

1. Flammable and Combustible Liquids

Standard operating procedures (SOP) are intended to provide you with general guidance on how to safely work with a specific class of chemical or hazard. This SOP is generic in nature. It addresses the use and handling of substances by hazard class only. In some instances multiple SOPs may be applicable for a specific chemical (i.e., both the SOPs for flammable liquids and carcinogens would apply to benzene). If you have questions concerning the applicability of any item listed in this procedure, contact Vanderbilt Environmental Health or Safety (322-2057) or the Principal Investigator of your laboratory. Specific written procedures are the responsibility of the principal investigator.

If compliance with all the requirements of this standard operating procedure is not possible, the principal investigator must develop a written procedure that will be used in its place. This alternate procedure must provide the same level of protection as the SOP it replaces. Vanderbilt Environmental Health and Safety is available to provide guidance during the development of alternate procedures.

Flammable Liquids:

Flammable liquids are classified as Class I Liquids and are described as any liquid that has a flash point below 100°F (37.8°C). Class I liquids are further classified as follows:

- (a) *Class IA Liquids* — those liquids that have flash points below 73°F (22.8°C) and boiling points below 100°F (37.8°C);
- (b) *Class IB Liquids* — those liquids that have flash points below 73°F (22.8°C) and boiling points at or above 100°F (37.8°C);
- (c) *Class IC Liquids* — those liquids that have flash points at or above 73°F (22.8°C), but below 100°F (37.8°C).

Combustible Liquids:

Combustible liquids are classified as Class II or III Liquids and are described as any liquid that has a flash point at or above 100°F (37.8°C). Combustible liquids are classified as Class II or Class III as follows:

- (a) *Class II Liquid* — any liquid that has a flash point at or above 100°F (37.8°C) and below 140°F (60°C);
- (b) *Class IIIA* — any liquid that has a flash point at or above 140°F (60°C), but below 200°F (93°C);
- (c) *Class IIIB* — any liquid that has a flash point at or above 200°F (93°C).

Training:

All Vanderbilt employees who work with hazardous chemicals must be apprised of the hazards of chemicals present in their work area. This training must be provided before initial assignment and before new exposure situations. Before a lab worker may begin work with Flammable Liquids they must be trained on the lab specific Standard Operating Procedure for these materials.

The primary factors that lab workers need to be trained on in regard to flammable liquids are lower and upper explosive limits, vaporization potential, location of flammable storage cabinets, which chemicals in the lab should be stored in the cabinet and handling precautions for these chemicals.

Securing of gas cylinders:

See Appendix O, section 10

Decontamination procedures:

Wash hands and arms with soap and water immediately following any skin contact with flammable liquids.

Designated area:

Not applicable

Emergency procedure:

Emergency procedures, which address response actions to fires, explosions, spills, injury to staff or the development of sign and symptom of overexposure, must be developed. The procedures should address as a minimum the following:

- Who to contact: University police, and Vanderbilt Environmental Health and Safety, Principal investigator of the laboratory including evening phone number
- The location of all safety equipment (showers, eye wash, fire extinguishers, etc.)
- The method used to alert personnel in nearby areas of potential hazards
- Specific spill control materials required by the type of flammable liquids handled in the laboratory (Student Health Clinic or Occupational Health Clinic should be consulted for first aid procedures).

Eye protection:

Eye protection in the form of safety glasses must be worn at all times when handling flammable liquids. Ordinary (street) prescription glasses do not provide adequate protection and cannot pass the rigorous test for industrial safety glasses. Adequate safety glasses must meet the requirements of the Practice for Occupational and Educational Eye and Face Protection (ANSI Z.87. 1 1989) and must be equipped with side shields. Safety glasses with side shields do not provide adequate protection from splashes. Therefore, when the potential for splash hazard exists, other eye protection and/or face protection must be worn. (Goggles, face shields, etc.)

Eyewash:

Where the eyes or body of any person may be exposed to flammable liquids, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the work area for immediate emergency use. Bottle type eyewash stations are not acceptable.

Glove (dry) box:

Not applicable

Gloves:

Gloves should be worn when handling flammable liquids. Nitrile gloves provide adequate protection against accidental hand contact with small quantities of most laboratory chemicals. However, when larger quantities are handled or regular contact is involved more protective gloves should be used. Lab workers should contact VEHS for advice on chemical resistant glove selection when direct or prolonged contact with flammable liquids is anticipated. A glove assessment chart can be found in Appendix H.

Hazard assessment:

Hazard assessment for work involving flammable liquids should thoroughly address the issues of proper use and handling, fire safety, chemical toxicity, storage, and spill response.

Lab hood:

When possible experiments involving greater than 500 ml of flammable liquids should be carried out in a fume hood.

Labels:

Containers: All flammable liquids must be clearly labeled with the correct chemical name. Handwritten labels are acceptable; chemical formulas and structural formulas or abbreviations are not acceptable.

Protective apparel:

Appropriate lab attire (lab coats, closed- toe shoes and long- sleeved clothing) should be worn when handling flammable liquids. Additional protective clothing should be worn if the possibility of skin contact is likely.

Safety shielding:

Safety shielding is required any time there is a risk of explosion, splash hazard or a highly exothermic reaction. All manipulations of flammable liquids, which pose this risk, should occur in a fume hood with the sash in the lowest feasible position. Safety shielding is required any time there is a risk of explosion, splash hazard or a highly exothermic reaction. Portable shields, which provide protection to all laboratory occupants, are acceptable.

Safety shower:

A safety shower should be available in a nearby location where the flammable liquids are used.

Special storage

The storage of flammable and combustible liquids in a laboratory, shop or building area must be kept to the minimum needed for research and/or operations. The following chart provides guidance on proper storage of flammable and combustible liquids:

Guideline for Maximum Allowable Container Capacity¹

Container Type	Flammable Liquids			Combustible Liquids	
	IA	IB	IC	II	IIIA
Glass	500 mL (1 pt) ²	1 L (1 qt) ²	4 L (1.1 gal)	4 L (1.1 gal)	20 L (5 gal) ³
Metal (other than DOT drums) or approved plastic	4 L (1.1 gal)	20 L (5 gal) ³	20 L (5 gal) ³	20 L (5 gal) ³	20 L (5 gal) ³
Safety cans	10 L (2.6 gal) ³	20 L (5 gal) ³	20 L (5 gal) ³	20 L (5 gal) ³	20 L (5 gal) ³
Metal container (DOT spec.)	4 L (1.1 gal)	20 L (5 gal) ³	20 L (5 gal) ³	227 L (60 gal) ³	227 L (60 gal) ³

	Flammable Liquids			Combustible Liquids	
Polyethylene (DOT Spec. 34, UN 1H1, or as authorized by DOT exemption)	4 L (1.1 gal)	20 L (5 gal) ³	20 L (5 gal) ³	227 L (60 gal) ³	227 L (60 gal) ³
<p>1. This table based upon Table 7.2.3.2 of NFPA 45 Standard for Fire Protection for Laboratories Using Chemicals is based on Table 4.2.3 of NFPA 30, Flammable and Combustible Liquids Code, except for allowable quantities of flammable liquids in metal (DOT specification) drums.</p> <p>2. Exception: Glass containers as large as 4 L (1.1 gal) shall be permitted to be used if needed and if the required purity would be adversely affected by storage in a metal or an approved plastic container, or if the liquid would cause excessive corrosion or degradation of a metal or an approved plastic container.</p> <p>3 In instructional laboratory work areas, no container for Class I or Class II liquids shall exceed a capacity of 4 L (1.1 gal) for ordinary containers and 8 L (2.1 gal) capacity for Listed Flammable Liquids Containers.</p>					

Special ventilation

Manipulation of flammable liquids outside of a fume hood may require special ventilation controls in order to minimize exposure to the material. Ventilation should be non-sparking. Fume hoods provide the best protection against exposure to flammable liquids in the laboratory and are the preferred ventilation control device. Always attempt to handle large quantities of flammable liquids in a fume hood. If your research does not permit the handling of large quantities of flammable liquids in your fume hood, contact Vanderbilt Environmental Health and Safety (VEHS) at 322-2057 to review the adequacy of all special ventilation.

Spill response

Anticipate spills by having the appropriate clean up equipment on hand. The appropriate clean up supplies can be determined by consulting the material safety data sheet. This should occur prior to the use of any flammable liquids. Spill supplies for flammable liquids are designed to control the liquid portion of the spill and minimize the production of flammable vapors. Never use paper towels on large spills of flammable liquids because it exacerbates vapor production. In the event of a spill all personnel in the area should be alerted. Turn off all sources of ignition. Do not attempt to handle a large spill of flammable liquids. Vacate the laboratory immediately and call for assistance.

- Vanderbilt University Police Department (VUPD) 1-1911 or 322-2745.

Remain on the scene, but at a safe distance, to receive and direct safety personnel when they arrive.

Vacuum protection

Evacuated glassware can implode and eject flying glass, and splattered chemicals. Vacuum work involving flammable liquids must be conducted in a fume hood, glove box or isolated in an acceptable manner.

If volatile materials are involved, mechanical vacuum pumps must be protected using cold traps and where appropriate, filtered to prevent particulate release. The exhaust for the pumps must be vented into an exhaust hood. Vacuum pumps should be rated for use with flammable liquids.

Waste disposal

All flammable liquids are hazardous wastes. When ever possible, attempt to design research in a manner that reduces the quantity of waste generated. Questions regarding waste disposal should

be directed to Vanderbilt Environmental Health and Safety (VEHS). This department can also assist you in minimizing waste generation.