

Syracuse University

Laboratory Guidance Document



Flammable Liquids

This Laboratory Guidance Document was created by Syracuse University Environmental Health & Safety Services (EHSS) to assist researchers in developing laboratory specific standard operating procedures for the storage, handling, and disposal of flammable liquids.

Potential Hazards:

Flammable liquids pose a unique fire hazard. Flammable liquids usually have high vapor pressures at room temperature, and their vapors can ignite and burn when mixed with air. As temperature increases, the risk of ignition of these materials also increases.

- Vapors of flammable liquids may be heavier than air and can cause vapor trails that can travel to an ignition source, resulting in a flashback fire.
- Fire can also result from reactions between flammables and oxidizers.
- Flammable liquids may also be classified as acutely toxic, peroxide-forming, or pyrophoric. Safe use requires assessing all potential hazards.
- Flammable liquids commonly used in the laboratory include: acetaldehyde, acetone, benzene, dimethyl sulfide, ethyl alcohol, ethyl ether, hexane, isopropanol, methyl ethyl ketone, toluene, xylenes.

Chemical Properties:

The following chemical properties should be taken into consideration when handling flammable liquids:

1. **Flash Point** is the minimum temperature at which the vapor concentration near the surface of the liquid is high enough to form an ignitable mixture.
 - a. Under the Globalized Harmonized System adopted by OSHA, all liquids with a flash point of not more than 199.4°F (93°C) are categorized as flammable liquids.
2. **Volatility** is the tendency of a liquid to vaporize.
3. **Vapor Pressure** is a measure of volatility. A high vapor pressure usually indicates that the liquid readily vaporizes.
4. **Vapor Density** is a measure of vapor weight compared to air (assigned a value of 1.0).
 - a. Vapors that are heavier/more dense than air (>1.0) sink to floor level while vapors that are lighter/less dense than air (<1.0) rise to the ceiling.
5. **Boiling Point** is the temperature at which the vapor pressure equals atmospheric pressure and the liquid becomes a vapor. In general, a low boiling point indicates a high vapor pressure.
6. **Auto-ignition Temperature** is the minimum temperature at which a vapor-air mixture will ignite without the necessity of a spark or flame.

Hazard Classifications:

The following tables list the National Fire Protection Association (NFPA) hazard classifications for flammable and combustible liquids:

Flammable Liquids			
Class	Flash Point	Boiling Point	Examples
I-A	below 73°F (23°C)	< 100°F (38°C)	diethyl ether, methyl chloride, pentane
I-B	below 73°F (23°C)	≥ 100°F (38°C)	acetone, benzene, ethanol
I-C	73-100°F (23-38°C)	----	p-xylene

Combustible Liquids			
Class	Flash Point	Boiling Point	Examples
II	101-140°F (39-60°C)	----	acetic acid, kerosene
III-A	141-199°F (61-93°C)	----	dimethyl sulfoxide, phenol
III-B	200°F (93°C) or above	----	ethylene glycol, glycerin

General Precautions:

1. Training.

The Principal Investigator is responsible for ensuring all personnel under their supervision are aware of the hazards of flammable liquids, have received appropriate hands-on training, adhere to the laboratory standard operating procedures, and are provided with the appropriate personal protective equipment.

2. Storage.

Safe storage of flammable liquids is imperative to help minimize exposure to ignition sources and the release of flammable vapors.

3. Awareness.

The chemical manufacturer's Safety Data Sheet (SDS) should be consulted for information regarding the chemical properties and firefighting measures.

Personal Protective Equipment (PPE):

In addition to the standard laboratory attire (i.e., long pants and closed toe shoes), the following PPE is recommended:

- ANSI certified (Z87) chemical splash goggles
- Knee-length flame resistant (FR) lab coat
- Chemically compatible gloves

Additional PPE may be necessary based on other hazards present.

Best Practices for the Safe Handling of Flammable Liquids:

1. Review the Safety Data Sheet (SDS), laboratory standard operating procedure (SOP), and emergency procedures before starting any work requiring flammable liquids.
2. Designate a storage area for all flammable liquids such as a flammable rated storage cabinet.
3. Post a hazard warning sign in all storage areas.
4. Remove ignition sources (e.g., open flame, hot surface) in areas where flammable liquids are stored and used.

5. Conduct work involving flammable liquids inside a chemical fume hood. Never leave large volumes of flammable liquids on the benchtop.
6. Use only refrigeration equipment designed for the storage of flammable materials, such as “flammable-safe” refrigerators which have no internal ignition sources (e.g., lightbulb, exposed wiring).

Best Practices for the Safe Handling of Flammable Liquids (cont'd):

7. Keep flammable liquids segregated from incompatible chemicals, such as corrosives and oxidizers.
8. Keep containers closed when not in use to prevent the release of flammable vapors.
9. Ensure that storage containers are in good condition and compatible with the chemical.
10. Transport all flammable liquids in secondary containment.
11. Never heat flammable liquids with an open flame; if flammable liquids must be heated, use a water bath and check the temperature at regular intervals.
12. When heating flammable liquids, ensure that the set temperature is below the auto-ignition temperature of the chemical.

Storage Considerations:

Federal, State, and Local fire codes restrict the volume of flammable liquids that can be stored in a laboratory. Contact Syracuse University Fire and Life Safety Services (FLSS) at 315-443-5474 for more information.

- Procure and store only the smallest practical quantities for the experiment performed.
- Store all flammable liquids inside a flammable rated storage cabinet or refrigerator.
- Place flammable rated storage cabinets in a cool, dry, and well-ventilated area that is away from sparks, temperature extremes, and direct sunlight.

Disposal & Waste Management:

Flammable liquids are not drain disposed. Flammable liquid waste must be stored in a compatible container and labeled with a hazardous waste tag provided by EHSS.

- Ensure the waste container is fitted with a proper screw cap.
- Segregate flammable liquid waste from incompatible chemical wastes.
- Place the waste container in the satellite accumulation area in secondary containment and notify the EHSS Hazardous Waste Group at 315-443-9132 for disposal.

Spill Response:

Only personnel who understand the hazards of flammable liquids and are confident in their ability to safely and properly clean a spill should perform a spill cleanup.

- EHSS and/or laboratory personnel may clean small spills by absorbing the spill with a compatible absorbent then decontaminating the spill area with water.
- EHSS will oversee and direct the cleanup of large spills. Depending on the location and/or severity of the spill, EHSS may seek assistance from an outside emergency response services provider.
- All spill cleanup materials contaminated with flammable liquids, including paper towels and absorbents, should be disposed of as hazardous waste.

Fire Extinguishers:

- Verify a fire extinguisher is present in the lab prior to working with flammable liquids.
- In the event of a fire, or emergency, immediately contact DPS.

- Only use a fire extinguisher if you have been trained and feel comfortable doing so.

First Aid:

The chemical's SDS should be readily available and used as a reference for determining appropriate first aid measures. The following information provides typical first aid measures recommended for chemical exposures.

1. **Skin Contact:** Remove all contaminated clothing and rinse affected area with water for at least 15 minutes.
2. **Eye Contact:** Flush with water at an emergency eyewash station for at least 15 minutes.
3. **Ingestion:** Seek medical attention immediately.
4. **Inhalation:** Move to fresh air and seek medical attention immediately.

Incident Response:

All laboratory emergencies must be reported to the Department of Public Safety at 315-443-2224.

Additional Resources:

1. National Fire Protection Association: [Codes and Standards](#)