

# Flammable Liquid Safety

## Safety Tips for Using Flammable Liquids in School Laboratories

### Introduction

The use of flammable liquids is an important component of most chemical laboratories. Understanding the properties and hazards of these materials is an important first step for the safe purchase, storage, use, and disposal of flammable liquids.

### Safety Precautions

All flammable liquids found in school environments are also organic compounds. Their principal hazard is flammability. Many are also slightly toxic by inhalation and are body tissue irritants. Mild headaches or dizziness may be a symptom of overexposure to an organic vapor. Good ventilation is highly recommended whenever volatile organic compounds are used. Specific hazards for common organic solvents are presented in this review. Always wear chemical splash goggles, chemical-resistant gloves, and chemical-resistant apron whenever using flammable liquids. Consult current Material Safety Data Sheets for specific safety, handling, and disposal information.

### Purchase

- Before purchasing any organic liquid, ask the following questions:
  - Do I understand the hazards of this material?
  - How often is this chemical used in a school setting?
  - What is the educational value of this chemical?
  - Have I used this chemical before?
  - Is my lab equipped for the safe use and storage of this chemical?

If these questions cannot be answered positively, please reconsider purchasing the chemical.

- Organic compounds are not easy to dispose of and frequently require costly disposal methods. Purchase only what is required for 1–2 years' usage.
- Purchase smaller-sized bottles of flammable liquids whenever possible to keep them fresh and to make storage and handling easier. It is easier to handle a 100- or 500-mL bottle than a 1- or 4-liter jug of liquid. Smaller bottles of liquids also contain less liquid that can spill in the event of an accident and will add less fuel to a potential fire.
- Always purchase flammable liquids in plastic bottles or in PVC-coated glass bottles. PVC-coated bottles will not shatter and spill material when dropped.

### Storage

- Store all flammable liquids, solids, and gases in a dedicated flammables cabinet. The best flammables cabinets are built using high-density wood. Metal is a heat conductor while wood is an insulator. Applying intense heat to a metal flammables cabinet may cause the door to warp and release flammable liquids and vapors into the fire. A wooden flammables cabinet insulates the chemicals inside the cabinet and will withstand a fire better than a metal cabinet. Wooden flammable cabinets have been reviewed and approved by the major standard-setting organizations, including OSHA and NFPA, and by many major city fire departments.
- Flammable storage cabinets should be located in a locked chemical storeroom to prevent theft. The cabinet should also be secured with a lock.
- Within the flammables cabinet, all the materials should be stored using the Flinn Scientific Chemical Storage Pattern.
- A chemical storeroom that contains flammable materials should be equipped with an ABC fire extinguisher, fire blanket, and smoke detector.

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### Store all flammable liquids in a dedicated flammables cabinet.

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- The chemical storeroom should also be equipped with a small, corrosive-resistant exhaust system. Flinn Scientific recommends a fan that will provide four air changes per hour. The fan should be placed near the ceiling of the storeroom. Since organic vapors are heavier than air, the exhaust system must draw vapors from the floor. Use a galvanized sheet metal duct to draw air from the floor to the exhaust fan near the ceiling. (See page 1118.)
- If a flammables cabinet is not available, store all flammable liquids in Flinn *Saf-Stor*<sup>™</sup> cans. (See page 1084.) This will provide good secondary containment and protection during fires.
- Never store flammable or combustible materials near strong oxidizing agents. As these materials react with one another, heat is evolved and a fire can occur. Use the Flinn Scientific Chemical Storage Pattern to prevent storage accidents. (See pages 1164–1173.)
- Diethyl ether may form explosive peroxides over the course of 1–2 years. Buy and store only small quantities of this material.



- Never store flammable liquids in a household refrigerator or freezer. Vapors can build up inside the refrigerator and a spark from the compressor, thermostat, light-bulb, or electrical switch can ignite the vapors. Explosion-proof refrigerators can be purchased but cost 3–4 times more than household refrigerators.
- Some alcohols will also form peroxides upon standing. These peroxides can be explosive if they are allowed to accumulate or are concentrated. Do not distill these materials. Consult the *Flinn Scientific Catalog/Reference Manual* or MSDS to determine storage recommendations for specific alcohols.

### Transporting

- Secondary containment is critical in preventing major spills or accidents when transporting flammable liquids. Make sure all flammable and combustible liquids are in unbreakable plastic bottles or PVC-coated glass bottles or transport them in unbreakable bottle carriers.
- Always carry large flammable liquid bottles with one hand underneath the bottle and the other hand around the neck of the bottle. This keeps the bottle closer to your body and decreases the risk of hitting a sharp object like a desk corner.
- If a cart is used to transport hazardous chemicals, place compatible chemicals inside an unbreakable secondary containment vessel, such as a plastic tote. The cart should be equipped with guardrails to prevent plastic totes or bottles from sliding off the cart.
- If hazardous chemicals are moved from one floor to another, use an elevator if possible. Only the teacher transporting the chemicals should be on the elevator. Although elevator accidents are rare, should a dangerous material be released in an elevator while passengers are trapped inside, the results could be catastrophic.

## Flammable Liquid Safety, continued

### Using and Dispensing Flammable Liquids

- If volatile organic solvents are going to be used, the lab must be well ventilated or have a working purge fan to ventilate the lab. The laboratory should also be equipped with one or two ABC, dry chemical fire extinguishers and fire blankets in addition to the other normal safety equipment (safety eyewash, safety shower, etc.).
- Always review the MSDS before using any hazardous material in the laboratory.
- Flammable liquids should not be mixed with strong oxidizing agents. As the organic material is oxidized, heat is evolved and may ignite the material resulting in a fire.
- Extreme care must be taken when using flammable liquids around any heat source, flames, or electrical equipment. Laboratory equipment (stirrers, meters, etc.) are designed to be sparkproof, but limiting vapors is always a good safety precaution.
- Organic vapors are heavier than air and will quickly travel along a lab bench or floor to an ignition source. Never use flammable liquids around an ignition source. Try to minimize the amount of volatile liquids used and be aware that organic vapors can travel great distances.
- Flammable liquids are very volatile. Dispense them in an operating fume hood.
- Use lab mats and/or plastic trays when dispensing organic solvents to contain spills and drips.
- Students should dispense flammable liquids from smaller bottles to limit spills and fumes. Do not allow students to dispense flammable liquids from containers larger than 1 liter. Larger volume containers increase the possibility of contamination and also increase the amount of fuel that will be available in case of a fire.
- During lab, dispense the flammable liquid from a central dispensing location and have students bring a graduated cylinder or test tube to the dispensing area. This will help to minimize spills and accidents as well as limit the amount of flammable liquid being transported back to the lab bench.

#### Dispense flammable liquids in an operating fume hood

- Instruct students to remove only the amount of flammable liquid needed for the experiment from the reagent bottle. Never add chemicals back to reagent bottles.
- Have spill cleanup materials readily available whenever flammable liquids are used. If a spill occurs, immediately restrict unprotected personnel from the area, remove all

ignition sources, and ventilate the area. If the spill is too large to contain, the vapors are overpowering, or ignition sources cannot be completely removed, immediately evacuate the school and call the fire department. If the spill is small, contain the spill with sand or an absorbent material. Depending on the spill material and the amount, allow the spilled material to evaporate off the sand or absorbent material in a fume hood or deposit it in a sealed bag or container.

- Absorbent spill pillows are great absorbents for most organic spills. The pillows quickly absorb 10–20 times their weight, making disposal very easy. (See page 1116.)

### Personal Protective Equipment and Safety Aids

- Consult the MSDS for the specific personal protective equipment required and other safety precautions for the flammable material being used.
- Neoprene rubber gloves are recommended for use when handling organic solvents. Plastic or vinyl gloves will provide some protection against the occasional splash, small spill, and splatter that may occur when using or dispensing solvents.
- Operating eyewashes must be available in any classroom or laboratory where chemicals are used. Approved eyewashes must treat both eyes and provide a stream of clean, potable water for at least 15 minutes.
- Chemical splash goggles must be worn anytime flammable liquids are used. Safety glasses are not adequate protection.
- During demos, it is very important that students wear chemical splash goggles anytime flammable liquids are used. The possibility of an explosion or fire always exists and both students and teachers must be protected. If safety goggles are not available, use a heavy duty safety shield to protect your students.

### First Aid

- Always seek professional medical attention upon exposure to any hazardous chemical, especially volatile organic solvents. For most organic solvents, the major hazards are flammability and inhalation. If there is a spill or accident, immediately remove any flames, heat, or electrical equipment from the area and begin to ventilate the area.

- If an organic liquid is splashed in the eyes, use an eyewash to irrigate the eyes with fresh, potable water for at least 15 minutes. Make sure the eyelids are held open to properly irrigate them. Ask the victim to look up, down, and sideways to better reach all parts of the eye. After using the eyewash, immediately seek professional medical help.
- If a flammable liquid is splashed onto bare skin, rinse the area with cool water for at least 15 minutes. Many organic solvents will "dry out" the skin and cause minor dermatitis. If the liquid causes burns or other skin irritations, seek medical help immediately.
- If a large amount of flammable liquid is splashed onto clothing, consider removing the clothing immediately and placing the clothing in a fume hood or outdoors. If flammable liquid splashes onto your skin and clothing, remove clothing and then begin rinsing the affected areas with water (using the safety shower is ideal).
- If an organic liquid is ingested, please consult the MSDS and immediately call the poison control center (1-800-222-1222) or local hospital emergency room. Follow their directions and seek medical attention as soon as possible. For most organic solvents, the goal is to trap the chemical in the stomach and prevent further injury caused by vomiting. Activated charcoal is sometimes given to help trap the chemical. Do not give the victim anything to drink or induce vomiting unless instructed by a medical professional.

### Disposal

- Consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures governing the disposal of laboratory wastes. For small amounts of most volatile organic liquids, Flinn Suggested Disposal Method #18a, evaporation in an operating fume hood, can be used. For larger amounts, a professional chemical waste disposal firm will have to be used.
- Waste crocks or "slop" buckets are used in many schools for liquid laboratory wastes. Organic wastes should be kept separate from aqueous wastes to prevent any accidental reactions. For organic waste containers, it is best to separate halogenated organic solvents (e.g., methylene chloride) from other organic solvents (e.g., ethyl alcohol) for disposal reasons. Sometimes, volatile organic solvents can be evaporated in a fume hood from the organic waste container. Be sure to label all waste containers with their approximate contents. Dispose of all waste solutions as soon as possible.

