

1. IDENTIFICATION

Name:	Tetrahydrofuran
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- *Synonyms:* 1,4-epoxybutane, diethylene oxide, tetramethylene oxide, butylene oxide, cyclotetramethylene oxide, THF
- Product Uses: Solvent in coatings, adhesives, inks, etc.

SupplierMegaloid Laboratories LimitedIdentifier:5515 North Service Road # 306Burlington, ON L7L 6G4

EMERGENCY INFORMATION: Call CHEMTREC - (800) 424-9300 (CCN# 693764)

GHS Class	flammable liquid	acute oral	eye damage	carcinogenic	STOT	STOT
(category)	(2)	(4)	(1)	(2)	(3)	(3)
Signal Word	DANGER					
Hazard Statements	highly flammable liquid & vapour (H225)	harmful if swallowed (H302)	causes serious eye damage (H318)	suspected of causing cancer (H351)	may cause respiratory irritation (H335)	may cause drowsiness or dizziness (H336)
	Hazardous	Pictograms				

2. HAZARD INDENTIFICATION

GHS Precautiona	ary Statements for Labelling
Prevention:	
P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P210	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P233	Keep container tightly closed
P240	Ground and bond container and receiving equipment.
P241	Use explosion-proof equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P261	Avoid breathing fume/gas/mist/vapours/spray.
P264	Wash hands and skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P280	Wear protective gloves/protective clothing/eye protection/face protection.
Response:	
P301+P312	IF SWALLOWED: Call a POISON CENTRE or doctor if you feel unwell.
P303 + P361 + P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water (or shower).
P304 + P340	IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308 + P313	IF exposed or concerned: Get medical advice or attention.
P330	Rinse mouth.
P370 + P378	IN CASE OF FIRE: Use appropriate foam, dry chemical powder to extinguish, water spray or fog to cool.
Storage:	
P403+P233	Store in a well-ventilated place. Keep container tightly closed.
P403 + P235	Store in a well-ventilated place. Keep cool.
P405	Store locked up.
Disposal:	
P501	Dispose of contents and container in accordance with local, regional, national and international regulations.

3. COMPOSITION / INFORMATION ON INGREDIENTS

Chemical Name:	CAS No.	%	Other Identifiers
Tetrahydrofuran	109-99-9	99%	EC #203-726-8

NOTE: May contain up to 0.5% (total) alcohols – eg: methanol, 2-propanol, & up to 0.5% (total) of other organic solvents, plus 250-400ppm BHT inhibitor. *

4. FIRST-AID MEASURES

Inhalation

Remove from contaminated area promptly. **CAUTION: Rescuer must not endanger himself**! If breathing stops, administer artificial respiration and seek medical aid promptly.

Skin Contact

Wash with plenty of water. Remove contaminated clothing and do not reuse until thoroughly laundered.

Eye Contact

Wash eyes with plenty of water, holding eyelids open. Seek medical assistance if there is any irritation.

Ingestion

Give plenty of water to dilute product. Do not induce vomiting. Keep victim quiet. If vomiting occurs, lower victim's head below hips to prevent inhalation of vomited material. Seek medical help promptly.

Most important symptoms and effects, both acute and delayed

Not expected to be a hazard in normal industrial use. Repeated or prolonged contact may cause defatting and drying of skin which may result in skin irritation and dermatitis. May irritate skin. Inhalation may cause irritation of the respiratory passages, headache, weakness, temporary nervous system depression with anesthetic effects such as dizziness, headache, confusion, incoordination and loss of consciousness. May cause severe eye irritation.

Notes to physician

Treat symptomatically

First-aid Comments

Inadvertent inhalation of vomited material may seriously damage the lungs. The danger of this is greater than the risk of poisoning through absorption of this relatively low-toxicity substance. The stomach should only be emptied under medical supervision, and after the installation of an airway to protect the lungs.

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media

Foam, dry chemical, water fog, water spray only to cool & dilute, product floats on water - water jet spreads flames.

Unsuitable Extinguishing Media

No data available

Specific Hazards Arising from the Product

Carbon monoxide, nitrogen oxides, smoke, part oxidised hydrocarbon fragments.

Special Protective Equipment and Precautions for Fire-fighters

Firefighters must wear SCBA Full Bunker Gear

Static Charge Accumulation

Readily accumulates a static charge on agitation or pumping.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Restrict access to area until completion of cleanup. Ensure cleanup is conducted by trained personnel only. Do not touch damaged containers or spilled product unless wearing appropriate protective equipment. Ventilate area. Extinguish or remove all ignition sources. Notify government occupational health and safety and environmental authorities. Eliminate all ignition sources if safe to do so.

Methods and materials for containment and cleaning up

Leak Precaution: dyke to control spillage and prevent environmental contamination handling Spill: ventilate contaminated area; recover free liquid with suitable pumps; absorb residue on an inert sorbent, sweep & pick up using plastic or aluminium shovel, & store in closed containers for recycling or disposal.

Environmental Precautions

It is good practice to prevent releases into the environment. Do not allow into any sewer, on the ground or into any waterway. If the spill is inside a building, prevent product from entering drains, ventilation systems and confined areas.

Serious Fire Potential: as a precaution against accidental ignition. Take extreme c

blanket spill with foam as a precaution against accidental ignition. Take extreme care to avoid sparks – do not operate (turn on OR off) electrical appliances near spill, unless explosion proof.

7. HANDLING AND STORAGE

WHEN FILLING STORAGE TANKS WITH TETRAHYDROFURAN, IN ADDITION TO NORMAL GROUNDING PROCEDURES, READ THE FOLLOWING:

This product may form an explosive mixture inside a bulk storage tank. Prior to filling a bulk storage tank with this product, consider filling the headspace with nitrogen. In addition, consider asking the supplier to put an anti-static additive in the product when you order. If the bulk tank has a floating level indicator, **this must be inspected regularly.** The float must have a fixed ground wire, **not a chain** connecting it to its support cable. This connection must be free of corrosion.

Consult NFPA 77, 2007: "Recommended Practice on Static Electricity" <u>http://www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=77</u>

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Precautions for Safe Handling

Keep cool, away from sources of ignition, heat & oxidising agents. Keep drums out of direct sun! Always use non-sparking bronze or aluminium hand tools. *All electrical & mechanical equipment (including lighting, switchgear & forklift trucks) used around this product must be explosionproof.* This product may accumulate a static charge; ground or electrically bond the source container, receiving container & transfer pump before transferring. Avoid splashing; ensure the product nozzle is below the surface in the receiving container.

This product may react with oxygen in the air to form explosive or flammable peroxides*. (An oxidation inhibitor may be added to suppress this.) Never distil THF to dryness – this may concentrate any peroxides present to become an explosion hazard. Ensure that containers are full & tightly sealed. If prolonged storage anticipated, flush headspace with dry nitrogen gas prior to sealing. Empty containers may contain a flammable or explosive vapour.

Avoid breathing product vapour. Use with adequate ventilation. If dealing with a spill, and ventilation is impossible or impractical, wear a suitable respirator with an organic vapour cartridge.

Never cut, drill, weld or grind on or near this container. Avoid contact with skin and wash work clothes frequently. An eye bath and safety shower must be available near the workplace.

* During prolonged storage tetrahydrofuran should be tested frequently for peroxides with starch-iodide paper. Accumulated peroxides can be removed from tetrahydrofuran using methods described in: Bretherick, L. Bretherick's handbook of reactive chemical hazards. 4th ed. Butterworths 1990. p466-468, 1746-1750

Conditions for Safe Storage

Store in an area that is: cool, well-ventilated, out of direct sunlight and away from heat and ignition sources.

8. EXPOSURE CONTROL / PERSONAL PROTECTION

Ontario TWAEV ACGIH TLV OSHA PEL	50ppm / 145mg/m ³ (skin) 50ppm / 145mg/m ³ (skin) 200ppm / 580mg/m ³ (skin)	Ontario STEV ACGIH STEL OSHA STEL	100ppm / 290mg/m ³ 100ppm / 290mg/m ³ 250ppm / 725mg/m ³
Ventilation	mechanical ventilation may be requ	ired to control airborn	e titre to regulated limits
Hands	"Barrier" or "Silver Shield" gloves – for suitability	other types may also	protect; consult supplier
Eyes	safety glasses with side shields – a	lways protect the eyes	3

Clothing no special protective clothing required

9. PHYSICAL AND CHEMICAL PROPERTIES

Odour & Appearance	clear, colourless, thin liquid with pleasant ether odour
Odour threshold	2.5-3.5 ppm
рН	none – (does not liberate hydrogen ions in solution)
Melting point/Freezing point	-109°C / -163°F
Initial boiling point/boiling range	66°C / 151°F
Flash point	-17°C / 1°F (closed cup)
Evaporation rate (Butyl Acetate=1)	8
Flammability (solid; gas)	no data available
Lower flammable/explosive limit	1.8%
Upper flammable/explosive limit	11.8%
Vapour pressure	132mmHg / 17.5kPa (20°C / 68°F)
Vapour density (air = 1)	2.5
Specific Gravity	0.89 (20/20°C)
Water Solubility	300 grams per litre (25°C / 77°F)
Also soluble with	most organic solvents
Partition coefficient – n– octanol/water	0.46
Auto ignition temperature	321°C / 610°F
Molecular Weight	72grams per mole
Viscosity	not known – thin mobile liquid
Conversion factor	1ppm = 2.9mg/m ³

10. STABILITY AND REACTIVITY

Reactivity:

Dangerously Reactive With - strong oxidising agents; reacts vigorously with bromine Also Reactive With - strong alkalis – any peroxide present may react violently with strong alkalis

Chemical Stability

Stable if oxidation inhibitors are present; will not polymerize

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Possibility of Hazardous Reactions

May form peroxides in the presence of air. May react with oxygen to form unstable peroxides. Peroxides are thermal unstable and shock sensitive.

Conditions to avoid Avoid excessive heat, open flames and all ignition sources.

Incompatible materials Strong alkalis. Bromine. Strong oxidizing agents.

Hazardous decomposition products:

Decomposes in Presence of oxygen, light Decomposition Products - without inhibitors, may form explosive peroxides on prolonged contact with air

Mechanical Impact

Not sensitive

11. TOXICOLOGICAL INFORMATION

	Acute Toxicity
Skin Contact	no apparent effect in humans; irritation has been observed in rabbits
Skin Absorption	yes; toxic effects unlikely by this route unless a considerable area of skin is exposed
Eye Contact	irritating to the eyes, may be severe in some
Inhalation	irritating to respiratory system; at 25,000ppm, anaesthetic effects, also stimulates breathing & lowers blood pressure
Ingestion	Not expected to be a hazard in normal industrial use.
LD ₅₀ (oral)	1650, 2050-2850, 3000, 3300, 3780, 4430 & 6210mg/kg (rat), 2000 & 2300mg/litre (mouse), 2300 & 2600mg/kg (guinea pig), 3120mg/litre (rabbit) & others
LD ₅₀ (skin)	no data available*
LC ₅₀ (inhalation)	18,200ppm (rat & mouse), 18,585, 21,725 & 22,760ppm (rat) & others
	* Skin absorption in rats & rabbits is rapid & can achieve a lethal blood concentration if $\sim 10\%$ of skin area is exposed.

11. TOXICITY, CONTINUED

General / Symptoms

Symptoms of respiratory tract irritation and damage to respiratory epithelium were reported in rats exposed to 5000 ppm of tetrahydrofuran for 90 days. Elevation of SGPT suggests a disturbance in liver function. Prolonged exposure may cause drying and dermatitis.

Reproductive toxicity No information available.

Carcinogen Suspected of causing cancer

Reproductive Effect No known effect in humans or animals

Mutagen No known effect on humans or animals

Synergistic With Not known

12. ECOLOGICAL INFORMATION

Bioaccumulation	not a bioaccumulator; biolgical ½-life ~30 minutes
Biodegradation	biodegrades in the presence of oxygen; rates from 34% in 28 days to 100% in 14 days
Abiotic Degradation	reacts with atmospheric hydroxyl radicals; estimated ½-life in air is 21-24 hours
Mobility in soil, water	water soluble; moves readily in soil and water
Aquatic Toxicity	
LC ₅₀ (Fish, 48hr)	2160 & 3800mg/litre (Pimephelas promelas, 96hr), 2400mg/litre (Carassius auratus & Cyprinus auratus), 4400mg/litre (Cyprinus carpio), 2820 & 2930mg/litre Leuciscus idus) 3800 & 5900mg/litre (Oryzias latipes), and others
EC ₅₀ (Crustacea, 48hr)	>10,000mg/litre (Daphnia magna), 8900mg/litre (Daphnia pulex)
EC ₁₀ (Algae)	>1000mg/litre ("plankton algae")
EC ₂₀ (Bacteria)	>1000mg/litre ("activated sludge")
EC ₁₀ (Bacteria)	800mg/litre ("activated sludge"), >1000mg/litre ("mixed bacterial population")

13. DISPOSAL CONSIDERATIONS

Waste Disposal

Do not flush to sewer, recycle solvent if possible, local regulations may permit disposal in sanitary landfill, may be incinerated in approved facility after mixing with a suitable flammable waste

Containers

Drums should be reused. Recondition and pressure test by a licensed reconditioner prior to re-use.

Pails must be vented and thoroughly dried prior to crushing and recycling.

IBCs (intermediate bulk containers): polyethylene bottle must be pressure tested & recertified at 30 months. Replace at 60 months (5yrs). **Steel containers** must be inspected, pressure tested & recertified every 5 years.

Never cut, drill, weld or grind on or near this container, even if empty

14. TRANSPORT INFORMATION

Canada TDG	UN / PIN #	UN 2056	<u>e</u>
	Shipping Name	Tetrahydrofuran	3
U.S.A. 49 CFR	Class & Packing Group	3, II	

Marine Pollutant	Not a marine pollutant		
ERAP Required (CA only)	Νο		
Emergency Response Guide No.	127		
Reportable Quantity (RQ –			
USA only)	1000 lbs (454 kgs)		

Important Note: Shipping descriptions may vary based on mode of transport, quantities, package size, and/or origin and destination. Consult your company's Hazardous Materials/Dangerous Goods expert for information specific to your situation.

15. REGULATORY INFORMATION

Canada DSL	On Inventory
U.S.A. TSCA	On Inventory
Europe EINECS	On Inventory

Canada Regulations:

CEPA - National Pollutant Release Inventory (NPRI)

Part 5.

U.S.A. Regulations:

Immediately Dangerous to Life or Health: 2000 ppm (Based on 10% of the lower explosion limit for safety considerations even though the relevant toxicological data indicated that irreversible health effects or impairment of escape existed only at higher concentrations.)

OSHA Standards: Permissible Exposure Limit: Table Z-1 8-hr Time Weighted Avg: 200ppm (590mg/m3). Vacated 1989 OSHA PEL TWA 200ppm (590mg/m3); STEL 250ppm (735 mg/m3) is still enforced in some states. NIOSH Recommendations: Recommended Exposure Limit: 10 Hr Time-Weighted Avg: 200 ppm (590 mg/cu m).

Recommended Exposure Limit: 15 Min Short-Term Exposure Limit: 250 ppm (735 mg/cu m).

Threshold Limit Values: 8 hr Time Weighted Avg (TWA): 50 ppm; 15 min Short Term Exposure Limit (STEL): 100 ppm. Skin. A3; Confirmed animal carcinogen with unknown relevance to humans.

State Drinking Water Guidelines: Massachusetts 600 ug/L New Hampshire 150 ug/L Wisconsin 50 ug/L Maine 70 ug/L Florida 4.6 ug/L

CERCLA Reportable Quantities: Persons in charge of vessels or facilities are required to notify the National Response Centre (NRC) immediately, when there is a release of this designated hazardous substance, in an amount equal to or greater than its reportable quantity of 1000 lb/454 kg. The NRC toll free number is (800) 424-8802. The rule for determining when notification is required is stated in 40 CFR 302.4 (section IV.D.3.b). TSCA Requirements: Section 8(a) of TSCA requires manufacturers of this chemical substance to report preliminary assessment information concerned with production, exposure, and use to EPA as cited in the preamble in 51 FR 41329. Effective date 3/11/94; Reporting date: 5/10/95. Pursuant to section 8(d) of TSCA, EPA promulgated a model Health and Safety Data Reporting Rule. The section 8(d) model rule requires manufacturers, importers, and processors of listed chemical substances and mixtures to submit to EPA copies and lists of unpublished health and safety studies. Tetrahydrofuran is included on this list. Effective date 3/11/94; Sunset date: 6/30/98. A testing consent order is in effect for tetrahydrofuran for health effects testing. FR citation: 1/23/95. RCRA Requirements: As stipulated in 40 CFR 261.33, when tetrahydrofuran, as a commercial chemical product or manufacturing chemical intermediate or an off-specification commercial chemical product or a manufacturing chemical intermediate, becomes a waste, it must be managed according to Federal and/or State hazardous waste regulations. Also defined as a hazardous waste is any residue, contaminated soil, water, or other debris resulting from the cleanup of a spill, into water or on dry land, of this waste. Generators of small quantities of this waste may gualify for partial exclusion from hazardous waste regulations (40 CFR 261.5).

FDA Requirements: Tetrahydrofuran is an indirect food additive for use only as a component of adhesives. **SARA 302/304:** This product contains no known chemicals regulated under SARA 302/304.

SARA 311/312: Based upon available information, this material is classified as the following health and/or physical hazards

according to Section 311 & 312:

Physical Hazards - Flammable liquids

Health Hazards - Acute toxicity, Serious eye damage, STOT - single exposure

SARA 313: This product contains no known chemicals regulated under SARA 313.

US State Regulations: Chemicals associated with the product which are subject to the state right-to-know regulations are listed along with the applicable state(s):

Pennsylvania - Listed

New Jersey - Listed

Massachusetts - Listed

California Proposition 65 - This material is not known to contain a chemical substance known to the State of California to cause cancer, reproductive, or developmental toxicity under California Proposition 65.

International Regulations:

International Inventories:

Listed on the chemical inventories of the following countries or qualifies for an exemption: Australia (AICS) China (IECSC) Japan (ENCS) Korea (KECI) New Zealand (NZIoC) Philippines (PICCS) Mexico (INSQ)

16. OTHER INFORMATION

NFPA RATING	Health	2	Flamn	nability	3	Instability	1
Prepared for	Megaloid Laboratories		by	by Rob Cangiano		Rob Cangiano	
Preparation Date:	March 2004	4					
Revision Dates:	May 2007, 2020	May 2010, N	lay 2013, (October 2	201	5, September 2018, Novemb	ber

With data from RTECS, Haz. Substance Data Base, Cheminfo (CCOHS), IUCLID Datasheets (European Chem. Substance Info. System), & others, as available

Key to ACGIH® = American Conference of Governmental Industrial Hygienists Abbreviations AIHA® = AIHA® Guideline Foundation HSDB® = Hazardous Substances Data Bank IARC = International Agency for Research on Cancer NIOSH = National Institute for Occupational Safety and Health NTP = National Toxicology Program OSHA = US Occupational Safety and Health Administration RTECS® = Registry of Toxic Effects of Chemical Substances References CHEMINFO database. Canadian Centre for Occupational Health and Safety (CCOHS). HSDB® database. US National Library of Medicine. Available from Canadian Centre for Occupational Health and Safety (CCOHS). NIOSH Pocket Guide database. National Institute for Occupational Safety and Health. Available from Canadian Centre for Occupational Health and Safety (CCOHS). Registry of Toxic Effects of Chemical Substances (RTECS®) database. Dassault Systèmes/BIOVIA ("BIOVIA"). Available from Canadian Centre for Occupational Health and Safety (CCOHS). Disclaimer Megaloid Laboratories Limited provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. Megaloid Laboratories Limited makes no representations or warranties, either expressed or implied, including without limitation any warranties of merchantability, fitness for a particular purpose with respect to the information set forth hererin or the product which the information ref		
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