



## Diethyl ether

### ***Principal Investigator (PI) Approval is Required Prior to Performing this Procedure***

#### **Description**

*This standard operating procedure outlines the handling and use of diethyl ether. Review this document and supply the information required in order to make it specific to your laboratory. In accordance with this document, laboratories should use appropriate controls, personal protective equipment, and disposal techniques when handling diethyl ether.*

Diethyl ether is commonly used as a solvent and for liquid-liquid extraction. Diethyl ether is highly flammable and must be kept away from heat/sparks/open flames/hot surfaces. Avoid breathing vapor. Diethyl ether may form explosive peroxides.

#### **Location**

Open and dispense diethyl ether in a fume hood and store in appropriate area like inside a flammable liquid storage cabinet.

#### **Potential Hazards**

- Diethyl ether is highly volatile and extremely flammable as a liquid or vapor. It is considered one of the most dangerous fire hazards commonly used in the lab due to its volatility and extremely low ignition temperature.
- Diethyl ether will spontaneously ignite at temperatures at or above 160°C (320°F).
- Diethyl ether vapor forms explosive mixtures in air at concentrations of 1.9-36% by volume.
- Diethyl ether may react violently with halogens or strong oxidizers (e.g. perchloric acid, nitric acid).
- Diethyl ether can form explosive peroxides upon storage in contact with air. This reaction is promoted by light.
- Inhalation of high concentrations of ether vapor can result in sedation, unconsciousness, and respiratory paralysis.
- Diethyl ether is mildly irritating to the eyes and skin. Repeated skin contact can result in dryness and cracking due to removal of skin oils.
- Chronic exposure to ether vapors can lead to loss of appetite, exhaustion, dizziness, drowsiness, and other central nervous system effects.
- The MIOSHA Permissible Exposure Limit (PEL) and ACGIH Threshold Limit Value (TLV) are both 400 ppm as an 8-hour time-weighted average and 500 ppm as a 15-minute short term exposure limit (STEL).
- For more in-depth information, refer to Prudent [Practice's Laboratory Chemical Safety Summary](#) for diethyl ether.

#### **Occupational Exposure Limits (OELs):**

- MIOSHA and ACGIH: **400 ppm Ethyl ether, 8-hour TWA**
- MIOSHA and ACGIH: **500 ppm Ethyl ether, 15- minute STEL**

## Engineering Controls

All work with diethyl ether should be done in a chemical fume hood because of its high volatility. Provide exhaust ventilation or other engineering controls to minimize the airborne concentrations of vapors. Ensure that eyewash stations and safety showers are proximal to the work-station location.

## Work Practice Controls

- Maintain the smallest amount necessary for ongoing work. Use in the smallest practical quantities for the experiment being performed.
- Never open a dented or otherwise compromised container of ether.
- Purchase diethyl ether with inhibitors added (to help reduce peroxide formation) when possible.
- Due to its peroxide-forming hazard, ether containers should be dated upon receipt and at the time they are opened. If tested, note the date it was tested.
- Periodically test ether containers with peroxide test strips.
- Do not allow to evaporate to near dryness unless absence of peroxides has been shown.
- Consult the SDS to determine how long an opened container can be used safely, and dispose of unused amounts after that period of time has passed (or if peroxides are found to be present by testing).
- Know the location of the nearest fire extinguisher before beginning work.
- Eliminate ignition sources such as open flames, hot surfaces, steam baths, and operation of mechanical and electrical equipment that is not intrinsically safe.
- Ensure proper grounding and avoid creating static electricity. Be sure to ground metal containers when transferring flammable liquids.

## Personal Protective Equipment (PPE)

- Wear chemical protective gloves (i.e. PVA, 8 nitrile), lab coat, respirator (only when the concentration of vapor in the breathing zone exceeds the PEL) and safety glasses for all work with diethyl ether. If a splash may occur, chemical splash goggles must be worn.
  - Note: Respirators are masks designed to protect the wearer from specific airborne hazards and are different from surgical masks, which protect the wearer only from splashes and are primarily intended to protect others from infectious aerosols exhaled by the wearer. Respirator use requires employee participation in the Respiratory Protection Program, which involves medical clearance and annual fit testing and training. Contact Environment, Health and Safety (EHS) at (810) 766-6763 for questions regarding respirator usage.

## Transportation and Storage

- Keep container in a cool (below 30°C; 86°F), well-ventilated area.
- Transport diethyl ether in secondary containment, preferably a polyethylene or other non-reactive acid/solvent bottle carrier.
- Diethyl ether should be stored with other flammables. Do not store ether near halogens or strong oxidizing agents.
- Diethyl ether must be stored in an air-impermeable container and placed in a dark area to prevent further promotion of the peroxide-forming reaction.
- Suitable fire control devices (such as fire extinguishers) must be available at locations where flammable or combustible liquids are stored. Contact University of Michigan-Flint's Department of Public Safety (DPS) at (810) 762-3333 if additional fire extinguishers are needed in your area. You may also consult with EHS at (810) 766-6763.
- Avoid contamination with oxidizing agents, i.e. nitrates, oxidizing agents, chlorine bleaches, pool chlorine, etc., as ignition may result.

- Avoid storing diethyl ether on the floor.
- Consult EHS at (810) 766-6763 for further information on storage (including allowed quantities) and transport of flammable substances.
- Flammable liquids shall not be stored in unapproved or residential-type refrigerators.

### Waste Disposal

- Contact EHS at (810) 766-6763 immediately to arrange for pick-up and disposal if:
  - (1) crystals are found around the lid of an ether container (do NOT open the container!) or
  - (2) the container tests positive for peroxides.

Handle and store hazardous waste following the guidelines above for work practice controls, transportation and storage. Contact EHS at (810) 766-6763 for waste containers, labels, manifests, waste collection and for any questions regarding proper waste disposal. Also refer to UM-Flint Hazardous Waste Management Program and EHS webpage <http://www.umflint.edu/ehs/environment-health-and-safety> for more information.

### Exposures/Unintended contact



*If the employee is in need of emergency medical attention, call 911 immediately.*



For an actual chemical exposure/injury:

- Remove contaminated clothing. Flush exposed eyes or skin with water for at least 15 minutes. Seek medical attention (see below).
- For situations with risk of inhalation exposure, remove all persons from the contaminated area.
- If an ambulance is needed, call UM-Flint DPS at 911 from a university telephone or at (810) 762-3333 from cell phone or non-university telephone to request assistance.

Contact EHS for advice on symptoms of chemical exposure, or assistance in performing an exposure assessment.

Report all work related accidents, injuries, illnesses or exposures to UM-Flint DPS. Additionally, employees and supervisors must be sure to report the injury to EHS and complete and submit the [Illness and Injury Report Form](#) to WorkConnections within 24 hours. Follow the directions on the WorkConnections website [Forms Instructions](#) to obtain proper medical treatment and follow-up.

If you were involved in or observed an incident or near miss, please complete the [EHS Laboratory Incident and Near-Miss Report Form](#). This will be valuable in improving laboratory safety on UM-Flint campus.

## TREATMENT FACILITIES:

MAJOR INJURIES	MINOR INJURIES –During Business Hours	MINOR INJURIES –After Business Hours
<b>Genesys Hospital</b> One Genesys Parkway Grand Blanc, MI 48439 (810) 606-5710  <b>Hurley Medical Center</b> One Hurley Plaza Flint, MI 48503 (810) 262-9000  <b>McLaren Hospital Flint</b> 401 South Ballenger Hwy Flint, MI 48532 (810) 342-2000	<b>Genesys Occupational Health Network</b> 1460 Center Rd. Burton, MI 48509 (810) 715-4620 Mon. to Fri. 7:30 am to 10 pm Sat. & Sun. Noon to 8 pm  <b>McLaren Flint-Burton OCC Center</b> 1459 S. Center Rd. Burton, MI 48509 (810) 496-0900 Mon. - Fri. 8 am to 8 pm Sat & Sun 10 am to 2 pm	<b>Downtown Flint</b> 420 S. Saginaw St. Flint, MI 48502 (810) 762-1550  <b>Genesys East</b> 1096 S. Belsay Rd, Suite F Burton, MI 48509 (810) 743-3351  <b>Genesys North</b> 4154 W. Vienna Rd Clio, MI 48420 (810) 686-7397  <b>Genesys South</b> 8447 N. Holly Rd Grand Blanc, MI 48439 (810) 603-0856 Mon. - Fri. 6 to 10pm / Sat. & Sun. 1-10pm

Click [here](#) for more information on the UM – Flint Emergency Preparedness and Response Plan.

### Spill Procedure

- When a spill occurs, ***personal safety should always come first.***
- Alert and clear everyone in the immediate area where the spill occurred.
- Spills of ether inside a chemical fume hood, or small spills outside a hood may be cleaned by laboratory personnel. Since ether is a peroxide-forming material, do not allow clean-up materials to dry – seal them inside a compatible container. Only use non-flammable absorbents to absorb spills. Call EHS at (810) 766-6763 immediately for pick-up of spill clean-up materials.
- **If any large diethyl ether solution is spilled, leave the lab and call UM-Flint DPS at 911 to request assistance from EHS.** Do not take any action to cover the spill. Post a warning on the lab and do not allow others to enter. Have a person available that has knowledge of the incident and laboratory to assist emergency personnel.

### Additional Spill Links:

- [www.oseh.umich.edu/pdf/chemspil.pdf](http://www.oseh.umich.edu/pdf/chemspil.pdf)
- <http://www.oseh.umich.edu/emer-chemical.shtml>.

Report all emergencies, suspicious activity, injuries, spills, and fires to the UM-Flint Department of Public Safety (DPS) at 911 from any university telephone or (810) 762-3333 from cell phone or non-university telephone. Register with the [University of Michigan-Flint Emergency Alert System](#) via Wolverine Access. Also, preprogram the UM-Flint DPS telephone number (810) 762-3333 into your cell phone for quick, easy use.

**Training of Personnel**

All personnel are required to complete Laboratory Safety Training. Documentation of the training is required. This training can be accomplished by completing the **Comprehensive Laboratory Safety** session (**BLS009** or equivalent) via [MyLINC](#), or UM-Flint EHS on-line training or other equivalent approved by EHS. Furthermore, all personnel shall read and fully adhere to this SOP when handling diethyl ether.

**Certification**

I have read and understand the above SOP. I agree to contact my Supervisor or Lab Manager if I plan to modify this procedure.

Name	Signature	UM ID #	Date

Principal Investigator \_\_\_\_\_

Revision Date \_\_\_\_\_