Brenntag Canada Inc.

BRENNTAG

MATERIAL SAFETY DATA SHEET

TETRAHYDROFURAN, LIQUID

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

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WHMIS#:	00060819
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EMERGENCY TELEPHONE NUMBERS (FOR EMERGENCIES INVOLVING CHEMICAL SPILLS OR RELEASE)

Toronto, ON (416) 226-6117	Montreal, QC (514) 861-1211	Winnipeg, MB (204) 943-8827
Edmonton, AB (780) 424-1754	Calgary, AB (403) 263-8660	Vancouver, BC (604) 685-5036

PRODUCT IDENTIFICATION

Product Name:	Tetrahydrofuran, Liquid.
Chemical Name:	Tetrahydrofuran.
Synonyms:	1,4-Epoxy Butane; Diethylene Oxide; THF; Tetramethylene Oxide; Butylene Oxide; Oxacyclopentane; Oxolane.
Chemical Family:	Cycloaliphatic Ether.
Molecular Formula:	C4H8O.
Product Use:	Industrial solvent, cleaner, degreaser. Chemical intermediate.

WHMIS Classification / Symbol:

B-2: Flammable Liquid

D-2B: Toxic (skin and eye irritant)

READ THE ENTIRE MSDS FOR THE COMPLETE HAZARD EVALUATION OF THIS PRODUCT.

2. COMPOSITION, INFORMATION ON INGREDIENTS (Not Intended As Specifications)

Ingredient	*CAS#*	*ACGIH TLV*		*% Concentration*
Tetrahydrofuran	109-99-9	50 ppm (Skin)	*A3	99 - 100

A3 = Confirmed animal carcinogen with unknown relevance to humans. (ACGIH-A3).

Skin Notation: Contact with skin, eyes and mucous membranes can contribute to the overall exposure and may invalidate the TLV. Consider measures to prevent absorption by these routes.

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW:	Harmful if inhaled, absorbed through skin, or swallowed. Causes skin and eye irritation. Vapours are irritating to eyes and respiratory tract. High vapour concentrations may cause drowsiness. See "Other Health Effects" Section. Extremely flammable liquid and vapour. May cause flash fire or explosion. May form explosive peroxides if not inhibited. Can decompose at high temperatures forming toxic gases.

POTENTIAL HEALTH EFFECTS

Inhalation:	Product is irritating to the nose, throat and respiratory tract. Prolonged and repeated exposure may cause shortness of breath, intoxication, collapse, fatigue and low blood pressure. See "Other Health Effects" Section.

Skin Contact:	Skin contact can cause irritation, especially under the finger nails (and other confined spaces such as under rings or watch bands). May cause defatting, drying and cracking of the skin. Prolonged and repeated contact may lead to dermatitis.
Skin Absorption:	May be absorbed through intact skin.
Eye Contact:	Vapours from this product are irritating to the eyes. This product causes irritation, redness and pain.
Ingestion:	This product causes irritation, a burning sensation of the mouth and throat and abdominal pain.
Other Health Effects:	Effects (irritancy) on the skin and eyes may be delayed, and damage may occur without the sensation or onset of pain. Strict adherence to first aid measures following any exposure is essential. May cause central nervous system (CNS) depression, blood changes, circulatory or blood clotting disorders, liver damage, kidney damage. CNS depression is characterized by headache, dizziness, drowsiness, nausea, vomiting and incoordination. Severe overexposures may lead to coma and possible death due to respiratory failure. Liver damage is characterized by the loss of appetite, jaundice (yellowish skin colour), and occasional pain in the upper left-hand side of the abdomen. Signs and symptoms of kidney damage generally progress from oliguria, to blood in the urine, to total renal failure.

4. FIRST AID MEASURES

FIRST AID PROCEDURES

Inhalation:	Move victim to fresh air. Give artificial respiration ONLY if breathing has stopped. Give cardiopulmonary resuscitation (CPR) if there is no breathing AND no pulse. Obtain medical attention IMMEDIATELY.
Skin Contact:	Start flushing while removing contaminated clothing. Wash affected areas thoroughly with soap and water. If irritation, redness, or a burning sensation develops and persists, repeat flushing and obtain medical attention.
Eye Contact:	Immediately flush eyes with running water for a minimum of 20 minutes. Hold eyelids open during flushing. If irritation persists, repeat flushing. Obtain medical attention IMMEDIATELY.
Ingestion:	Do not attempt to give anything by mouth to an unconscious person. If victim is alert and not convulsing, rinse mouth out and give 1/2 to 1 glass of water to dilute material. IMMEDIATELY contact local Poison Control Centre. Vomiting should only be induced under the direction of a physician or a poison control centre. If spontaneous vomiting occurs, have victim lean forward with head down to avoid breathing in of vomitus, rinse mouth and administer more water. IMMEDIATELY transport victim to an emergency facility.
Note to Physicians:	This product contains materials that may cause severe pneumonitis if aspirated. If ingestion has occurred less than 2 hours earlier, carry out careful gastric lavage; use endotracheal cuff if available, to prevent aspiration. Observe patient for respiratory difficulty from aspiration pneumonitis. Give artificial resuscitation and appropriate chemotherapy if respiration is depressed. For Tetrahydrofuran ingestion: prepare an activated charcoal slurry by suspending 50 g activated charcoal in 400 mL water in plastic bottle and shake well. Give 5 mg/Kg of body weight, or 350 mL for an average adult. (3) Medical conditions that may be aggravated by exposure to this product include neurological, cardiovascular and skin disorders, diseases of the skin, eyes or respiratory tract, preexisting liver and kidney disorders.

5. FIRE-FIGHTING MEASURES

		Flammability Limits in Air (%):	
Flashpoint (°C)	***AutoIgnition Temperature (°C)***	***LEL***	***UEL***
-17. (3)	321 (3)	1.8. (3)	11.8. (3)

Flammability Class (WHMIS):	B-2: Flammable Liquid
Hazardous Combustion Products:	Thermal decomposition products are toxic and may include peroxides, oxides of carbon and irritating gases.

Unusual Fire or Explosion Hazards:	Tetrahydrofuran: Extremely flammable liquid. Tetrahydrofuran is classed by OSHA Class IB flammable liquid. Five percent Tetrahydrofuran in water is flammable. (3) Vapours from this product are heavier than air, and may "travel" to a source of ignition (eg. pilot lights, heaters, electric motors) some distance away, and then "flash back" to the point of product discharge causing an explosion and fire. Vapours may form explosive mixtures with air. Closed containers exposed to heat may explode. Enforce NO SMOKING rules.
Sensitivity to Mechanical Impact:	Not expected to be sensitive to mechanical impact.
Rate of Burning:	Not available.
Explosive Power:	Not available.
Sensitivity to Static Discharge:	Expected to be sensitive to static discharge when vapours are present between the lower and upper explosive limits.
EXTINGUISHING MEDIA	
Fire Extinguishing Media:	Alcohol resistant foam. Use carbon dioxide or dry chemical media for small fires. If only water is available, use it in the form of a fog. Water may be ineffective due to low flash point. Use water spraying for cooling. This material may produce a floating fire hazard in extreme fire conditions. Do not use high volume water jet.
FIRE FIGHTING INSTRUCTIONS	
Instructions to the Fire Fighters:	Use water spray to cool fire-exposed containers or structures. Use water spray to disperse vapours; re-ignition is possible. Spilled material may cause floors and contact surfaces to become slippery.
Fire Fighting Protective Equipment:	Use self-contained breathing apparatus and protective clothing.

6. ACCIDENTAL RELEASE MEASURES

Information in this section is for responding to spills, leaks or releases in order to prevent or minimize the adverse effects on persons, property and the environment. There may be specific reporting requirements associated with spills, leaks or releases, which change from region to region.

Containment and Clean-Up Procedures:	In all cases of leak or spill contact vendor at Emergency Number shown on the front page of this MSDS. Wear protective clothing. Do not use combustible materials such as sawdust as an absorbent. Recover spilled material on non-combustible absorbents, such as sand or vermiculite, and place in covered containers for disposal. Use spark-resistant tools. Eliminate all sources of ignition. Collect product for recovery or disposal. For release to land, or storm water runoff, contain discharge by constructing dykes or applying inert absorbent; for release to water, utilize damming and/or water diversion to minimize the spread of contamination. Ventilate enclosed spaces. Notify applicable government authority if release is reportable or could adversely affect the environment.

7. HANDLING AND STORAGE

HANDLING	
Handling Practices:	Ground and bond equipment and containers to prevent a static charge buildup. Use spark-resistant tools and avoid "splash-filling" of containers. Use normal "good" industrial hygiene and housekeeping practices. Containers exposed to heat may be under internal pressure. These should be cooled and carefully vented before opening. A face shield and apron should be worn.
Ventilation Requirements:	See Section 8, "Engineering Controls".
Other Precautions:	Use only with adequate ventilation and avoid breathing vapours or mists. Avoid contact with eyes, skin or clothing. Wash thoroughly with soap and water after handling. Wash contaminated clothing thoroughly before re-use. Do not use cutting or welding torches on empty drums that contained this material/product. Store wiping rags and similar material in metal cans with tight fitting lids. Enforce NO SMOKING rules in area of use.
STORAGE	
Storage Temperature (°C):	See below.
Ventilation Requirements:	Ventilation should be explosion proof.

Storage Requirements:	Tetrahydrofuran: Can self-react, polymerize. Heat liberated will raise temperature and pressure and possibly rupture container unless properly inhibited. Check periodically to confirm inhibitor content. If below desired level, add extra inhibitor and mix well to be effective. Vapour space above stored liquid may be flammable or explosive unless blanketed with inert gas. (3) Store in a cool, well-ventilated area. Keep away from heat, sparks and flames. Keep containers closed. Do not expose sealed containers to temperatures above 40° C. Protect from direct sunlight. Protect against physical damage.
Special Materials to be Used for Packaging or Containers:	Materials of construction for storing the product include: stainless steel. (3) Equipment for storage, handling or transportation should NOT be made of: CPVC, Polypropylene, polyethylene or cast bronze. Attacks some types of rubber, plastics and coatings. Confirm suitability of any material before using.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Recommendations listed in this section indicate the type of equipment, which will provide protection against overexposure to this product. Conditions of use, adequacy of engineering or other control measures, and actual exposures will dictate the need for specific protective devices at your workplace.

ENGINEERING CONTROLS

Engineering Controls:	Local exhaust ventilation required. Ventilation should be explosion proof. Make up air should be supplied to balance air that is removed by local or general exhaust ventilation. Ventilate low lying areas such as sumps or pits where dense vapours may collect. For personnel entry into confined spaces (i.e. bulk storage tanks) a proper procedure must be followed. It must include consideration of, among other things, ventilation, testing of tank atmosphere, provision and maintenance of SCBA, and emergency rescue. Use the "buddy" system. The second person should be in view and trained and equipped to execute a rescue. (4)
PERSONAL PROTECTIVE EQUIPMENT (PPE)	
Eye Protection:	Use full face-shield or chemical safety goggles when there is potential for contact. Contact lenses should not be worn when working with this material.
Skin Protection:	Gloves and protective clothing made from Silver Shield / should be impervious under conditions of use. Do not use gloves or protective clothing made from butyl rubber, natural rubber, neoprene, nitrile rubber, polyethylene, PVC or viton. (4) Prior to use, user should confirm impermeability. Discard contaminated gloves.
Respiratory Protection:	No specific guidelines available. Do not use compressed oxygen in hydrocarbon atmospheres. A NIOSH/MSHA-approved air-purifying respirator equipped with organic vapour cartridges for concentrations up to 500 ppm. An air-supplied respirator if concentrations are higher or unknown. If while wearing a respiratory protection, you can smell, taste or otherwise detect anything unusual, or in the case of a full facepiece respirator you experience eye irritation, leave the area immediately. Check to make sure the respirator to face seal is still good. If it is, replace the filter, cartridge or canister. If the seal is no longer good, you may need a new respirator. (4) Tetrahydrofuran: Immediately Dangerous to Life and Health (IDLH) value: 2, 000 ppm. The purpose of establishing an IDLH value is to ensure that the worker can escape from a given contaminated environment in the event of failure of the most protective respiratory equipment. In the event of failure of respiratory protective equipment, every effort should be made to exit immediately. (4)
Other Personal Protective Equipment:	Wear an impermeable apron and boots. Locate safety shower and eyewash station close to chemical handling area. Take all precautions to avoid personal contact. Clothing and footwear that is fire retardant and dissipates static electrical charges should be worn when handling flammable materials. Natural fibers (cotton, wool, leather and linen) should be selected in favour of synthetic materials (rayon, nylon and polyester).

EXPOSURE GUIDELINES

SUBSTANCE	***ACGIH TLV***	***OSHA PEL***		***NIOSH REL***	
	(STEL)	***(TWA)***	***(STEL)***	***(TWA)***	***(STEL)***
Tetrahydrofuran	100 ppm	200 ppm	---	200 ppm	250 ppm

9. PHYSICAL AND CHEMICAL PROPERTIES (Not intended as Specifications)

Physical State:	Liquid.

Appearance:	Clear, colourless liquid.
Odour:	Ether-like odour.
Odour Threshold (ppm):	2 - 61 (detection)
Boiling Range (°C):	66. (3)
Melting/Freezing Point (°C):	-109. (3)
Vapour Pressure (mm Hg at 20° C):	129 - 173.
Vapour Density (Air = 1.0):	2.5. (4)
Relative Density (g/cc):	0.889. (3)
Bulk Density:	889 kg/m³.
Viscosity:	0.46 cPs (25°C).
Evaporation Rate (Butyl Acetate = 1.0):	8.0. (4)
Solubility:	Soluble in water.
% Volatile by Volume:	100.
pH:	7.
Coefficient of Water/Oil Distribution:	0.47.
Volatile Organic Compounds (VOC):	Not available.

10. STABILITY AND REACTIVITY

CHEMICAL STABILITY

Under Normal Conditions:	Stable in the presence of an inhibitor.
Under Fire Conditions:	Flammable.
Hazardous Polymerization:	Stable in the presence of inhibitor. Liable to polymerize in the presence of catalyst or prolonged heating.
Conditions to Avoid:	High temperatures, sparks, open flames and all other sources of ignition. Avoid excessive temperature or prolonged reflux, such as in batch distillation. Air sensitive. Keep tightly closed to protect quality. Can gradually turn yellow during storage.
Materials to Avoid:	Strong oxidizers. Strong acids. Violently reactive with: bromine and Acids. Avoid extended contact with air or oxygen. Oxygen exposure may lead to the formation of explosive peroxides. Lithium Aluminum Hydride. Borane. Thionyl Chloride. Attacks some types of rubber, plastics and coatings.
Decomposition or Combustion Products:	Thermal decomposition products are toxic and may include peroxides, oxides of carbon and irritating gases.

11. TOXICOLOGICAL INFORMATION

TOXICOLOGICAL DATA:

SUBSTANCE	***LD50 (Oral, Rat)***	***LD50 (Dermal, Rabbit)***	***LC50 (Inhalation, Rat, 4h)***
Tetrahydrofuran	1 650 - 2 880 mg/kg (1,3)	---	18 187 ppm (1 3)

Carcinogenicity Data:	The International Agency for Research on Cancer (IARC) has not evaluated the carcinogenicity of this chemical. (4) The US National Toxicology Program (NTP) has not listed this chemical in its report on carcinogens. (4) The American Conference of Governmental Industrial Hygienists (ACGIH) has designated this chemical as an animal carcinogen (A3). CARCINOGENICITY DESIGNATION A3 - Animal Carcinogen: Substance is carcinogenic in laboratory animals under conditions that are not considered relevant to worker exposure. Available human studies and evidence suggest that the substance is not likely to cause cancer in humans except under unusual or unlikely routes or levels of exposure. Worker exposure to an A3 carcinogen should be controlled to levels as low as reasonably achievable below the TLV. (4)
Reproductive Data:	No adverse reproductive effects are anticipated.
Mutagenicity Data:	Mutagenicity tests have been negative or inconclusive.
Teratogenicity Data:	Teratogenicity tests in animals have been negative or inconclusive.
Respiratory / Skin Sensitization Data:	None known.

Synergistic Materials:	None known.
Other Studies Relevant to Material:	Symptoms of respiratory tract irritation and damage to respiratory epithelium due to Tetrahydrofuran (THF) were reported in rats exposed to 5,000 ppm of Tetrahydrofuran for 90 days. (3) Tetrahydrofuran was not genotoxic in microbiological microorganisms (Cancer Research 39:682, 1979), Drosphila (Env.Mut. 7:325, 1985) or in the unscheduled DNS synthesis assays (Env.Mut. 5:482, 1983). (3) In a National Toxicology Program study, rats and mice were exposed by inhalation to 0, 200, 600 or 1800 ppm tetrahydrofuran for 105 weeks (6 hrs/d; 5 d/wk). There was some evidence of carcinogenic activity in male rats based on increased incidences of renal tubule adenoma or carcinoma (combined; not statistically significant) at 600 and 1800 ppm. There was no evidence of carcinogenic activity in female rats or male mice. There was clear evidence of carcinogenic activity in female mice based on increased incidences of hepatocellular neoplasms at 1800 ppm. Tetrahydrofuran applied to the skin of mice, twenty-five times over 17.5 months, gave no evidence of carcinogenicity. (4) The US National Toxicology Program (NTP) has not listed this chemical in its report on carcinogens. (4)

12. ECOLOGICAL INFORMATION

Ecotoxicity:	May be harmful to aquatic life. Tetrahydrofuran: 96-hour LC50 (Fathead Minnow) = 2,160 mg/L (3)
Environmental Fate:	This product is biodegradable. Volatalizes rapidly. This product does not bioaccumulate in aquatic or terrestrial food chains. Can be dangerous if allowed to enter drinking water intakes. Do not contaminate domestic or irrigation water supplies, lakes, streams, ponds, or rivers. Biochemical Oxygen Demand (BOD): Greater than 80 % of ThOD. (3) Chemical Oxygen Demand (COD): 1, 572 mg/g (3)

13. DISPOSAL CONSIDERATIONS

Deactivating Chemicals:	None required.
Waste Disposal Methods:	This information applies to the material as manufactured. Reevaluation of the product may be required by the user at the time of disposal since the product uses, transformations, mixtures and processes may influence waste classification. Dispose of waste material at an approved (hazardous) waste treatment/disposal facility in accordance with applicable local, provincial and federal regulations. Do not dispose of waste with normal garbage, or to sewer systems.
Safe Handling of Residues:	See "Waste Disposal Methods".
Disposal of Packaging:	Empty containers retain product residue (liquid and/or vapour) and can be dangerous. Empty drums should be completely drained, properly bunged and promptly returned to a drum reconditioner. Do not expose such containers to heat, flame, sparks, static electricity, or other sources of ignition; they may explode and cause injury or death. Do not dispose of package until thoroughly washed out.

14. TRANSPORTATION INFORMATION

CANADIAN TDG ACT SHIPPING DESCRIPTION:

TETRAHYDROFURAN, Class 3, UN2056, PG II.

Label(s): Flammable Liquids. Placard: Flammable Liquids.

ERAP Index: -----. Exemptions: None known.

US DOT CLASSIFICATION (49CFR 172.101, 172.102):

TETRAHYDROFURAN, Class 3, UN2056, PG II.

Label(s): Flammable Liquid. Placard: Flammable Liquid.

CERCLA-RQ: 1 000 lb / 454 kg. Exemptions: None known.

15. REGULATORY INFORMATION

CANADA

CEPA - NSNR: All constituents of this product are included on the DSL.

CEPA - NPRI: Not included.

Controlled Products Regulations Classification (WHMIS):

B-2: Flammable Liquid

D-2B: Toxic (skin and eye irritant)

USA

Environmental Protection Act: All constituents of this product are included on the TSCA inventory.

OSHA HCS (29CFR 1910.1200): Flammable Liquid, Skin and Eye Irritant.

NFPA: 2 Health, 3 Fire, 1 Reactivity (6)

HMIS: 2 Health, 3 Fire, 1 Reactivity (3)

INTERNATIONAL

This product or its components are on the European inventory of existing commercial chemicals (EINECS).

16. OTHER INFORMATION

REFERENCES

1. RTECS-Registry of Toxic Effects of Chemical Substances, Canadian Centre for Occupational Health and Safety RTECS database.
2. Clayton, G.D. and Clayton, F.E., Eds., Patty's Industrial Hygiene and Toxicology, 3rd ed., Vol. IIA,B,C, John Wiley and Sons, New York, 1981.
3. Supplier's Material Safety Data Sheet(s).
4. CHEMINFO, through "CCINFOdisc", Canadian Centre for Occupational Health and Safety, Hamilton, Ontario, Canada.
5. Guide to Occupational Exposure Values, 2007, American Conference of Governmental Industrial Hygienists, Cincinnati, 2007.
6. Regulatory Affairs Group, Brenntag Canada Inc.
7. The British Columbia Drug and Poison Information Centre, Poison Managements Manual, Canadian Pharmaceutical Association, Ottawa, 1981.
8. NFPA 325M Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids, 1994 Edition, Quincy, MA, 1994.

To obtain revised copies of this or other Material Safety Data Sheets, contact your nearest Brenntag Canada Regional office.

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