

PART A: GENERAL SAFETY MANAGEMENT

Chapter 1 Starting Points for Planning and Policy Setting

OVERVIEW

This chapter sets the stage for safety planning for science classrooms. The chapter outlines the roles of key stakeholders, and lists sample actions that are appropriate to these roles. It also summarizes legislative requirements that impact on planning for science safety. Finally, it provides general guidelines for promoting safety.

DUE DILIGENCE: AN APPROACH TO SCIENCE SAFETY

A first step in planning for science safety is to become aware of the potential hazards that science activities may present. Further steps focus on minimizing risks by taking reasonable safety precautions—in other words, by acting with due diligence.

In a legal context, due diligence means taking all reasonable steps to prevent accidents and injuries, thus avoiding the assumption of legal liability. However, due diligence is more than just a legal concept; it is a positive approach to avoiding accidents and injuries by identifying possible hazards, planning precautionary actions, and fulfilling one's responsibilities. This more general definition provides a common sense starting point for safety planning.

Principals, administrators, teachers and other staff can demonstrate due diligence by taking action in the following three key areas:

- ensuring awareness of potential risks and the related safety regulations
- ensuring staff competency in meeting these regulations, thereby avoiding unnecessary risk
- implementing monitoring and compliance strategies to ensure that regulations are met.

Awareness of Legislated Safety Requirements

Principals, administrators, teachers and other personnel need to know about the legislated requirements that apply to science programs offered in their schools. It is important to know about these regulations not only because they are legal obligations, but also because they help educators to better understand potential risks and the preventative measures that can be taken. Relevant legislation and requirements are summarized in this chapter inasmuch as they relate to safe practices in the science classroom. For access to the actual legislation, regulation, code or bylaw itself see Appendix J for the Web site addresses.

Staff Competency

As outlined in section 8 of the Teachers Code of Conduct, Alberta Teachers' Association (ATA) and section 13 of the *Occupational Health and Safety Regulation*, AR 62/2003, it is essential that teachers and other staff who perform potentially dangerous tasks are competent to handle these tasks. Competency means being aware of risks and properly trained in relevant procedures. One of the legal responsibilities of administrators is to develop and implement plans to provide staff this knowledge and training.

Evidence of staff competency may be required by provincial inspectors or investigators. For example, if a teacher was burned while handling chemicals in a science preparation area, a provincial investigator would determine whether the teacher:

- had received Workplace Hazardous Materials Information System (WHMIS) training
- knew where information on the chemicals was available
- knew how to use the appropriate safety equipment.

If the investigator found that the teacher was not competent to handle the chemicals, his or her employer could be held liable and charged under the Alberta Occupational Health and Safety legislation.

Monitoring and Compliance

The third area of due diligence involves monitoring work environments and activities to ensure compliance with health and safety legislation. For principals and administrators, this means monitoring their schools or work sites to make sure that staff comply with legislation and work in a safe and healthy manner. For teachers and other staff, it means identifying and following safe procedures, and reporting situations that create potential risks.

Monitoring and compliance can be supported by:

- discussing safety at staff meetings regularly
- reviewing plans, practices and responsibilities related to science safety periodically
- developing processes to keep staff aware of changes in legislation

- communicating regularly and sharing information on safety issues (for example, if an individual encounters a problem with a piece of equipment, he or she makes others in the school and district aware of the problem)
- evaluating unusual activities for safety considerations, and dealing with any health and safety issues before the activity begins
- reporting any violations of legislative requirements or district policy, using appropriate procedures
- giving regular attention to the following areas in planning:
 - ◆ emergency preparedness. Are plans updated as required to reflect changes? Are students' home telephone numbers current? Are drills conducted regularly?
 - ◆ hazard identification and control. Are hazards identified, evaluated and dealt with appropriately? Are inspections conducted regularly? Are recommendations dealt with promptly?
 - ◆ accident/incident reporting and investigation. Are all accidents reported to appropriate authorities as required? Has a near-miss incident-reporting system been set up and is it working effectively? Have incident statistics been analyzed and are appropriate actions being taken in response?
 - ◆ environmental protection. Are all releases (leaks or spills) being reported? Is hazardous waste being properly identified, stored and disposed of from the school?
 - ◆ safe work practices. Are safe operating procedures in place or being developed for hazardous activities? Are staff trained in these procedures? Are Material Safety Data Sheets accessible to staff in electronic or hard copy format?
 - ◆ training. Are all new staff given safety orientation training? Are existing staff members trained as necessary? Are training records kept?

Alberta Building Code, 1997															
Part 3															
3.1.16. Occupant Load															
3.1.16.1 Occupant Load Determination															
1) The occupant load of an area or part of an area shall be based on <ul style="list-style-type: none"> a) the number of seats in an assembly occupancy having fixed seats, b) 2 persons per sleeping room in a dwelling unit, or c) the number of persons for which the area is designed, but not less than that determined from Table 3.1.16.1 for occupancies other than those described in Clauses (a) and (b), unless it can be shown that the area will be occupied by fewer persons. 															
Table 3.1.16.1, Occupancy Load, Forming Part of Article 3.1.16.1															
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; padding: 2px;">Type of Use of Floor Area or Part Thereof</th> <th style="text-align: left; padding: 2px;">Area Per Person m²</th> </tr> </thead> <tbody> <tr> <td style="padding: 2px;">Assembly uses</td> <td style="padding: 2px;"></td> </tr> <tr> <td style="padding: 2px;"> space with fixed seats</td> <td style="padding: 2px;">See 3.1.16.1.(1)(a)</td> </tr> <tr> <td style="padding: 2px;"> space with non-fixed seats</td> <td style="padding: 2px;">0.75</td> </tr> <tr> <td style="padding: 2px;"> space with non-fixed seats and tables</td> <td style="padding: 2px;">0.95</td> </tr> <tr> <td style="padding: 2px;"> classrooms</td> <td style="padding: 2px;">1.85</td> </tr> <tr> <td style="padding: 2px;"> laboratories in schools</td> <td style="padding: 2px;">4.60</td> </tr> </tbody> </table>	Type of Use of Floor Area or Part Thereof	Area Per Person m ²	Assembly uses		space with fixed seats	See 3.1.16.1.(1)(a)	space with non-fixed seats	0.75	space with non-fixed seats and tables	0.95	classrooms	1.85	laboratories in schools	4.60	
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Fire Protection, Occupant Safety and Accessibility															
3.2.4. Fire Alarm and Detection Systems (See Appendix A.)															
3.2.4.1. Determination of Requirement for a Fire Alarm System															
1) Except as permitted by Sentences (3) to (5) and Sentence 3.2.4.2. (4), a fire alarm system shall be installed in a building that is not sprinklered throughout but which contains: <ul style="list-style-type: none"> a) A school, college or day care facility with an occupant load more than 40. 															
3.2.4.10. Fire Detectors															
1) Fire detectors required by this Article shall be connected to the fire alarm system.															
2) Except as required in Sentences (3) and (4), if a fire alarm system is required in a building that is not sprinklered throughout, fire detectors shall be installed in the following spaces if they are not sprinklered. <ul style="list-style-type: none"> a) Rooms in which hazardous substances are to be used or stored 															

KEY PLAYERS: ROLES AND RECOMMENDED ACTIONS

Responsibility for ensuring safety in the science classroom is shared by many members of the educational system, including:

- Alberta Education
- universities and colleges
- school boards and superintendents
- school administrators
- science teachers
- science technicians
- science students
- parents
- educational assistants
- volunteers.

Individuals in each of these groups have roles to play in promoting safety in the science classroom. Example role statements and recommended actions to fulfill each role are described below. Roles frequently overlap, and need to be aligned with local circumstances. For example, some schools employ science technicians to help teachers prepare materials for laboratory activities whereas in other schools, materials preparation is done directly by the teacher. Whatever the staffing pattern may be, it is up to everyone involved to work together as a team to ensure that responsibilities are determined, understood and fulfilled.

Alberta Education

Role: Make safety information available to Alberta schools.

Recommended Actions

- Develop and/or authorize resources that offer information and guidelines on safety in science classrooms and laboratories.
- Periodically update authorized science safety resources.
- Provide information sessions to highlight safety roles, strategies and resources.

Universities and Colleges

Role: Make safety information available to education students who take courses in science curriculum and instruction.

Recommended Actions

- Include safety knowledge and skills into curriculum and instruction courses delivered to students prior to their participation in classroom practicums.

School Boards and Superintendents

Role: Provide leadership and resources to support science safety.

Recommended Actions

- Develop safety policies and procedures consistent with current legislated requirements, and facilitate the implementation of these policies.
- Ensure that school and district staff carry out their safety responsibilities.
- Provide training and support to ensure staff competency.
 - ◆ Ensure that each school has staff trained in first aid and emergency care.
 - ◆ Ensure that staff are trained in the Workplace Hazardous Materials Information System (WHMIS) and in Transportation of Dangerous Goods (TDG), as required.
- Make staff assignments that support safe operation of science facilities on an ongoing basis, e.g., by assignment of science department heads or science technicians.
- Establish a system to monitor the effectiveness of safety policies and practices in their schools.
- Establish a system to periodically assess the adequacy of science facilities and safety equipment in each school, and provide for their ongoing maintenance.
- Make provisions for the safety of students with special needs or language difficulties.
- Request and/or direct safety and health investigations.

School Administrators

Role: Ensure safe policies and practices are in place at the school level, and support teachers in providing a safe working environment.

Recommended Actions

- Ensure that staff have required safety training and expertise.
 - ◆ Ensure that teachers and substitute/supply teachers of science have the expertise to teach the assigned curriculum safely.
 - ◆ Ensure that staff who handle hazardous materials and prepare laboratories have the expertise to do so safely.
 - ◆ Enable teachers and technicians to obtain training in science safety—in particular, to become familiar with the *Occupational Health and Safety Regulation*, AR 62/2003, to meet the requirements of the Workplace Hazardous Materials Information System (WHMIS) and the *Transportation of Dangerous Goods Act*.
 - ◆ Ensure proper disposal of chemical and organic wastes, in accordance with the *Environmental Protection and Enhancement Act*, R.S.A. 2000, c. T-2, *Canada Water Act*, R.S.C. 1985, c. C-11 and local bylaws.

- In setting policies and practices for school organization, give consideration to:
 - ◆ the numbers of students per science class
 - ◆ classroom size and facilities
 - ◆ curricular requirements.
- Ensure that facilities used for science activities are safe and appropriate for the activities carried out in them, and that necessary safety equipment is available. (See the Safety Equipment and Supplies section in Chapter 3 for further information.)
- Implement and maintain safe storage and waste disposal systems for hazardous substances used or produced in the school.
- Ensure that procedures are in place for hazard reporting, and that all safety concerns regarding facilities, equipment and procedures are addressed.
- Ensure that schools have effective policies and practices to follow in case of accidents and emergencies.
- Maintain accurate records of accidents and first aid treatments provided, report accidents as required by the *Occupational Health and Safety Regulation, AR 62/2003*, and document near-misses.
- Cooperate with outside personnel and agencies in promoting science safety (e.g., local Fire Marshal, Occupational Health and Safety, Alberta Environment).
- Stop any practices that jeopardize student or staff safety.
- Provide for the safety of students with special needs or language difficulties.
- Support disciplinary measures that the teacher may take to ensure safety in science classes.
- Ensure the school follows safety regulations and procedures.

Science Teachers

Role: Plan and prepare learning activities with a view to safety, and model and supervise safe practices in the science classroom/laboratory.

Recommended Actions

- Make prudent decisions regarding the selection of laboratory activities, taking into account the learning environment, the knowledge and skills of the students, and the teacher's knowledge, expertise and training to conduct activities in a safe and effective manner.
- Provide safety guidelines or lessons to students at the beginning of each year, term or course. Outline students' roles and actions in maintaining classroom safety, and the location and use of safety equipment, and, where appropriate, obtain written confirmation from students that these responsibilities are understood and accepted. (See Appendix B for a sample safety contract for elementary students and Appendix C for a sample safety contract for secondary students.)
- Explain and model safety procedures for each learning activity.
- Monitor students and correct behaviour that jeopardizes safety.

- Maintain a confidential list of students with any physiological (e.g., allergies, asthma) or physical disabilities. Use a buddy system or other system for those with special needs.
- Implement safety regulations specified by Board policy and relevant legislation.
- Contribute to developing and implementing school laboratory safety policy and procedures.
- Be familiar with the location and use of safety equipment and the location of main gas valves and electrical breakers.
- Report any defects in science equipment, facilities or practices to the school administrator responsible for safety.
- Verbally report any injuries or accidents to the school principal immediately, followed by a written report. Written reports of accidents are required under the *Occupational Health and Safety Regulation*. Also document near-misses so that colleagues can avoid similar situations (a recommended, but not legal requirement).
- Participate in health and safety training provided by the employer.
- Be WHMIS trained if handling chemicals. (If responsibilities include shipping and/or receiving chemicals, Transportation of Dangerous Goods (TDG) training is required.)
- Inform administration when work conditions or responsibilities have changed and additional training is required.
- Take on roles and responsibilities of a science technician that have not been designated to someone else.

Science Technicians

This section applies to staff that may have a variety of related titles, such as laboratory aid, laboratory assistant, laboratory technician or science technologist.

Role: In general terms, their responsibility is to assist in the preparation of science laboratory materials as requested by teachers for specific laboratory activities. However, their role may also include promoting and maintaining safety standards in laboratory and classroom activities, managing chemical inventories in accordance with WHMIS and other regulations, and ensuring that all science and safety equipment is in good condition.

Recommended Actions

- Maintain laboratory safety equipment and ensure it is accessible.
- Ensure all science equipment is in good working condition.
- Identify, document and inform teachers of safety problems related to specific lab activities, and adapt activities when necessary to eliminate problems while still meeting curriculum goals.
- Follow WHMIS and TDG regulations when dealing with chemicals, organic materials and waste.
- Conduct a yearly chemical inventory, ensuring Materials Safety Data Sheets (MSDSs) are current, and submit the inventory to the school's designated person responsible for hazardous materials.

- Ensure proper disposal of chemical/organic wastes in accordance with the *Environmental Protection and Enhancement Act*, *Canada Water Act* and local bylaws.
- Work with the science curriculum leader to promote safe procedures and maintain safety standards in all science activities.
- Keep safety in the forefront within the science department through meetings, articles, posters and other methods.

Science Students

Role: Support safety in the science classroom by acting responsibly and knowing how to respond to unsafe situations and emergencies.

Recommended Actions

- Inform the teacher of health concerns and circumstances that could affect personal safety, e.g., allergies, medications, use of contact lenses.
- Come to the laboratory appropriately dressed for lab work, e.g., closed shoes, long hair tied back, secured clothing or jewellery.
- Wear goggles and an apron, or use other safety equipment as required.
- Learn about the hazards posed by materials and equipment to be used in each activity, and about procedures to be used and/or avoided.
- Learn about the location and use of safety equipment.
- Follow all safety procedures and instructions, and act in a way that shows concern for everyone's safety.
- Begin activities only with the teacher's permission.
- Report unsafe situations or accidents to the teacher immediately.
- Dispose of all chemicals, specimens and other materials as instructed by the teacher.
- Wash hands thoroughly after each experiment.

Parents

Role: Support the school's efforts to provide safety in the classroom or laboratory.

Recommended Actions

- Inform the school about relevant student medical problems.

Educational Assistants and Volunteers

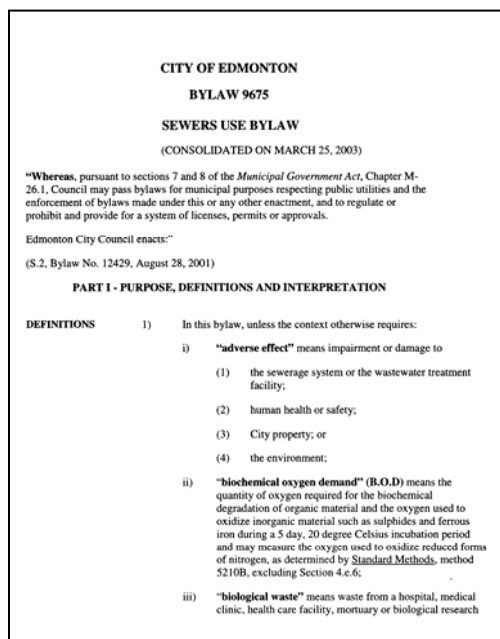
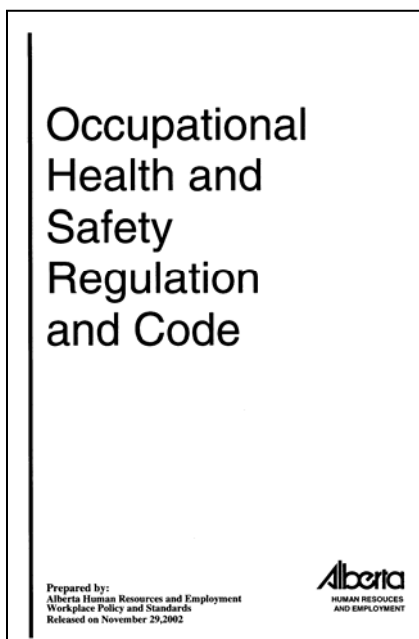
Role: Support the classroom teacher in maintaining safety.

Recommended Actions

- Find out about the hazards posed by materials and equipment to be used in science activities, and about procedures to be used and avoided.
- Understand and model safe behaviour.
- Monitor equipment and student behaviour, and report any unsafe conditions to the teacher.

LEGISLATED REQUIREMENTS

Legislated requirements relevant to science safety are found in the following sources (listed by category). **Note:** The information provided in this section was current as of November 2005.



Fire and Building Codes

- *Alberta Fire Code*, 1997
- *Alberta Building Code*, 1997

Occupational Requirements

- *Labour Relations Code*, R.S.A. 2000, c. L-1
- *Occupational Health and Safety Act*, R.S.A. 2000, c. O-2
Occupational Health and Safety Regulation, AR 62/2003
Occupational Health and Safety Code
 - ◆ Chemical Hazards, Biological Hazards and Harmful Substances
 - ◆ Emergency Preparedness Plan
 - ◆ First Aid
 - ◆ Workplace Hazardous Materials Information System (WHMIS)
- *School Act*, R.S.A. 2000, c. S-3, and regulations
- *Teaching Profession Act*, R.S.A. 2000, c. T-2

Environmental Requirements

- *Environmental Protection and Enhancement Act*, R.S.A. 2000, c. E-12, and regulations
- *Waste Control Regulation*, AR 192/96
- *Canadian Environmental Protection Act*, 1999, S.C. 1999, c. 33

- *Canada Water Act*, R.S.C. 1985, c. C-11
- *Transportation of Dangerous Goods Act*, 1992, S.C. 1992, c. 34 and regulations
- local bylaws

Other Legislated Requirements

Hazardous Products Act, R.S.C. 1985, c. H-3

Many aspects of school safety are governed by more than one piece of legislation. For example:

- the “maximum permissible occupancy load” of science laboratories and classrooms is regulated by the *Alberta Fire Code*, 1997, which refers back to the *Alberta Building Code*, 1997 for base figures on “occupancy load”
- the use of chemicals is regulated under the *Occupational Health and Safety Code*, the *Hazardous Products Act*, the *Transportation of Dangerous Goods Act and Regulations* and the *Environmental Protection and Enhancement Act*, R.S.A. 2000, c. E-12. Additional aspects of chemical safety are regulated by the *Waste Control Regulation*, AR 192/96 and the *Canada Water Act*, R.S.C. 1985, c. C-11, and may be further regulated by municipal sewer and solid waste bylaws.

Fire and Building Codes

The following sections highlight some important elements of key legislation as they relate to science safety, and outline how teachers, administrators and other staff can meet these requirements.

Alberta Fire Code, 1997

The *Alberta Fire Code*, 1997 outlines standards for building designs, equipment and procedures required to minimize risk of fire and enable safe exit of occupants when fire occurs. Particular sections of the Code provide standards for:

- storage of combustible or dangerous substances (including combustible and flammable liquids with regards to their storage, arrangement, labelling and venting)
- chemical spill control
- fire safety plans
- emergency procedures, fire drills and fire department access
- fire protection equipment, including extinguishing systems, extinguishers, water supply systems, fire alarm systems and emergency power installations
- required fire doors and separations
- ventilation systems and strategies
- maximum permissible occupant load.

Factors used in determining the maximum permissible occupant load of a science room or laboratory include the type of use of the room, the room layout, the number and location of exits, and the size and location of furnishings. For advice on the maximum permissible occupant (student) load of a particular science facility, please request an evaluation by your local fire marshal or his/her designate.

Alberta Building Code, 1997

The *Alberta Building Code, 1997* outlines standards for the design, construction and alteration of buildings in order to ensure the “life safety” of future occupants. Standards set by the *Alberta Building Code, 1997* include electrical wiring, fire alarm systems, fire extinguisher requirements, emergency routes, and lighting and ventilation (including the venting of chemical storage areas).

Occupational Requirements

Labour Relations Code, R.S.A. 2000, (Chapter L-1)

In cases of a Labour Board inquiry into employment conditions, this code gives the board or an officer of the board the right to inspect the school premises, question employees and examine school records relating to safety inspections, fire drills and staff training programs.

Occupational Health and Safety Act, Regulation and Code

The *Occupational Health and Safety Act* along with the *Occupational Health and Safety Regulation* and *Occupational Health and Safety Code* were established to ensure reasonable levels of health and safety in the workplace. It deals with chemical hazards and harmful substances, hazard assessment, first aid, emergency preparedness, fire and explosion hazards, personal protective equipment and ventilation.

This Act has extensive implications for both employers and employees (referred to as “workers” in the Act). Note that Alberta Justice does not consider students to be workers under this legislation except for those in registered apprenticeship or off-campus work experience programs.

According to the Act:

- the employer is responsible for the health, safety and welfare of workers on the job
- the employer must provide information on and control hazards, and establish an occupational health and safety program
- employees must take steps to protect their own health and safety, and the health and safety of co-workers

- employees have rights under the Act to:
 - ◆ know about workplace hazards
 - ◆ participate in health and safety activities
 - ◆ refuse “work they believe may endanger the worker or others”
- suppliers must supply MSDSs and ensure that the biological or chemical products they supply are safe for use in the workplace when used according to the instructions they provide.

The following parts of the *Occupational Health and Safety Code* are particularly relevant for science classrooms.

Part 4: Chemical Hazards, Biological Hazards, and Harmful Substances:

- gives occupational exposure limits for a variety of chemical substances for periods of 15 minutes and 8 hours (exposure limits are described in ppm or mg/m²). Given that schools do not normally have the means to measure the presence of chemicals in these low concentrations, schools often use other sources of information, specifically those provided by MSDSs, as an alternate guide to exposure limits. If further information is required on exposure limits, see Schedule 1, Table 2 of the *Occupational Health and Safety Code*
- provides specific employer obligations and procedures for treating overexposure or contamination
- prohibits eating, drinking and smoking in areas contaminated by a harmful substance
- includes a Code of Practice that governs the storage, handling, use and disposal of a number of specific chemicals and groups of chemicals used at work sites. (See Chapter 7 for a complete list of these substances.) The Code of Practice applies only in instances where the amounts of these chemicals exceed 10 kg when in pure form or, if in a mixture, 10 kg at a concentration of 0.1% or more.

Part 7: Emergency Preparedness Plan:

- states that employers must develop emergency response plans
- outlines the minimum requirements of such a plan, the need for updating the plan and the importance of employee training.

Part 11: First Aid:

- requires the employer to maintain first aid equipment and supplies, and a first aid room
- specifies contents of first aid kits for low-, medium- and high-hazard sites
- states that kits must be clearly labelled so that every worker knows their location.

Part 29: The Workplace Hazardous Materials Information System (WHMIS):

- outlines a system to inform people of the hazards of materials they might be handling in the workplace and minimize risks
- provides information for controlled or regulated chemicals with higher inherent risks
- specifies standards for:
 - ◆ labelling of chemicals: Labels alerting the user to hazards of the product and precautions for safe use are mandatory for controlled products
 - ◆ material safety data sheets (MSDSs): These sheets provide extensive information about the product, including potential hazards, health effects, proper handling and disposal, and by law must be provided by the supplier with any substance covered under WHMIS
 - ◆ WHMIS training and education: Knowledge about potential hazards and safety procedures is mandatory for teachers, laboratory technicians or any other person working with or near controlled products.

See Chapters 4 and 8 of this document for additional details on WHMIS and MSDSs, and Chapter 8 for details on labelling of chemicals. Agents or consultants that provide WHMIS training in your area can be found on the Work Safe Alberta Web site at <http://www3.gov.ab.ca/hre/whs/network/condir/>, or access an approved computer learning package such as *WHMIS and You* for in-school training and/or review.

School Act, R.S.A. 2000, (Chapter S-3 and regulations)

The *School Act*, R.S.A. 2000, c. S-3 indicates the following responsibility for the care of students:

“A board shall ensure that each student enrolled in a school operated by the board is provided with a safe and caring environment that fosters and maintains respectful and responsible behaviours.” (Section 45 (8))

Teaching Profession Act, R.S.A. 2000, (Chapter T-2)

The *Teaching Profession Act* indicates that teacher conduct is considered unprofessional if it “is detrimental to the best interests of students.”

Environmental Requirements

Environmental Protection and Enhancement Act (EPEA), R.S.A. 2000, (Chapter E-12)

The EPEA was established to help protect and improve the environment. The Act is essentially preventative in nature: it ensures that potentially damaging activities can proceed only if their impact has been closely examined and provisions have been made to adequately protect the environment against damage. Approval licenses typically stipulate requirements for ongoing reporting on groundwater quality and air emissions. The Act also states that all polluters—including schools—are expected to pay for the cost of their actions. If any potentially damaging substance is released into the environment:

- ◆ the release must be reported immediately
- ◆ immediate steps must be taken to confine, clean up and dispose of the substance
- ◆ the environment must be returned to a condition that is satisfactory to Alberta environmental protection.

Waste Control Regulation, (Alberta Regulation 192/96)

This regulation sets out requirements for handling, storing and disposing of hazardous wastes generated by industry or institutions, including schools or school districts, and stipulates how to deal with hazardous waste spills. Although specific waste products are not identified by name, the regulations describe the properties that determine whether waste materials can be disposed of in landfills.

Canadian Environmental Protection Act, 1999, (Statutes of Canada, 1999, Chapter 33)

The *Canadian Environmental Protection Act, 1999, S.C. 1999, c. 33* is the federal equivalent of the EPEA. The Act and its regulations describe procedures for storage, transport and disposal of hazardous wastes produced by industries as well as schools or school districts, and outlines how to deal with spills. Like the EPEA, this Act states that all polluters are expected to pay for the cost of their actions.

Canada Water Act, R.S.C. 1985, (Chapter C-11)

This Act defines ‘waste’ as substances that alter water quality to the extent that its use would be detrimental to humans, animals, fish, or to plants that are useful to humans. It prohibits pollution of water in areas designated for restoring, maintaining or improving water quality, and specifies the penalties for doing so.

Transportation of Dangerous Goods Act (TDG), 1992, (Statutes of Canada, 1992, Chapter 34)

The *Transportation of Dangerous Goods Act and Regulations* protects the general public and the environment during the transport of hazardous goods, including regulated chemicals ordered or disposed of by schools. TDG provides

a complementary system to WHMIS: during transportation, these products are called dangerous goods and are governed by the regulations of TDG. The TDG Act states that during transport, dangerous goods must be identified by:

- labels on containers
- placards on trucks
- shipping documents.

These TDG regulations terminate with the reception of the regulated/hazardous chemicals by a receiver, at the point of delivery. For this reason, the receiver must be TDG trained to receive the chemicals at a school or school district site. This person must also undergo TDG recertification every three years. Refer to Receiving Chemicals in Chapter 8 for more information on steps to follow when receiving chemicals. Once the regulated/hazardous goods have been unloaded from the transport vehicle and received, they become controlled products and fall under WHMIS regulations.

This information is important to staff and others in emergencies, as well as in routine activities. The TDG chemical classifications used in these labels and documents are international in scope, and as a result they are rigidly specified.

Local Bylaws

Large cities such as Calgary and Edmonton have established bylaws related to waste management and disposal, particularly disposal of substances classified as *hazardous, prohibited or restricted*. Smaller centres such as Red Deer, Lethbridge, Medicine Hat and Grande Prairie are following the lead of these larger centres in the development of documented bylaws restricting the limits of waste materials disposed of via the sewage system, and possibly, via the local landfill site(s).

In most cases, local bylaws support and reinforce the regulations of federal and provincial legislation, but they may also provide more specific disposal limits or other details. For example, in the City of Edmonton, the *City of Edmonton, Bylaw No. 9675, Sewers Use Bylaw* (14 December 2004) states that no person shall release or permit the release of any matter containing a hazardous waste into a sanitary sewer. It also states that a small quantity of waste water containing a prohibited or restricted waste may be released with prior permission of the City Manager, but only if it is determined to have a minimal adverse effect on the sewage system. The bylaw also lists wastes that cannot be disposed of via the drain. Similarly, the City of Calgary's bylaw prohibits or limits wastes disposal through drains, e.g., the bylaw limits the concentration of phosphates, sulfates and nitrates disposed through drains. Check with your municipal office or town/city council for relevant bylaws in your area.

Other Legislation

Hazardous Products Act, 1985:

This Act defines what materials are designated as *controlled products* in Canada. Designation of *controlled products* has the following significance for schools:

- the Workplace Hazardous Materials Information System (WHMIS) requirements apply to all materials designated as *controlled products*. Suppliers of *controlled products* are required to provide a Material Safety Data Sheet (MSDS) for each product, and ensure the product or its container is labelled with required information and hazard symbols
- the advertising, sale and importation of *controlled products* for use in the workplace, including Canadian schools, is regulated under the Act.

IMPLEMENTING SAFETY IN THE SCIENCE CLASSROOM OR LABORATORY

The following general procedures are recommended to use in day-to-day routines of planning, preparation, guiding and follow-up to science activities. Two sets of guidelines are provided—a basic set of procedures for elementary schools, and a more extensive set of guidelines for junior and senior high schools. The more extensive guidelines reflect the increased complexity of science activities at the upper grade levels.

Science Safety Rules and Procedures

For secondary science students (not a conclusive list):

1. Read all directions before starting an experiment.
2. Behave responsibly in the science laboratory at all times.
3. Know the location and purpose of safety equipment.
4. Always alert the teacher immediately if any accident occurs.
5. If you wear contact lenses, notify the teacher. Some activities may require you to remove contact lenses.
6. When instructed, wear safety goggles and protective clothing.
7. Wear closed shoes during laboratory sessions.
8. Keep your hair tied back if it is long.
9. Do not use cracked or chipped laboratory glassware.
10. Use chemicals in the lab only.
11. Take only as much chemical as needed and never return excess chemicals to the original container.
12. Dispose of chemicals as directed by your teacher.
13. Hold bottles only by the base, not by the neck.
14. Do not taste anything unless you are instructed to do so.
15. Never eat or drink in the science classroom.
16. Never enter the chemical storeroom without permission.
17. Always clean off the bench and sink after an experiment.
18. Wash your hands thoroughly with warm water and soap at the end of the activity or laboratory session.

Elementary Schools

Elementary students thrive on hands-on activities. The opportunity to explore and investigate real materials is a powerful motivator for learning and provides starting points for concept and skill development. The benefits of hands-on activities are well-known to teachers, who regularly incorporate them into their programs, taking care to ensure student safety. Steps taken to ensure student safety involve all stages of planning, preparation, supervision and activity follow-up. Example strategies for ensuring safety in elementary science activities are described below, beginning with the early stages of planning.

Selecting Activities and Materials

- Consult teacher guides and safety resources to become familiar with risks posed by the activities and materials under consideration.
- Access and review information on student allergies and health conditions that could limit their involvement in science activities.
- Select activities and materials taking into account:
 - ◆ potential hazards
 - ◆ student allergies and health conditions
 - ◆ the knowledge, skills, maturity and disabilities of students
 - ◆ the equipment and facilities available to safely carry out the activity.
- Avoid bringing poisonous plants or wild animals—dead or alive—into the classroom, and do not engage in direct investigations of human body tissues and fluids.

Preparing Activities

- Obtain and prepare safety supplies; e.g., obtain personal equipment, such as goggles and gloves.
- Prepare materials for safe use; e.g., organize materials to facilitate safe distribution.
- Prepare for clean-up and disposal of chemicals and other waste products; e.g., label waste containers.

Introducing and Guiding Activities

- Involve students in preparing the classroom for safe activity by clearing work surfaces and aisles.
- Introduce equipment and supplies to be used, and how they can be used safely by identifying procedures to follow and actions to avoid.
- Ensure that all students are aware of risks inherent in the materials to be used.
- Ensure that students use personal protective equipment as required for the activity.
- Initiate short, simple tasks that provide opportunity for students to practise safe procedures before moving on to more complex tasks.
- Model safety at all times.
- Consider having students sign a safety contract as a commitment to safety. See Appendix B for a sample contract.

Follow-up Procedures

- Have students clean up their workspace, following safe and environmentally-responsible procedures.
- Have students wash their hands after taking part in activities that involve chemical or biological materials.

Junior and Senior High Schools

As in earlier grades, activities with real materials in junior and senior high schools can be powerful motivators for learning and provide starting points for concept and skill development. At the junior and senior high school levels, experience with materials also provides opportunities to learn about the nature of science investigation and to critically examine the link between evidence and theory. With the increasing complexity of concepts studied, investigations may involve more complex equipment and a broader range of materials than studied at the elementary level, creating new challenges for ensuring student safety.

The general strategies for ensuring science safety nevertheless have much in common with earlier levels, involving all stages of planning, preparation, supervision and activity follow-up. The following general strategies are thus recommended. It is further recommended that secondary schools refine and extend these practices to reflect the program, student characteristics, facilities and staff roles within the particular school.

Selecting Activities and Materials

- Consult teacher guides and safety resources to become familiar with risks posed by the activities and materials under consideration.
- Access and review information on student allergies and health conditions that could limit their involvement in science activities.
- Select activities and materials taking into account:
 - ◆ potential hazards
 - ◆ student allergies and health conditions
 - ◆ the knowledge, skills and maturity of the students
 - ◆ the equipment and facilities available to carry out the activity safely.
- Avoid bringing poisonous plants or wild animals—dead or alive—into the classroom, and do not engage in direct investigations of human body tissues and fluids.

Preparing Activities

- Obtain and prepare safety supplies; e.g., obtain personal equipment, such as goggles, aprons and gloves.
- Prepare materials for safe use; e.g., prepare dilute solutions in advance, organize materials to facilitate safe distribution.
- Prepare for clean-up and disposal of chemicals and other waste products; e.g., label waste containers.

Introducing and Guiding Activities

- Set standards for safety preparation and behaviour in laboratories. See Appendix A for example science safety rules and procedures that could be used with students.
- Introduce WHMIS and MSDS symbols, data sheets and safety procedures, and ensure that students understand the need for and application of these standards.
- Provide a general introduction to risks and safety procedures at the outset of the course. In this introduction, review procedures for:
 - ◆ handling medical emergencies and accidents
 - ◆ handling chemical wastes and spills
 - ◆ reporting defective equipment and potential hazards.
- Familiarize students with the location and use of safety equipment; e.g., eyewash stations.
- Introduce equipment and supplies to be used in each activity, and describe how they can be used safely by identifying procedures to follow and actions to avoid.
- Ensure that all students are aware of risks inherent in the materials to be used.
- Ensure that students use personal protective equipment as required for the activity.
- Provide opportunity for students to practise safe procedures.
- Model safety at all times.
- Consider having students sign a safety contract as a commitment to safety. Retain the contract, but recognize that this is not a legal document. See Appendix C for a sample contract.

Follow-up Procedures

- Have students clean up their workspace, following safe and environmentally-responsible procedures.
- Have students wash their hands after taking part in activities that involve use of chemical or biological materials.

