

## V. Safety Strategies in the Classroom

### **Knowledge and Common Sense Are Keys to Safety**

Safety in the science laboratory requires common sense, preparation, and knowledge by teachers and students. Teachers make their laboratories safe by:

- planning and implementing instruction that provides students the information they need to conduct laboratory investigations safely.
- ensuring that functioning safety equipment is readily accessible in the laboratory.
- modeling compliance with safety rules and using the proper protective measures.
- supervising students to ensure that safety rules are obeyed.
- documenting all student instruction in laboratory safety.

#### **TEACHERS MAKE LABORATORIES SAFE BY . . .**

- **teaching students how to conduct investigations safely.**
- **making sure that safety equipment is functioning and available.**
- **being a model for obeying safety rules.**
- **supervising students to ensure that they obey safety rules.**
- **documenting safety instruction.**

Teaching students the proper way to handle materials in the school laboratory should also help them learn correct handling of chemicals found at home or on the job. Good safety instruction must be continuous throughout the year. Emphasize safety practices on the first day and reinforce the concepts at the start of each experiment. Students will not take safety rules seriously unless the teacher obeys and strictly enforces these rules.

The successful science safety program begins with the teacher's belief in safety as an integral part of science instruction. A demonstration lesson is a good opportunity for the teacher to illustrate the proper use of safety equipment and practices. Maryland law requires approved chemical splash safety goggles for certain laboratory activities and does not permit exceptions, including classroom visitors. Teachers should advise visitors of safety precautions before they enter the laboratory area.

#### **A. Safety Guidelines for the Teacher**

##### **1. Safety Rules**

Teachers should develop a set of safety rules for students. Specific sanctions should be identified for student violations of the rules. The rules and sanctions should be spelled out in a rules agreement that is signed by the students and parents. Signed copies of the agreement should be kept on file by the teacher. This is not a legal document but can help make students aware of their responsibility for safety and the seriousness of the matter. The school administration should give written acknowledgment of its support of the rules

agreement and sanctions.

► See Appendix A, Safety Rules Agreement.

## 2. **Safety Quiz**

Teachers should give students a safety quiz to assess their understanding of safety rules and procedures.

## 3. **Safety Instructions**

Teachers should include safety concerns and precautions specific to each topic or experiment as part of their lessons throughout the year. When appropriate, require students to include safety information in laboratory written work such as a statement or paragraph indicating the safety equipment used and safety practices followed. Students' compliance with safe techniques and practices may become part of a teacher's evaluation of laboratory work. A record of this evaluation should be included in the teacher's lesson plan as legal proof of this additional safety instruction.

## 4. **Posters and Signs**

Posters highlighting your safety rules and techniques are effective reminders to students and all who enter the laboratory.

## 5. **Handling Reagents**

Teachers can reduce students' exposure to harmful chemicals by selecting those that pose a minimum risk. Teachers are responsible for training students in the proper handling of reagent chemicals. Training should include the importance of –

- safe storage of chemicals and proper disposal of chemical waste.
- using a ventilation (fume) hood for any experiment that may generate hazardous or irritating fumes.
- smelling substances by wafting the fumes toward the nose with a cupped hand.
- pouring corrosive reagents from their containers by using a stirring rod. If chemicals drip down the sides, clean the bottle before picking it up.
- taking care with reagent bottle stoppers. Stoppers placed near a spill or returned to the wrong bottles could have unexpected and dangerous results. Penny-head stoppers must be removed from the bottle by grasping between the index and middle fingers with the back of the hand toward the bottle. The same hand can then be used to hold the bottle and pour into the target container.

► See Chapter VII.A.4, Chemical Storage; VII.C, Chemical Waste Strategies; and

VII.B, Handling Reagent Chemicals.

## 6. **Safe Laboratory Protocols**

- a. Teachers should circulate among students to monitor students' work and ensure that they can respond to emergencies quickly.
- b. Teachers should stay in the laboratory at all times when students are working and not let students work alone or unattended.
- c. Teachers should make sure their students understand instructions before the students begin work. Teachers should inform students about the special hazards and precautions associated with specific experiments.
- d. Teachers should allow sufficient time for student performance. Rushing students often causes accidents.

## 7. **Knowledge of Chemicals**

Teachers must be familiar with the chemicals, equipment, and procedures they are using. As required by the chemical hygiene plan in each school, a file of Material Safety Data Sheets (MSDSs) must be kept in alphabetical order. Teachers should have a thorough understanding of the potential hazards of materials, processes, and equipment used in their laboratories. Teachers should always perform classroom experiments prior to assigning them to a class. Such preparation will allow teachers to break down the laboratory into stages, determine the hazards for each stage, and establish precautions to avoid these hazards.

► See Appendix C, MSDS: Explanation and Samples.

## 8. **Safety Practices**

Teachers should follow current safety practices. The substitution of a less hazardous chemical in an experiment can improve laboratory safety and minimize the need to dispose of hazardous waste (See Chapter VII.C.1.a, Alternative Substances.) Teachers must be careful when using older books and laboratory manuals as sources of experiments because laboratory practices have changed in recent years. As needed, teachers should consult science journals and publications to keep current on safety techniques.

## 9. **Access to Chemicals**

The teacher must maintain strict control of access to chemicals. Chemical storage rooms and cabinets should be locked and access restricted. Teachers should not leave storage containers of reagents in the classroom during an activity. Students should have access only to the chemicals and quantities needed. Locking the laboratory when it is not in use is important to prevent

unauthorized experimentation or theft.

## 10. Good Housekeeping and Safe Storage

Good housekeeping can make a significant contribution to safety in the laboratory. Teachers can promote good housekeeping habits by –

- insisting on proper laboratory cleanup from the first laboratory session. Proper cleanup includes keeping all laboratory areas, sinks, and implements clean, neat, and orderly.
- establishing a procedure for “checking” students out of laboratory at the end of an experiment or class period. Teachers should make sure students have cleaned up properly and have not left any hidden dangers. Materials and equipment should also be checked.
- holding each student responsible for cleaning up his or her own area and materials. Teachers and students should help each other with cleanup.
- assigning individuals or teams to take charge of common areas and by checking on the return of items used in the laboratory activity.
- scanning common areas such as sinks and supply tables several times during the period. If the condition of any of these areas is unsatisfactory, the teacher should stop the activity and supervise the cleanup of the area or areas before allowing students to resume their laboratory assignment.
- storing glassware on drying racks or open shelves. Allowing water to evaporate saves time and paper towels.
- including time for cleanup in the regular lesson schedule.
- labeling shelves and trays so students can tell where to return materials.
- having students return to their seats after cleanup, scanning the laboratory and equipment, and not dismissing students until all is in order.
- complimenting students if things look good or cleanup was performed quickly and efficiently.
- making sure that laboratory benches and tables are scrubbed frequently so that spilled chemicals will not injure either the students or equipment. Materials must be kept clean and orderly. It is important to eliminate the possibility of the residue of one experiment being present in an apparatus when the next experiment is conducted. The combination of chemicals might be dangerous.
- making sure that fragile and bulky equipment is stored in a manner that minimizes the chances of brushing or jarring it off the shelf. Shelves with raised edges are recommended for equipment storage.

- making sure that cabinets and drawers are closed when not in use.
- arranging seats to allow safe and quick exiting in the event of an emergency. Aisles should be unobstructed, and access to safety equipment such as fire extinguishers or safety blankets must not be blocked.
- making sure that wastes are deposited in appropriate receptacles.  
▶ See Chapter VII.C.3, Disposing of Waste, for removal procedures.

## 11. Accidents

Be alert for the possibility of an accident. Know where all safety equipment is located and how it works. Know the location of emergency cutoff switches or valves for gas and electricity. Check all physical facilities and equipment to ensure maximum safety conditions. Take prompt action to report and correct unsafe conditions.

- ▶ See *below* Chapter V.C.2, Responses to Specific Types of Injuries.
- ▶ See *also* Chapter III, Safety Concerns and Emergency Laboratory Equipment, and Chapter VI, Safe Handling of Equipment.

## B. Safety Rules for Students

The following general safety precautions for students supplement those found in other chapters.

- Know the location of safety and first aid equipment, including fire extinguisher, safety shower, fire blanket, and eye wash.
- Do not engage in horseplay or other acts of carelessness.
- Dispose of wastes properly. Do not put matches in the sink. Broken glassware should be discarded in proper containers.
- Never eat or drink in the laboratory.
- Never drink from laboratory glassware.
- Notify the teacher when you observe hazardous conditions in the classroom.
- Examine equipment for malfunction, cracks, or other defects before beginning.
- Report all accidents, no matter how minor, to your teacher immediately.
- Know the possible hazards for each experiment before conducting it.
- Perform only authorized and approved experiments.
- Follow instructions explicitly.
- If at any time you do not understand an experimental procedure, ask your teacher to explain the procedure.
- Always prepare for an experiment by reading the directions before you come

to the laboratory.

- Set up equipment away from table edges to avoid dropping it on the floor.
  - Wash hands after all spills and at the end of each laboratory period.
  - Read all labels twice before using any chemical.
  - Never return excess reagents to the stock bottle; discard any excess according to approved procedures.
  - Never mix chemicals together unless the teacher or experiment directions instruct you to do so.
  - Never taste chemicals.
  - Always add acid to water (with vigorous stirring), not vice versa.
- See Appendix A, Safety Rules Agreement, for a more complete list of rules.
- See also Chapter IV, Personal Safety Provisions, and Chapter VI, Safe Handling of Equipment, for specific laboratory and equipment handling rules.

## C. Responses to Injuries

### 1. General Procedures

Emergency procedures should be established at the beginning of the school year and conspicuously posted in your classroom.

- a. In the event of a student injury, the established emergency procedure should direct teachers to –
    - contact the school nurse or other school staff trained in emergency medical treatment, or outside medical personnel.
    - call 911 as needed for additional medical assistance.
    - notify the school administration.
    - keep the injured student calm and comfortable while awaiting the arrival of medical assistance.
    - notify the injured student's parents or guardians immediately according to school system procedures.
  - b. Teachers should strongly encourage parents or guardians of injured student to seek follow-up care for the student from medical specialists.
  - c. Teachers should never have students go for medical assistance by themselves. In circumstances where it is appropriate for students to seek medical assistance, always have another student accompany the injured student.
  - d. Safety equipment should be located in a prominent place and clearly identified with signs.
- See Chapter III.B, Facilities, and Appendix C, MSDS: Explanation and

Samples, for additional information on emergency procedures.

## 2. Responses to Specific Types of Injuries

- a. *Bleeding.* After putting on a pair of latex gloves or equivalent, hold a clean cloth pad directly over the wound and apply hand pressure. A tourniquet should not be applied.
- b. *Chemical Burns.* A chemical burn is a severe injury involving destruction of tissue following contact with strong acids, alkalis, or oxidizing materials. Affected areas of skin should be promptly and freely flushed with water for at least 15 minutes. Contaminated clothing should be promptly removed. Copious flushing with water is necessary to remove (mechanically or by dilution) all injurious materials. Do not consider chemical antidotes as the reactions could produce further injury. Check the MSDS sheet for possible delayed effects.
- c. *Clothing Fire.* The student whose clothing is on fire should drop to the floor and roll. If the safety shower is immediately available, it may be used to douse the flames. The teacher should calm the student since running in panic fans the flames and can result in more serious burns.
- d. *Eye Injuries.* Splashes of chemicals or exposure to vapors of some chemicals should be thoroughly flushed with an eye wash. Eyelids should be held apart so the entire surface of the eye may be flushed. Flushing should be continuous for at least fifteen minutes. Contact lenses, if worn, should be removed prior to flushing the eyes.  
  
▶See Chapter IV.A, Eye Protection Concerns.
- e. *Poisoning by Inhalation.* Certain vapors, fumes, mists, or dusts can cause injury if inhaled. If such an injury occurs, remove the student from exposure as quickly as possible and move him or her to fresh air. If breathing has stopped, begin artificial respiration.
- f. *Swallowed Poisons.* If a student swallows an acid or base, quickly give the student large amounts of water to drink to dilute the substance. For other materials, follow the instructions on the label. Never give liquids to an unconscious person.
- g. *Thermal Burns.* Immerse the burned area in cool water. Continue immersion until the pain is relieved and does not return when the burn is removed from water. Prompt application of cold eases the pain and tends to reduce the severity of the burn. In the case of serious burns, cover the burned area with sterile gauze or a clean sheet until medical personnel arrive.

**D. Student Science Laboratory Aides**

Teachers are responsible for the well-being of students assigned to them as aides. A student should not be accepted in this role unless the teacher knows the student to be responsible and trustworthy. Students selected to serve as aides should be required to sign safety rules agreements before beginning work as aides. In assigning tasks to an aide, the teacher should alert the aide to potential hazards and how to avoid them. It is suggested that the teacher maintain a log of each student aide's assignments. In addition, a chart of general safety regulations should be posted in the preparation room for aides to follow. At no time can an aide substitute for a teacher, nor should an aide work unsupervised. The teacher has the same responsibilities in supervising an aide as in supervising other students.