HARVARD
Campus Services
ENVIRONMENTAL HEALTH & SAFETY

Laboratory Safety Guideline

Diethyl Ether (1,1'-oxybis-ethane; ethyl ether; ether)

[CAS No. 60-29-7]

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Overview

This document outlines minimum expectations for use of diethyl ether (also known as ether or ethyl ether) in Harvard labs. Departments or labs may choose to implement more stringent requirements for those operating in their spaces.

Ether is commonly used as a lab solvent and has a sweet odor. It is extremely volatile, flammable, may be ignited by heat sources such as hot plates, and may form potentially explosive peroxides.

Hazards

Hazard Symbol	Hazard Description
	Ether is an extremely flammable liquid and vapor. The boiling point for ether is 34 degrees Celsius (°C) and 93.2 degrees Fahrenheit (°F), and it readily volatilizes. The flash point is -45 °C (-49 °F). This is the lowest temperature at which ether vapor can ignite when exposed to an ignition source. The auto-ignition temperature is 180 °C (356 °F). Ether can form potentially explosive peroxides. To reduce the risk of peroxide formation, purchase ether that has an added inhibitor or stabilizer when possible.
	Ether is harmful if swallowed, may cause drowsiness or dizziness, and may cause eye irritation. It is critical that users limit their exposure to ether vapors.

Training

Lab personnel working with ether must complete applicable EHS training and keep it up to date.

- General Lab Safety: Renewed annually.
- Laboratory Safety Orientation Checklist: Completed for each lab a person works in and kept on file by the lab.

In addition, ether users and those working in spaces where this chemical is used should review this document and be familiar with emergency procedures.

Precautions

Personal Protective Equipment

Proper personal protective equipment (PPE) and attire are important whenever working with hazardous chemicals. Each space should have a lab-specific PPE Assessment posted for reference by lab users.

The following table outlines basic requirements. More information can be found on the EHS Lab PPE webpage.

PPE Type	Requirement
Attire	Wear a combination of clothing and shoes that fully cover the legs and feet.
Eye and Face Protection	Wear safety glasses with side shields at a minimum. Use chemical splash goggles when there is a greater risk of splashes and for spill cleanup. A face shield over safety goggles may be needed when working with larger volumes or where there is a greater splash risk.

PPE Type	Requirement
Gloves	Wear compatible chemically-resistant gloves when handling potentially hazardous chemicals. At a minimum, wear nitrile gloves when handling ether. Change immediately if gloves come in contact with ether. For spill cleanup, work with larger volumes, or where there is a greater splash hazard, wear Teflon or polyvinyl acetate (PVA) gloves. Glove compatibility with other chemicals used in combination with ether must also be considered. Refer to each chemical's Safety Data Sheet (SDS) and the EHS Lab Glove Selection Guide for help identifying compatible gloves.
Lab Coat	Lab coats are required when handling ether, such as when carrying stock bottles or taking hazardous waste to a mini-main accumulation area.
Respiratory Protection	Respiratory protection should not be needed if using engineering controls such as fume hoods or local exhaust ventilation. If work with ether is conducted without engineering controls, contact EHS for an assessment.

Before Starting Work

- Determine if a less hazardous substance can be used instead of ether.
- Review the manufacturer's SDS and additional chemical safety information available on the EHS website.
- Ensure all bottles have a peroxide-former tag on them. These are available through the Chemical Waste Pickups and Services form.

- Test for peroxide formation periodically and before distillation, regardless of whether stabilizers are present.
    - Ether is a Class B peroxide former. For this class, test every 3 months if it is at least 6 months after receipt of the bottle or is past the manufacturer's expiration date.
    - Use peroxide testing strips, which can be purchased through VWR. Follow the manufacturer's guidelines for using and storing the testing strips, which have a limited shelf life.
    - Any detected level of peroxides is considered unsafe. Dispose of any containers that test positive for peroxides, regardless of level.
- Be familiar with the general University emergency procedures in the EHS Lab Emergency Response Guide.
- Identify the location of the nearest eyewash and shower and verify that they are accessible.
- Locate and verify that appropriate spill cleanup materials are available.

During Work

- **Avoid inhaling ether!** Perform operations in a certified chemical fume hood or other approved ventilated enclosure when possible. Keep sash lowered as much as possible. Always work at least 6 inches into the fume hood and behind the sash.
- **Avoid any contact with ether!** Wear PPE as outlined in the PPE section of this document.
- Keep all containers tightly closed when not in use and during transport.
- Be aware of potential incompatibilities, such as strong oxidizers, halogens, and sulfur and sulfur compounds.
- Use materials and containers appropriate for ether, such as glass.
- Wash hands and forearms thoroughly with soap and water each time gloves are removed.

After Completing Work

General Guidance

- Clean work area.
- Wash hands and forearms thoroughly with soap and water before leaving the lab.

Storage

Return ether and other chemicals to appropriate storage following the Lab Chemical Storage Guide.

- Store ether in its original container in a flammable storage cabinet, tightly sealed, and protected from light, moisture, and air.
- Store ether away from incompatible materials, including but not limited to strong oxidizers, halogens, and sulfur and sulfur compounds.
- If storing ether cold, it must be placed in a flammable storage refrigerator or freezer. Do not place in a standard refrigerator or freezer or in a cold room.

  Note that peroxide formation may be enhanced by refrigeration because the rate of peroxide degradation is slowed more than the rate of peroxide formation, leading to more rapid accumulation of peroxides in solution. Cooling may also cause the precipitation of peroxides from solution.

Ether can form peroxides over time when exposed to oxygen and light. Labs should follow the procedures outlined in Laboratory Safety Guideline: Peroxide-Forming Chemicals.

Outline of key points from Laboratory Safety Guideline: Peroxide-Forming Chemicals:

- Unopened containers may be stored until the manufacturer's expiration date, if they are stored appropriately, not used, and are frequently inspected for peroxide formation. If the chemical doesn't have a manufacturer's expiration date, store for up to 6 months after date received.

- Opened containers can be stored for 6 months, or up to the manufacturer's expiration date. They may be kept after 6 months or the expiration date if they are tested every 3 months starting at the 6-month mark and they remain peroxide-free.
- All containers must have a peroxide-former tag, available through the Chemical Waste Pickups and Services form.
- Follow directions from the peroxide test strip manufacturer when testing for peroxide formation.
- Routinely check for signs of peroxide formation. If any of the listed indicators are observed, avoid additional testing or handling and contact EHS immediately. Do not move or disturb the container if there is any question regarding the presence of peroxides.

  Indicators include:

  - Suspended wisp-like structures in liquid.
  - Precipitated crystal formation appearing as chips, ice-like structures, or solid mass.
  - Appearance of cloudiness.
  - Gross contamination.
  - White crystals under the rim of the cap.
  - Visible discoloration.
- Never return ether to its original storage container once withdrawn.
- Distillation of a stabilized solvent will remove the stabilizer. As a result, the distillate must be stored with care and closely monitored for peroxide formation.

Waste Disposal

Dispose of ether-containing waste following standard Hazardous Waste Procedures.

- Mark “ignitable” as the chemical hazard on the waste tag. Other chemicals in solutions may have additional hazards.
- Keep the peroxide-former tag on the bottle in addition to the waste tag.
- Contact EHS if greater than 50 ppm of peroxides are detected. Above this level requires special waste procedures.

Emergency Procedures

Refer to the Lab Emergency Response Guide and the information outlined in this section.

Notify PI or supervisor of any exposures or incidents involving ether. The PI or their designee must report all exposures or injuries within 24 hours.

First Aid

- For serious medical emergencies, go to the closest emergency room or call 911.
- For non-emergency medical attention following lab exposures, contact the Exposure Response Call Center (ERCC) hotline at 1-866-360-8100.

Skin Contact

Treatment starts immediately following exposure.

- Remove all potentially contaminated clothing and jewelry.
- Flush affected skin area using sink if on hands or arms or safety shower for 15 minutes.
- Follow up with the ERCC at 1-866-360-8100 for minor skin exposure. Call 911 for major skin exposure.

Eye Contact

- Rinse eyes at an eyewash station for at least 15 minutes.
- Follow up with the ERCC at 1-866-360-8100.

Inhalation

- Move person to a location with fresh air.
- Follow up with the ERCC at 1-866-360-8100.

Ingestion

- Do not induce vomiting if ether is swallowed.
- Never give anything by mouth to an unconscious person.
- Call 911 for medical assistance.

Sharps Injury

- Immediately wash the area with soap and water for at least 15 minutes.
- Follow up with the ERCC at 1-866-360-8100.

Spill Response

Spills outside fume hood or ventilated enclosure:

- Alert others of the spill.
- Turn off ignition sources near spill, if this can be done safely.
- Evacuate to a safe distance and prevent entry.
- Contact the Operations Center by calling 617-495-5560. HMS and HSDM labs should call 617-432-1901.

- Remain in a safe location until EHS or other response personnel arrive.

Spills inside fume hood or ventilated enclosure less than 500 mL:

- A person may assist in the cleanup effort of small amounts of ether if trained and comfortable doing so.
- Wear PPE described in the Personal Protective Equipment section and use appropriate spill supplies.
- If possible, put the fume hood into emergency purge.
- Collect debris in appropriate container and move to the Satellite Accumulation Area (SAA).
- Label container with appropriately completed hazardous waste tag.
- Request a waste pickup.

Otherwise close the fume hood sash and contact the Operations Center by calling 617-495-5560. HMS and HSDM labs should call 617-432-1901.

Fire

- In the event of fire, evacuate and bar further entry.
- Activate the fire alarm and leave the building.
- Once at a safe location, call 911 to notify them of the nature of the alarm.

Supporting Documents

- Laboratory Safety Guideline: Peroxide-Forming Chemicals
- PubChem Diethyl Ether Laboratory Chemical Safety Summary (LCCS)