Material Safety Data Sheet

Tetrahydrofuran

L0000087 Revised 6-MAY-1997 Printed 2-MAR-1998

CHEMICAL PRODUCT/COMPANY IDENTIFICATION

Material Identification

Corporate MSDS Number : DU000109

CAS Number : 109-99-9
Formula : CH2CH2CH2CH20
Molecular Weight : 72.11
CAS Name : FURAN, TETRAHYDRO
Grade : TECHNICAL

Tradenames and Synonyms

THF
Tetramethylene Oxide
Diethylene Oxide
1,4-Epoxybutane
Oxolane

Company Identification

MANUFACTURER/DISTRIBUTOR
DuPont
"TERATHANE" Products
1007 Market Street
Wilmington, DE 19898

PHONE NUMBERS
Product Information : 1-800-441-7515
Transport Emergency : CHEMTREC 1-800-424-9300
Medical Emergency : 1-800-441-3637

COMPOSITION/INFORMATION ON INGREDIENTS

Components

Material	CAS Number	%
TETRAHYDROFURAN	109-99-9	100

HAZARDS IDENTIFICATION

Potential Health Effects

Inhalation of Tetrahydrofuran vapors may cause irritation of the respiratory passages, possibly with coughing and discomfort; temporary nervous system depression with anesthetic effects such as dizziness, headache, confusion, incoordination, and loss of consciousness; abnormal liver function as

detected by laboratory tests; or nonspecific discomfort, such as nausea, headache, or weakness.

Skin contact with Tetrahydrofuran may cause skin irritation with discomfort or rash from contact with the liquid. Evidence suggests that skin permeation can occur in amounts capable of producing the effects of systemic toxicity.

Exposure to vapors of Tetrahydrofuran may cause eye irritation with tearing, pain or blurred vision. Contact with the liquid may cause severe irritation or burns. Damage may be permanent.

Individuals with preexisting diseases of the lungs or liver may have increased susceptibility to the toxicity of excessive exposures.

Carcinogenicity Information

None of the components present in this material at concentrations equal to or greater than 0.1% are listed by IARC, NTP, OSHA or ACGIH as a carcinogen.

FIRST AID MEASURES

First Aid

INHALATION

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

SKIN CONTACT

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician. Wash clothing before reuse.

EYE CONTACT

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

INGESTION

If swallowed, do not induce vomiting. Immediately give two glasses of water or activated charcoal slurry. Call a physician. Never give anything by mouth to an unconscious person.

NOTE: To prepare activated charcoal slurry, suspend 50 grams activated charcoal in 400 mL water in plastic bottle and shake well. Give 5 mL/kg of body weight, or 350 mL for an average adult.

FIRE FIGHTING MEASURES

Flammable Properties

Flash Point	: -14 C (7 F)
Method	: TCC
Flammable limits in Air, % by Volume	
LEL	: 2.0
UEL	: 11.8
Autoignition	: 321 C (610 F)

Actual AIT's can be affected by the concentration of vapors and oxygen, vapor/air contact time, pressure, volume, catalytic impurities, etc. Process conditions should be analyzed to determine if the AIT may be higher or lower.

Fire and Explosion Hazards:

Extremely flammable; OSHA Class IB flammable liquid. Five percent THF in water is flammable. Follow appropriate National Fire Protection Association (NFPA) codes. Vapors are heavier than air and may travel to a source of ignition.

THF can form heat sensitive peroxide which may explode on concentration by distillation or drying. Do not distill or allow THF, or solutions containing THF, to dry if tests show more than 0.05% THF peroxide present. To avoid a possible explosion, THF should never be distilled to dryness. BHT antioxidant is added to THF to minimize peroxide formation unless specifically requested otherwise.

Extinguishing Media

Use Ansul “Purple K” potassium bicarbonate-base dry chemical or National “Aer-O-Foam” Universal alcohol resistant foam.

Fire Fighting Instructions

Evacuate affected area, stay upwind and avoid smoke and fumes. Use water spray to cool containers. If smoke and fumes cannot be avoided, wear self-contained breathing apparatus.

ACCIDENTAL RELEASE MEASURES

Safeguards (Personnel)

NOTE: Review FIRE FIGHTING MEASURES and HANDLING (PERSONNEL) sections before proceeding with clean-up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

Accidental Release Measures

Evacuate to fresh air and ventilate area before reentering. Self-contained breathing apparatus should be utilized when responding to spills or heavy fumes. Remove sources of heat sparks, flame, impact, friction, and electricity. Dike spill. Use water spray to disperse vapors or to flush liquid away from fire exposure. Prevent liquid from entering sewer waterways, or low areas. Comply with Federal, State, and local regulations. The Superfund reportable discharge is 1,000 lbs.

DuPont Emergency Exposure Limits (EEL) are established to facilitate site or plant emergency evacuation, and to . specify airborne concentrations of brief durations which should not result in permanent adverse health effects or interfere with escape. EEL's are expressed as airborne concentration multiplied by time (CxT) for up to a maximum of 60 minutes and as a ceiling airborne concentration. These limits are used in conjunction with engineering controls/monitoring and as an aid in planning for episodic releases and spills. For more information on the applicability of EEL's, contact DuPont.

The DuPont Emergency Exposure Limit (EEL) for Tetrahydrofuran is 1,000 ppm for up to 60 minutes, with a not-to-exceed ceiling of 1,000 ppm.

HANDLING AND STORAGE

Handling (Personnel)

Do not get in eyes. Avoid breathing vapors or mist. Avoid contact with skin and clothing. Wash thoroughly after handling.

Storage

Store in a cool place out of sun and away from heat, sparks, and flame. Keep containers tightly closed. Use drums on a first in, first out basis.

EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Good general ventilation should be provided to keep vapor concentrations below the flammability and exposure limits.

Extremely flammable - keep away from ignition sources and clean up spills promptly.

(EXPOSURE CONTROLS/PERSONAL PROTECTION - Continued)

Personal Protective Equipment

EYE/FACE PROTECTION

Wear safety glasses with side shields. Wear coverall chemical splash goggles/face shield combination where the possibility exists for eye and face contact due to splashing or spraying of material.

RESPIRATORS

A NIOSH/MSHA approved air purifying respirator with an organic vapor cartridge or canister may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits. Protection provided by air purifying respirators is limited. Use a positive pressure air supplied respirator if there is any potential for an uncontrolled release, where exposure levels are not known, or in any other circumstances where air purifying respirators may not provide adequate protection.

PROTECTIVE CLOTHING

Where there is potential for skin contact, have available and wear as appropriate, impervious clothing such as gloves, apron, pants, jacket, hood and boots; or full chemical suit. Refer to vendor or published data for permeation times and durability to select clothing suitable for the application.

Permeation data supplied by vendors for the 4H Glove (tm) indicate that the breakthrough time for tetrahydrofuran is >1440 minutes, however, to avoid tears and punctures in the glove it should only be used as a liner under a heavy duty glove that suits the application.

Exposure Guidelines

Exposure Limits

Tetrahydrofuran

PEL (OSHA)	: 200 ppm, 590 mg/m3, 8 Hr. TWA
TLV (ACGIH)	: 200 ppm, 590 mg/m3, 8 Hr. TWA STEL 250 ppm, 737 mg/m3
AEL * (DuPont)	: 25 ppm, 8 & 12 Hr. TWA STEL 75 ppm, 15 minute TWA

* AEL is DuPont's Acceptable Exposure Limit. Where governmentally imposed occupational exposure limits which are lower than the AEL are in effect, such limits shall take precedence.

PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL DATA

Boiling Point	: 66 C (151 F) @ 760 mm Hg
Vapor Pressure	: 160 mm Hg @ 25 C (77 F) 280 mm Hg @ 38 C (100 F)
Vapor Density	: 2.5 (Air = 1)
Melting Point	: -108.5 C (-163.3 F)
Evaporation Rate	: >1 (Butyl Acetate = 1)
Solubility in Water	: 100 WT%
pH	: ~7 (Aqueous solution)
Odor	: Ethereal
Odor Threshold	: 2-50 ppm
Form	: Clear liquid
Color	: Colorless
Specific Gravity	: 0.9

STABILITY AND REACTIVITY

Chemical Stability

Can form potentially explosive peroxides upon long exposure to air.

Incompatibility with Other Materials

Incompatible with strong oxidizers. Explosions have been reported with THF/borane and THF/thionylchloride mixtures.

Decomposition

May occur with heat if peroxides are present and concentrated by distillation or drying.

Polymerization

Can occur in presence of cationic initiators such as selected Lewis acids or strong proton acids.

TOXICOLOGICAL INFORMATION

Animal Data

Tetrahydrofuran

Oral LD50	:3.2 mL/kg (2842 mg/kg) in rats
Inhalation LC50, 3 hr	:21,000 ppm in rats

Animal testing indicates that Tetrahydrofuran is a moderate skin irritant, and a severe eye irritant. It is not a skin sensitizer in animals.

(TOXICOLOGICAL INFORMATION - Continued)

Tetrahydrofuran rapidly penetrated the skin of rats and rabbits resulting in fatalities.

Ingestion of Tetrahydrofuran caused decreased food and water consumption, and body weights, and increases in kidney weights. Repeated exposures produced no functional or pathological changes in the liver or kidneys of animals that ingested approximately 888 mg/kg/day.

Inhalation exposures of animals to 100-200 ppm of Tetrahydrofuran vapors caused slight local irritation of the eyes and upper respiratory tract. Exposures to concentrations greater than 5000 ppm resulted in marked local irritation symptoms, including nasal bleeding and corneal opacity, clonic muscle spasms, anesthesia at near lethal levels, and coma. Repeated exposure produced irritation of the eye, skin and respiratory system at concentrations of approximately 100-400 ppm. At concentrations of 3000 ppm and greater damage to the respiratory system was observed. Liver function was affected in animals exposed to 1000 ppm. Higher doses caused transient sedation. Clinical chemistry and hematological changes, microscopic and functional changes of the liver, thickening of the lining of the forestomach, and microscopic changes of the adrenal cortex and uterus have also been reported. Slight damage to the upper respiratory tract occurred in rats exposed to 200 ppm for 12-24 weeks; severe damage to the upper respiratory tract resulted from exposure to 1000 ppm from the same study. In a different study, cats, rabbits, and dogs exposed to 1000 ppm for one year demonstrated no signs of toxicity. When-compared to control animals, no significant differences were observed in mice exposed 3000 ppm.

Data show carcinogenic activity in the liver and kidneys of laboratory animals. Animal data show developmental effects only at exposure levels producing other toxic effects in the adult animal. Animal testing for reproductive effects shows no change in reproductive performance. Tetrahydrofuran has not produced genetic damage in bacterial or mammalian cell cultures or in animals. It has not been tested for its ability to cause permanent genetic damage in reproductive cells of mammals (not tested for heritable genetic damage).

ECOLOGICAL INFORMATION

Ecotoxicological Information

Aquatic Toxicity

96-hour LC50, fathead minnows: 2,160 mg/L

DISPOSAL CONSIDERATIONS

Waste Disposal

Cleaned-up material is an RCRA Hazardous Waste. Treatment, storage, transportation and disposal must be in accordance with applicable Federal, State, and local regulations. If permits allow, may be incinerated.

TRANSPORTATION INFORMATION

Shipping Information

DOT
Proper Shipping Name : TETRAHYDROFURAN
Hazard Class : 3
I.D. No. (UN/NA) : 2056
DOT Label(s) : FLAMMABLE LIQUID
Packing Group : II

IMO
Proper Shipping Name : TETRAHYDROFURAN
Hazard Class : 3.2
UN No. : 2056
Packing Group : II
IMO Label : FLAMMABLE LIQUID

Shipping Containers

Tank Cars
Tank Trucks

ISO Containers
55-gallon Steel Drums
Reportable Quantity : 1,000 lbs/454 kg

REGULATORY INFORMATION

U.S. Federal Regulations

TSCA Inventory Status : Reported/Included.

TITLE III HAZARD CLASSIFICATIONS SECTIONS 311, 312

Acute : Yes
Chronic : No
Fire : Yes
Reactivity : Yes
Pressure : No

LISTS:

SARA Extremely Hazardous Substance -No
CERCLA Hazardous Material -Yes
SARA Toxic Chemicals -No

TETRAHYDROFURAN is a flammable liquid as defined by OSHA in 29 CFR 1910.1200(c). Use of this product may require compliance with 29 CFR 1910.119, Process Safety Management of Highly Hazardous Chemicals.

Canadian Regulations

CLASS D Division 2 Subdivision B - Toxic Material. Skin or Eye Irritant.

CLASS B Division 2 - Flammable Liquid.

OTHER INFORMATION

NFPA, NPCA-HMIS

NFPA Rating
Health : 2
Flammability : 3
Reactivity : 1

NPCA-HMIS Rating
Health : 3
Flammability : 3
Reactivity : 1

Personal Protection rating to be supplied by user depending on use conditions.

Additional Information

For further information, see DuPont Tetrahydrofuran Data Sheet and Properties, Uses, Storage, and Handling Bulletin.

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Responsibility for MSDS : DuPont "TERATHANE" Products
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> : P.O. Box 80023, Barley Mill Plaza
> : Wilmington, DE 19880-0023
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# Indicates updated section.

END OF MSDS