Tetrahydrofuran (THF) Standard Operating Procedure

Revision: August 17, 2022

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This standard operating procedure (SOP) outlines the handling and use of THF. 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 THF. All laboratory workers must read and understand the Laboratory Emergencies SOP prior to commencing any work in a laboratory.

Description [Provide additional information as it pertains to your research protocol]

THF (CAS #109-99-9) is a colorless, **highly flammable** liquid with an ether-like odor that can be detected as low as 4 ppm (odor threshold).

It is used in industry primarily as a solvent for various polymers, resins and also used in rubber production, cellophane, adhesives, magnetic tapes and printing inks. It is also an industrial solvent for PVC, is used in varnishes and to degrease metal parts. It is a moderately polar solvent and can dissolve a wide range of nonpolar and polar chemical compounds.

THF is often used in polymer science, e.g., to dissolve polymers prior to determining their molecular mass using gel permeation chromatography and as a component in mobile phases for reversed-phase liquid chromatography. THF is a popular solvent when a moderately higher-boiling ethereal solvent is required and its water miscibility is not an issue.

⚠ **THF is capable of forming explosive peroxides.** ⚠

Also, refer to the Environment, Health & Safety (EHS) Peroxide Forming Materials SOP.

Synonyms include: Diethylene oxide; 1,4-Epoxybutane; Tetramethylene oxide; THF; Oxacyclopentane.

Useful THF Links:

- *CDC NIOSH Tetrahydrofuran*
- Prudent Practices in the Laboratory: Handling and Disposal of Chemicals (1995)

Process [Write the steps for using the chemical in your research protocol]

Potential Hazards [Provide additional information as it pertains to your research protocol]

- THF is ***highly flammable***. Its vapor can travel a significant distance through the air to an ignition source and flash back.
- A 5% solution of THF in water is flammable. THF vapors may form explosive air mixtures at concentrations

of 2-12% by volume.
- When exposed to air, THF may form explosive peroxides if concentrated by distillation or evaporation. Light exposure may also exacerbate peroxide formation.
- THF may react violently with strong oxidizers.
- THF is a severe eye irritant and skin irritant. Prolonged or repeated eye exposure may cause conjunctivitis; prolonged skin contact can cause defatting and dermatitis.

Occupational Exposure Limits (OELs)

- MIOSHA: **200 ppm, 8-hour** PEL
- MIOSHA: **250 ppm, 15-minute** STEL

Engineering Controls **[Provide additional information as it pertains to your research protocol]**

All work with THF should be done in a well-ventilated area. Work with large volumes or concentrated THF **must** be done within the fume hood.

Work Practice Controls **[Provide additional information as it pertains to your research protocol]**

- Eliminate ignition sources such as open flames, hot surfaces, steam baths, and operation of mechanical and electrical equipment that is not intrinsically safe.
- Keep container closed when not in use to minimize creation of flammable vapor concentrations.
- Ensure proper grounding and avoid creating static electricity. Be sure to ground metal containers when transferring flammable liquids.
- 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 THF.**
- **Purchase THF with inhibitors added (for peroxide-forming) when possible.**
- **Due to its peroxide-forming hazard, THF containers must be dated upon receipt and at the time they are opened. If tested, note the date it was tested.**
- Periodically test THF containers with peroxide test strips.
- **Do not allow to evaporate to near dryness unless absence of peroxides has been shown.**
- Consult THF's 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.

Personal Protective Equipment **[Provide additional information as it pertains to your research protocol]**

In order to select the appropriate PPE for the workplace, a Hazard Assessment is conducted. The hazard assessment determines the hazards and potential hazards associated with a task, machinery, or process. The appropriate PPE for the situation may be subsequently determined.

For more information, view the Hazard Assessment Form. It may be completed either by the workplace supervisor or the department's EHS representative.

- Recommended gloves include Polyvinyl alcohol (PVA), Teflon, or 4H/Silver Shield brand (Norfoil). Butyl or

natural rubber offer short term protection and should be removed and discarded when material is spilled on them.

NOTE: THF permeates standard nitrile laboratory gloves in less than one minute and neoprene or latex in less than 2 minutes; thus, tasks should be planned to minimize glove contact with THF. If gloves become contaminated, change your gloves and wash your hands immediately to avoid skin exposure.

- Lab coat, long pants, closed toe shoes and safety glasses (ANSI/ISEA Z87.1 approved) for all work with THF. If a splash may occur, chemical splash goggles and a face shield **must** be worn.
- The EHS Glove Compatibility webpage can also be used to determine the recommended gloves.
- Review THF's SDS for more information.

Transportation and Storage **[Provide additional information as it pertains to your research protocol]**

- Transport THF in secondary containment, preferably a polyethylene or other non-reactive acid/solvent bottle carrier.
- THF should be stored with other flammables. Do not store THF near strong oxidizing agents, acids, bases, or organic alkali compounds.
- THF 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 U-M's Fire Extinguisher Shop at (734) 647- 2059 for installation of appropriate devices.
- Open flames shall not be permitted in flammable or combustible liquid storage areas.
- Avoid storing THF on the floor.
- Store THF protected from moisture.
- Containers should be dated when opened and tested periodically for the presence of peroxides.
    - Testing Frequency, Inhibited: 12 months
    - Testing Frequency, Uninhibited: 3 months

Should crystals form in a peroxidizable liquid, peroxidation may have occurred and the product should be considered extremely dangerous. In this instance, the container should only be opened remotely by professionals. All peroxidizable substances should be stored away from heat and light and be protected from ignition sources.

Waste Disposal **[Provide additional information as it pertains to your research protocol]**

Contact EHS Hazardous Materials Management (HMM) at (734) 763-4568 immediately to arrange for pick-up and disposal if one of the following scenarios are noted:

- Crystals are found around the lid of a THF container. **Do NOT attempt to open the container!**
- The container tests positive for peroxides.

Because most spent, unused, and expired chemicals/materials are considered hazardous wastes, they **must** be properly disposed of. **Do not dispose of chemical wastes by dumping them down a sink, flushing in a toilet or**

discarding in regular trash containers, unless authorized by EHS Hazardous Materials Management (HMM). Contact EHS-HMM at (734) 763-4568 for waste containers, labels, manifests, waste collection and for any questions regarding proper waste disposal. Also, refer to the EHS Hazardous Waste Web page for more information.

Training of Personnel

All personnel shall read and fully adhere to this SOP when handling THF.

References

- NIOSH Pocket Guide to Chemcial Hazards. n.d. 22 April 2022.
- "Prudent Practices in the Laboratory: Handling and Disposal of Chemicals." Washington, DC: The National Academies Press, 1995. 402.
- PubChem Compound Summary for CID 8028, Tetrahydrofuran. n.d. 22 April 2022.

Certification

I have read and understand the above SOP. I have received approval from my Lab Director to perform this procedure. I agree to contact my Lab Director if I plan to modify this procedure.

Name	Signature	UMID #	Date

Laboratory Director **Revision Date**

Revision History (Do not print as part of SOP)		
04/22/2022	Partial Revision	Updated links, added peroxide testing frequency, removed old SDS link, added references (RSH)
05/15/2020	Partial Revision	Updated editing rights to headings (RSH)
03/04/2019	Link Update	Updated links and format (DML).
04/24/2018	Partial Revision	Changed injury type and action from paragraph to table format (AKJ).
04/09/2018	Partial Revision	Revised formatting (AKJ).
03/26/2018	Partial Revision	Put into EHS format, changed department name, and fixed links. Revised Spill Procedure section (AKJ).