

TETRAHYDROFURAN

THF

CAUTIONARY RESPONSE INFORMATION

Common Synonyms		Liquid	Colorless	Faint fruity odor
Diethylene oxide Tetramethylene oxide THF		Floats and mixes with water. Flammable, irritating vapor is produced.		
<p>Keep people away. Shut off ignition sources and call fire department. Stay upwind and use water spray to "knock down" vapor. Avoid contact with liquid and vapor. Notify local health and pollution control agencies. Protect water intakes.</p>				
Fire	<p>FLAMMABLE. Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear goggles and self-contained breathing apparatus. Extinguish with dry chemical or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.</p>			
Exposure	<p>CALL FOR MEDICAL AID.</p> <p>VAPOR Irritating to eyes, nose and throat. If inhaled, will cause nausea, headache or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.</p> <p>LIQUID Irritating to skin and eyes. Harmful if swallowed. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.</p>			
Water Pollution	<p>Effect of low concentrations on aquatic life is unknown. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>			

1. CORRECTIVE RESPONSE ACTIONS	2. CHEMICAL DESIGNATIONS
Dilute and disperse Stop discharge	<p>2.1 CG Compatibility Group: 41; Ether</p> <p>2.2 Formula: CH₂CH₂CH₂CH₂O</p> <p>2.3 IMO/UN Designation: 3.1/2056</p> <p>2.4 DOT ID No.: 2056</p> <p>2.5 CAS Registry No.: 109-99-9</p> <p>2.6 NAERG Guide No.: 127</p> <p>2.7 Standard Industrial Trade Classification: 51659</p>
3. HEALTH HAZARDS	
<p>3.1 Personal Protective Equipment: Self-contained breathing apparatus; goggles or face shield; rubber or plastic gloves.</p> <p>3.2 Symptoms Following Exposure: Vapors cause nausea, dizziness, headache, and anesthesia. Liquid can de-fat the skin and cause irritation. Liquid also irritates eyes.</p> <p>3.3 Treatment of Exposure: INHALATION: remove victim from contaminated area; administer artificial respiration and oxygen if necessary. INGESTION: gastric lavage and saline cathartics are usually helpful; subsequent treatment is symptomatic and supportive. SKIN OR EYE CONTACT: wash with copious amounts of water.</p> <p>3.4 TLV-TWA: 200 ppm</p> <p>3.5 TLV-STEL: Not listed.</p> <p>3.6 TLV-Ceiling: 250 ppm.</p> <p>3.7 Toxicity by Ingestion: Grade 3; LD₅₀ = 50 to 500 mg/kg</p> <p>3.8 Toxicity by Inhalation: Currently not available.</p> <p>3.9 Chronic Toxicity: Currently not available</p> <p>3.10 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.</p> <p>3.11 Liquid or Solid Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.</p> <p>3.12 Odor Threshold: 20-50 ppm</p> <p>3.13 IDLH Value: 2,000 ppm.</p> <p>3.14 OSHA PEL-TWA: 200 ppm.</p> <p>3.15 OSHA PEL-STEL: Not listed.</p> <p>3.16 OSHA PEL-Ceiling: Not listed.</p> <p>3.17 EPA AEGL: Not listed</p>	

4. FIRE HAZARDS

- 4.1 **Flash Point:** 6°F C.C. -4°F O.C.
- 4.2 **Flammable Limits in Air:** 1.8%-11.8%
- 4.3 **Fire Extinguishing Agents:** Dry chemical or carbon dioxide
- 4.4 **Fire Extinguishing Agents Not to Be Used:** Water may be ineffective.
- 4.5 **Special Hazards of Combustion Products:** Irritating vapor is generated when heated.
- 4.6 **Behavior in Fire:** May explode. Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.
- 4.7 **Auto Ignition Temperature:** 610°F
- 4.8 **Electrical Hazards:** Not pertinent
- 4.9 **Burning Rate:** 4.7 mm/min.
- 4.10 **Adiabatic Flame Temperature:** Currently not available
- 4.11 **Stoichiometric Air to Fuel Ratio:** 26.2 (calc.)
- 4.12 **Flame Temperature:** Currently not available
- 4.13 **Combustion Molar Ratio (Reactant to Product):** 8.0 (calc.)
- 4.14 **Minimum Oxygen Concentration for Combustion (MOCC):** Not listed

5. CHEMICAL REACTIVITY

- 5.1 **Reactivity with Water:** No reaction
- 5.2 **Reactivity with Common Materials:** No reaction
- 5.3 **Stability During Transport:** Stable unless 0.1% of peroxides has accumulated because of prolonged storage in presence of air. When concentrated by evaporation of solution, they explode.
- 5.4 **Neutralizing Agents for Acids and Caustics:** Not pertinent
- 5.5 **Polymerization:** Not pertinent
- 5.6 **Inhibitor of Polymerization:** 0.025% butylated hydroxytoluene (BHT) present to prevent peroxide formation.

6. WATER POLLUTION

- 6.1 **Aquatic Toxicity:** Currently not available
- 6.2 **Waterfowl Toxicity:** Currently not available
- 6.3 **Biological Oxygen Demand (BOD):** Currently not available
- 6.4 **Food Chain Concentration Potential:** None
- 6.5 **GESAMP Hazard Profile:**
Bioaccumulation: 0
Damage to living resources: 1
Human Oral hazard: 1
Human Contact hazard: 0
Reduction of amenities: 0

7. SHIPPING INFORMATION

- 7.1 **Grades of Purity:** Currently not available
- 7.2 **Storage Temperature:** Ambient
- 7.3 **Inert Atmosphere:** Padded
- 7.4 **Venting:** Pressure-vacuum
- 7.5 **IMO Pollution Category:** D
- 7.6 **Ship Type:** 3
- 7.7 **Barge Hull Type:** 3

8. HAZARD CLASSIFICATIONS

- 8.1 **49 CFR Category:** Flammable liquid
- 8.2 **49 CFR Class:** 3
- 8.3 **49 CFR Package Group:** II
- 8.4 **Marine Pollutant:** No
- 8.5 **NFPA Hazard Classification:**
- | | |
|---------------------------|----------------|
| Category | Classification |
| Health Hazard (Blue)..... | 2 |
| Flammability (Red)..... | 3 |
| Instability (Yellow)..... | 0 |
- 8.6 **EPA Reportable Quantity:** 1000 pounds
- 8.7 **EPA Pollution Category:** C
- 8.8 **RCRA Waste Number:** U213
- 8.9 **EPA FWPCA List:** Not listed

9. PHYSICAL & CHEMICAL PROPERTIES

- 9.1 **Physical State at 15° C and 1 atm:** Liquid
- 9.2 **Molecular Weight:** 72.10
- 9.3 **Boiling Point at 1 atm:** 151°F = 66°C = 339°K
- 9.4 **Freezing Point at 1 atm:** -163.3°F = -108.5°C = 164.7°K
- 9.5 **Critical Temperature:** 512.6°F = 267.0°C = 540.2°K
- 9.6 **Critical Pressure:** 753 psia = 51.2 atm = 5.19 MN/m²
- 9.7 **Specific Gravity:** 0.888 at 20°C (liquid)
- 9.8 **Liquid Surface Tension:** 28 dynes/cm = 0.028 N/m at 20°C
- 9.9 **Liquid Water Interfacial Tension:** Not pertinent
- 9.10 **Vapor (Gas) Specific Gravity:** Not pertinent
- 9.11 **Ratio of Specific Heats of Vapor (Gas):** (est.) 1.083
- 9.12 **Latent Heat of Vaporization:** 180 Btu/lb = 98 cal/g = 4.1 X 10⁵ J/kg
- 9.13 **Heat of Combustion:** -14,990 Btu/lb = -8330 cal/g = -348.8 X 10⁵ J/kg
- 9.14 **Heat of Decomposition:** Not pertinent
- 9.15 **Heat of Solution:** Not pertinent
- 9.16 **Heat of Polymerization:** Not pertinent
- 9.17 **Heat of Fusion:** Currently not available
- 9.18 **Limiting Value:** Currently not available
- 9.19 **Reid Vapor Pressure:** 7.7 psia

NOTES

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9.20 SATURATED LIQUID DENSITY		9.21 LIQUID HEAT CAPACITY		9.22 LIQUID THERMAL CONDUCTIVITY		9.23 LIQUID VISCOSITY	
Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F	Temperature (degrees F)	British thermal unit inch per hour-square foot-F	Temperature (degrees F)	Centipoise
35	56.750	0	0.372		N		N
40	56.560	10	0.376		O		O
45	56.370	20	0.380		T		T
50	56.180	30	0.384				
55	55.990	40	0.388		P		P
60	55.800	50	0.392		E		E
65	55.610	60	0.397		R		R
70	55.420	70	0.401		T		T
75	55.230	80	0.405		I		I
80	55.040	90	0.409		N		N
85	54.850	100	0.413		E		E
90	54.650	110	0.417		N		N
95	54.460	120	0.422		T		T
100	54.270	130	0.426				
105	54.080	140	0.430				
110	53.890	150	0.434				
115	53.700						
120	53.510						

9.24 SOLUBILITY IN WATER		9.25 SATURATED VAPOR PRESSURE		9.26 SATURATED VAPOR DENSITY		9.27 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	Pounds per 100 pounds of water	Temperature (degrees F)	Pounds per square inch	Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F
	M	0	0.336	0	0.00491	100	0.375
	I	5	0.397	5	0.00574	120	0.384
	S	10	0.467	10	0.00668	140	0.393
	C	15	0.547	15	0.00774	160	0.402
	I	20	0.639	20	0.00895	180	0.411
	B	25	0.744	25	0.01031	200	0.420
	L	30	0.864	30	0.01185	220	0.428
	E	35	0.999	35	0.01357	240	0.437
		40	1.153	40	0.01550	260	0.445
		45	1.327	45	0.01766	280	0.454
		50	1.522	50	0.02006	300	0.462
		55	1.742	55	0.02273	320	0.470
		60	1.988	60	0.02570	340	0.478
		65	2.264	65	0.02898	360	0.486
		70	2.571	70	0.03260	380	0.494
		75	2.913	75	0.03660	400	0.501
		80	3.293	80	0.04099	420	0.509
		85	3.714	85	0.04580	440	0.516
		90	4.180	90	0.05108		
		95	4.694	95	0.05684		
		100	5.261	100	0.06313		
		105	5.884	105	0.06999		
		110	6.568	110	0.07744		
		115	7.317	115	0.08552		
		120	8.137	120	0.09428		
		125	9.032	125	0.10380		