XII. Spill Prevention, Response, and Control

Being a conscientious science teacher means being proactive in taking steps to prevent spills. However, no matter how careful you are, or what precautions you take, a spill is always possible. Proper response procedures and safety equipment must always be available to contain and control a spill.

Spill Prevention

The first step in safety is prevention. Laboratories and experiments should be designed to minimize the possibility of chemical spills. A clean, organized, clutter-free laboratory can be maintained by putting away chemicals, equipment, and related materials when you are done with them.

Chemicals should be stored and dispensed in unbreakable containers, such as plastic or PVC coated glass bottles. Store highly toxic materials in secondary containment devices, such as heavy-duty plastic bags or airtight containers. If a container is dropped, secondary containment will help safely contain a spill.

Note: Review the SDS for any chemicals you will be using BEFORE starting any experiment, as a proactive measure for quicker response in case of an emergency.

Chemical Dispensing

Many spills occur when a chemical is dispensed. Awareness and an understanding of prevention procedures will minimize the possibility of a spill. Heed the following safe-handling recommendations when dispensing chemicals:

1. Establish a safe location in the laboratory to dispense chemicals. The laboratory fume hood should always be used.
2. Dispense chemicals over a spill containment tray or an absorbent pad. Plastic cafeteria trays are usually chemical resistant and make good containment devices. Do not return the trays to the cafeteria.
3. Use a spatula and weighing boat to weigh out chemicals.
4. Read the label carefully before removing a chemical from its container. Using the wrong material can lead to accidents. Review the SDS before using any chemical.
5. Do not use more material than directed. Once you remove the appropriate amount of the chemical, re-seal the container immediately.
6. Choose experiments that use the least amount of chemicals whenever possible.
7. Never return any quantity of a chemical to its original container; this practice can lead to contamination and possibly to a dangerous situation. Deposit unused chemicals in the appropriate, labeled waste container. Follow all regulatory hazardous waste procedures for final disposal.
8. Try to avoid raising chemical “dust” into the air when using solids during an experiment.
9. Use a stirring rod when pouring liquids to help direct the flow. (See *Section X - Preparing and Handling Chemicals For Use* for further information.)
10. Pour slowly when mixing concentrated solutions into other liquids.

11. Add chemicals to a reaction mixture slowly. Chemicals should never be quickly dumped together, unless that is the experiment's specific procedure. Observe the initial reaction when a small amount is mixed, and wait before adding more.
12. Review the experiment's procedures if a chemical reaction fails to initiate as expected. Make sure that the proper chemicals were used, in the proper amounts, before proceeding.

Spill Kit Materials

Chemistry laboratories should have spill control materials, or, at a minimum, kits that contain sand (for absorption) and neutralizers. These materials should be available in a volume capable of handling a spill from the largest container used in the laboratory. Contact Ward's Science to order your spill control materials. Neutralizers and absorbents should be used as directed by the SDS for the specific chemical to be contained, absorbed or neutralized. Chemical spill response materials should also be kept in the chemical storage area.

Sand

Sand is used to contain a spill. Ward's Science recommends that 30 pounds of clean, dry sand be immediately available in the laboratory Sandbox sand will suit the purpose and can be purchased from a local discount or hardware store.

Chemical Absorbent

The chemical absorbent contains and absorbs chemical liquid spills for easier control and clean up. Ward's Science recommends that 20 pounds of odorless kitty litter, vermiculite, or oil absorbent be immediately available in the laboratory.

Neutralizers

An acid neutralizer is a base such as sodium carbonate or calcium hydroxide and is used to neutralize inorganic acid spills. If acids are used, Ward's Science recommends that 30 pounds of sodium bicarbonate (baking soda) be immediately available in the laboratory. If strong bases are used in the laboratory, a supply of vinegar or citric acid should be on hand to neutralize the base. A 2.5-kg bottle of vinegar or citric acid should be large enough to neutralize the contents of any amount of base material used in a laboratory. Sodium bicarbonate, vinegar, and citric acid can be purchased from Ward's Science as well as from an industrial chemical, building supply, or swimming pool supply distributors.

The sand, absorbent, and neutralizers should be stored in sealed, labeled containers that can be quickly opened and used. A plastic broom, plastic dustpan, and large heavy-duty plastic garbage bags should be included with the response materials. You can also obtain spill control pillows, blankets and specialized neutralizers and absorbents if desired. Convenient spill control kits are available from Ward's Science.

Spill Response and Control Procedures

As the chemistry teacher, you (and your school) are required to define and establish a written contingency plan, specifying your school's procedure to handle chemical spills. This should be part of your Chemical Hygiene Plan, (See *Section VII* for more information on Chemical Hygiene Plans.) Responsibilities and specific applications and procedures will need to be defined in your contingency. This is a standard chemical response plan for chemicals that are not highly toxic or highly hazardous. Response procedures rely on the proper spill response, containment, and clean up training for response individuals. At a minimum, your contingency plan should consist of the following:

1. Quickly assess the spill, its hazards, and the danger to you and your students. Notify other laboratory personnel of the accident, and if necessary, evacuate the area. If the spilled chemicals are unknown, assume the worse. Always evacuate.
2. Contact internal spill response personnel (such as your safety coordinator or trained spill response team) immediately.
3. Call **911** (fire department, ambulance) if your students' safety is at risk.
4. Review the SDS for the spilled chemical, including its hazards, spill response procedures, and first aid measures.
5. Tend to injured or contaminated persons as directed by the SDS. If you are splashed by a chemical you know is innocuous, you may have time contain the spill before cleaning yourself. **Note:** If you use a safety shower near a chemical spill, the water may expand spill area.
6. Avoid breathing vapors from the spill. Ventilate the room and wait before cleaning up if the material is producing heat or giving off vapors.
7. Wear appropriate protective equipment as directed by the SDS when cleaning the spill.
8. Contain the spill as follows when it is safe to approach the area without exposing yourself to the risk:
    a. Gently pour sand around and over the spill. The sand will contain the spill, prevent it from spreading, and provide traction if you need to walk over it.
    b. Gently sprinkle the absorbent (kitty litter, vermiculite, oil absorbent) around and over the entire spill to avoid further spreading. This will absorb the liquid and help contain vapors.
    c. Apply the appropriate neutralizer around and over the entire spill, if it is an inorganic acid or base. Using a plastic broom, mix the spilled chemical, sand and neutralizer to make sure the neutralizer contacts all of the spilled chemical.
9. Clean up the spill using standard procedures described in the chemical's SDS.
10. Use a plastic dustpan and plastic broom to sweep up the residue and place it into a heavy-duty garbage bag, plastic container, or other appropriate container, and dispose of it as chemical waste. Follow federal and local regulations for disposal. See *Section XIV - Chemical Disposal* for further information.
11. Clean spill area with water and a suitable cleanser.
12. Decontaminate clothes, personal protective equipment, and tools.
13. Evacuate the area and get help if you feel uncomfortable at any time.

For a highly hazardous or toxic chemical spill, the following procedure should be used:

1. Attend to injured or contaminated persons and remove them from the hazard area.
2. Turn off ignition and heat sources if the spilled material is flammable.
3. Close all doors to area where the spill is. Notify other personnel of the accident evacuate the area. Call 911 to notify emergency personnel.

Emergency Procedures

In the event of an accident or emergency, teachers should act promptly and decisively. A pre-existing emergency plan should be established, practiced, and followed. If you are expected to respond to chemical related accidents or spills, you should be trained to do so. In the event of injury to personnel or students, the following steps should be taken:

- Assess the situation and take immediate action to remove any hazards. This will help reduce student exposure and the potential for injury. Assess the severity of any injuries to guide your course of action.

- Call **911** and notify school nurse, principal and other emergency personnel, if an injury requires medical attention. Follow emergency procedures defined in the appropriate SDS, and make the form available to emergency personnel.
- Flush any chemicals from a victim's eyes immediately. The eyewash should consist of potable, aerated water, from 60° F - 90° F (15.5 °C – 32.2 °C), at a rate of 3-5 gallons/minute (11.4-18.9 liters/minute). Hold the victim's eyelids open as wide as possible and flush for at least 15 minutes (or until emergency personnel arrive). DO NOT flush with anything other than water. Flushing should wash out contact lenses. If the lens chemically adheres to the eye DO NOT remove the contact. Allow emergency personnel to remove it.
- Immediately place a burning victim under an emergency shower. If a shower is not nearby, the individual should drop and roll. Smother the flames with a fire blanket or with the spray from a fire extinguisher. DO NOT wrap an upright student in a fire blanket. This could create a "chimney effect" and increase the severity of fire.
- Spray burning chemicals with an ABC fire extinguisher. All personnel who might need to use a fire extinguisher should be properly trained to do so. Stand within 6 feet (1.8 meters) of the fire and make sure there is an exit in case the fire cannot be controlled. Administer the PASS method to use the extinguisher.

  P – Pull the pin.
  A – Aim low or at the base of the fire.
  S – Squeeze trigger.
  S – Sweep from side to side of the fire.

  The average fire extinguisher operates at maximum efficiency for 8-10 seconds. Take care not to blow and scatter the material on fire. Some fires, such as alkali metals, cannot be extinguished with ABC extinguishers and must be extinguished with dry sand or specialty extinguishers. If these chemicals are used in your lab, keep a covered bucket of sand available for extinguishing purposes.
- Obtain medical attention for any victims. Contact the victim's parent, guardian, or designated person.
- Complete an accident investigation, using school reporting forms, including eyewitness testimonies. Assess the procedures that led up to the accident and adjust them to eliminate or reduce the possibility of a reoccurrence.

Spill Prevention and Response Training

As a chemistry teacher, you provide your students with a number of chemicals, most of which have hazardous properties of varying degrees. You are responsible for keeping this potentially dangerous environment a safe one. Providing a safe environment includes instituting methods that help prevent accidents. All chemistry teachers need to be trained in prevention methods, and must understand how to incorporate them into their daily chemistry activities. This training should include hazard communication (as defined by OSHA and Health Canada); the use of a Safety Data Sheet (SDS); experiments planning; laboratory layout; procedures and equipment usage; dispensing techniques; and ways to utilize small quantity chemical experiments. In addition, teachers should complete refresher safety training annually, and when new chemicals and hazards are introduced into the environment.

Since every second counts when handling a spill, knowing what you are working with and how to respond is essential in protecting you and your students. Chemical safety is most successful when you are proactive in your preparedness, so using the information in this section will greatly reduce the potential for spills, and help you handle them in the safest manner possible in the event that a spill occurs.

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