# Chapter 4
# Risk Management

## OVERVIEW

All activities involve potential risks. In order to manage risks, teachers need to evaluate the risks involved in each potential activity, and make prudent choices in the selection and development of those activities. The selection of an experiment or demonstration should take into account what that activity will achieve, what potential hazards it involves and how to control or minimize these hazards. Risk management also means ensuring that staff have the proper safety education and training, including WHMIS and TDG training, and teaching safe attitudes and behaviours to students.

## RISKS

### Inherent Risks

*Inherent risks* arise as the direct consequence of the particular materials and activities used. Most science activities involve some inherent risks. For example, an activity aimed at helping students learn about heat might require use of heat sources and heat resistant containers, creating an underlying risk of burns and minor cuts. More serious risks are inherent in the use of particular chemicals, equipment or procedures.

Before selecting materials and activities, it is important to consider ways to minimize inherent risks. For example, in planning an activity that requires elementary students to transfer liquids from one container to another, teachers can avoid the inherent risk of cuts caused by broken glassware by opting instead to use plastic containers. Similarly, a teacher could minimize inherent risks in an activity involving the handling of acid solutions by preparing the solutions in advance, rather than have students prepare them as part of the activity. Decisions such as these should also take into account the learning outcomes, the grade level, and the skill level of students.

### Situational Risks

*Situational risks* arise from the context in which the materials and procedures are used. For example, if heat sources are used in a crowded workspace, the situation of crowding creates an additional risk of burns. If situational risks are not considered, an activity that has low inherent risk can grow into a high-risk situation.

Situational risks can be minimized by ensuring that:

- teacher and students are aware of inherent risks involved in an activity
- teacher and students understand and are able to carry out appropriate procedures
- steps are taken to minimize potential distractions or disruptions
- workspaces are adequately sized and well-organized
- sufficient supervision and guidance are provided at all times.

The most effective way to minimize situational risks is through a collaborative effort between teachers and students. Teachers thus need to enlist students in planning for safety, and in establishing safe classroom procedures. This strategy for risk minimization can be supported by involving students in activities such as the following:

- identifying risks
- developing class lists of required and prohibited laboratory activities
- creating posters that show appropriate and inappropriate activities
- developing a safety contract for students to sign at the beginning of the school year.

## CHOOSING SCIENCE ACTIVITIES

Safety is a primary concern in selecting activities for science classes. Factors to consider before proceeding with a science activity include:

- potential hazards (both inherent and situational risks)
- the knowledge, skills and maturity of the students
- the experience and expertise of the teacher
- the equipment and facilities available to safely carry out the activity.

Inherent risks increase dramatically with the use of materials that are highly toxic, corrosive or flammable. The selection of materials can thus help minimize risks. Even highly qualified teachers need to assess the risks of different alternatives and select the one that presents the least hazards for students—even though another choice might produce a more spectacular result. Alternatively, an activity might be carried out as a demonstration by a teacher with appropriate safety precautions in place. A further alternative is to use videos or CD–ROMs. Although this may take away from the drama of a live demonstration, it effectively communicates what students need to know and understand.

In addition, many of the approaches described in Chapter 8 under the heading Strategies for Minimizing Hazardous Waste Production are excellent ways to reduce safety risks. These strategies include microscale experiments, dispensing pre-measured quantities of chemicals and using laboratory stations.

Teachers should also be aware that the *Occupational Health and Safety Regulation*, AR 62/2003 (Part 1, item 14) specifies that "A worker who is not competent to perform work that may endanger the worker or others must not perform the work except under the direct supervision of a worker who is competent to perform the work." This clause places an onus on teachers to evaluate their own competence in choosing activities that they will carry out. This provision under the Act could also be the basis for a substitute or regular teacher to refuse an assignment that requires them to carry out specific tasks where they are not competent. It could also be a consideration in tasks that are assigned to, and accepted by, a science aide or science technician.

## Field Trips

Field trips are a valuable addition to any science program, giving students the opportunity to explore applications of science and to investigate living things in their environment. Potential hazards associated with off-site excursions depend on the nature of the trip and the site visited, but in general the possibility of accidents can be reduced if the field trip is well-planned and organized. Field trip planning should be guided by district field trip policy that will often identify standards in such areas as supervision and first aid preparation. Planning for adequate supervision should take into account the age and number of students, the kinds of hazards present at the site, and the types of activities to be carried out. Planning for first aid preparation should also take into account the Occupational Health and Safety standard that specifies that a number 1 first aid kit be on hand for each 9 persons engaged in "off site work" or a number 2 kit for each 49 persons. (See page 46 for a list of kit contents).

Transportation is a further element of field trip planning. Local policy should be reviewed to determine what modes of transportation are considered acceptable and what guidelines apply. For example, there may be local guidelines on the use of parent-supplied transport.

Preparations for field trips safety should also include briefing student on safe and unsafe activities.

## Museum, Zoo or Industrial Site

The two primary concerns for these kinds of trips are safe transportation and adequate supervision. Be aware of any on-site hazards if these exist, and make students and supervisors aware of them prior to the trip. Also ensure that a first aid kit and someone who can provide first aid (certified first aider) is available on site at all times. In many cases this may be available at the site to be visited, but if in doubt this should be included in trip preparation.

## Nature Site

Field trips to environmental sites present their own set of challenges because students are exposed to the weather, physical hazards and local organisms. Taking the following precautions can reduce risks.

- Be thoroughly familiar with the site and any potential hazards. Visit the site prior to the field trip if necessary.
- Provide students with a map of the site, identifying the specific locations to be visited, the routes by which they will get there and the potential hazards.
- Specify the clothing and footwear to be worn.
- Special requirements such as insect repellant during breeding of biting insects, particularly mosquitoes.
- Use appropriate precautions and equipment if working on or near water; e.g., whistles, life jackets, throw line, 'buddy' system.
- Ensure supervisors are located so that all students have an adult relatively nearby at all times.
- Have a first aid kit and someone who can provide first aid on site at all times.
- Maintain access to a vehicle at all times in case of an emergency.
- Carry a cell phone to access emergency services and information.

For more information on Biology field trips, see Chapter 5.

# SAFETY AWARENESS AND EDUCATION

Safety awareness and education is a responsibility at all levels of educational planning. All staff should be aware of hazardous materials and procedures used in their working environment, and have the knowledge and skill needed to eliminate or minimize risks to themselves and to others. As employers, school districts have responsibility to ensure that school staff have this knowledge and skill—a responsibility that also falls on each employee. As overseers of school programs and school environments, school districts also have responsibility for ensuring that students develop the knowledge, skills and attitudes they need to support their own safety and the safety of others. With appropriate safety education, all staff and students will be able to act responsibly, follow appropriate safety procedures to avoid hazards and injury, and deal appropriately with injury or accidents if they occur.

## WHMIS

As described in Chapter 1, the Workplace Hazardous Materials Information System (WHMIS) is designed to identify and minimize risks for human health and safety. Under federal and provincial legislation, people in every workplace have the right and responsibility to know whether materials they are working with are hazardous, the nature of the hazard and what safety measures to take. Although students are not specifically referred to in WHMIS, except in the case of registered apprenticeship or work experience programs, their presence in the school workplace suggests that a level of care be provided consistent with WHMIS standards. This implies making students aware of any potentially hazardous materials in areas accessible to them, and providing training in the safety skills needed to use these materials. The safest and most practical

approach is to manage the environment so that student access to these materials is limited to times of teacher supervision.

Although the legal force of WHMIS requirements is not well-defined with respect to students, this is not the case when it comes to school staff and school districts. School staff are bound by the WHMIS requirements in its capacity as workers, and each school district is bound by the regulations that apply to employers. This means, among other things, that science teachers and other school staff who work with potentially hazardous materials, must be WHMIS trained. This training must be provided by the employer to enable the employee to:

- recognize risks of controlled products they are handling
- learn how to safely handle these materials
- know where the Manufacturer's Safety Data Sheets (MSDSs) are filed and how to use the information on them
- apply proper labelling to containers holding controlled products.

This training must be generic, as well as product- and site-specific, so that staff know, among other things, what hazardous materials they will encounter in their work location, where the hazardous materials and safety equipment are located, as well as the location of the MSDSs. Since the site-specific component of WHMIS training differs from school to school, science teachers that move to a new school should go through a safety orientation that covers such detail without having to repeat the generic WHMIS training.

Some districts require that staff working with WHMIS controlled products receive refresher training at least once every three years. Schools may find it useful to maintain records of courses taken, but this is not a formal requirement. The ability of workers to demonstrate the above knowledge and skills is sufficient evidence of the requirement being met.

For more details on what must be covered by WHMIS training, refer to part 1 of the *Occupational Health and Safety Code*, available at http://www.worksafely.org.

WHMIS training agencies in your area can be found on the Work Safe Alberta Web site at http://www3.gov.ab.ca/hre/whs/network/condir/, or by contacting Workplace Health and Safety. At the time of publication, the contact number was 1–866–415–8690. A number of online and CD–ROM training programs are also available from Workplace Health and Safety.

## Staff Training

Training of science teachers and support staff would generally cover much of the following through WHMIS training. Any details not covered could be included as part of a school refresher/orientation for members of the science staff.

- legislation that regulates or defines safety standards in the school, particularly Occupational Health and Safety, Environmental Protection, WHMIS and TDG regulations

- due diligence and staff responsibilities
- school and/or district safety policies for science classrooms, laboratories and field trips
- safety equipment, location and use
- management of chemicals: location and safe storage, classes, specific risks, safe use of controlled products, and disposal of chemicals
- location of MSDSs and how to read them
- response to spills and spill clean-up
- response to accidents, including first aid procedures
- accident and near-miss reporting procedures
- review of basic laboratory techniques and identification of inherent hazards. See Appendix I for examples of such techniques and their hazards.

## *Transportation of Dangerous Goods Act* and Regulation

The purpose of the *Transportation of Dangerous Goods (TDG) Act* and regulation is to protect the general public and the environment during the transportation of dangerous goods. The Act and regulation require that anyone transporting, shipping or receiving dangerous goods be trained and have their training certificate available for inspection. A training certificate is valid only for three years; after that time, the individual must be retrained and issued a new certificate. These requirements apply to anyone who:

- offers dangerous goods for transport, such as a shipper at a chemical supply company
- receives dangerous goods, such as the individual at a school who accepts delivery and signs the delivery docket or manifest
- handles dangerous goods by loading or unloading materials
- drives a vehicle carrying dangerous goods.

Principals and administrators are responsible for ensuring that staff members who receive or ship dangerous goods are TDG trained and certified. Certified staff will know:

- the classes of dangerous goods and associated hazards
- the information that is required on shipping documents
- what labels and markings are required on packages and containers
- what placards must be shown on vehicles
- what protective measures to adopt during transport
- what responsibilities they have if they are the shipper, receiver or transporter of the dangerous goods
- how and when to report accidents or incidents involving dangerous goods, especially those releases deemed dangerous occurrences.

Refer to Chapter 1 for more information on TDG regulations.

## *Environmental Protection and Enhancement Act* and Local Bylaws

The *Environmental Protection and Enhancement Act*, R.S.A. 2000, c. E-12 (EPEA) and its regulations outline a system to protect, improve and ensure wise use of the environment. This provincial statute sets the standard on a broader regulatory level with regards to human environmental impact, whereas municipalities take responsibility for establishing specific guidelines and standards for waste management. Such standards are embedded in local bylaws, identifying prohibited or restricted materials and regulating where and what wastes may be disposed of via local landfill sites and the sewage system. For specific details about bylaws in your area, see the section on Bylaws in Chapter 1.

One way that principals and administrators can ensure compliance with EPEA regulations and local bylaws is by educating staff about these regulations. With proper training, staff who handle chemicals will know:

- how to ensure that chemicals are used, handled and disposed of in an environmentally-safe manner
- what emergency and reporting procedures to follow if there is a major accidental leak or spill requiring evacuation
- how to confine the release and ensure prompt clean-up takes place to restore the environment to a satisfactory condition
- what preventive and protective measures to use
- how to implement measures to minimize and/or recycle hazardous waste.

Refer to Chapter 1 for more information on the *Environmental Protection and Enhancement Act*, R.S.A. 2000, c. E-12 and local bylaws.

## Use of Safety Equipment

Science teachers need to be familiar with the location, use and limitations of all safety equipment in the science area. Such familiarity may require initial training and periodic refresher sessions. Sharing this information with students will help them take appropriate action if the teacher is not immediately available in an emergency or accident.

## Safety and the Student

Part of the role of science educators is not only to ensure a safe learning environment, but to instill in students an understanding of their own responsibilities in the science classroom. Learning about science includes learning to respect the materials being used, and this respect can be taught only by example. In this way, science teachers are role models—advocates and practitioners of safety. Increasing students' awareness of safety issues in general, and knowledge of safety practices specifically, is one of the most important ways to reduce situational risks.

## Student Safety Training

Safety training is an integral part of learning laboratory techniques. Though infrequently put to the test, safety training is an excellent way of encouraging students to make safety a lifelong practice at home and in the workplace. As part of such training, general safety issues and student expectations would be addressed at the beginning of each course. These would be posted and periodically reviewed. See Appendix A for example science safety rules and procedures for students. More specific safety issues inherent in the activities would be discussed as part of the pre-activity instruction.

Safety expectations can be taught in a number of ways:

**General Safety Practices**

- handing out written copies of good laboratory practices and reviewing these with students throughout the term
- posting lists of safe practices in appropriate areas and reminding students of them on a regular basis
- modelling safe behaviour during all activities.

**Specific Safety Concerns**

- reviewing specific safety issues and procedures before each activity, including relevant WHMIS information, required personal protection equipment, and emergency response procedures in case of accidents.

Development of common expectations for student behaviours and procedures can be a helpful starting point in planning for safety training. By planning as a science team, and by sharing common lists of expectations and procedures, the science staff in a school can ensure consistency in their messages, and avoid student confusion about what they may and may not do. See Appendix H for Suggested Science Department Safety Policies and Procedures.

Making safety an integral part of every course helps to reinforce its importance and conditions students to think about safety whenever they undertake any activity in the laboratory.

## Developing Safety Awareness and Responsible Habits

One of the most important ways to promote safety in science classrooms is to increase students' awareness of safe practices and to help them develop responsible attitudes. Good laboratory practices can be broken down into three time periods.

**Before entering the laboratory**

- confine long hair and loose clothing
- put on closed-toe shoes
- put on eye protection
- cover exposed areas of the body with chemical-resistant clothing (protective gloves, aprons or lab coats, and face shields) when using toxic or corrosive material

- know the hazards of chemicals to be used
- understand response procedures in case of an accident; if unsure, ask the teacher or check the MSDS information.

**While in the lab**

- behave responsibly and respect the safety of others at all times
- never work alone or unsupervised
- do not eat, drink or keep food in the laboratory
- never pipette by mouth
- replace stoppers and caps of chemical containers immediately after use
- treat a substance as hazardous unless definitely known as safe—read the WHMIS label to be sure
- work under a fume hood if using substances that produce a hazardous vapour or dust.

**Prior to leaving the lab**

- dispose of hazardous wastes in specified containers or as instructed by the teacher
- turn off and put away all equipment, and clean all glassware
- wash hands thoroughly.

The more awareness students have of these issues, the greater chance they will develop safe and responsible habits of mind. See Appendix A: Example Science Safety Rules and Procedures for a more comprehensive list of 'Dos' and 'Don'ts.'