Appendix 1: Sample key players roles and recommended actions

Saskatchewan Education

Role: Make safety information available to Saskatchewan schools and ensure legislated requirements for health and safety are followed by staff

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 Directors

Role: Provide leadership and resources to support science safety

Recommended Actions:

- Develop safety policies and procedures consistent with current legislative requirements, and facilitate the implementation of those policies
- Ensure that school and division staffs uphold legislated safety responsibilities
- Provide training and support to ensure staff competency:
  - Ensure that each school has staff trained in first aid and emergency care
  - Ensure any staff transporting chemicals has Transportation of Dangerous Goods (TDG) training
  - Ensure all staff working with or in proximity to controlled products has Workplace Hazardous Materials Information System (WHMIS) training
  - Ensure staff are trained on the use of all personal protective equipment that has been provided
- 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 safety audit system to evaluate safety policies and practices
- Establish an inspection/maintenance system of science facilities and safety equipment in each school
- Make safety provisions for students with additional needs or language difficulties
- Request and/or direct safety and health inspections and 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.

OHS Regulation, 1996 section 19(4) requires the employer to ensure that no worker is permitted to perform work unless the worker has been trained and has sufficient expertise to perform the work safely and in compliance with the act and regulations.

Recommended Actions:

- Ensure that staff has required safety training and expertise
- Ensure that teachers and science substitute teachers have the expertise to safely teach the assigned curriculum
- 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 Act, 1993* and *Regulations, 1996*, to meet the requirements of the *Workplace Hazardous Materials Information System* (WHMIS) and the *Transportation of Dangerous Goods Act,1992*
- Ensure proper disposal of chemical and organic wastes, in accordance with the *Canadian Environmental Protection Act, 1999, The Environmental Management and Protection Act, 2002, c. E-10.22, Canada Water Act, R.S.C. 1985, c. C-11*, local bylaws and MSDS
- 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 and personal protective equipment is available, well maintained, and used appropriately by those who use it. (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 incidents and emergencies
- Maintain accurate records of incidents and first aid treatments provided, report incidents as required by the *OHS Regulations, 1996*, and document near-misses
- Cooperate with external personnel and agencies in promoting science safety (e.g., local Fire Marshal, Occupational Health and Safety, Saskatchewan Ministry of Environment, etc)

- Stop any practices that jeopardize student or staff safety
- Provide for the safety of students with additional needs
- 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 safety in mind, 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 available safety equipment, 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. Have students demonstrate the required knowledge. (See Appendix 3 for a sample safety contract for elementary students and Appendix 4 for a sample safety contract for secondary students.)
- Explain and model safety procedures for each learning activity
- Monitor students and correct behavior that jeopardizes safety
- Maintain a confidential list of students with any physiological (e.g., allergies, asthma) or physical and/or cognitive limitations. Use a buddy system or other system for those with intensive 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, use and maintenance 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
- Verbally report any incidents injuries or near misses to the school principal immediately, followed by a written report. This report must also be provided to the occupational health and safety committee. Written reports of incidents are required under the *OH&S Regulations*, *1996*. It is important to document near-misses so that colleagues can avoid similar situations and trends can be identified prior to incident (a recommendation, 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 administrators when work conditions or responsibilities have changed and when 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 specific science laboratory materials as requested by teachers. 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 appropriate condition.

Recommended Actions:

- Maintain laboratory safety equipment and ensure it is accessible; Flush eyewash and safety shower on a regular basis
- 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 (MSDS) are current and less than three years old, and submit the inventory to the school's designated person responsible for hazardous materials
- Assist in the yearly review of the WHMIS program
- Ensure proper disposal of chemical/organic wastes in accordance with the *Canadian Environmental Protection Act, 1999, The Hazardous Product Act, The Environmental Management and Protection Act, 2010, The Canada Water Act R.S.C. 1985 c. C-11and* 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 jewelry
- Do not bring food or drink or chew gum in laboratory
- Wear appropriate safety equipment as required
- Learn about activity procedures being used/avoided and hazards arising from the materials and equipment being used
- Learn 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 incidents 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

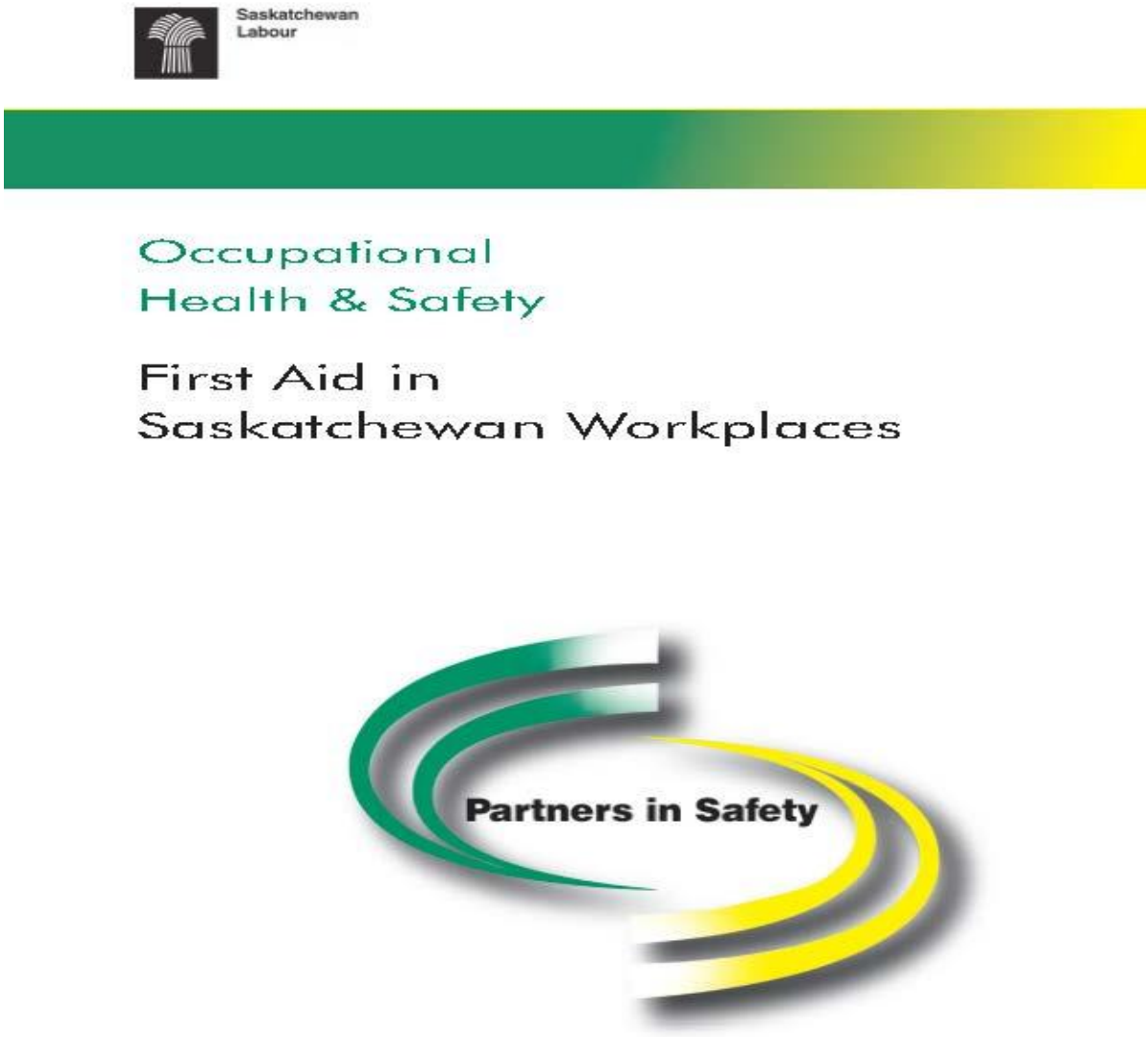
Recommended Actions

- 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 behavior
- Monitor equipment and student behavior, and report any unsafe conditions to the teacher

Appendix 2: First aid in Saskatchewan workplaces

To access the full publication, visit:

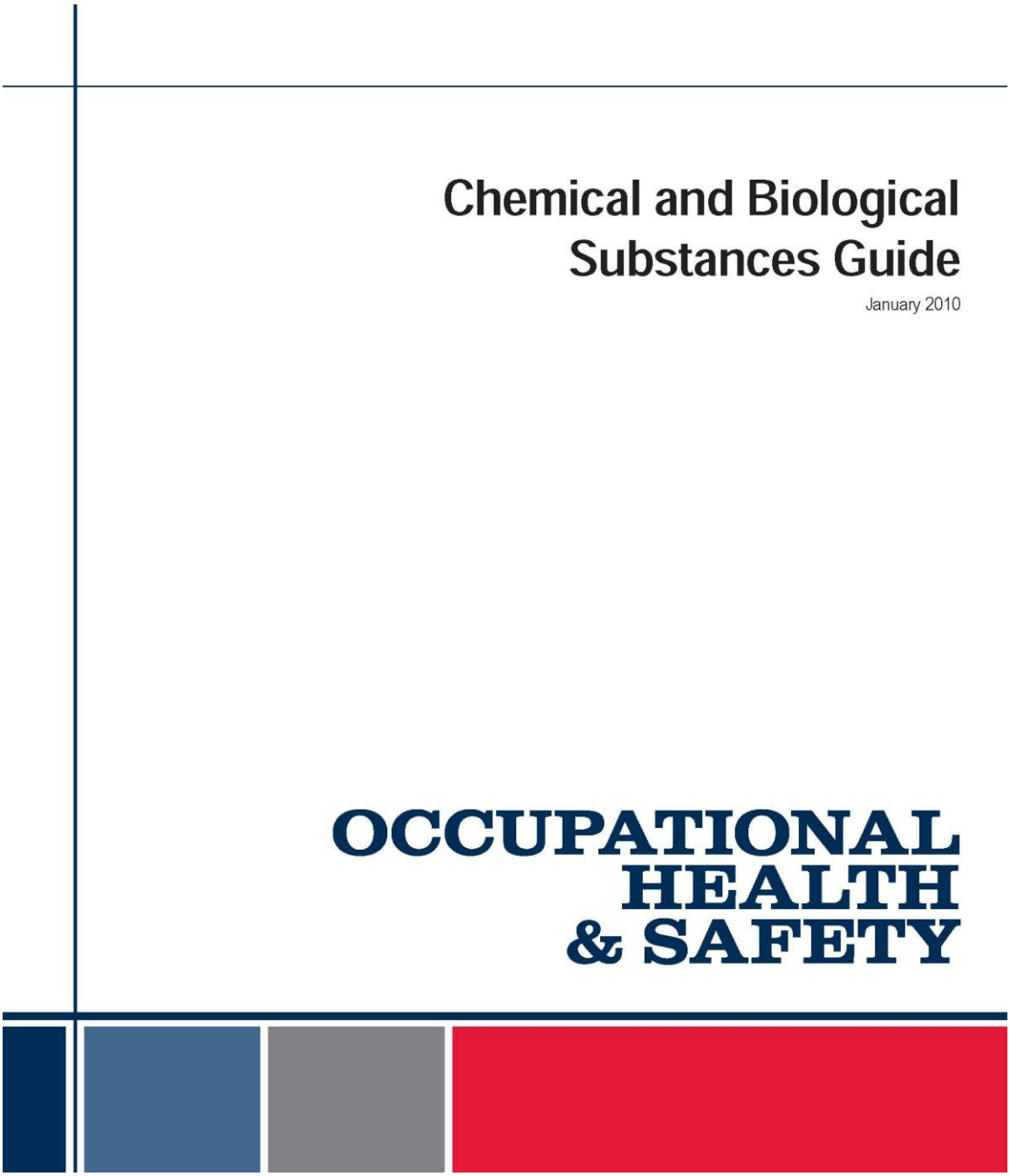
www.aeei.gov.sk.ca/first-aid-sk-workplaces



Appendix 3: Chemical and Biological Substances Guide

To access the full publication, visit:

http://www.lrws.gov.sk.ca/chemical-biological-substances-guide



Appendix 4: Guidelines for emergency shower and eyewash

To access the full publication, visit:

http://www.lrws.gov.sk.ca/emergency-showers-eyewashes-workplace

Table of Contents

Appendix 5: Sample student safety contract/agreement - elementary

Class: _____ Student's Name: _____

Teacher's Name: _____

Room: _____

I am learning to be a safe science student. I know that to learn science safely I must be neat, organized and responsible.

I _____ promise to:

Student's name

- Be prepared for science activities.
- Listen to directions and make sure that I understand them before I start.
- Follow directions.
- Observe carefully.
- Be calm and quiet so that I can learn more.
- Handle equipment carefully and put it away when I am done.
- Wash and return all things to its proper places, then wash my workspace and hands.
- Follow all safety rules.

Student's (signature): _____ Date: _____

Parent's or Guardian's (signature): _____ Date: _____

Appendix 6: Example science safety rules and procedures

1. Learn about safe and unsafe practices before beginning science activities.
    - Pay attention to safety notes provided by the teacher or textbook.
    - Find out what procedures are safe and which ones are unsafe.
    - Learn the location, purpose and operation of safety equipment.
    - Speak out if you have a safety concern or question.

2. Use protective devices and clothing to ensure safety of eyes, face, hands and body.
    - When instructed, wear safety goggles and protective clothing.
    - Wear closed shoes during laboratory sessions.
    - Tie your hair back if it is long.

3. If you wear contact lenses, notify the teacher. Some activities will require you to remove contact lenses.

4. Behave responsibly at all times during science activities.

5. Use chemicals safely and responsibly.
    - Take only as much chemical as needed and never return excess chemicals to the original container.
    - Handle chemical containers safely; e.g., hold bottles by the base, not by the neck.
    - Use chemicals in the lab only.
    - Dispose of chemicals as directed by your teacher.

6. Alert the teacher immediately if an accident or spill occurs.

7. Clean up your work area after science activities.

8. Wash your hands thoroughly with warm water and soap at the end of each activity.

9. Do not use equipment if it appears to be in an unsafe condition. For example, do not use cracked or chipped glassware.

10. Do not eat, drink or chew gum in the science classroom. Do not taste anything including chemicals.

Note: Students should not be taught to taste or eat anything in a laboratory. Students should be taught early that ingestion of chemicals results in unnecessary exposures and could lead to negative health effects. Hygiene after leaving the laboratory is important not to contaminate other surfaces or food items to avoid all unnecessary exposures. Teaching safe practices is important, especially for students entering the workforce where they could be exposed to more hazardous substances.

Appendix 7: Sample student safety contract/agreement - secondary

Class: _____ Student's Name: _____

Teacher's Name: _____

Room: _____

I understand that incidents can be caused by being unprepared, careless or in a hurry. I will come to class prepared to be responsible, so that my safety and welfare as well as that of others is not jeopardized.

I _____ will:
student's name

- Follow all written and oral instructions given by the teacher.
- Ask any questions or state any concerns I have before beginning a laboratory procedure.
- Behave in a manner that will ensure the health and safety of myself and others in the laboratory or classroom at all times.
- Use protective devices for my eyes, face, hands, body and clothing during laboratory activities.
- Know the location and use of first aid and fire extinguishing equipment, shower and emergency eyewash stations.
- Refrain from eating, drinking, chewing gum or applying cosmetics in the laboratory.
- Keep my work area clean and free of clutter during laboratory class.

I have read the written science safety rules prepared by my teacher and agree to follow these and any other rules.

Student's signature: _____ Date: _____

Parent's/Guardian's signature: _____ Date: _____

Teacher's signature: _____ Date: _____

Please list any known allergies or health problems, such as asthma, epilepsy, heart condition that may affect participation in science activities. If additional space is needed, please use the back of this sheet.

Do you wear contact lenses: □ YES □ NO
Students wearing contact lenses will need to remove contacts prior to entering the laboratory and completing experiments. When prescription glasses are worn, safety goggles will still be a requirement.

Parent's/Guardian's Signature: _____ Date: _____

Appendix 8: Chemical laboratory safety inspection checklist

Inspected By: _____ Date: _____

Building and Room: _____

A. Documentation

	Yes	No	N/A	Comments
Science safety rules and procedures are posted?				
Emergency procedures are posted?				
Chemical spill response guidelines are available?				
Chemical inventory is available and up to date?				
MSDSs are available for all controlled products and less than three years old?				
WHMIS and other training records available?				

B. Housekeeping

	Yes	No	N/A	Comments
Benches and sinks are clean and tidy?				
Exit doors are unobstructed?				
Aisles are unobstructed?				
No tripping hazards are present (i.e. cords, hoses, equipment)				
Separate disposal bin available for broken glass?				
No food or drink is present in the laboratory?				

C. Emergency and Safety Equipment

	Yes	No	N/A	Comments
Appropriate fire extinguisher(s) available?				
Are fire extinguishers regularly inspected?				
First aid kit is accessible and fully stocked?				
Safety glasses or goggles are available and in use?				
Laboratory coats and gloves are available and properly used?				
Eyewash is available and accessible?				
Is Eyewash station flushed regularly?				
Emergency shower is available and accessible?				
Is emergency shower flushed regularly?				
Spill kit accessible and fully stocked?				
Is spill kit appropriate for all types of chemical spills?				

D. Chemical Storage

	Yes	No	N/A	Comments
All chemicals have WHMIS compliant labels?				
Do chemicals have adequate space on shelves? (**Do not overstock shelves. Do not store chemicals in the fume hood).**				
Chemicals are segregated by compatibility class?				
Chemicals are dated upon receipt?				
Peroxides are labelled with container opening date?				
All gas cylinders are upright and secured in cool storage?				
Chemical waste is properly store and labelled?				
Does the ventilation work effectively in the storage room? Are there odours present?				

Appendix 9: Sample incident report/investigation form

INCIDENT REPORT/INVESTIGATION

PART 1 TO BE FILLED OUT BY THE TEACHER

Date of Incident:	**Time of Incident**: ❑**am** ❑**pm**

Type of Incident: (Check √ all that apply):

❑Property/Equipment Damage ❑Injury ❑Serious Accident SK OH&S Regulations 8(1) & 29

❑Dangerous Occurrence SK OH&S Regulations 9(1) & 31 ❑Near Miss

Potential Consequences of Near Miss (If Applicable) (Check √ all that apply):

❑Death ❑Serious Injury ❑Minor Injury ❑Property Damage ❑Equipment Damage

Reported To:	**Date Reported:**

Will injured/exposed person be seeking a Health Care Provider? ❑Yes ❑No ❑Not Sure

Exact Location Where Incident Occurred:

Description of Events (Describe in detail and list sequence of events, use an additional sheet of paper if required):

Injury Details (If Applicable)

Nature or Type	Please mark the injured part(s) X		Agent of Damage
❑ Amputation ❑ Asphyxiation ❑ Bruise or crushing ❑ Burn or scald ❑ Concussion ❑ Cut or open wound ❑ Dislocation ❑ Exposure ❑ Foreign body ❑ Fracture ❑ Inhalation ❑ Internal injury ❑ Nervous system injury or disorder ❑ Poisoning ❑ Puncture ❑ Skin disorder ❑ Sprain or strain ❑ Teeth ❑ Other (specify)	Front	Back	❑ Animal or insect ❑ Biological ❑ Chemical ❑ Electricity ❑ Equipment ❑ Tool ❑ Explosion ❑ Muscular effort - single event ❑ Muscular effort - repetitive ❑ Slip, trip or fall ❑ Stepping on or striking against object ❑ Struck by falling or moving object ❑ Thermal (heat or cold) ❑ Vehicle ❑ Vibration ❑ Other (specify)

Corrective Actions Recommended (Describe in detail and use an additional sheet of paper if required):

Part 1 Completed By

Name & Title (Please Print)	Date	Signature

PART 2 INVESTIGATION	
Investigation Completed By: (Check √ all that apply) ❑Immediate Supervisor ❑Occupational Health Committee ❑Safety Officer ❑Other (specify)	
Root Cause(s) Identified (Attach investigation report and use an additional paper if required):	**Degree of Risk:**

Corrective Actions Identified From Incident Investigation			
Corrective Action/Control to be Implemented	**Completion Target Date (DD/MM/YY)**	**Date Completed (DD/MM/YY)**	**Verified By (Signature)**

Part 2 Completed By:		
Name & Title (Please Print)	Date	Signature
Name & Title (Please Print)	Date	Signature
Name & Title (Please Print)	Date	Signature

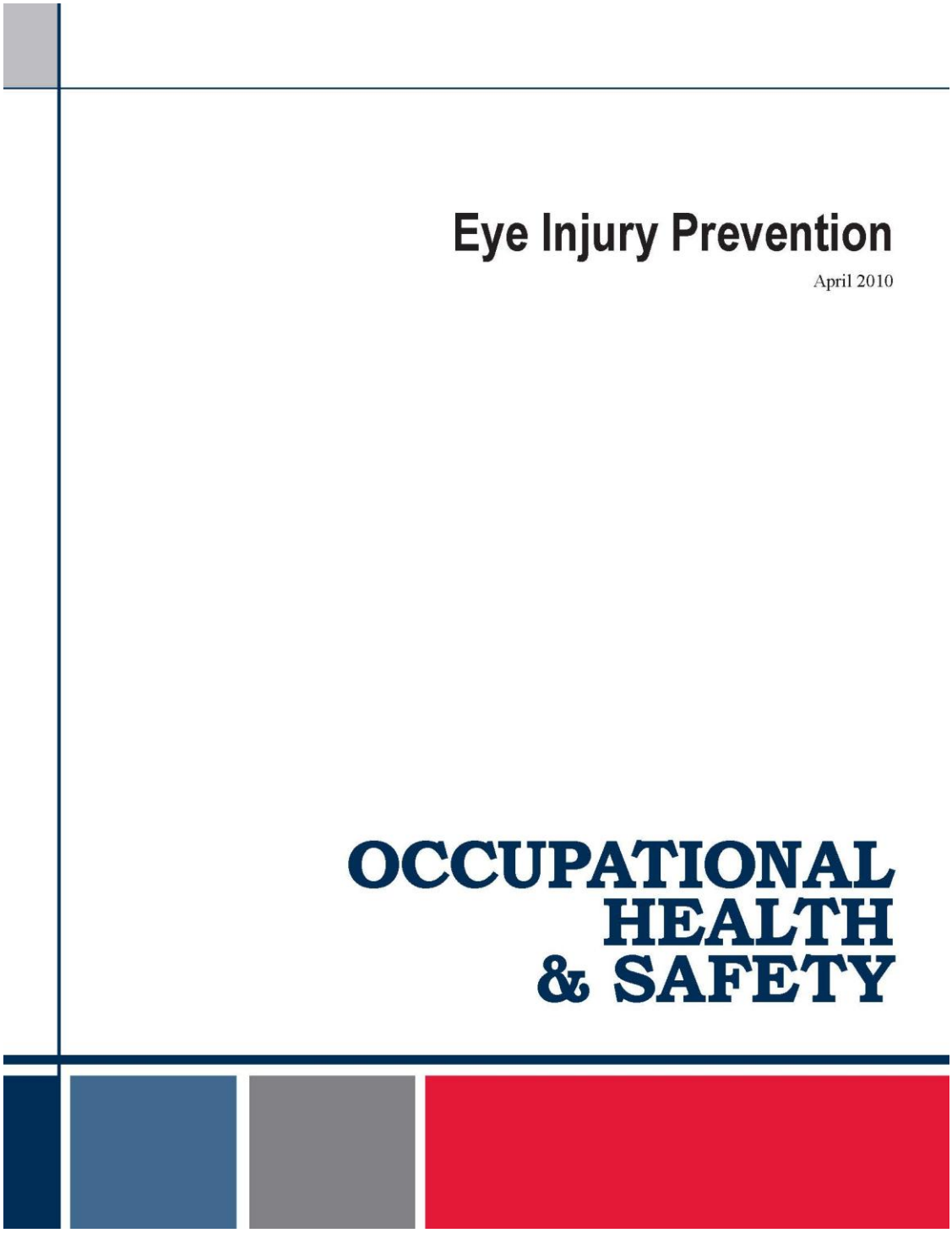
Copy Provided to Occupational Health Committee By:		
Name & Title (Please Print)	Date	Signature

Management Review of Incident Report and Investigation By:		
Name & Title (Please Print)	Date	Signature

Appendix 10: Eye injury prevention

To access the full publication, visit:

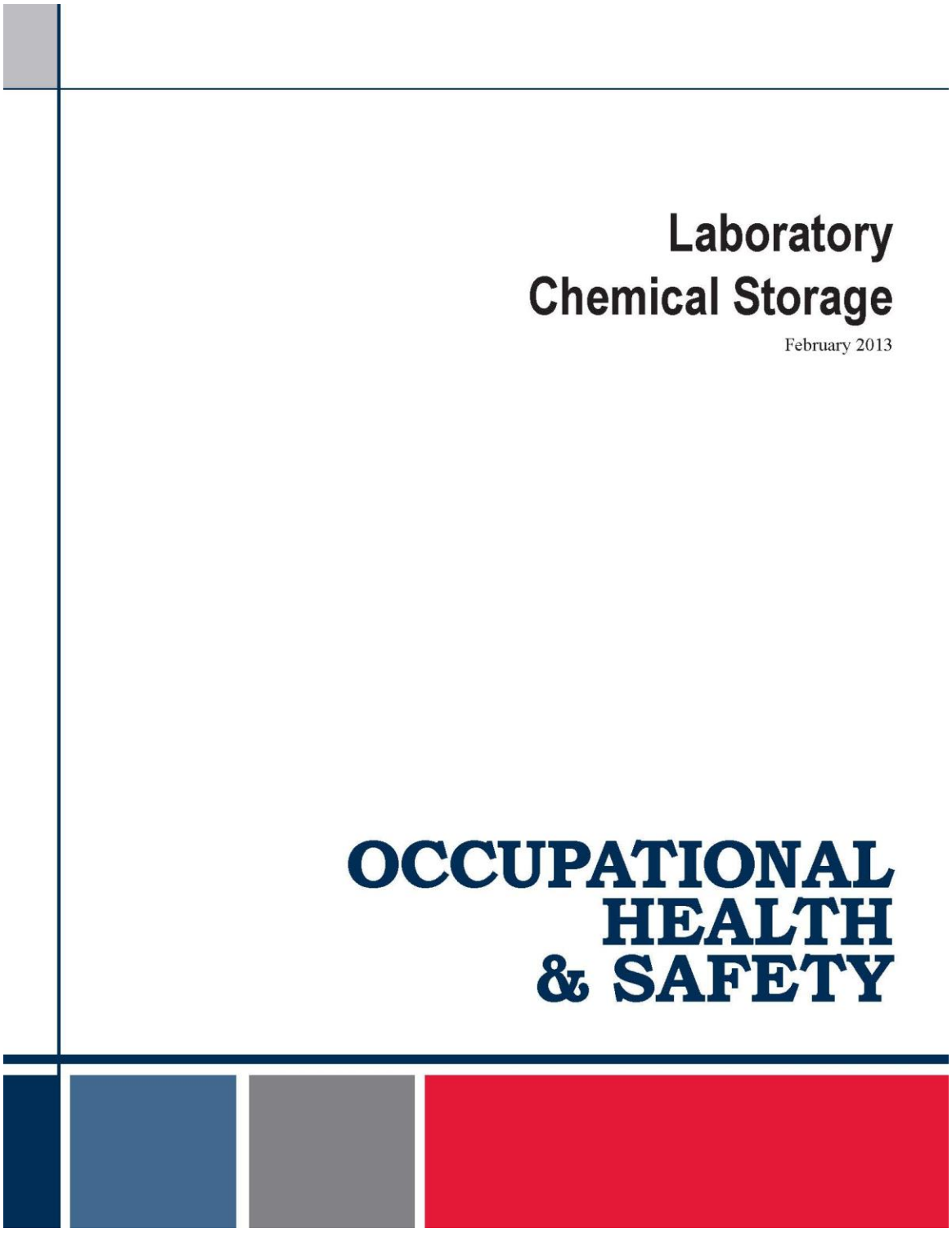
http://www.lrws.gov.sk.ca/eye-injury-prevention



Appendix 11: Laboratory chemical storage

To access the full publication, visit:

http://www.lrws.gov.sk.ca/laboratory-chemical-storage



Appendix 12: Basic laboratory techniques

1. Lighting a Bunsen Burner

Steps to follow are:

a) Attach the rubber intake hose of the Bunsen burner to the nearest gas valve.
b) Check that all gas valves at the laboratory benches are shut off, then open the
c) main gas valve.
d) Close off air intake ports at the base of the barrel so as to produce a cool red
e) flame upon lighting. This is done either by rotating the barrel clockwise until it
f) stops or rotating a sleeve at the base of the barrel to cover intake ports.
g) If there is a gas valve at the base of the barrel check that it is open about one-half
h) to one revolution.
i) Fully open the valve attached to the intake hose. If there is no valve at the base of the barrel, then partially open the valve at the intake hose. Using a flint striker or a match, light the gas at the top of the barrel. If there is too much gas/air mixture coming through the barrel, it will create a strong current of gas difficult to light and one that may blow out the match. If this happens, check the air intake ports to ensure they are closed. Once lit, you should have a cool red flame.
j) The air ports can then be opened by turning the barrel counter clockwise or rotating the sleeve to get the desired intensity of flame (blue flame is hottest).
k) The gas valve can be opened further to get a bigger flame.

2. Pouring Solutions into a Funnel Filter

Pour the liquid along a glass stirring rod, the end of which is in line with the centre of the filter in the funnel. This will avoid slashing of solution or liquid.

3. Diluting Concentrated Acids and Bases

Working with concentrated acids or bases safely requires careful handling and an understanding of hazards involved. The following steps help to reduce the inherent hazards associated with these concentrates:

a) Put on a long sleeved laboratory coat, rubber gloves and full face protection.
b) Determine the volume ratio of water and acid/base required for the concentration intended and the total volume of dilute acid/base needed. Let's assume 1 L of 10% sulfuric acid is required and 50% sulfuric acid is on the shelf. To get a 10% concentration requires a ratio of 2 mL of 50% acid to 8 mL of distilled water. Therefore, to make 1 L of 10% acid, add 200 mL of the acid to 800 mL of water.
c) Measure the required amount of the concentrated acid or base in a graduated cylinder. This can be done in a fume hood to avoid inhaling fumes, particularly acid fumes that are very corrosive. Now add it slowly to the proportionate amount of water in another container. Using a glass stirring rod, stir the water as the acid or base is added to dissipate the heat. Never add the water to the concentrated acid or base as this causes an excessive build-up of heat and spattering may result.
d) Avoid inhaling concentrated acid vapours.

4. Cutting Glass Tubing

Follow the procedure as outlined.

a) Etch the glass with a triangular file.
b) With the etch facing away from you, hold the tubing with both hands so that the thumbs are pressing on each side of the etch. Apply gentle pressure on the thumbs to snap the tubing.
c) Glazing of fire polishing the cut end of the tubing in a hot Bunsen burner flame will remove the rough edges.

5. Inserting Glass Tubing Into a Stopper

Safe insertion of tubing or a thermometer (Note: avoid using mercury containing thermometers) into a rubber stopper can be done as follows:

a) Ensure there are no rough edges on the end being inserted. If necessary, glaze the end in a hot flame and let cool.
b) Lubricate the glass with glycerin, Vaseline or stopcock grease.
c) Wrap a cloth around the tubing or thermometer, or put on thick gloves before starting the insertion.
d) Grasp the tubing close to the end to be inserted with the fingers of one hand and the stopper in the fingers of the other. Avoid grasping either with the palm of your hand.
e) Insert with a rotating motion while applying gentle pressure. Avoid excessive force that can snap the tubing. If excessive force is required check to ensure the hole is large enough to accommodate the tubing.

Note: If glass tubing or thermometers remain in stoppers for prolonged periods of time the stoppers will harden and the glass will bind to the stopper surface. Do not attempt to push or pull glass tubing or thermometers from rubber or cork stoppers that have hardened. It is best to cut away the stopper from the glass with a sharp knife or scalpel.

6. Boiling Liquids

Liquids often boil in an uneven fashion called “bumping” because bubbles of steam cannot form regularly on the smooth container walls. This leads to irregular flashes of superheating that results in large bubbles of steam erupting violently to the surface causing splashing and spitting, or, at worst, expulsion of contents from full containers.

Bumping can be prevented by adding a few boiling chips to the liquid before you start heating. These chips provide a rough surface upon which bubbles can form. Avoid adding the chips to liquids near boiling temperature because this can cause immediate boiling over of the liquid. “Porous” boiling chips cannot be reused since the pores become filled with liquid on cooling. “Sharp” chips like silicon carbide or coal are reusable until they become coated with residues and become ineffective.

7. Heating Flammable Liquids

Heating flammable liquids should be done in a water bath heated by a hot plate. Test tubes of flammable liquid can be placed in a beaker of water large enough to immerse the test tube contents but small enough to keep the tubes upright. If the use of an open flame cannot be

avoided in heating the water bath container, place the container on a wire gauze or alternative surface to ensure that the flame does not reach the flammable vapours. Alternatively, a larger metal tray of water placed on a stand plus a beaker of water set into the tray to hold test tubes of flammable liquid would be the safest arrangement when an open flame is used. If it is the beaker itself that holds the flammable liquid, then it may have to be weighed down to offset buoyancy while in the water bath.

8. Avoiding a Van De Graaff Discharge

Operating a Van De Graaff generator in a draft-free room with low humidity may result in a build up of electric charge on your body if your shoes are non-conducting and prevent flow of current to the floor. Once electrified, you will get an electric discharge if you touch any grounded object such as the metal switch to turn the machine off. To avoid this unpleasant "zap" hold a small metal object in your hand while using the generator, then touch it against ground before turning off the generator switch with your other hand.

9. Removing Stuck Glass Stoppers

Follow the procedure outlined below:

a) Stand the bottle in a large sink.
b) Cover the stopper and the neck of the bottle with a cloth.
c) Gently tap the stopper. If the jammed stopper is glass, use another glass stopper to tap against it, since glass stoppers will set up a resonance that will often successfully loosen the stopper stuck in the bottled. If possible, run the neck of the bottle under a stream of hot water to allow for expansion of the neck, and then repeat the tapping.
d) If these measures fail, it will be necessary to break the neck of the bottle to remove its contents. Score around the neck with a glass file, then apply a point of hot glass to the score mark. The neck should break cleanly along the score mark.

10. Weighing Chemicals

When handling chemicals, keep the following points in mind:

a) Wear a protective apron and gloves.
b) Always place the powdered chemical on paper (filter paper, hand towel) when weighing necessary amounts; avoid chemical contact with metal pan of balance.
c) Use a fume hood when handling powders of more toxic or corrosive chemicals to avoid inhalation.
d) Replace the cover or stopper on the chemical container as soon possible, particularly for more volatile substances.
e) If required to smell the chemical or solution, hold the container slightly in front of and beneath your nose and waft the fumes towards your nostrils with your hand. Never smell it directly.

11. Use of Scalpels

Remember the following points when using scalpels:

a) Always cut away from fingers near the area being dissected.
b) Never try to catch a scalpel that has been dropped.

c) After completing a series of dissections immerse in 5% sodium hypochlorite solution for at least 30 minutes to prevent carry over of contaminants. Follow with a thorough cleaning of scalpels.
d) Remove or change scalpel blades using a hands free system to avoid cuts.
e) Dispose of scalpel blades in a sharps disposal container, not in the regular garbage.

12. Use of an Autoclave

Autoclaves are high pressure steam or dry heat devices used to sterilize infected or potentially infected material or to prepare for sterilized solutions or equipment. To operate an autoclave safely, remember the following points:

a) Ensure the door is completely closed before starting the sterilization process.
b) Use containment procedures when sterilizing known infected material. Wear full protection including a long-sleeved laboratory coat or gown, protective gloves and a face mask as a minimum protection against infection.
c) Always use a “hot hand” or glove to remove any article from the autoclave. It must never be presumed that the autoclave has cooled down.
d) Carry out regular sterilization effectiveness testing using spore strips or an equivalent.
e) Regularly check mechanical parts of the autoclave for normal functioning. Poorly maintained autoclaves can be lethal.

13. Pressure Cooker Type Autoclave

a) Ensure safety valve is clear and operative.
b) Tighten wing nuts evenly by tightening two opposite nuts simultaneously.
c) Do not allow the operational pressure (gauge reading) to exceed that specified in the operation manual. Generally, this will be between 101.3 kPa to 138 kPa (15–20 psi) pressure.
d) Allow to cool before opening the stopcock to equalize pressure.
e) Remove the cover only when the pressure has been equalized.

14. Shaking a Test Tube

The proper and safe technique of shaking the contents of a test tube is as follows:

a) Place a stopper into the tube.
b) Shake the tube by flicking it with your finger or by holding the stopper with your thumb and turning the tube over several times.

Appendix 13: Suggested science department safety policies and procedures

Teacher classroom practice should be a good example of safety in action and be consistent with laboratory procedures set out for students. Example policies and procedures for science teachers include:

Policies

1. Safety always precedes other priorities in planning for laboratory activities. If the design of an investigation compromises safety it should be modified or avoided.
2. Materials to be used in student activities are prepared and the classroom environment set up in ways that minimizes safety risks.
3. Teachers model safe behaviour and provide guidance, direction and supervision to support student safety.
4. In preparation for science activities, students are made aware of potential risks, appropriate procedures, procedures to avoid, and procedures to follow in case of an incident.
5. Open-ended investigations proposed by students are not to be approved until a complete risk assessment has been done and precautions can be identified before any hazards are encountered. **Teachers must sign off on the experiment or investigation before students are allowed to initiate the experiment. This process must also be completed for science fair type projects.****
6. In general, if the regular classroom teacher is absent, practical laboratory activities should not be done. Special concessions may be made if the supply or substitute teacher is an experienced science teacher.

Procedures

1. Teachers hand out, discuss and post laboratory rules and procedures for students.
2. Teachers diligently enforce laboratory rules.
3. Teachers require students to report all incidents and near misses.
4. Teachers do not leave students unsupervised in laboratories.
5. Teachers are aware of the location of all emergency equipment such as fire extinguishers, first aid kits and eyewash facilities, and know how to use them.
6. Teachers educate their students about the emergency procedures of the school and the fire exits in their area.
7. Teachers inform students of any hazards that may be associated with specific activities and the precautions they should take to minimize these risks.
8. Lock science laboratories and chemical storage areas when not in use.
9. Turn off gas valves at the end of each class/day. Put away any 110 volt operated electrical apparatus when not required for classroom use.

**** In the past students have been seriously injured by carrying out open ended experiments. It is very important that teachers approve and/or make the required changes to these types of experiments to prevent serious injuries or death to the students. Injuries or dangerous occurrences arising could result in a prosecution under OHS legislation.**

Appendix 14: MSDS sample

SAFETY DATA SHEET

Date of issue: 20/05/02

1. Identification of the substance/preparation and of the company/undertaking

Identification of the product

Catalogue No: P20877 ID No.: 2700300

Product name: **Acetaldehyde (ethanal)**

Manufacturer/supplier identification

Company: VWR International Ltd., Merck House, Poole, Dorset, BH15 1TD, England
Telephone : + 44 (0) 1202 669700 Telefax : + 44 (0) 1202 665599

Emergency telephone No.: + 44 (0) 1202 669700

2. Composition/information on ingredients

Chemical characterization

Organic liquid

Product name: Acetaldehyde

CAS number: 75-07-0 EC-No.: 200-836-8
Molecular formula: CH_3CHO = 44.05 g/mol

3. Hazards identification

Extremely flammable. Irritating to eyes and respiratory system. Limited evidence of a carcinogenic effect.

4. First aid measures

- Eye contact: Irrigate thoroughly with water for at least 10 minutes. If discomfort persists, obtain medical attention.
- Inhalation: Remove from exposure, rest and keep warm. In severe cases obtain medical attention.
- Skin contact: Wash off thoroughly with soap and water. Remove contaminated clothing and wash before re-use. In severe cases, OBTAIN MEDICAL ATTENTION.
- Ingestion: Wash out mouth thoroughly with water and give plenty of water to drink. OBTAIN MEDICAL ATTENTION.

5. Fire-fighting measures

Special risks:

Extremely flammable. Vapour/air mixture explosive. Vapours heavier than air. Beware of backfires.

Suitable extinguishing media:

Foam, dry powder or carbon dioxide Cool containers with water spray.

6. Accidental release measures

Shut off all sources of ignition. Inform others to keep at a safe distance. Wear appropriate protective clothing.
If local regulations permit, mop up with plenty of water and run to waste, diluting greatly with running water. Otherwise absorb on an inert absorbent, transfer to container and arrange removal by disposal company. Ventilate area to dispel residual vapour.
For large spillages liquids should be contained with sand or earth and both liquids and solids transferred to salvage containers. Any residues should be treated as for small spillages.

7. Handling and storage

Handling:

Take precautions against static discharge. All electrical equipment must be flameproofed.
Avoid contact with skin and eyes.

Storage:

Keep at a temperature not exceeding 15°C. Keep well closed and protected from direct sunlight and moisture. Store small containers in suitable flammable liquid storage cabinets when not in use. Larger drums (200l) must be kept in purpose-built stores.

8. Exposure controls/personal protection

UK Exposure Limits:

WEL, Acetaldehyde:
Long term: 37 mg/m3 (20 ppm) Short term: 92 mg/m3 (50 ppm)

Personal protective equipment:

Engineering methods to control or prevent exposure are preferred. Methods could include process enclosure or mechanical ventilation.

As appropriate to the situation and the quantity handled.
- Ventilation: Fume cupboard, flameproof
- Respirator: Self-contained breathing apparatus when vapours are generated.
- Gloves: Butyl rubber or PE/EVAL (Silver Shield). Gloves subject to permeation or any sign of degradation must be removed and replaced immediately.
- Eye Protection: Goggles or face-shield
- Other Precautions: Plastic apron, sleeves, boots - if handling large quantities

9. Physical and chemical properties

General information:

Form:	liquid
Colour:	colourless
Odour:	fruity

Health, safety and environmental information:

Melting temperature	-123°C
Boiling temperature	21°C

Density(g/ml)		0.788 (16°C)
Vapour pressure		760mmHg, 21°C
Relative vapour density:		1.52
Solubility in water		Miscible in all proportions
pH value		5 (10g/l H2O)
Flash point		-27°C
Explosion limits:	lower:	4%
	upper:	57%
Auto-ignition temperature		185°C
Viscosity:		0.02456 mPa.s (15°C)
Log P(o/w):		-0.34

10. Stability and reactivity

Formation of peroxides possible. tends to polymerize. highly reactive. Incompatible with: various plastics, rubber.

Substances to be avoided
alkali hydroxides, halogens, halogen oxides, bases, acids, oxidizing agents, air, oxygen, nitrogen oxides, hydrogen peroxide, iron.
The possibility of reaction with other substances cannot be excluded.

11. Toxicological information

- After inhalation: Irritation of the mucous membranes, coughing, and dyspnoea.
- After skin contact: local irritation symptoms.
- After eye contact: Lacrimal irritation due to vapours.

Systemic effect: nausea, vomiting, spasms, narcosis, depressed respiration. Absorption may result in damage of the following: liver.

Further data

LD50 661 mg/kg oral, rat.
LC50 37 mg/l inhalation, rat.
Has been found to cause cancer in laboratory animals. May cause adverse mutagenic or teratogenic effects.
Carcinogen, Category 3

12. Ecological information

Moderate aquatic toxicity. Bioaccumulation potential: low (Log Pow <2).. Biological degradability: good. Risk of formation of explosive vapours above water surface.

Fish toxicity: LC50 (Pimephales promelas): 28-44 mg/l/96h
Henry constant: 8 Pa m3/mol

Adverse ecological effects cannot be excluded in the event of improper handling or disposal. Do not allow to enter drinking water supplies, waste water, or soil!

13. Disposal considerations

Chemical residues are generally classified as special waste, and as such are covered by regulations which vary according to location. Contact your local waste disposal authority for advice, or pass to a chemical disposal company. Rinse out empty containers thoroughly before returning for recycling.

When recovery and recycling is not possible, incineration in a high temperature incinerator is the recommended method of

disposal.

14. Transport information

UN-No.: 1089 Class: 3 Packaging group: I
Proper shipping name: ACETALDEHYDE

15. Regulatory information

Labelling according to EC directives

Symbol(s): F+ Xn Extremely flammable. Harmful.

R-phrases: R12-36/37-40
Extremely flammable. Irritating to eyes and respiratory system. Limited evidence of a carcinogenic effect.

S-phrases: S16-33-36/37-47B
Keep away from sources of ignition - No smoking. Take precautionary measures against static discharges. Wear suitable protective clothing and gloves. Keep at a temperature not exceeding 15°C.

EC-No.: 200-836-8
Carcinogen, Category 3

Local Regulations

Within the UK, the use of this material must be assessed under the Dangerous Substances and Explosive Atmospheres (DSEAR) Regulations.

U.K. Transport Category 1

Within the UK, the use of this material must be assessed under the Control of Substances Hazardous to Health (COSHH) regulations.

16. Other information

Revision.
Supersedes edition of: 14/11/00
Reason for alteration: Changes in Section : 3,7,8,15

Date of issue: 20/05/02
Date of print: 13/07/05

Appendix 15: Chemical inventory

Review Date: _____

Chemical Name & CAS number	Quantity	Supplier	MSDS Mo/Yr	Purchase Date	WHMIS Class	Stored as per MSDS and regulations	Disposal Method	Disposal Date

Appendix 16: Category D chemicals

Omission from this list is not an indication of the safety of the chemical. It is the responsibility of the school divisions and individual teachers to verify the chemicals they have chosen to use are safe for use given the conditions in the school.

1. acetaldehyde
2. acetyl chloride
3. acrolein
4. acrylic acid
5. ammonium fluoride
6. ammonium oxalate
7. ammonium sulfide
8. ammonium vanadate
9. antimony pentachloride
10. antimony trichloride
11. arsenic
12. asbestos
13. arsenic pentoxide
14. arsenic trichloride
15. arsenic trioxide
16. barium powder
17. benzene
18. benzenesulfonic acid
19. benzoyl peroxide
20. beryllium salts
21. bromine liquid/gas
22. cadmium metal powder
23. cadmium salts
24. calcium sulfide
25. carbolic acid
26. carbon disulfide
27. carbon tetrachloride
28. chlorine gas
29. chloroform
30. chromium (VI) oxide
31. chromium (VI) salts
32. cobalt powder
33. colchicine
34. copper metal powder
35. diethyl ether (ethyl ether)
36. dimethyl sulfate
37. dinitrophenol
38. 1,4-dioxane
39. ethylamine (liquid and gas)
40. ethyl bromide
41. ethylene dichloride
42. ethylenediamine
43. fluorine
44. formaldehyde
45. hydrofluoric acid
46. hydrogen cyanide (hydrocyanic acid)
47. hydrogen sulfide
48. lead metal powder
49. lead compounds (powders)
50. nickel metal (powder)
51. nickel compounds
52. nitrogen dioxide (commercial cylinders of gas)
53. paraformaldehyde
54. perchloric acid
55. phenol
56. phosphorus (yellow)
57. picric acid
58. potassium chromate
59. potassium dichromate
60. prussic acid
61. sodium arsenite
62. sodium oxalate
63. sodium sulfide
64. thorium