparel and equipment (154, 169).
Some of the full-time personnel of the laboratory should be trained in the proper use of emergency equipment and procedures (6).
Such training as well as first aid instruction should be available to (154) and encouraged for (176) everyone who might need it.
(c) Receiving and stockroom/storeroom personnel should know about hazards, handling equipment, protective apparel, and relevant regulations (217).
(d) Frequency of Training: The training and education program should be a regular, continuing activity - not simply an annual presentation (15).
(e) Literature/Consultation: Literature and consulting advice concerning chemical hygiene should be readily available to laboratory personnel, who should be encouraged to use these information resources (14).
11. Waste Disposal Program.
(a) Aim: To assure that minimal harm to people, other organisms, and the environment will result from the disposal of waste laboratory chemicals (5).
(b) Content (14, 232, 233, 240): The waste disposal program should specify how waste is to be collected, segregated, stored, and transported and include consideration of what materials can be incinerated. Transport from the institution must be in accordance with DOT regulations (244).
(c) Discarding Chemical Stocks: Unlabeled containers of chemicals and solutions should undergo prompt disposal; if partially used, they should not be opened (24, 27).
Before a worker's employment in the laboratory ends, chemicals for which that person was responsible should be discarded or returned to storage (226).
(d) Frequency of Disposal: Waste should be removed from laboratories to a central waste storage area at least once per week and from the central waste storage area at regular intervals (14).
(e) Method of Disposal: Incineration in an environmentally acceptable manner is the most practical disposal method for combustible laboratory waste (14, 238, 241).
Indiscriminate disposal by pouring waste chemicals down the drain (14, 231, 242) or adding them to mixed refuse for landfill burial is unacceptable (14).
Hoods should not be used as a means of disposal for volatile chemicals (40, 200).
Disposal by recycling (233, 243) or chemical decontamination (40, 230) should be used when possible.
E. Basic Rules and Procedures for Working with Chemicals
The Chemical Hygiene Plan should require that laboratory workers know and follow its rules and procedures. In addition to the procedures of the sub programs mentioned above, these should include the rules listed below.
1. General Rules
The following should be used for essentially all laboratory work with chemicals:
(a) Accidents and spills - Eye Contact: Promptly flush eyes with water for a prolonged period (15 minutes) and seek medical attention (33, 172).
Ingestion: Encourage the victim to drink large amounts of water (178).
Skin Contact: Promptly flush the affected area with water (33, 172, 178) and remove any contaminated clothing (172, 178). If symptoms persist after washing, seek medical attention (33).
Clean-up. Promptly clean up spills, using appropriate protective apparel and equipment and proper disposal (24, 33).
See pp. 233-237 for specific clean-up recommendations.
(b) Avoidance of "routine" exposure: Develop and encourage safe habits (23); avoid unnecessary exposure to chemicals by any route (23);
Do not smell or taste chemicals (32).
Vent apparatus which may discharge toxic chemicals (vacuum pumps, distillation columns, etc.) into local exhaust devices (199).
Inspect gloves (157) and test glove boxes (208) before use.

Do not allow release of toxic substances in cold rooms and warm rooms, since these have contained recirculated atmospheres (209).
(c) Choice of chemicals: Use only those chemicals for which the quality of the available ventilation system is appropriate (13).
(d) Eating, smoking, etc.: Avoid eating, drinking, smoking, gum chewing, or application of cosmetics in areas where laboratory chemicals are present (22, 24, 32, 40); wash hands before conducting these activities (23, 24).
Avoid storage, handling, or consumption of food or beverages in storage areas, refrigerators, glassware or utensils which are also used for laboratory operations (23, 24, 226).
(e) Equipment and glassware: Handle and store laboratory glassware with care to avoid damage; do not use damaged glassware (25). Use extra care with Dewar flasks and other evacuated glass apparatus; shield or wrap them to contain chemicals and fragments should implosion occur (25). Use equipment only for its designed purpose (23, 26).
(f) Exiting: Wash areas of exposed skin well before leaving the laboratory (23).
(g) Horseplay: Avoid practical jokes or other behavior which might confuse, startle or distract another worker (23).
(h) Mouth suction: Do not use mouth suction for pipeting or starting a siphon (23, 32).
(i) Personal apparel: Confine long hair and loose clothing (23, 158). Wear shoes at all times in the laboratory but do not wear sandals, perforated shoes, or sneakers (158).
(j) Personal housekeeping: Keep the **work area** clean and uncluttered, with chemicals and equipment being properly labeled and stored; clean up the **work area** on completion of an operation or at the end of each day (24).
(k) Personal protection: Assure that appropriate eye protection (154-156) is worn by all persons, including visitors, where chemicals are stored or handled (22, 23, 33, 154).
Wear appropriate gloves when the potential for contact with toxic materials exists (157); inspect the gloves before each use, wash them before removal, and replace them periodically (157). (A table of resistance to chemicals of common glove materials is given p. 159).
Use appropriate (164-168) respiratory equipment when air contaminant concentrations are not sufficiently restricted by engineering controls (164-5), inspecting the respirator before use (169).
Use any other protective and emergency apparel and equipment as appropriate (22, 157-162).
Avoid use of contact lenses in the laboratory unless necessary; if they are used, inform supervisor so special precautions can be taken (155).
Remove laboratory coats immediately on significant contamination (161).
(l) Planning: Seek information and advice about hazards (7), plan appropriate protective procedures, and plan positioning of equipment before beginning any new operation (22, 23).
(m) Unattended operations: Leave lights on, place an appropriate sign on the door, and provide for containment of toxic substances in the event of failure of a utility service (such as cooling water) to an unattended operation (27, 128).
(n) Use of hood: Use the hood for operations which might result in release of toxic chemical vapors or dust (198-9).
As a rule of thumb, use a hood or other local ventilation device when working with any appreciably volatile substance with a TLV of less than 50 ppm (13).
Confirm adequate hood performance before use; keep hood closed at all times except when adjustments within the hood are being made (200); keep materials stored in hoods to a minimum and do not allow them to block vents or air flow (200).
Leave the hood "on" when it is not in active use if toxic substances are stored in it or if it is uncertain whether adequate general laboratory ventilation will be maintained when it is "off" (200).
(o) Vigilance: Be alert to unsafe conditions and see that they are corrected when detected (22).
(p) Waste disposal: Assure that the plan for each laboratory operation includes plans and training for waste disposal (230).
Deposit chemical waste in appropriately labeled receptacles and follow all other waste disposal procedures of the Chemical Hygiene Plan (22, 24).
Do not discharge to the sewer concentrated acids or bases (231); highly toxic, malodorous, or lachrymatory substances (231); or any substances which might interfere with the biological activity of waste water treatment plants, create fire or explosion hazards, cause structural damage or obstruct flow (242).
(q) Working alone: Avoid working alone in a building; do not work alone in a laboratory if the procedures being conducted are hazardous (28).
2. Working with Allergens and Embryotoxins
(a) Allergens (examples: diazomethane, isocyanates, bichromates): Wear suitable gloves to prevent hand contact with allergens or substances of unknown allergenic activity (35).
(b) Embryotoxins (34-5) (examples: organomercurials, lead compounds, formamide): If you are a woman of childbearing age, handle these substances only in a hood whose satisfactory performance has been confirmed, using appropriate protective apparel (especially gloves) to prevent skin contact.
Review each use of these materials with the research supervisor and review continuing uses annually or whenever a procedural change is made.
Store these substances, properly labeled, in an adequately ventilated area in an unbreakable secondary container.
Notify supervisors of all incidents of exposure or spills; consult a qualified physician when appropriate.
3. Work with Chemicals of Moderate Chronic or High Acute Toxicity
Examples: diisopropylfluorophosphate (41), hydrofluoric acid (43), hydrogen cyanide (45).
Supplemental rules to be followed in addition to those mentioned above (Procedure B of "Prudent Practices", pp. 39-41):
(a) Aim: To minimize exposure to these toxic substances by any route using all reasonable precautions (39).
(b) Applicability: These precautions are appropriate for substances with

moderate chronic or high acute toxicity used in significant quantities (39).
(c) Location: Use and store these substances only in areas of restricted access with special warning signs (40, 229).
Always use a hood (previously evaluated to confirm adequate performance with a face velocity of at least 60 linear feet per minute) (40) or other containment device for procedures which may result in the generation of aerosols or vapors containing the substance (39); trap released vapors to revent their discharge with the hood exhaust (40).
(d) Personal protection: Always avoid skin contact by use of gloves and long sleeves (and other protective apparel as appropriate) (39). Always wash hands and arms immediately after working with these materials (40).
(e) Records: Maintain records of the amounts of these materials on hand, amounts used, and the names of the workers involved (40, 229).
(f) Prevention of spills and accidents: Be prepared for accidents and spills (41).
Assure that at least 2 people are present at all times if a compound in use is highly toxic or of unknown toxicity (39).
Store breakable containers of these substances in chemically resistant trays; also work and mount apparatus above such trays or cover work and storage surfaces with removable, absorbent, plastic backed paper (40).
If a major spill occurs outside the hood, evacuate the area; assure that cleanup personnel wear suitable protective apparel and equipment (41).
(g) Waste: Thoroughly decontaminate or incinerate contaminated clothing or shoes (41). If possible, chemically decontaminate by chemical conversion (40).
Store contaminated waste in closed, suitably labeled, impervious containers (for liquids, in glass or plastic bottles half-filled with vermiculite) (40).
4. Work with Chemicals of High Chronic Toxicity
(Examples: dimethylmercury and nickel carbonyl (48), benzo-a-pyrene (51), N-nitrosodiethylamine (54), other human carcinogens or substances with high carcinogenic potency in animals (38).)
Further supplemental rules to be followed, in addition to all these mentioned above, for work with substances of known high chronic toxicity (in quantities above a few milligrams to a few grams, depending on the substance) (47). (Procedure A of "Prudent Practices" pp. 47-50).
(a) Access: Conduct all transfers and work with these substances in a "controlled area": a restricted access hood, glove box, or portion of a lab, designated for use of highly toxic substances, for which all people with access are aware of the substances being used and necessary precautions (48).
(b) Approvals: Prepare a plan for use and disposal of these materials and obtain the approval of the laboratory supervisor (48).
(c) Non-contamination/Decontamination: Protect vacuum pumps against contamination by scrubbers or HEPA filters and vent them into the hood (49).
Decontaminate vacuum pumps or other contaminated equipment, including glassware, in the hood before removing them from the controlled area (49, 50).
Decontaminate the controlled area before normal work is resumed there (50).
(d) Exiting: On leaving a controlled area, remove any protective apparel (placing it in an appropriate, labeled container) and thoroughly wash hands, forearms, face, and neck (49).
(e) Housekeeping: Use a wet mop or a vacuum cleaner equipped with a HEPA filter instead of dry sweeping if the toxic substance was a dry powder (50).
(f) Medical surveillance: If using toxicologically significant quantities of such a substance on a regular basis (e.g., 3 times per week), consult a qualified physician concerning desirability of regular medical surveillance (50).
(g) Records: Keep accurate records of the amounts of these substances stored (229) and used, the dates of use, and names of users (48).
(h) Signs and labels: Assure that the controlled area is conspicuously marked with warning and restricted access signs (49) and that all containers of these substances are appropriately labeled with identity and warning labels (48).
(i) Spills: Assure that contingency plans, equipment, and materials to minimize exposures of people and property in case of accident are available (233-4).
(j) Storage: Store containers of these chemicals only in a ventilated, limited access (48, 227, 229) area in appropriately labeled, unbreakable, chemically resistant, secondary containers (48, 229).
(k) Glove boxes: For a negative pressure glove box, ventilation rate must be at least 2 volume changes/hour and pressure at least 0.5 inches of water (48). For a positive pressure glove box, thoroughly check for leaks before each use (49). In either case, trap the exit gases or filter them through a HEPA filter and then release them into the hood (49).
(l) Waste: Use chemical decontamination whenever possible; ensure that containers of contaminated waste (including washings from contaminated flasks) are transferred from the controlled area in a secondary container under the supervision of authorized personnel (49, 50, 233).
5. Animal Work with Chemicals of High Chronic Toxicity
(a) Access: For large scale studies, special facilities with restricted access are preferable (56).
(b) Administration of the toxic substance: When possible, administer the substance by injection or gavage instead of in the diet. If administration is in the diet, use a caging system under negative pressure or under laminar air flow directed toward HEPA filters (56).
(c) Aerosol suppression: Devise procedures which minimize formation and dispersal of contaminated aerosols, including those from food, urine, and feces (e.g., use HEPA filtered vacuum equipment for cleaning, moisten contaminated bedding before removal from the cage, mix diets in closed containers in a hood) (55, 56).
(d) Personal protection: When working in the animal room, wear plastic or rubber gloves, fully buttoned laboratory coat or jumpsuit and, if needed because of incomplete suppression of aerosols,

other apparel and equipment (shoe and head coverings, respirator) (56).
(e) Waste disposal: Dispose of contaminated animal tissues and excreta by incineration if the available incinerator can convert the contaminant to non-toxic products (238); otherwise, package the waste appropriately for burial in an EPA-approved site (239).
F. Safety Recommendations
The above recommendations from "Prudent Practices" do not include those which are directed primarily toward prevention of physical injury rather than toxic exposure. However, failure of precautions against injury will often have the secondary effect of causing toxic exposures. Therefore, we list below page references for recommendations concerning some of the major categories of safety hazards which also have implications for chemical hygiene:
1. Corrosive agents: (35-6)
2. Electrically powered laboratory apparatus: (179-92)
3. Fires, explosions: (26, 57-74, 162-64, 174-5, 219-20, 226-7)
4. Low temperature procedures: (26, 88)
5. Pressurized and vacuum operations (including use of compressed gas cylinders): (27, 75-101)

G. Material Safety Data Sheets
Material safety data sheets are presented in "Prudent Practices" for the chemicals listed below. (Asterisks denote that comprehensive material safety data sheets are provided).

o Acetyl peroxide (105)

o Acrolein (106)

o Acrylonitrile

Ammonia (anhydrous)(91)

o Aniline (109)

o Benzene (110)

o Benzo[a]pyrene (112)

o Bis(chloromethyl) ether (113)

Boron trichloride (91)

Boron trifluoride (92)

Bromine (114)

o Tert-butyl hydroperoxide (148)

o Carbon disulfide (116)

Carbon monoxide (92)

o Carbon tetrachloride (118)

*Chlorine (119)

Chlorine trifluoride (94)

o Chloroform (121)

Chloromethane (93)

o Diethyl ether (122)

Diisopropyl fluorophosphate (41)

o Dimethylformamide (123)

o Dimethyl sulfate (125)

o Dioxane (126)

o Ethylene dibromide (128)

o Fluorine (95)

o Formaldehyde (130)

o Hydrazine and salts (132)

Hydrofluoric acid (43)

Hydrogen bromide (98)

Hydrogen chloride (98)

o Hydrogen cyanide (133)

o Hydrogen sulfide (135)

Mercury and compounds (52)

o Methanol (137)

o Morpholine (138)

o Nickel carbonyl (99)

o Nitrobenzene (139)

Nitrogen dioxide (100)

N-nitrosodiethylamine (54)

o Peracetic acid (141)

o Phenol (142)

o Phosgene (143)

o Pyridine (144)

o Sodium azide (145)

o Sodium cyanide (147)

Sulfur dioxide (101)

o Trichloroethylene (149)

o Vinyl chloride (150)

Appendix B to 1910.1450

- **Standard Title: References (Non-Mandatory)**
- **SubPart Number: Z**
- **SubPart Title: Toxic and Hazardous Substances**

The following references are provided to assist the employer in the development of a Chemical Hygiene Plan. The materials listed below are offered as non-mandatory guidance. References listed here do not imply specific endorsement of a book, opinion, technique, policy or a specific solution for a safety or health problem. Other references not listed here may better meet the needs of a specific laboratory. (a) Materials for the development of the Chemical Hygiene Plan:
1. American Chemical Society, Safety in Academic Chemistry Laboratories, 4th edition, 1985.
2. Fawcett, H.H. and W.S. Wood, Safety and Accident Prevention in Chemical Operations, 2nd edition, Wiley-Interscience, New York, 1982.
3. Flury, Patricia A., Environmental Health and Safety in the Hospital Laboratory, Charles C. Thomas Publisher, Springfield IL, 1978.
4. Green, Michael E. and Turk, Amos, Safety in Working with Chemicals, Macmillan Publishing Co., NY, 1978.
5. Kaufman, James A., Laboratory Safety Guidelines, Dow Chemical Co., Box 1713, Midland, MI 48640, 1977.
6. National Institutes of Health, NIH Guidelines for the Laboratory use of Chemical Carcinogens, NIH Pub. No. 81-2385, GPO, Washington, DC 20402, 1981.

7. National Research Council, Prudent Practices for Disposal of Chemicals from Laboratories, National Academy Press, Washington, DC, 1983.
8. National Research Council, Prudent Practices for Handling Hazardous Chemicals in Laboratories, National Academy Press, Washington, DC, 1981.
9. Renfrew, Malcolm, Ed., Safety in the Chemical Laboratory, Vol. IV, J. Chem. Ed., American Chemical Society, Easlon, PA, 1981.
10. Steere, Norman V., Ed., Safety in the Chemical Laboratory, J. Chem. Ed. American Chemical Society, Easlon, PA, 18042, Vol. I, 1967, Vol. II, 1971, Vol. III, 1974.
11. Steere, Norman V., Handbook of Laboratory Safety, the Chemical Rubber Company Cleveland, OH, 1971.
12. Young, Jay A., Ed., Improving Safety in the Chemical Laboratory, John Wiley & Sons, Inc. New York, 1987.
(b) Hazardous Substances Information:
1. American Conference of Governmental Industrial Hygienists, Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended Changes, 6500 Glenway Avenue, Bldg. D-7, Cincinnati, OH 45211-4438.
2. Annual Report on Carcinogens, National Toxicology Program U.S. Department of Health and Human Services, Public Health Service, U.S. Government Printing Office, Washington, DC, (latest edition).
3. Best Company, Best Safety Directory, Vols. I and II, Oldwick, N.J., 1981.
4. Bretherick, L., Handbook of Reactive Chemical Hazards, 2nd edition, Butterworths, London, 1979.
5. Bretherick, L., Hazards in the Chemical Laboratory, 3rd edition, Royal Society of Chemistry, London, 1986.
6. Code of Federal Regulations, 29 CFR part 1910 subpart Z. U.S. Govt. Printing Office, Washington, DC 20402 (latest edition).
7. IARC Monographs on the Evaluation of the Carcinogenic Risk of chemicals to Man, World Health Organization Publications Center, 49 Sheridan Avenue, Albany, New York 12210 (latest editions).
8. NIOSH/OSHA Pocket Guide to Chemical Hazards. NIOSH Pub. No. 85-114, U.S. Government Printing Office, Washington, DC, 1985 (or latest edition).
9. Occupational Health Guidelines, NIOSH/OSHA. NIOSH Pub. No. 81-123 U.S. Government Printing Office, Washington, DC, 1981.
10. Patty, F.A., Industrial Hygiene and Toxicology, John Wiley & Sons, Inc., New York, NY (Five Volumes).
11. Registry of Toxic Effects of Chemical Substances, U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, Revised Annually, for sale from Superintendent of documents US. Govt. Printing Office, Washington, DC 20402.
12. The Merck Index: An Encyclopedia of Chemicals and Drugs. Merck and Company Inc. Rahway, N.J., 1976 (or latest edition).
13. Sax, N.I. Dangerous Properties of Industrial Materials, 5th edition, Van Nostrand Reinhold, NY., 1979.
14. Sittig, Marshall, Handbook of Toxic and Hazardous Chemicals, Noyes Publications. Park Ridge, NJ, 1981.
(c) Information on Ventilation:
1. American Conference of Governmental Industrial Hygienists Industrial Ventilation (latest edition), 6500 Glenway Avenue, Bldg. D-7, Cincinnati, Ohio 45211-4438.
2. American National Standards Institute, Inc. American National Standards Fundamentals Governing the Design and Operation of Local Exhaust Systems ANSI Z 9.2-1979 American National Standards Institute, N.Y. 1979.
3. Imad, A.P. and Watson, C.L. Ventilation Index: An Easy Way to Decide about Hazardous Liquids, Professional Safety pp 15-18, April 1980.
4. National Fire Protection Association, Fire Protection for Laboratories Using Chemicals NFPA-45, 1982.
Safety Standard for Laboratories in Health Related Institutions, NFPA, 56c, 1980.
Fire Protection Guide on Hazardous Materials, 7th edition, 1978.
National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.
5. Scientific Apparatus Makers Association (SAMA), Standard for Laboratory Fume Hoods, SAMA LF7-1980, 1101 16th Street, NW., Washington, DC 20036.
(d) Information on Availability of Referenced Material:
1. American National Standards Institute (ANSI), 1430 Broadway, New York, NY 10018.
2. American Society for Testing and Materials (ASTM), 1916 Race Street, Philadelphia, PA 19103.
[55 FR 3327, Jan. 31, 1990; 57 FR 29204, July 1, 1992; 61 FR 5507, Feb. 13, 1996]

APPENDIX 2

LETTER OF APPOINTMENT

FOR

CHEMICAL HYGIENE OFFICER (CHO)

In compliance with the Federal Laboratory Standard the Menomonie Area School District realizes our responsibility for the protection of our **employee**s. We hereby institute the enclosed Chemical Hygiene Plan to assist us in our safety program.

The Menomonie Area School District of hereby appoints _____ to be our Chemical Hygiene Officer. We acknowledge the Chemical Hygiene Officer has the knowledge and authority to implement and enforce our Chemical Hygiene Plan.

Although we (Menomonie Area School District) are designating _____ as our Chemical Hygiene Officer, we realize the success of our Chemical Hygiene Plan rests with all of our **employee**s. The ultimate responsibility of the Chemical Hygiene Plan rests with the School Board and the District Administrator.

_____ _____

District Administrator, Joe Zydowsky Date

APPENDIX 3

LIST OF INDIVIDUALS RESPONSIBLE FOR SDMA 2017-2018 CHEMICAL HYGIENE PLAN

A. Administrators
    Superintendent
    Principals:
        High School
        Middle School
        River Heights Elementary
        Knapp Elementary
        Downsville Elementary
        Wakanda Elementary
        Oak Lawn Elementary

B. Chemical Hygiene Officer

C. High School Departments
    K-12 Science
    K-12 Art
    K-12 Technical Education

D. All Instructional Staff and students using hazardous materials

Administrators' Documentation of Commitment

I agree to provide continuing support for the District-wide Chemical Hygiene Plan during the 2018-2019 school year.

		Initial	Date
District Administrator:	Joe Zydowsky	_____	_____
Principals/Acting Principals:			
Downsville Elementary	Mary Begley	_____	_____
Knapp Elementary	Kristin Humphrey	_____	_____
Oak Lawn Elementary	Lori Smith	_____	_____
River Heights Elementary	Peggy Kolden	_____	_____
Wakanda Elementary	Susan Mommsen	_____	_____
Middle School	Bart Boettcher	_____	_____
	Mark Anderson	_____	_____
High School	David Munoz	_____	_____
	Michael Hosapopoulos	_____	_____
	Caleb Hundt	_____	_____

APPENDIX 4

LABORATORY SAFETY LIBRARY
ROOM 207A
SENIOR HIGH SCHOOL
MENOMONIE AREA SCHOOL DISTRICT

1. **Preparing, Understanding and Using Material Safety Data Sheets** revised 1994 by Lab Safety Supply Inc. booklet

2. **First Aid Manual for Chemical Accidents 2nd ed** 1989 Marc J. Lefevre revised by Shirley A. Conibear from Van Nostrand Reinhold Company ISBN 0-442-20490-6

3. **Rapid Guide To Hazardous Chemicals in the Workplace** 1986 edited by N. Irving Sax and Richard J. Lewis, Sr from Van Nostrand Reinhold Company ISBN 0-442-28220-6

4. **Prudent Practices in the Laboratory Handling and Disposal of Chemicals** by National Academy of Sciences from National Academy Press, Washington D.C. 1995 ISBN 0-309-05229-7

5. **Laboratory Waste Management A Guidebook** by ACS Task Force, American Chemical Society, Washington, D.C. 1994 ISBN 0-8412-2849-3

6. **Safety in Academic Chemisty Laboratories** 4th ed 1985 by American Chemical Society ISBN 0-8412-0938-3

7. **Laboratory Hazards Bulletin** December 1986 Royal Society of Chemistry

8. **Chemical Hazards in Industry Bulletin** December 1986 Royal Society of Chemistry

9. **How To Handle Flammable Liquids Safely** Justrite Manufacturing Company

10 **Health and Safety Guidelines for Chemistry Teachers** by Kenneth M. Reese American Chemical Society December 1979

11 **Safety First: Chlorine** PPG Industries. Inc. 21 min video VHS

12 Guide to Reading A Material Safety Data Sheet http://www-portfolio.stanford.edu:80/104239

13 *The Right-to-know Network* RTK NET supports Emergency Planning and Community Right to Know Act (EPCRA) http://www.rtk.net/

APPENDIX 5

GUIDELINES

FOR

EYE PROTECTION

Goggle Safety
What Do the ANSI Standards Really Mean?

An important obligation of a responsible science teacher is to provide students with safe, appropriate eye protection. As you compare the wide array of goggles and safety glasses, you often see the phrase "Meets ANSI Z87.1 Standards". In the Flinn Scientific Catalog/Reference Manual we list several eyewear styles which all meet the ANSI standard. Obviously, there must be more to choosing safe eyewear than merely picking any style which meets this standard. To choose the most suitable eyewear for yourself and your students it is helpful to understand ANSI and its relationship to regulations concerning school laboratories.

What is ANSI Z87.1?

The American National Standards Institute (ANSI) is a non-profit association which publishes standards covering a broad range of equipment and industries. The complete title of the current ANSI document pertaining to eyewear is *American National Standard Practice for Occupational and Face Protection,* ANSI Z87.1—1989. This document includes standards for several different styles of safety eyewear ranging from eyeglass-type spectacles to heavy-duty welding helmets. Each style has its own standards. ANSI's objective is to provide basic performance requirements for eye and face protection. For example, the tests listed below are two of the standards for removable goggle lenses:

- lenses shall resist impact from a 25.4 mm diameter steel ball dropped from 127 cm.
- lenses shall resist penetration from a projectile weighing 44.2 g dropped from 127 cm.

For clarification of the relevance of these standards to your choice of laboratory eyewear it is helpful to understand more about ANSI and Z87.1.

- ANSI is not a federal agency. As an independent association it is not involved in establishing or enforcing the OSHA Laboratory Standard.
- ANSI does not test, inspect or approve eyewear. The eye protection manufacturer can choose to contract an independent testing facility to conduct tests to determine if their products meet ANSI standards.
- There are important factors that are difficult to measure and are not covered in Z87.1 which must not be ignored when choosing eyewear. Among these are durability, comfort, anti-fog performance and chemical splash protection.

Keep in mind that not all eyewear is created equally. There are a lot of cheaply made goggles on the market that will not survive even one semester. How safe is a goggle if it meets ANSI standards, but it is left in a desk drawer, unworn, because it is broken or uncomfortable?

- Eyewear should fit comfortably and securely. Try different styles and sizes to find the right fit.
- Chemical splash goggles should have a soft, pliable flange which seals around the eyes. The hard plastic edge on models lacking a flange becomes extremely uncomfortable.
- The availability of replacement parts (headbands, lenses, vent covers) is a real cost-saving advantage.
- Anti-fog performance is affected by temperature and humidity. Experiment with different eyewear styles and features (vents and fog-free lenses) to find the best eyewear for your application.

Chemical Splash Protection

Just because eyewear meets Z87.1 standards does not necessarily mean it provides adequate protection from the dangers of splashed chemicals. Eyewear that does not provide a complete, snug seal around the eyes may be fine for some activities but not when using hazardous chemicals. When vent openings are provided on splash goggles the vents should be indirect, with covers and/or baffles preventing straight-line passage of liquids into the goggle.

The Choice Is Up To You

As a responsible science teacher, you must select eyewear which provides you and your students the most suitable protection from the hazards involved in your laboratory activities. The following regulations address the role of the teacher's judgment in selecting suitable eye protection:

ANSI Z87.1 Section 7.3(3) page 15

The teacher must "make a judgement in selection of the appropriate protective equipment so that the protection is greater than the estimated hazards".

Occupational Safety and Health Administration OSHA 1910.1450 (Laboratory Standard) Section D(6)

School laboratories should include "protective apparel compatible with the required degree of protection for substances being handled".

Basic Recommendations

As you ponder which type of protective eyewear to purchase, or whether eye protection is needed at all, keep the following suggestions in mind:

- Will you be using heat, glassware or chemicals in the lab? If so, it is a good basic policy to use protective eyewear.
- Chemical splash goggles designed to provide a complete, snug seal around the eyes should be worn whenever hazardous chemicals are used.
- The educational laboratory is a unique environment where each student is often surrounded by other students conducting experiments. Hazards could come from any direction. Protective eyewear should provide sufficient angular coverage.
- Contact lenses should not be worn in the laboratory. If wearing contacts is unavoidable, use non-vented chemical splash goggles.
- Face shields which provide added splash protection coverage should not be worn alone. Always wear the appropriate goggle or safety glasses underneath a face shield.

Conclusion

While ANSI has established many standards for a variety of protective eyewear it does not provide specific standards for several factors important to the science teacher. Among those factors are durability, comfort and chemical splash protection. It is the teacher's responsibility to keep these factors in mind when selecting eyewear. As clearly stated in the Flinn Scientific Catalog/Reference Manual, "You, the instructor, should decide what type of eyewear your students must wear in every case." The information and high quality eye and face protection Flinn provides will help you make an informed, responsible choice.

FLINN SCIENTIFIC, INC.
"Your Safer Source for Science Supplies"
P.O. Box 219, Batavia, IL 60510
(800) 452-1261 / Fax: (630) 879-6962
E-mail: flinn@flinnsci.com
Web Site: www.flinnsci.com

Contact Lenses in the School Science Laboratory

Are They Safe? Should They Be Allowed?

Wisconsin Dept of Public Instruction policy is that Contact Lenses may be worn in school science laboratories provided non-vented snug fitting splash proof ANSI Z87.1Standard goggles are worn.

Contact lenses are commonly worn by students and in many instances, are the only corrective eyewear they possess. What type of policy should you set for regulating the use of contact lenses in the science laboratory? The answer is not clear and opinions have been changing over the last few years. First, let's explore the three primary hazards associated with the wearing of contact lenses in the science laboratory.

- Should a chemical splash to the eye occur, the chemical could be held under the contact lens and against the surface of the cornea, possibly causing permanent eye damage.
- Involuntary spasm of the eyelid, and the "panicked" nature of the victim who has the chemical splashed in his eye makes removal of the contact lens virtually impossible. By the time the lens is removed, irreversible damage already may have occurred.
- In a situation where the victim is unconscious, people attempting to irrigate the victim's eyes may be unaware that the victim wears contacts.

Teachers should know which students wear contact lenses. Students should also know if their lab partners are wearing contact lenses. A good way to find out which students wear contact lenses is to ask them on the first day of class. Perhaps you will want to make this question a part of your safety contract. Record this information in your grade, or lesson plan book. Whatever method is used, it is the teacher's responsibility to know which students wear contact lenses.

The hazards of wearing contact lenses in the science laboratory are why safety specialists stated for years, "Contact lenses should not be worn in a laboratory."[1,2,3]

However, the American Chemical Society (ACS) has recently studied the issue of wearing contact lenses in the laboratory and has reversed its stance. A careful review of the literature by knowledgeable consultants has refuted many of the risks. In addition, recent studies and experience have suggested that contact lenses do not increase the risks of eye damage and may in fact minimize injury in many situations. Therefore, the ACS suspended its prohibition against contact lenses in the laboratory provided that the appropriate eye protection is also worn.[1,6]

OSHA and the American National Standards Institute (ANSI) agree that "wearers of contact lenses shall be required to wear appropriate covering eye and face protection devices in a hazardous environment. It should be recognized that dusty and/or chemical environments may represent an additional hazard to contact lens wearers."

The National Institute of Occupational Health and Safety (NIOSH) lists more than 400 chemicals in their *Pocket Guide to Chemical Hazards.* Most of the chemical listings recommend against contact lens use. Everyone agrees, including Prevent Blindness America, that all contact lens wearers should be identified and some policy towards the use of contact lenses be written.

The fact is that science teachers probably cannot prevent a student from being involved in laboratory experiments if that student insists on wearing contact lenses. What should the teacher do?

First, adopt a policy which states that contact lenses should not be worn in the laboratory. Second, inform students of the special dangers that contact lenses pose in the science laboratory. Many students who wear contact lenses also have eyeglasses and should wear them on lab days. Third, students who still insist on wearing contact lenses should be provided a pair of non-ventilated chemical splash goggles. These goggles will keep out irritating vapors and make a chemical splash to the eye nearly impossible. Finally, in cases where students insist on wearing contact lenses, we suggest getting the parents involved. Send home a letter informing the parents of the hazards related to wearing contact lenses in the chemistry laboratory. The letter should be read and signed by both the parent and student.
Some states have their own regulations pertaining to contact lenses. We recommend you consult your state department of education for any specific regulations or guidelines concerning the use of contact lenses in the science laboratory.

Science teachers must establish a policy concerning the use of contact lenses in the science laboratory. No matter what policy is set, the use of properly adjusted chemical splash goggles offers the best eye protection in a chemical laboratory and will greatly reduce all eye accidents.

We hope the information provided in this article will help you design a contact lens policy for your school's science laboratories. If you want more information, a recent series of review articles has been published.[4,5]

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1 Wood, C. G. Safety in School Science Labs; J. Weston Walch: Portland, Maine, 1991; p 50.
2 Prudent Practices for Handling Hazardous Chemicals in Laboratories; National Academy of Science: Washington, DC, 1981; p 155.
3 Safety in Academic Chemistry Laboratories; American Chemical Society: 1985; Washington, DC, pp 11–12.
4 Segal, E. B. *Chemical Health and Safety,* 1995, *2,* 12–24.
5 Segal, E. B. *Chemical Health and Safety,* 1997, 33–37.
6 *Chemical Health and Safety,* 1998, *3,* 32.

First Aid for Contact Lens Emergencies

Exposure to Fume or Vapor: Remove lenses for cleaning and rinsing. If no eye irritation is felt, the lenses may be reinserted. Badly soiled lenses should be discarded.

Chemical Splash: Vigorously irrigate the eye with water while holding the lids apart. In these critical circumstances, do not worry about losing the contact lens. If the lens remains in the eye after initial flushing (2–3 minutes), remove it or slide it onto the inside of the eyelid and continue irrigation. Seek medical attention immediately. For a caustic splash, irrigation should be continued during transportation.

Foreign Bodies: Remove the lens and irrigate the eye. If the eye remains uncomfortable, or it seems that the foreign body has remained in the eye or vision is blurred, the eye should be examined by an eye doctor before lenses are reinserted. All cases of injury from flying particles should be evaluated by qualified medical personnel.

Dust in the Eyes: Remove the contact lenses and irrigate the eyes. Clean lenses and reinsert if eyes are not red or uncomfortable. Otherwise, consult eye doctor before reinserting lenses.

Blunt Trauma: Swelling or lacerations may make removal of lens (or pieces of lens) difficult. Professional evaluation of whole eye is recommended.
(From Cullen, A. P. "Contact Lenses in the Work Environment" in *Environmental Vision;* Pitts, D.C. and Kleinstein, R. N., Eds; Butterworth-Heineman: Boston, 1993; p 328.)

APPENDIX 6

HIGH SCHOOL

CHEMICAL STORAGE

High School Chemical Storage Pattern

Flammables in flammables cabinet

INORGANIC

ORGANIC

Inorganic #10 Sulfur, Phosphorus, Arsenic, Phosphorus Pentoxide	**Inorganic # 7** Arsenates, Cyanates	**Organic # 2** Alcohols, Glycols, Sugars, Amines, Amides	**Organic # 8** Phenols, Cresols
Inorganic # 2 Halides, Sulfates, Sulfites, Thiosulfates, Phosphates, Halogens, Acetates	**Inorganic # 5** Sulfides, Selenides, Phosphides, Carbides, Nitrides	**Organic # 3** Hydrocarbons, Oils,Esters, Aldehydes	**Organic # 6** Peroxides, Azides, Hydroperoxides
Inorganic # 3 Amides, Nitrates (not Ammonium Nitrate),	**Inorganic # 8** Borates, Chromates, Manganates, Permanganates	**Organic # 4** Ethers, Ketones, Ketenes, Halogenated Hydrocarbons	**Organic # 1** Acids, Amino Acids, Anhydrides, Peracids

Nitrites, Azides			
Inorganic # 1 Metals & Hydrides	**Inorganic # 6** Chlorates, Bromates, Iodates, Chlorites, Hypochlorites, Perchlorates, Peroxides, Hydrgen Peroxide	**Organic # 5** Epoxy Compounds, Isocyantes	**Organic # 9** Dyes, Stains Indicators
Inorganic # 4 Hydroxides, Oxides, Silicates, Carbonates, Carbon	**Miscellaneous**	**Organic # 7** Sulfides, Polysulfides	**Miscellaneous**

Photos High School Science Chemical Storage

Note: Color photos included only in the CHP binder located in the high school chemical storage room.

Some Suggested Practices in the Storage and Handling of Laboratory Chemicals

1. Storage of concentrated acids and bases should be limited to a maximum of 2 pints (1 liter) of each product unless you have an area designed and equipped for more. We suggest you consider acquiring an acid storage cabinet for this purpose.

2. No flammable materials should be stored outside an approved flammables storage cabinet. Flammables kept outside a cabinet should be in safety cans.

3. Do not allow incoming shipments of chemicals to be opened and transported by school personnel other than qualified science teachers. The special and expensive shipping containers used are frequently discarded and would prove valuable for shelf storage.

4. If possible, keep certain items in the original shipping package, e.g., acids and bases in the special and expensive styrofoam cubes.

5. All chemicals should be dated upon receipt. Flinn chemicals are labeled with brightly colored date purchased labels.

6. A permanent and perpetual inventory should be maintained..

7. Establish a separate and secured storage area for chemicals.

8. All chemicals should be stored in chemically compatible families. (See Flinn Suggested Chemical Storage Pattern Chart on pages 954-957.)

9. Avoid storing chemicals on shelves above eye level.

10. The storage area and cabinets should be labeled to identify the hazardous nature of the products stored within. (See labels in safety apparatus section.)

11. Proper type (Tri-Class ABC) and size (minimum 15 pound gross weight) fire extinguishers, in working order, should be in the chemical stores area.

12. Shelving above any **work area**, such as a sink, should be free of chemicals or other loose miscellany.

13. Shelving sections should be secured to walls or floor to prevent tipping of entire sections.

14. Shelves should be equipped with lips to prevent products from rolling off.

15. Chemicals should not be stored on the floor except in approved shipping containers.

16. Storage area should be ventilated by at least four changes of air per hour. Isolate the chemical storage exhaust from the building ventilation system.

17. No unlabeled products should be stored anywhere in the science facility.

18. There should be two methods of exiting from a chemical storage area. Exits should be entirely free of the presence of hazardous materials.

19. Be thoroughly familiar with the hazards and precautions for protection before using any chemical. Study the precautionary label and review its contents frequently before using any chemical product.

20. Know applicable local regulations before disposing of chemicals.

21. Never store chemicals in a standard (non-explosion-proof) refrigerator.

22. Do not store chemicals in a fume hood.

23. Open ether cans should be drained after use and not stored unless absolutely necessary. Rely on expiration date to dispose of the material.

24. Glycerin should be available only to the instructor.

25. Water-reactive products (sodium metal, potassium metal, etc.) should be stored under dry oil.

26. Neutralizing chemicals, such as a spill kit, dry sand, vermiculite, and other spill control materials should be readily available.

27. Establish an annual safety review procedure for your chemical stores area.

28. Post emergency telephone numbers in the chemical stores area. Ideally, a telephone should be located in this area in the event of an emergency.

29. Smoke detectors should be installed in the chemical storage area.

30. Review the school's purchasing practices. If the science department will be held responsible for safety, then the science department should have a say in how the chemicals are acquired.

31. An approved eyewash station and fire blanket should be within 25 feet of the chemical stores area.

32. Discourage the purchasing of large containers of chemicals and dispensing into smaller containers.

33. Keep sources of ignition away from the chemical stores area.

34. Chemicals should not be stored in the science classroom or laboratory; but rather in a separate, securable and dedicated area.

Hazardous Chemical Storage

OSHA, EPA, NFPA, and UFC Regulations and Guidelines You Must Follow

Flinn Scientific, Inc. supports the philosophy of the Manufacturing Chemists Association which states:

"Chemicals in any form can be safely stored, handled, or used if the physical, chemical, and hazardous properties are fully understood and the necessary precautions including the use of proper safeguards and personal protective equipment, are observed."

For years, the Flinn Scientific Catalog/Reference Manual has provided science teachers across the United States with detailed information on the chemicals they use. The physical, chemical, and hazardous properties are all fully explained. However, is your school using the proper safeguards and personal protective equipment necessary to protect you, your students, and the school building?

A common problem in many school science laboratories is how and where hazardous laboratory chemicals are stored. The solutions to the proper storage of hazardous laboratory chemicals are really quite simple.

A. Store minimum quantities. The less you have—the smaller your risk.
B. Separate and isolate your most serious hazards.

Store Minimum Quantities

We urge you and your school to adopt a policy of only storing a two-year supply (or less) of your most serious hazardous chemicals. Flinn Scientific provides smaller package sizes for all of the hazardous chemicals you use. Smaller package sizes mean less risk. Smaller package sizes also mean fresher material. It's a fact that the fresher your chemicals, the better your experiments and demonstrations will work. Storing only small quantities of your most serious chemical hazards will solve many of your storage problems.

Separate and Isolate Your Most Serious Hazards

An effective way to minimize a chemical accident or "event" is to isolate your chemical hazards. Chemical compatibility and security are critical. The two types of chemical hazards with which you should be most concerned are corrosives (acids and bases) and flammable liquids. No single group of chemicals found on the entire school premises presents a greater threat to life and/or property. The improper storage of corrosives and flammable liquids is an "event" waiting to happen.
The most effective way to isolate your flammable and corrosive hazards is to store them properly in approved safety storage cabinets. Chemical safety storage cabinets isolate corrosives and flammable liquids from other incompatible chemicals, provide a higher level of security against theft and vandalism, and will contain and control the hazards should an "event" occur.
Common sense and good laboratory procedure tell us we should isolate corrosive and flammable liquids in approved safety storage cabinets. Federal and state laws, insurance companies, and other regulating agencies also dictate how hazardous chemicals must be stored.
Flinn Scientific has thoroughly reviewed all chemical storage regulations and guidelines. These regulations have been condensed into a brief easy-to-understand format. References have been provided should you wish to review the regulations in more detail. Regulations on chemical storage have been obtained from the Environmental Protection Agency (EPA), The Uniform Fire Code (UFC), The National Fire Protection Association (NFPA), and the Occupational Health and Safety Administration (OSHA). The following is a listing of the regulations you must follow if you wish to store corrosive or flammable liquids.

Secondary Containment

Secondary containment simply means that when a chemical spill develops the spill will be contained and controlled in a secondary area (i.e., specially designed safety storage cabinet) which will reduce the risk of chemical exposure, fire, explosion, etc. Several regulatory agencies have stated that "secondary containment" must be provided and that spill control procedures be adopted for hazardous chemicals.

Occupational Safety and Health Administration, OSHA 1910.1450 Pages 385–386:

"(b) Stockrooms/storerooms ... Chemicals which are highly toxic ... should be in unbreakable secondary containers."

OSHA 1910.1450 Page 387:

"A spill control policy should be developed and should include consideration of prevention, containment, cleanup and reporting."

Environmental Protection Agency, EPA 264.175:

"(a) Container storage area must have a containment system that is designed and operated in accordance with paragraph (b)."

"(b) A containment system must be designed and operated as follows: (1) a base must underlie the containers which is free of cracks or gaps and is sufficiently

impervious to contain leaks, spills ...
(3) The containment system must have sufficient capacity to contain 10% of the volume of containers or the volume of the largest container whichever is greater."

Secondary containment must be provided for all corrosives and flammable liquids. Flinn safety acid and flammable storage cabinets are ideal for the prevention of accidents and spills. Every Flinn safety storage cabinet has a liquid tight bottom trough which will contain and control your most serious spills. Flinn cabinets meet the requirements described above for secondary containment.

Segregated Chemical Storage

Corrosives and flammables should never be stored together. While common sense and the knowledge of chemical reactions tell us this, regulations on segregated chemical storage are quite specific.

Uniform Fire Code. UFC 80.301 (n):

"Storage of incompatible hazardous materials shall be separated. Separation shall be accomplished by ... Storing hazardous materials in storage cabinets ... Materials which are incompatible shall not be stored within the same cabinet."
National Fire Protection Association Comments following section 4-3.1:

"Finally, it must be remembered that these cabinets are designed and constructed for flammable and combustible liquid storage only ... incompatible materials, whether liquid or solid, should not be stored in these cabinets."

Corrosives (Acids and Bases)

Corrosive chemicals in a science laboratory are usually strong acids and/or bases. Inhalation of vapors or mists can cause severe bronchial irritation. Corrosive chemicals will severely damage the skin and eyes. OSHA regulation 1910.1450, "Occupational Exposure to Hazardous Chemicals in Laboratories," takes many of its recommendations from the book *Prudent Practices for Handling Hazardous Chemicals in Laboratories* which was published in 1981 by the National Research Council. The following excerpts are taken from this book.

Prudent Practices for Handling Hazardous Chemicals in Laboratories, Page 38:
"Bottles of corrosive liquids should be stored in acid containers ... To ensure that mutually reactive chemicals cannot accidentally contact one another, such substances should be stored in corrosion-resistant secondary containers."

Flinn acid cabinets are constructed entirely of 1" thick, high density, 9-ply plywood—making them completely corrosion-resistant. No metal is used anywhere in the interior construction of Flinn acid cabinets. Beware of metal acid cabinets or acid cabinets which use corrosion resistant hardware. These types of cabinets, because of the acid fumes, are guaranteed to corrode over time.

Fire—The Greatest Fear

While the proper storage of corrosives is important, much more concern has been placed on how flammable liquids should be stored and the best way to reduce the risk of fire.
What is a flammable or combustible liquid? The National Fire Protection Association defines flammable and combustible liquids as follows:

National Fire Protection Association. NFPA #30: "Flammable liquid

Class I Flash point below 100 °F (37.8 °C) Combustible liquid

Class II Flash point above 100 °F (37.8 °C) and below 140 °F (60 °C)

Class III Flash point above 140 °F (60 °C)"

Flash point is the temperature at which a liquid or volatile solid gives off a vapor sufficient to form an ignitable mixture with the air. Chemical solvents like ethyl alcohol, methyl alcohol, acetone, and isopropyl alcohol are commonly used in school science laboratories and are all considered Class I flammable liquids.

Both the Uniform Fire Code and the National Fire Protection Association have regulations specifying when flammable liquids should be stored in an approved flammables safety storage cabinet.

Uniform Fire Code. UFC 79.202A(2):

"In group A occupancies used as classrooms or laboratories ... flammable and combustible liquids are allowed to be stored in amounts necessary for use in demonstration ... or laboratory work ... When quantities exceed 10 gallons, storage shall be in cabinets in accordance with section 79.202 (C)."

National Fire Protection Association. NFPA #30 Section 45.4.2:

"Not more than 10 gallons of Class I or Class II liquids combined shall be stored ... outside a safety storage cabinet."

If you store in excess of 10 gallons of flammable/combustible liquids, then you are required to store them in an approved flammables safety storage cabinet. All Flinn flammables cabinets meet or exceed NFPA and OSHA specifications for the storage of flammable/combustible liquids.

Important Note

While the regulations and guidelines described in our article have been adopted by most states, it is very important for you to learn what state laws specifically apply to your school. The Right to Know section of our Flinn Scientific Catalog/Reference Manual lists the name, address, and phone number of the agency that is involved in these types of regulations and guidelines in your state. We encourage you to contact them directly about which regulations and guidelines apply to your school.

Conclusion

Does your school comply with the regulations and guidelines governing the way hazardous laboratory chemicals must be stored?
Hazardous chemicals should be stored in locked safety storage cabinets within a central chemical storage area. The issue isn't whether you can afford proper hazardous chemical storage. The real issue is whether you can afford ***not*** to give your attention to this critical storage need.
Corrosive and flammable liquids deserve special storage attention. Depend on Flinn safety storage cabinets to solve this serious problem. If you have questions or comments, please call toll free 1-800-452-1261. We will gladly help you in any way we can.

APPENDIX 7

MATERIAL SAFETY DATA SHEETS (MSDS)/

SAFETY DATA SHEETS (SDS)

Note: MSDS have been replaced by Safety Data Sheets (SDS). MSDS binders are no longer being kept. Instead of keeping hard copies of SDS, SDMA is using an online service to view any required SDS for a substance.

To find an SDS, go to the SDMA website:
1. Click on "District Information" in the top bar, far left.
Click on "Buildings and Grounds" under District Services (far right column).
Click on "Links" on the left side. **-OR-**
2. Click on "Staff"
Click on "Material Safety Data Sheets" under "Staff Resources"
Click on "MSDS Online" at the bottom of the right column.
Click on "Log In" at the top of the page.
Enter Username "Menomonie" and password "Mustangs".
Search for the name of the chemical or substance that you need to look up. There are options to search alphabetically or by date entered.

A CD of all instructional chemicals purchased from Flinn Scientific will be kept in the MHS Chemical Inventory 3 ring binder in the locked chemical storage room 207A at Menomonie High School. If you need assistance looking up an SDS, contact the Chemical Hygiene Officer.

If you have ordered and received a chemical not previously in the SDMA inventory, please notify the Director of Buildings and Grounds of the name of the substance, amount on hand, and the location in which it is stored. They will enter the chemical into the database.

Terms Found on a Material Safety Data Sheet (MSDS) or Safety Data Sheet (SDS)

ABSORPTION
Passing through the skin.

ACUTE
Acute means sudden or brief. Acute can be used to describe either an exposure or a health effect. An acute exposure is a short-term exposure. Short-term means lasting for minutes, hours or days. An acute health effect is an effect that develops either immediately or a short time after an exposure. Acute health effects may appear minutes, hours or even days after an exposure. (See also Chronic.)

AEROSOL
An aerosol is a collection of very small particles suspended in air. The particles can be liquid (mist) or solid (dust or fume). The term aerosol is also commonly used for a pressurized container (aerosol can) which is designed to release a fine spray of a material such as paint.
Inhalation of aerosols is a common route of exposure to many chemicals. Also, aerosols may be fire hazards.

ANSI
ANSI stands for the American National Standards Institute.

BIOHAZARDOUS INFECTIOUS MATERIAL
Under the Canadian Controlled Products Regulations, a biohazardous infectious material is a material that contains organisms which can cause disease in humans or animals. For example, a person exposed to a blood sample from someone with hepatitis B may contract the disease. Some jurisdictions require MSDSs for products which contain biohazardous infectious materials.

BOILING POINT
The boiling point is the temperature at which the material changes from a liquid to a gas. Below the boiling point, the liquid can evaporate to form a vapor. As the material approaches the boiling point, the change from liquid to vapor is rapid and vapor concentrations in the air can be extremely high. Airborne gases and vapors may pose fire, explosion and health hazards.
Sometimes, the boiling point of a mixture is given as a range of temperatures. This is because the different ingredients in a mixture can boil at different temperatures.
If the material decomposes (breaks down) without boiling, the temperature at which it decomposes may be given with the abbreviation "dec." Some of the decomposition chemicals may be hazardous. (See also Thermal Decomposition Products.)

CARCINOGEN, CARCINOGENIC, CARCINOGENICITY
A carcinogen is a substance which can cause cancer. Carcinogenic means able to cause cancer. Carcinogenicity is the ability of a substance to cause cancer.
Under the Canadian Controlled Products Regulations, materials are identified as carcinogens if they are recognized as carcinogens by the American Conference of Governmental Industrial Hygienists (ACGIH), or the International Agency for Research on Cancer (IARC).
Under the US OSHA Hazard Communication (Hazcom) Standard, materials are identified as carcinogens on MSDSs if they are listed as either carcinogens or potential carcinogens by IARC or the US National Toxicology Program (NTP), if they are regulated as carcinogens by OSHA, or if there is valid scientific evidence in man or animals demonstrating a cancer causing potential.

CAS REGISTRY NUMBER
The CAS Registry Number is a number assigned to a material by the Chemical Abstracts Service (CAS) of the American Chemical Society (ACS). The CAS number provides a single unique identifier. A unique identifier is necessary because the same material can have many different names. For example, the name given to a specific chemical may vary from one language or country to another. The CAS Registry Number is similar to a telephone number and has no significance in terms of the chemical nature or hazards of the material. The CAS Registry

Number can be used to locate additional information on the material, for example, when searching in books or chemical databases.
Response, Compensation and Liability Act (U.S.).

CHEMICAL NAME
The chemical name is a proper scientific name for an ingredient of a product. For example, the chemical name of the herbicide 2,4-D is 2,4-dichlorophenoxyacetic acid. The chemical name can be used to obtain additional information.

CHEMICAL REACTIVITY
Chemical reactivity is the ability of a material to undergo a chemical change. A chemical reaction may occur under conditions such as heating, burning, contact with other chemicals, or exposure to light. Undesirable effects such as pressure buildup, temperature increase or formation of other hazardous chemicals may result. (See also Dangerously Reactive Material and Reactive Flammable Material.)

CHRONIC
Chronic means long-term or prolonged. It can describe either an exposure or a health effect. A chronic exposure is a long-term exposure. Long-term means lasting for months or years. A chronic health effect is an adverse health effect resulting from long-term exposure or a persistent adverse health effect resulting from a short-term exposure. The Canadian Controlled Products Regulations describe technical criteria for identifying materials which cause chronic health effects. (See also Acute.)

COMBUSTIBLE
Combustible means able to burn. Broadly speaking, a material is combustible if it can catch fire and burn. However, in many jurisdictions, the term combustible is given a specific regulatory meaning. (See Combustible Liquid.)
The terms combustible and flammable both describe the ability of a material to burn. Commonly, combustible materials are less easily ignited than flammable materials.

COMPRESSED GAS
A compressed gas is a material which is a gas at normal room temperature and pressure but is packaged as a pressurized gas, pressurized liquid or refrigerated liquid.
The Canadian Controlled Products Regulations and the U.S. Hazcom standard describe technical criteria for identifying materials which are classified as compressed gases.
Regardless of whether a compressed gas is packaged in an aerosol can, a pressurized cylinder or a refrigerated container, it must be stored and handled very carefully. Puncturing or damaging the container or allowing the container to become hot may result in an explosion.

CORROSIVE MATERIAL
A corrosive material can attack (corrode) metals or human tissues such as the skin or eyes. Corrosive materials may cause metal containers or structural materials to become weak and eventually to leak or collapse. Corrosive materials can burn or destroy human tissues on contact and can cause effects such as permanent scarring or blindness.
The Canadian Controlled Products Regulations and the US OSHA Hazcom Standard, specify technical criteria for identifying materials which are classified as corrosive materials for the purposes of each regulation. (See also pH.)
Volume of a material in a container can be calculated from its density and weight.

ENGINEERING CONTROLS
Engineering controls help reduce exposure to potential hazards either by isolating the hazard or by removing it from the work environment. Engineering controls include mechanical ventilation and process enclosure. They are important because they are built into the work process.
Engineering controls are usually preferred to other control measures such as the use of personal protective equipment. Substitution of a less hazardous material or industrial process is the best way to reduce a hazard and is often considered to be a type of engineering control.

EVAPORATION RATE
The evaporation rate is a measure of how quickly the material becomes a vapor at normal room temperature. Usually, the evaporation rate is given in comparison to certain chemicals, such as butyl acetate, which evaporate fairly quickly. For example, the rate might be given as "0.5 (butyl acetate=1)." This means that, under specific conditions, 0.5 grams of the material evaporates during the same time that 1 gram of butyl acetate evaporates. Often,

the evaporation rate is given only as greater or less than 1, which means the material evaporates faster or slower than the comparison chemical.
In general, a hazardous material with a higher evaporation rate presents a greater hazard than a similar compound with a lower evaporation rate.

EXPLOSION DATA
Explosion data is information on the explosive properties of a material. Quantitative explosion data is seldom available and is usually given in descriptive terms such as low, moderate or high.
The following types of information can be used to describe the explosive hazard of a material:
- Sensitivity to mechanical impact. This information indicates whether or not the material will burn or explode on shock (for example, dropping a package) or friction (for example, scooping up spilled material).
- Sensitivity to static discharge. This information indicates how readily the material can be ignited by an electric spark.
Detailed information is available on the properties of commercial explosives. In Canada, the storage, transportation and handling of commercial explosives are strictly regulated under the Explosives Act and TDG. Commercial explosives are not regulated by the Controlled Products Regulations.
Under the U.S. OSHA HAZCOM standard, a chemical is identified as explosive if it causes a sudden, almost instantaneous release of pressure, gas and heat when subjected to sudden shock, pressure or high temperature.

EXTINGUISHING MEDIA
Extinguishing media are agents which can put out fires involving the material. Common extinguishing agents are water, carbon dioxide, dry chemical, "alcohol" foam, and halogenated gases (Halons). It is important to know which extinguishers can be used so they can be made available at the worksite. It is also important to know which agents cannot be used since an incorrect extinguisher may not work or may create a more hazardous situation. If several materials are involved in a fire, an extinguisher effective for all of the materials should be used.

FIRST AID
First aid is emergency care given immediately to an injured person. The purpose of first aid is to minimize injury and future disability. In serious cases, first aid may be necessary to keep the victim alive.

FLAMMABLE, FLAMMABILITY
Flammable means able to ignite and burn readily. Flammability is the ability of a material to ignite and burn readily. (See also Combustible.) Under the Canadian Controlled Products Regulations and the U.S. HAZCOM Standard, there are specific technical criteria for identifying flammable materials. (See Flammable Aerosol, Flammable Gas, Flammable Liquid, Flammable Solid and Reactive Flammable Material.)
There are closely related criteria for the classification of certain flammable materials under the Canadian Transportation of Dangerous Goods (TDG) Regulations and the U.S. Department of Transportation regulations. (See TDG Flammability Classification.) In Canada, at least, local, provincial and national fire codes also classify and regulate the use of flammable materials in workplaces. (See also Combustible.)
The U.S. OSHA HAZCOM Standard has a specific definition. Refer to the regulations for detailed information.

FLASH BACK
Flash back occurs when a trail of flammable gas, vapor or aerosol is ignited by a distant spark, flame or other source of ignition. The flame then travels back along the trail of gas, vapor or aerosol to its source. A serious fire or explosion could result.

FLASH POINT
The flash point is the lowest temperature at which a liquid or solid gives off enough vapor to form a flammable air-vapor mixture near its surface. The lower the flash point, the greater the fire hazard. The flash point is an approximate value and should not be taken as a sharp dividing line between safe and hazardous conditions. The flash point is determined by a variety of test methods which give different results. Two types of methods are abbreviated as OC (open cup) and CC (closed cup).

FUMES
Fumes are very small, airborne, solid particles formed by the cooling of a hot vapor. For example, a hot zinc vapor may form when zinc-coated steel is welded. The vapor then condenses to form fine zinc fume as soon as it contacts the cool surrounding air. Fumes are smaller than dusts and are more easily breathed into the lungs.

GAS
A gas is a material without a specific shape or volume. Gases tend to occupy an entire space uniformly at normal room pressure and temperature. The terms vapor and fume are sometimes confused with gas.

GENERAL VENTILATION
As used in an MSDS, general ventilation, also known as dilution ventilation, is the removal of contaminated air from the general area and the bringing in of clean air. This dilutes the amount of contaminant in the work environment. General ventilation is usually suggested for non-hazardous materials. (See also Mechanical Ventilation, Local Exhaust Ventilation and Ventilation.)

HAZARD, HAZARDOUS
Hazard is the potential for harmful effects. Hazardous means potentially harmful. The hazards of a material are evaluated by examining the properties of the material, such as toxicity, flammability and chemical reactivity, as well as how the material is used. How a material is used can vary greatly from **workplace** to **workplace** and, therefore, so can the hazard.
In Canada and the U.S., the term hazardous is used by many different regulatory agencies. Definitions may vary. For example, OSHA defines a hazardous chemical as any chemical which is a physical hazard or a health hazard according to the OSHA Hazard Communication (Hazcom) criteria.

HAZCOM
HAZCOM stands for the Hazard Communication Standard (U.S.) (29CFR1910.1200). .

INGESTION
Ingestion means taking a material into the body by mouth (swallowing).

INHALATION
Inhalation means taking a material into the body by breathing it in.

IRRITANCY, IRRITATION
Irritancy is the ability of a material to irritate the skin, eyes, nose, throat or any other part of the body that it contacts. Signs and symptoms of irritation include tearing in the eyes and reddening, swelling, itching and pain of the affected part of the body.
Irritancy is often described as mild, moderate or severe, depending on the degree of irritation caused by a specific amount of the material. Irritancy may also be described by a number on a scale of 0 to 4, where 0 indicates no irritation and 4 means severe irritation. Irritancy is usually determined in animal experiments.
The Canadian Controlled Products Regulations and the U.S. OSHA Hazcom Standard describe technical criteria for identifying materials which are skin or eye irritants for the purposes of each regulation.

OSHA
OSHA stands for Occupational Safety and Health Administration. It is the branch of the United States government which sets and enforces occupational health and safety regulations. For example, OSHA sets the legal exposure limits in the United States, which are called Permissible Exposure Limits (PELs). OSHA also specifies what information must be given on labels and Material Safety Data Sheets for materials which have been classified as hazardous using their criteria.

PERSONAL PROTECTIVE EQUIPMENT
Personal protective equipment is clothing or devices worn to help isolate a person from direct exposure to a hazardous material or situation. Recommended personal protective equipment is often listed on an MSDS. This can include protective clothing, respiratory protection and eye protection.
The use of personal protective equipment is the least preferred method of protection from hazardous exposures. It can be unreliable and, if it fails, the person can be left completely unprotected. This is why engineering controls are preferred. Sometimes, personal protective equipment may be needed along with engineering controls. For example, a ventilation system (an engineering control) reduces the inhalation hazard of a chemical, while gloves and an apron (personal protective equipment) reduce skin contact. In addition, personal protective equipment can be an important means of protection when engineering controls are not practical: for example, during an emergency or other temporary conditions such as maintenance operations.

pH
The pH is a measure of the acidity or basicity (alkalinity) of a material when dissolved in water. It is expressed on a scale from 0 to 14. Roughly, pH can be divided into the following ranges:

```
pH 0 - 2        Strongly acidic
pH 3 - 5        Weakly acidic
pH 6 - 8        Neutral
pH 9 - 11       Weakly basic
pH 12 - 14      Strongly basic
```

Under the Canadian Controlled Products Regulations, materials with pH values of 0-2 or 11.5-14 may be classified corrosive. Corrosive materials must be stored and handled with great care.

POISONOUS AND INFECTIOUS MATERIAL
Under the Canadian Controlled Products Regulations, a Poisonous and Infectious Material is any material which meets the criteria for a Material Causing Immediate and Serious Toxic Effects, a Material Causing Other Toxic Effects, or a Biohazardous Infectious Material.

POLYMER
A polymer is a natural or man-made material formed by combining units, called monomers, into long chains. The word polymer means many parts. Examples of polymers are starch (which has many sugar units), polyethylene (which has many ethylene units) and polystyrene (which has many styrene units).
Most man-made polymers have low toxicity, low flammability and low chemical reactivity. In these ways, polymers tend to be less hazardous than the chemicals (monomers) from which they are made.

POLYMERIZE, POLYMERIZATION
Polymerization is the process of forming a polymer by combining large numbers of chemical units or monomers into long chains. Polymerization can be used to make some useful materials. However, uncontrolled polymerization can be extremely hazardous. Some polymerization processes can release considerable heat, can generate enough pressure to burst a container or can be explosive. Some chemicals can polymerize on their own without warning. Others can polymerize upon contact with water, air or other common chemicals. Inhibitors are normally added to products to reduce or eliminate the possibility of uncontrolled polymerization. Most MSDSs have a section called "Hazardous Polymerization" which indicates whether hazardous polymerization reactions can occur.

ppb
ppb stands for parts per billion.

ppm
The abbreviation ppm stands for parts per million. It is a common unit of concentration of gases or vapor in air. For example, 1 ppm of a gas means that 1 unit of the gas is present for every 1 million units of air. One ppm is the same as 1 minute in 2 years or 1 cent in $10,000.

REACTIVE FLAMMABLE MATERIAL
Under the Canadian Controlled Products Regulations, a reactive flammable material is a material which is a dangerous fire risk because it can react readily with air or water. This category includes any material which:
- is spontaneously combustible, that is, a material which can react with air until enough heat builds up that it begins to burn;
- can react vigorously with air under normal conditions without actually catching fire;
- gives off dangerous quantities of flammable gas on reaction with water; or
- becomes spontaneously combustible when it contacts water or water vapor.

Reactive flammable materials must be kept dry and isolated from oxygen (in air) or other oxidizing agents. Therefore, they are often stored and handled in an atmosphere of unreactive gas, such as nitrogen or argon.

SENSITIZATION
Sensitization is the development, over time, of an allergic reaction to a chemical. The chemical may cause a mild response on the first few exposures but, as the allergy develops, the response becomes worse with subsequent exposures. Eventually, even short exposures to low concentrations can cause a very severe reaction.
There are two different types of occupational sensitization: skin and respiratory. Typical symptoms of skin sensitivity are swelling, redness, itching, pain, and blistering. Sensitization of the respiratory system may result in

symptoms similar to a severe asthmatic attack. These symptoms include wheezing, difficulty in breathing, chest tightness, coughing and shortness of breath.
The Canadian Controlled Products Regulations and the U.S. OSHA HAZCOM Standard describe technical criteria for identifying materials which are respiratory tract sensitizers or skin sensitizers.

SOLUBILITY
Solubility is the ability of a material to dissolve in water or another liquid. Solubility may be expressed as a ratio or may be described using words such as insoluble, very soluble or miscible.
Often, on an MSDS, the "Solubility" section describes solubility in water since water is the single most important industrial solvent. Solubility information is useful for planning spill clean-up and fire fighting procedures.

SOLVENT
A solvent is a material, usually a liquid, which is capable of dissolving another chemical. Chemicals commonly called solvents can dissolve many different chemicals. Examples of common solvents are water, ethanol, acetone, hexane and toluene.

STABILITY
Stability is the ability of a material to remain unchanged in the presence of heat, moisture or air. An unstable material may decompose, polymerize, burn or explode under normal environmental conditions. Any indication that the material is unstable gives warning that special handling and storage precautions may be necessary.

VAPOR DENSITY
Vapor density is the weight per unit volume of a pure gas or vapor. On an MSDS, the vapor density is commonly given as the ratio of the density of the gas or vapor to the density of air. The density of air is given a value of 1. Light gases (density less than 1) such as helium rise in air. If there is inadequate ventilation, heavy gases and vapors (density greater than 1) can accumulate in low-lying areas such as pits and along floors.

VAPOR PRESSURE
Vapor pressure is a measure of the tendency of a material to form a vapor. The higher the vapor pressure, the higher the potential vapor concentration. In general, a material with a high vapor pressure is more likely to be an inhalation or fire hazard than a similar material with a lower vapor pressure.

VENTILATION
Ventilation is the movement of air. One of the main purposes of ventilation is to remove contaminated air from the **workplace**. There are several different kinds of ventilation. (See General Ventilation, Local Exhaust Ventilation, Mechanical Ventilation and Natural Ventilation.)
More detailed information is available in the CCOHS publication "A Basic Guide to Industrial Ventilation."

VOLATILE, VOLATILITY
Volatile means a material can evaporate. Volatility is the ability of a material to evaporate. The term volatile is commonly understood to mean that a material evaporates easily.
On an MSDS, volatility is commonly expressed as the "% volatile." The percent volatile can vary from 0% (none of the material will evaporate) to 100% (all of the material will evaporate if given enough time).
If a product contains volatile ingredients, there may be a need for ventilation and other precautions to control vapor concentrations.

WATER REACTIVE
Under the U.S. OSHA HAZCOM standard, a chemical is identified as water reactive if it reacts with water to release a gas that is either flammable or presents a health hazard.

GATEWAY PROCLEAN, INC.

MATERIAL SAFETY DATA SHEET

Product Name: **Laundry Bleach**

PROTECTIVE EQUIPMENT

A=SAFETY GLASSES

Product Identity: **Powdered Chlorine Bleach**

B=SAFETY GLASSES, GLOVES

C=SAFETY GLASSES, GLOVES AND APRON

NFPA HAZARD RATING		SCALE
HEALTH	1	0=LEAST
FLAMMABILITY	0	1=SLIGHT
REACTIVITY	1	2=MODERATE
PROTECTIVE EQUIPMENT	B	3=HIGH
		4=EXTREME

SECTION I - GENERAL INFORMATION

Manufacturer's Name and Address:	GATEWAY PROCLEAN, INC. 2081 Exchange Dr. St. Charles, MO 63303	**FOR CHEMICAL EMERGENCY** Spill, leak, fire, exposure, or accident, call: 24 hours
Phone Number for Information:	(888) 947-9191	**CHEM-TEL 800-255-3924**
Date Prepared: 8-15-95		
Date Last Reviewed:	July 1999	

SECTION II - HAZARDOUS INGREDIENTS/INFORMATION

HAZARDOUS COMPONENTS	OSHA PEL	ACGIH TLV	CAS#	OTHER SKIN STEL	%
Sodium dichloroisocyanurate dihydrate	1ppm*	1ppm*	51580-86-0	1ppm*	>20

*As Chlorine(CAS#7782-50-5)

SECTION III - PHYSICAL/CHEMICAL CHARACTERISTICS

Melting Point:	Decomposes	Appearance: White Granular Powder
Vapor Pressure (mm Hg):	N/A	Bulk Density Unknown
Vapor Density (Air=1):	N/A	Evaporation Rate (Water=1): N/A
Solubility in Water:	23g/100g H_2O @ 25° C	pH: 6.5

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point (Method Used):	None
Extinguishing Media:	Foam X CO_2 X Dry Chemical X Water Fog X Other
Unusual Fire and Explosion Hazards:	Bleach decomposes when heated and may cause containers to rupture or burst. Vigorous reaction possible with organic or oxidizing agents.
Flammable Limits:	Lower - N/A Upper - N/A
Special Fire Fighting Procedures:	Avoid fumes, dilute copiously with water, ventilate and be prepared to use respiratory equipment if needed.

SECTION V - REACTIVITY DATA

Stability:	Stable

Hazardous Decomposition or Byproducts:	Chlorine, Cyanogen Chloride, Nitrogen Trichloride, Ammonia, Carbon Dioxide, Toxic Sulfur Oxides and Sodium Oxides.
Hazardous Polymerization:	Will Not Occur
Incompatibility (Materials to Avoid):	Nitrogen Compounds, Amines, Ammonium Compounds, Reducing Agents, Oxidizable or Combustible Organics, Strong Oxidizers, Acids, Alkalis.

SECTION VI - HEALTH HAZARD DATA

Route(s) of Entry:	Inhalation?	Toxic	Skin?	Moderate
	Ingestion?	Moderately Toxic	Eyes?	Severe Irritant

Acute Effects(Health Hazards Acute and Chronic): Skin or Eye Contact Can Cause Severe Irritation.

Carcinogenicity: NTP/IARC Monographs? None OSHA Regulated? No

Signs and Symptoms of Exposure:	Inhalation:	Severe Irritation, Burns	Ingestion:	Irritation, Nausea
	Skin Contact:	Irritation with Extended Contact	Eye Contact:	Severe Irritation, Burns.

Medical Conditions Generally Aggravated by Exposure: Dermatitis

Emergency First Aid Procedures:	If Swallowed:	Give Water, DO NOT Induce vomiting, Get Medical Attention.
	If Inhaled:	Move To Fresh Air, Seek Medical Help If Breathing Has Stopped.
	Eye Contact:	Flush With Water For at Least 15 Minutes, Get Medical Help.
	Skin Contact:	Remove Contaminated Clothing and Shoes. Flush With Copious Amounts of Water.

SECTION VII - PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken in Case Material is Released or Spilled: Small Spills: Flush With Water, Avoid Heat and Contamination With Acid.
Do Not Use Combustible Material to Absorb.
Large Spills: Dike Spill; Neutralize With Sodium Thiosulfate,Absorb and Collect for Recovery to be Picked up by a Certified/Registered Waste Disposal Hauler.

Waste Disposal Method: Neutralize With Sodium Thiosulfate Solution and Dilute With Copious Amounts of Water. Follow Federal, State, and Local Regulations.

Precautions to be Taken in Handling and Storing: Store in Vented, Properly Labeled Container in a Cool Dry Area.

Other Precautions: Keep Product Away From Skin and Eyes. **DO NOT** Breathe Spray Mists or Vapor. Keep Out of Reach of Children.

DO NOT mix this or any other chemical with anything but water.

SECTION VIII - CONTROL MEASURES/PERSONAL PROTECTION

Respiratory Protection (Specify Type):	Use NIOSH Approved Respirator With Chlorine Canister.
Ventilation:	Local Exhaust(General Ventilation), Unless Exposed to Decomposition Condition.
Protective Gloves:	Water Repellent, Rubber.
Eye Protection:	Safety Glasses, Goggles or Face Shield
Other Protective Clothing or Equipment:	Rubber Apron; Also Have Safety Showers and Eye Wash Station Near By.
Work/Hygienic Practices:	If Spilled Onto Clothing, Remove and Launder Before Reusing. Wash Hands With Soap and Water Before Eating, Smoking or Drinking.

SECTION IX - DOT AND TRANSPORTATION INFORMATION

Not Regulated
Label Required: Product Label

APPENDIX 8
SHORT SHELF LIFE CHEMICAL LIST

*Currently in High School Chemistry storage as of inventory dated 06/05/2018

List A:
May form peroxides simply on storage after air exposure.
Concentration by evaporation is not required for hazardous concentrations to develop.

List B:
Peroxide-forming solvents which are typically not hazardous until concentrated.

List C:
Monomers which may undergo explosive polymerization following peroxide formation.

List A: (12 months)	**List B (18 months)**	**List C (18 months)**
Diethyl ether	Acetal	Styrene
Isopropyl ether	Dioxane	Butadiene
Divinyl acetylene	Tetrahydrofuran	Tetrafluoroethylene
Vinylidene chloride	Vinyl ethers	Chlorotribluoroethyl - ene
Ethylene glycol, Di- Methyl ether (Glyme)	Vinyl acetylene	
Dicyclopentadiene	Vinyl acetate	
Diacetylene	Vinyl chloride	
Methyl acetylene	Vinyl pyridine	
Cumene	Chlorobutadiene (Chloroprene)	
Tetrahydronaphthalene		
*** Cyclohexene (90ml)**	Methyl cyclopentane	

APPENDIX 9

Safety For Showers and Eyewash Stations

Eyewash & Shower Safety

By:
Chris Bollas
Encon Safety Products
Houston, TX

When a corrosive chemical comes in contact with eyes or skin, tissue damage begins immediately. While the rate and extent of this damage depends upon the chemical involved, the most important step in halting the damage is the same: The affected area must be irrigated immediately with copious amounts of water for a minimum of 15 minutes.

When done properly, irrigation improves the medical prognosis and reduces the risk of long-term tissue damage. If delayed or cut short, however, first aid treatment (irrigation) is less effective, and the full extent of the injury becomes problematic.

Proper irrigation is made easier by emergency shower and eyewash equipment. This equipment is specially designed to wash chemicals from the whole body, the eyes and face, or specific areas. Although emergency shower and eyewash stations have been part of the **workplace** for more than 70 years, it wasn't until 1981 that a comprehensive industry standard was developed. Through the coordinated efforts of the Industrial Safety Equipment Association, industry, labor, government, and the medical community, a consensus standard was approved, culminating in the creation of the ANSI Standard Z358.1, first issued in 1981. This standard is on its newly released third issue and is now referred to as ANSI Standard Z358.1-1998.

The "standard" is valued by planners, hygienists, and safety specialists as the source tool to outline the types of emergency shower and eyewash equipment, provide uniform minimum requirements for equipment performance, and provide information regarding installation, testing, maintenance, and training.

Types of Equipment

Each type of equipment outlined in the standard is designed to perform a specific function; one piece of equipment is not a substitute for another. The types of equipment covered include:

- Emergency showers
- Eyewash stations
- Eye/facewash stations
- Hand-held drench hoses
- Combination equipment

Emergency showers. Emergency showers are designed to provide a deluge large enough to encompass the whole body. Emergency showers should be selected when large volumes of potentially injurious materials are present, i.e., chemical storage areas.

Emergency showers shall deliver a pattern of potable water at least 50.8 cm (20 inches) across, flowing at a rate of at least 75.7 liters (20 gallons) per minute at a velocity low enough so as not to be injurious to the user. The diameter ensures the entire body receives a direct, fresh supply of water.

Emergency showers are not to be considered or used for irrigating chemicals from the face and eyes, due to the delicate nature of these tissues and the potentially high velocity and volume of water an emergency shower may produce.

Emergency eyewash stations. Emergency eyewash stations are specifically designed to provide a controlled flow of water to both eyes simultaneously. To maintain a soft, controlled flow to the eyes,

regulation of the volume and pressure from the station is required. Eyewash stations require an uninterrupted, 15-minute supply of water. As a general rule, select a plumbed unit if plumbing is available. Plumbed units are recommended because of the greater volume of water available to the user—between 7.5 and 13.25 liters (2.0 and 3.5 gallons) per minute.

Emergency eye/facewash stations. An enhancement of the eyewash station is the eye/facewash station, a product designed to irrigate the eyes and face simultaneously. An eye/facewash station delivers a substantially greater volume of water (minimum 11.4 lpm/3.0 gpm) than an eyewash station and does so to irrigate the larger target area. In planning equipment selection, one should recognize the probability that when a chemical splash affects the eyes, it will also affect the face. With this in mind, **eye/facewash stations are strongly recommended when selecting plumbed chemical splash irrigation equipment**.

Drench bases. Drench hoses have been part of emergency stations for many years. They are particularly common in laboratories and provide first aid capability in **conjunction** with eyewash/eye-facewash equipment. Drench hoses are used:

- to spot drench an affected area when a full shower is not required.
- to irrigate exposures when the victim is unconscious or unable to stand, and
- to irrigate under clothing prior to the removal of clothes.

It is important to note that **drench hoses serve as a secondary piece of equipment to emergency showers and eyewash stations *but do not replace them.***

Combination equipment. Combination equipment refers to multiple-use stations with a common plumbing unit, i.e., combination shower/eyewash. Combinations of shower, eyewash, eye/facewash, and drench hose equipment are available in a variety of configurations. When combination stations are used, the water line must be at least 3.2 cm (1 1/4") in diameter in order to readily supply multiple pieces of equipment. When planning system requirements, it is important to note that it is a standards requirement to be able to operate both shower and eyewash devices simultaneously.

Use of Equipment

Location. The location of the emergency equipment is critical to its ability to successfully serve its purpose. Because of the destructive capability of many chemicals, a recommended location for shower/eyewash equipment is within 10 seconds travel time from the identified hazard.

Specific distance references have been removed from the 1998 standard, and it is incumbent upon the planner to select a location based on the suspected time of travel of a person **with compromised vision**. (To help you develop a frame of reference, the average adult walking four miles an hour can travel 50 feet in 10 seconds. With compromised vision and no assistance the travel distance will be greatly reduced.) Assure there are no stairways, changes in floor levels, potential trip hazards, and doors that could be locked unknowingly between the emergency equipment and the **work area**. It is also recommended that the equipment should be readily accessible on paths of access and egress from the **work area**.

Water temperature. The ANSI Z358.1-1998 standard now addresses the subject of temperature. The standard refers to "tepid" temperatures, those being moderately warm or lukewarm. Medical references support tepid temperatures in first aid treatment for a majority of chemical exposures, and providing water at a temperature conducive to use is considered an integral part of providing suitable first aid facilities.

One could reasonably support a "tepid" range from 78 °F to 92 °F. Temperatures above 100 °F, have proven to be harmful to the eyes and can enhance chemical interaction with body tissues.

Controls. Commonly referred to as activation devices, pull rods, and push plates, these controls are required to cause water flow. Key characteristics of activation devices to consider are user visibility and durability. Stay-open valve devices are specified in the ANSI standard, with the purpose of assuring continuous flow while the hands remain free to remove clothing or hold the eyelids open. Actuation of the device shall provide water within one second to meet ANSI requirements.

Visibility. Equipment visibility is an important factor. Locating equipment on normal access and egress paths in the laboratory helps reinforce the location to potential users, who will pass the equipment in day-to-day work. Increasing the recognition factor of emergency equipment can be achieved by various means. The use of high-visibility signs that can be seen anywhere within the area being served by the first aid equipment is required. Another method is to paint the floors, walls, or emergency equipment itself in a bright color contrasting from the environment, but this can be expensive and will require ongoing maintenance. The area around the emergency shower/eyewash station shall be well lit to help the user identify the area and assist in conducting first aid activities.

Water disposal. How to dispose of chemically contaminated water is a growing concern. Can a chemical, even in diluted state, be released into the sewer system without violating local codes? This question can only be answered at each school.

Training. Although the steps involved in training personnel on how to use emergency shower/eyewash stations are quite simple, training is often overlooked. The standard requires personnel to know how, when, where, and how long to use emergency shower/eyewash equipment, and what they should do after the initial irrigation is completed.

Testing, inspection, and maintenance. Testing the equipment regularly is the best preventive maintenance program available. According to the ANSI standard, plumbed emergency equipment shall be tested weekly to verify flow and proper operation. Testing also clears the water lines, allowing any dirt or pipe scale to pass. Broken or worn parts should be repaired or replaced immediately. An annual inspection of emergency equipment is now required per the ANSI standard to assure equipment conformance.

Summary. The purpose of emergency shower/eyewash equipment is to reduce and eliminate chemical incident injuries. Proper equipment selection, location, utilities, training, and scheduled inspections can make the difference in how well first aid is performed.

You hope that emergency shower and eyewash stations are only tested and are never used. But in case of emergency, proper planning can minimize the impact of a chemical exposure and protect the school, teachers and students from unnecessary hardship.

Flinn Scientific would like to thank Chris Bollas for writing and allowing us to reproduce this article on eyewash and shower safety.

Chris Bollas is Operations Manager of Encon Safety Products, Inc., a supplier of eyewash and safety shower equipment. Encon products can be purchased through Flinn Scientific.

Safety For Showers and Eyewash Stations

Test Record Tags

EYE WASH/ SHOWER INSPECTION RECORD

Date	Initials	Comments

APPENDIX 10

High School Chemistry

Lab Training

and Citation Forms

Flinn Scientific's Student Safety Contract

``````http://www.flinnsci.com/Sections/Safety/safety.asp

Cheminstry in the Community used Flinn's student safety agreement until 5th Ed of Chem Com text became available in September of 2007. The following is now used for ChemCom.

**ChemCom Laboratory Safety Agreement Form**
**Rules of Laboratory Conduct**

1. Do laboratory work only when your teacher is present. Unauthorized or unsupervised laboratory experimenting is not allowed.

2. Your concern for safety should begin even before the first laboratory investigation. Before starting any laboratory work, always read and think about the details of your laboratory assignment.

3. Know the location and use of all safety equipment in your laboratory. These should include safety shower, eyewash, first-aid kit, fire extinguisher, fire blanket, exits, emergency warning system, and evacuation routes.

4. Wear a laboratory apron and impact/splash-proof goggles as indicated by MSDS for all laboratory work. Wear closed shoes (rather than sandals or open-toed shoes), preferably constructed of leather or some similar water impervious material and tie back loose hair. Shorts or short skirts should not be worn.

5. Clear your bench top of all unnecessary materials before starting your work.

6. Check chemical labels twice to ensure you have the correct substance and the correct solution concentration. Chemical formulas and names may differ by only a letter or a number.

7. You may be asked to transfer some laboratory chemicals from a common bottle or jar to your own test tube or beaker. Do not return any excess material to its original container unless authorized by your teacher, as you may contaminate the supply bottle.

8. Avoid unnecessary movement and talk in the laboratory.

9. Never taste laboratory materials. Do not bring gum, food, or drinks into the laboratory. Do not put fingers, pens, or pencils in your mouth while in the laboratory.

10. If you are instructed to smell something, do so by fanning some of the vapor toward your nose. Do not place your nose near the opening of the container. Your teacher will show you the correct technique.
``````

11. Never look directly into a test tube; view the contents from the side. Never point the open end of a test tube toward yourself or your neighbor. Never directly heat a test tube in a Bunsen burner flame.

12. Any laboratory accident, however small, should be reported immediately to your teacher.

13. In case of a chemical spill on your skin or clothing, rinse the affected area with plenty of water. If your eyes are affected, rinsing with water must begin immediately and continue for at least 10 to 15 minutes. Professional assistance must be obtained.

14. Minor skin burns should be placed under cold, running water.

15. When discarding or disposing of used materials, carefully follow all provided instructions. Waste chemical substances usually are not permitted in the sewer system.

16. Return equipment, supplies, aprons, and protective goggles to their designated locations.

17. Before leaving the laboratory, make sure that gas lines and water faucets are shut off.

18. Wash your hands before leaving the laboratory.

19. If you are unclear or confused about proper safety procedures, ask your teacher for clarification. If in doubt, ask!

Students exhibiting misconduct or disregard for safety during a laboratory period will be asked to leave the lab or be subject to other disciplinary action.

STUDENT NAME _____ Date_____

By signing below, the student and parent or guardian indicates that they have read and agree to follow these "Rules of Laboratory Conduct". The student is expected to follow these rules as well as any additional printed or verbal safety instructions given by the teacher. This slip is to be returned by _____. If a parent or guardian has any questions, please feel free to telephone _____ at _____.

STUDENT SIGNATURE _____ DATE_____

PARENT/GUARDIAN SIGNATURE_____ DATE_____

CITATION FOR VIOLATION OF SCIENCE LABORATORY RULES

DATE: _____ PERIOD:_____ TIME: _____

STUDENT'S NAME _____

STATION # _____

CLASS:
Anat. & Phys, Biology II., Biology, ChemCom, Adv Chem, AP

Physics, Physics, Phys Sci, Env Biology, OTHER _____

TEACHER (S) _____

VIOLATION:
Rule Number _____

Description _____

CONSEQUENCE:
Warning Point Deduction Referral

Removal from Lab Other consequence

CONSEQUENCES FOR VIOLATION OF LABORATORY RULES

1st Violation: Warning, point deduction and/or after school detention depending on the situation.

2nd Violation: Point deduction and/or after school detention depending on the situation.

3rd Violation: Referral to administrator and/or ALAC (removal for lab)

To ensure the safety of others, a student may be removed from the lab at any time.

Laboratory Fundamentals (Chemistry)

Name _____Date _____ Period _____

Station_____ Drawer # _____Partner_____

PART I Lab Safety (10pts)

_____ 1. Safety in the laboratory p 4-8
_____ 2. Emergency Procedures p 9
_____ 3. Safety Test Score _____
_____ 4. Laboratory safety agreement signed

PART II Equipment Inventory (10pts)

_____ 1. Equipment Identification p 11-13
Date Test Past _____
_____ 2. Assign Equipment Drawers & Lab Teams / Area
_____ 3. Take inventory using checklist handout
_____ 4. Laboratory safety agreement signed

PART III Laboratory Techniques (30pts)

_____ 1. Pouring liquids p 14
Demonstrate technique described
_____ 2. Filtering a mixture p 14
Demonstrate technique described
_____ 3. Using a gas burner p 15
Be able to explain the purpose of each part of the burner. Vary air adjustment to obtain the hottest flame possible. Use a length of copper wire held with a tong to determine the hottest part of the flame. Place a pin through a paper match near the head… with the burner turned off, place the match upright in the center of the barrel, now light the burner with out moving the match.
_____ 4. Heating liquids p 16
_____ 5. Inserting glass tubing p 16
See Item #8 below – Wait for instructor.
_____ 6. Measuring mass
Using electronic balance: directly and by difference
_____ 7. Measuring volume p 18
Using a graduated cylinder. Demonstrate technique described
_____ 8. Glassworking p 19-20
Cut off a 20cm piece of glass tubing and make a right angle bend. Use *CAUTION* when inserting the glass tubing in the rubber stopper.

Laboratory Safety Violation Citation

LABORATORY SAFETY VIOLATION CITATION

STUDENT'S NAME_____

PERIOD_____ DATE_____

(Check one or more)

- ☐ Failure to wear proper eye protection device during laboratory activity
- ☐ Unapproved and dangerous behavior
- ☐ Failure to follow laboratory instructions
- ☐ Failure to follow established safety instructions
- ☐ Other

_____
_____
_____
_____

☐ Other comments

_____
_____
_____
_____

Science Instructor's Name_____

This page left blank to keep page numbers consistent with SDMA Crisis Communication Manual.

APPENDIX 11

MENOMONIE MIDDLE SCHOOL LABORATORY RULES

1. Horseplay cannot be tolerated. Decorum must be maintained.
2. Do NOT wander around the lab, visit other groups or disturb other lab groups.
3. ALWAYS prepare for an activity by reading the directions and listening to any special instructions from your teacher.
4. Do only the authorized activities assigned by your teacher. Unauthorized work and altered procedures are NOT permitted.
5. Wear safety goggles when directed by your teacher.
6. Do not touch chemicals with your hands. Wash your hands before you leave the room.
7. NEVER taste chemicals.
8. Observe odors by fanning a small amount of vapor toward you. DO NOT place your face directly over a chemical container or lab glassware.
9. If a chemical is spilled, tell your teacher and follow spill procedures.
10. In case of fire, inform your teacher immediately.
11. Handle hot objects with extreme care.
12. Report all accidents to your teacher immediately.
13. Check the label on chemical bottles carefully. Verify that what you have is what you want.
14. Do not return excess chemicals to the chemical bottles unless directed to do so.
15. DO NOT place the wrong dropper or spoon into a chemical bottle.
16. Treat lab equipment with respect and care. Always store equipment in its proper place.
17. Dispose of liquid and solid waste in the proper wasted container.
18. Keep your **work area** clean.

APPENDIX 12

Safe Science in the Elementary Grades

Teaching science to the younger elementary grades is a stimulating and rewarding experience. When the teacher has their attention, it is also time for the children to learn all about safety. Teachers need to teach them how to investigate and explore safely. Showing children how to protect themselves will instill in them an attitude of doing things safely. Children will learn to think and act safely, and this attitude will last a lifetime. The following are guidelines taken from the teachers' version of Discovery Works by Silver Burdett & Ginn which is used K-5 district wide.

GENERAL SAFETY GUIDELINES

- Post an easy-to-read list of safety rules in a prominent place in the classroom. Review it with students on a regular basis.
- Become familiar with the safety procedures that are necessary for each activity before introduction to your students.
- Discuss specific safety precautions with students before beginning every hands-on science activity.
- Always act as an exemplary model of safe behavior.
- Have students wear protective aprons, goggles, and gloves whenever these items will prevent injury.
- Keep safety equipment, such as fire blankets and fire extinguishers, readily accessible and know how to use it.
- Prepare students for emergencies by having them practice leaving the classroom quickly and safely.
- Show students how to obtain help in an emergency by using the telephone, an intercom, or other available means of communication.
- Never leave students unattended while they are involved in science activities.
- Provide ample space for science activities that require students to move about and handle materials.
- Keep your classroom and all science materials in proper condition. Check their condition regularly.
- Tell students to report all injuries to you immediately.

STUDENT SAFETY DIRECTIONS

The best way to be safe in the classroom is to use common sense. Prepare yourself for each activity before you start it. Get help form you teacher when there is a problem. Most important of all, pay attention. Here are some other ways that you can stay safe.

- STAY SAFE FROM STAINS Wear protective clothing or an old shirt when your work with messy materials. If anything spills wipe it up or ask your teacher to help you clean it up.
- STAY SAFE FROM FLAMES Keep your clothes away from open flames. If you have long or baggy sleeves, roll them up. Don't let your hair get close to a flame. If you have long hair, tie it back.
- STAY SAFE DURING CLEAN UP Wash up after you finish working. Dispose of things in the way that your teacher tells you to.
- STAY SAFE FROM INJURIES Protect your eyes by wearing safety goggles when you are told that you need them. Keep your hands dry around electricity. Water is a good conductor of electricity, so you can get a shock more easily if your hands are wet. Be careful with sharp objects. If you have to press on them, keep the sharp side away form you. Cover any cuts you have that are exposed. If you spill something on a cut, be sure to wash it off immediately. Don't eat or drink anything unless your teacher tells you that it's OK.
- MOST IMPORTANTLY if you ever hurt yourself or one of your group members gets hurt, tell your teacher right away.

APPENDIX 13
TEACHER CHP ACCIDENT/INCIDENT REPORT

1. Staff member completing the report _____
2. Date of accident/incident _____
3. Time of the accident/incident _____
4. Location of the Building _____ Room ____ Other _____
5. Other staff members witnessing the event: _____

   _____
6. Students witnessing the event: _____

   _____
7. Teacher's description of the event:

   Safety goggles in use: Yes No Lab Apron used: Yes No

8. Immediate action taken to deal with the emergency or event:

9. Corrective action taken to avoid a repeat of the accident/incident in the future.

10. Date of report completed _____ Staff Signature _____

APPENDIX 14
STEP BY STEP ACCIDENT PROCEDURE PLAN

1. Following an accident, the immediate concern should be for the injured student.

2. First aid should be administered in the room to stop immediate flow of blood (follow blood borne pathogen training) and/or to wash off any caustic chemicals on the body or in the eyes. This should be immediate!!

3. If it is judged that the injured should not be moved, a reliable student should send for the nurse. The teacher should remain with the student.

4. If the injury is severe, the injured student should be accompanied by the teacher to the nurse. In the case of minor injuries, the injured student can be accompanied by another student.

5. If the injury involves the possibility of chemicals being ingested or under the skin in any manner, the Poison Control Center should be called for further instructions and their advice followed.

6. At this time, the nurse's judgment and procedures should be followed. The nurse is the professional in this situation and is in charge at this point. She will administer what additional first aid is necessary, contact the parents, and pursue additional treatment in the case of emergency care.

7. If the nurse is not available, the teacher is obligated to follow through the outlined procedures, remembering that the student's welfare comes first.

   a. The parents should be called and advised of the severity of the accident and their permission granted for treatment as deemed necessary.

   b. If the parents cannot be reached, the teacher must act in accordance with the situation. A physician should be called and, upon the physician's advice, seek treatment for the injured student.

MASD Health Coordinator's Pager: _Ramie McMahon 715-440-0213
Cell 715-440-0213_ SDMA ext 41104 (messages go to email)
High School Medical: Health Officer: 40105
Red Cedar Clinic-Mayo Health System Triage Nurse: 233-7677
Red Cedar Clinic-Mayo Health System Urgent Care: 233-7777
Madison Poison Control Center: 1-800-222-1222
American Assoc. of Poison Control Centers: 1-800-222-1222

EMERGENCY MEDICAL/HAZMAT 911

APPENDIX 15

STUDENT WITNESS ACCIDENT/INCIDENT REPORT

1. Name of student completing report _____

2. Date of the accident/incident _____ time _____

3. Location of the accident/incident:

4. Comments of the student:

Date report completed _____

Student signature _____

APPENDIX 16

SDMA Chemical Inventory (laboratory/classroom)

The inventories for the following elementary buildings are on file with CHO.

Knapp	05/09
Downsville	05/09
Wakanda	03/06
Oaklawn	04/04
River Heights	02/23/09

Elementary and Middle School instructional inventories are available in the CHP binder located in the Right-to-Know Center of their respective buildings. Inventories are updated annually.

Middle School Inventory was last update 10/31/2017

High School Chemical Inventories.

a. Science Chemical Storeroom, CHO and Fire Department (updated 06/05/18)

b. High School Art (updated 9/20/04) on file with Art Dept.

c. Technology Education department (completed as of 9/20/08) and on file with Technology Dept.

APPENDIX 17

EXPOSURE EVALUATION

Routine medical surveillance shall be given to anyone whose work involves regular or frequent handling of toxicologically significant quantities of a chemical. This will be determined on an individual basis whether a regular schedule of medical surveillance is desirable. If overexposure to a toxic substance is apparent or "reasonably" suspected, an evaluation by a physician is required. Formal documentation (see Part VI) of the incident with the physician follow-up must be handled through the School Administration.

Evaluation criteria of "reasonable" suspicion of exposure will be used by the Chemical Hygiene Officer for all suspected exposures. This criteria is as follows:

1. Teacher had direct skin or eye contact with a chemical substance

2. Odor was noticed, especially if the individual was working with any chemical which has a lower TLV than the Odor Threshold.

3. Health hazard symptoms such as headache, rash, nausea, coughing, tearing, irritation of nose or throat, dizziness, loss of motor dexterity or judgment which resemble drunkenness,etc were manifested.

4. Some or all symptoms disappeared when the individual was removed form the chemical area.

5. Symptoms reappeared soon after the teacher started working with the chemicals again.

6. Complaints are received from more than one individual from the same work area.

APPENDIX 18

ODOR AS AN AID TO CHEMICAL SAFETY*

CHEMICAL	TLV (ppm) (Threshold Limit Value)	AOT (ppm) (Air Odor Threshold)
Acetone	750	13 (nail polish remover)
Ammonia	25	5.2
Arsine	0.05	0.5
Carbon Monoxide	50	100,000
Chlorine	1	0.31
Chloroform	10	85
p-Dichlorobenzene	75	0.18 (a type of mothball)
Ethyl Alcohol	1000	84
Ethyl Ether	400	8.9
Hydrogen Sulfide	10	0.008
Methyl Alcohol	200	100 (wood alcohol/HEET)
Methylene Chloride	100	250
Naphthalene	10	0.084 (other type of mothball)
Ozone	0.1	0.045
Phenol	5	0.04
Toluene	100	2.9
Vinyl Chloride	5	3.000
m-Xylene	100	1.1

* Extracted from Journal of Applied Toxicology, Vol. 3 (6), 1983

APPENDIX 19

Request for Correction of Classroom/Workplace Safety Concern

(TO BE USED ONLY IF YOUR BUILDING PRINCIPAL or SUPERVISOR DOES NOT HAVE A SIMILAR FORM FOR THIS PURPOSE)

Date filed with administrator _____ Building _____ Room _____

Teacher's Signature _____

THE FOLLOWING IS A SAFETY CONCERN REGARDING COMPLIANCE WITH MASD CHEMICAL HYGIENE PLAN:

APPENDIX 20

- **EPA'S Consolidated List of Chemicals Subject to the Emergency Planning and Community Right-To-Know Act (EPCRA) and Section 112(r) of the Clean Air Act - - - - - - on file High School Room 209A**

- **Air Contaminants OSHA PEL - - - - - - on file High School Room 209A**

- **National Fire Protection Association (NFPA) Labeling p. 49 Prudent Practices… - - - - - - High School Room 209A**

- **NFPA Fire Hazard Ratings, Flash Points, Boiling Points, Ignition Temperatures and Flammable Limits of some common lab chemicals Table 3.7 p. 48 Prudent Practices… - - - - - - High School Room 209A**

The following is from EPA's list of Extremely Hazardous Substances that create serious disposal problems**. * = currently in high school science inventory (05-19-17)**

I. INORGANIC COMPOUNDS

Due to severe toxicity and other health hazards

a) Any arsenic compounds [As_2O_3, Cu_3 $(AsO4)_2$, etc] and elemental arsenic
b) Any azides (NaN_3, etc)
c) Any cadmium compounds [$Cd(NO_3)_2$, $CdCl_2$, etc.]
d) Any cyanide salt (NaCN, KCN, etc) or hydrogen cyanide gas (HCN).
e) *** Chromate (potassium)** or dichromate salts, especially lead & zinc
f) * Any lead compounds
g) Any selenium compounds or elemental selenium
h) Any sulfide salts or hydrogen sulfide gas

Due to severe contact health hazards and corrosiveness

a) * Any bromine (Br_2) liquid or concentration above 10%
b) Any chlorine or fluorine gas
c) Hydrofluoric acid (HF)
d) Fuming nitric or sulfuric acid
e) Perchloric acid

Due to high reactivity

a) Highly active metals especially potassium (K, Li, etc) If sodium is kept, have only a small amount and in small pieces.
b) Finely powdered magnesium metal
c) Elemental phosphorus (white phosphorus)
d) Any perchlorate salts ($KClO_4$)

e) Sodium peroxide (Na_2O_2)
f) Any hydrogen peroxide over 30% concentration
g) Hydrazine (N_2H_2)

II. ORGANIC COMPOUNDS

a) Acetyl chloride (CH_3COCl)
b) Aniline (C_6H_7N)
c) Benzene
d) Benzoyl chloride
e) Benzoyl peroxide
f) Carbon disulfide
g) Carbon Tetrachloride
h) Dioxane
i) * Ethers
j) * Formaldehyde
k) * Hydrocarbons liquid and room temp…pentane, pentene, hexane, cyclohexane or hexene…. Very flammable
l) Methylamine
m) Methyl ethyl ketone
n) Methyl methacrylate
o) Nitromethane
p) Phenol
q) * Petroleum ether
r) Picric acid
s) Pryridine
t) Trichloroacetic acid

APPENDIX 21

9/15/08

TO: «principal», Principal
«school» Elementary

FROM: Deanna Suilmann
District Chemical Hygiene Officer

RE: Material Safety Data Sheets M(SDS) for instructional chemicals

Teachers in your building completed an inventory check list of chemical supplies. They are to be commended for getting this done in a timely manner. Please find enclosed:

- Your building summary (contains red '√' marks)
- A copy of your teachers' inventory check lists
- MSDS for all items available on my Flinn MSDS database.

You will have to request that your supplier or the manufacturer provide you with MSDS for all items on your building summary which do **NOT** have a red check mark. Please insert the building summary, teachers' check lists and MSDS's in the back of your yellow & black Material Safety Data Sheet binder and inform your teaching **staff**.

There may be a need for a **staff** inservice to explain some of the terms and implications of MSDS's. Of particular interest, the teachers should review Sections 3 (Hazards Identification), Section 8 (Exposure Controls, Personal Protection) and Section 11 (Toxicological Information).

CAUTION ALERT: RUBBER CEMENT AND SPRAY ADHESIVES

TEACHERS, **SUPPORT STAFF** AND STUDENTS SHOULD NOT ALLOW SKIN CONTACT OR INHALE VAPORS FROM RUBBER CEMENT OR SPRAY ADHESIVES.... If possible, do not use these products. This was brought to my attention by Mr. Norton of the High School Art department and member of the Chemical Hygiene Committee. Contact him about alternative products which might be less hazardous.

cc: Dr. Smette, Mike Fisher, Chemical Hygiene Plan

APPENDIX 22

9/15/08

TO: «principal», Principal
«school» Elementary
FROM: Deanna Suilmann
District Chemical Hygiene Officer

RE: Eye protection for elementary teachers and students

A number of our elementary teachers indicated that they are in need of eye protection for themselves and their students when 'doing science'. Please find enclosed a copy of the DPI manual for Eye Protection in Educational Institutions.

In Chemistry, Biology, and Chem Com. classes the students have their own goggle straps and goggles are sterilized in a UV chamber after each use. The splash proof goggles are used when we are using flames (Bunsen burner or alcohol burners), glassware or solutions (vinegar, ammonia, alcohol, hydrogen peroxide etc.).

At the elementary level some kits come equipped with goggles. If you are using the type of eye wear that requires a strap, be sure that they are treated to destroy eggs, nits and lice before given to another student to use. If the students use their own personal goggle strap then there is a considerable amount of time and manipulative skills needed to reattach the straps. Another option is that the goggle and strap are stored in zip-lock bag and is used only by one student during the year. At the end of the year the straps should be discarded and the goggles washed in a detergent (like Ivory liquid) and then soaked in a solution of an appropriate percentage of disinfectant, rinsed thoroughly and air dried. Craft stores have inexpensive material that can be used for new straps the following year.

GOGGLES SHOULD BE WORN ANYTIME A TEACHER FEELS THERE IS A POTENTIAL FOR SOMETHING TO HAPPEN, SUCH AS ABRASIVES BEING USED, OR SOLUTION THAT MIGHT SPLASH ETC..... THE BEST RULE IS "SAFETY FIRST"....WHEN IN DOUBT, PUT THEM ON!

Be sure to include eye protection for teachers and students in your material budget.

Delta Education (1-800-258-1302) supplies materials for FOSS project kits and may have Junior size goggles. Also contact FISCO (1-800-288-3260), they have chemical junior goggles starting at $3.66 (36 or more).

cc: Dr. Smette, Mike Fisher, Chemical Hygiene Plan

APPENDIX 23

TELEPHONE NUMBERS

1. School District of the Menomonie Area		#'s - extensions	after hours #'s
District Administrator	Joe Zydowsky	232-1642 (11111)	715-944-9090(c)
High School Principals	David Munoz	232-2606 (41005)	715-309-2328(h)
		232-5425(direct)	715-505-5905(c)
	Michael Hasapopoulos	232-2609 (41003)	651-216-4597(c)
	Caleb Hundt	232-2609 (41004)	608-487-2454(c)
Middle School Principal	Bart Boettcher	232-1673 (30104)	715-505-3192(c)
	Mark Anderson	232-1673 (301020	715-790-7947(c)
Downsville Principal	Mary Begley	664-8546 (80005)	715-828-3757(c)
Knapp Principal	Kristin Humphrey	665-2131 (20112)	715-894-2008(c)
Wakanda Principal	Susan Mommsen	232-3898 (70102)	715-308-0564(c)
Oaklawn Principal	Lori Smith	232-3798 (50201)	715-556-3968(c)
River Heights Principal	Peg Kolden	232-3987 (61022)	715-505-6522(c)
Director of Bldg/Grounds	Kevin Tomaszewski	232-1642 (11063)	715-773-2392(c)
Pool/Fieldhouse Coordinator	Kale Proksch	232-1197 (42138)	
Health Coordinator	Ramie McMahon	232-2609 (41104)	715-440-0213(c)
			715-828-0762(h)
Technology Director	Katie Krueger	232-1642 (10124)	920-540-3274(c)
Chemical Hygiene Officer	Deanna Suilmann	232-2609 (40204)	715-828-7554(c)
High School Health Office	Melissa Kuhn	232-2609 (40105)	232-5452 (direct)
Youth Services Officer	Maloree Zassenhaus	232-2609 (41101)	715-308-8077(c)
School Nutrition Director	Michelle Kloser	232-1642 (11064)	608-533-2570(c)

2. Emergency Services and Consultants other than 911 (Fire, Medical or HAZMAT emergency)

Dunn County Sheriff's Office	232-1564 or 232-1348
Dunn County Emergency Management	232-2333
Steven Findlay, coordinator	231-2981
Dunn County Solid Waste/Recycling	232-4017
DNR-Department of Natural Resources -State	232-2429 (local)
Poison Center - Madison	1-800-222-1222
Menomonie Fire Department	232-2414
UW-Stout Department of Environmental Health & Safety - Safety Risk Management & Hazardous Materials	232-1793
Wisconsin Dept. of Safety and Professional Services	**1-877-617-1565**
4822 Madison Yards Way, Madison, WI 53705	608-266-2112

The Safety and Buildings Division protects the health, safety, and welfare of people in constructed environments in Wisconsin. The division promulgates, administers and enforces state laws and rules relating to building construction and safety and health.

Worker's Compensation Division of the Wis Dept of Workforce Development

Provides safety resources for Wisconsin Employers http://www.dwd.state.wi.us/

Wisconsin Council of Safety 1-800-236-3400 or 608-258-3400

https://www.wmc.org/programs/wisconsin-safety-council/contactwsc/

Consultation services – OSHA

Wisconsin Division of Worker's Compensation
June 15, 1997

Do you need help in recognizing and correcting safety hazards, developing or improving your safety program, or staying current with new standards? Are you confident your business meets the latest OSHA standards? If you need help, the Safety Consultation program is for you!

The Wisconsin Dept. of Commerce offers a free consultation service for employers to find out about potential hazards at their worksites, improve their **workplace** safety. It is completely separate from the OSHA Compliance inspection activities. No citations or penalties are issued as part of a consultation visit, nor will there be routine reports of possible violations to OSHA enforcement **staff**.

A skilled **staff** member from the consultation program with up-to-date knowledge of OSHA standards and their interpretation is available to assist you in:

- Identification and correction of hazards
- Establishment of basic safety program elements
- Assessment of machine guarding
- Provision of safety training
- Meeting current OSHA standards
- Your telephone call or letter sets the consultation process in motion. You may request a complete review of your worksite, or limit the visit to one or more specific problems. The visit consists of an opening conference, a walk-through of the worksite, and a closing conference. You will receive a written report explaining the consultant's findings, and an outline of abatement periods.

Employers benefit in many ways from this free service:

- Help you recognize hazards in your **workplace**
- Suggest approaches or options for solving a safety or health problem
- Assess current safety programs
- Provide you with a written report the summarizes findings
- Assist you in developing an effective safety program
- Appraise mechanical hazards
- Offer training and education to you and your **employee**s at your **workplace**
- Evaluate work practices
- Under special circumstances, recommend you for recognition by OSHA and a one-year exclusion from general schedule enforcement inspections

This program is administered by the Wisconsin Dept. of Commerce, not the Federal OSHA. For more information on a Safety Consultation call:

Waukesha	(414) 521-5063
LaCrosse	(608) 785-9339
Chippewa Falls	(715) 726-2543
Green Bay	(414) 492-5603

THE U.S. OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)….

Standards and Regulations

OSHA - Eau Claire Office
Kimberly Stille - Area Director
Timothy Kobernate - Supervisor
U.S. Dept. of Labor - OSHA
500 Barstow St., Room B-9
Eau Claire, WI 54701
Phone 715-832-9019
FAX 715-832-1147

WISCONSIN DNR PROVIDE SPILL RESPONSE AND SUPPORT

24 hr toll-free hotline to report hazardous substance spills: 1-800-943-0003

West Central Region Spill Coordinator: John Grump 715-839-3775
grumpj@dnr.state.wi.us

Department of Natural Resources
P.O. Box 4001
Eau Claire, WI 54702-4001 715-839-4001

State Spill Coordinator: Robin Schmidt 608-267-7569
schmir@dnr.state.wi.us

Bureau of Communication & Education: Al Stenstrup 608-264-6282
stensa@dnr.state.wi.us

DNR toll free number for forms or additional information: 1-800-367-6076

Appendix 24

List of Pages to be Updated Yearly

Title Page
Page 49: Emergency Numbers
Page 73: List of Individuals Responsible for Chemical Hygiene Plan
Page 74: Administrators' Documentation of Commitment
Page 100 : Short Shelf Life Chemical List
Page 117: Emergency Numbers
Page 119: MASD Chemical Inventory
Page 123: Extremely Hazardous Substances in Science Department inventory
Page 127: MASD Emergency Numbers