

1,4-DIOXANE

DOX

CAUTIONARY RESPONSE INFORMATION

Common Synonyms Di(ethylene oxide) Dioxane p-Dioxane		Liquid Colorless Slight alcohol odor Sinks and mixes with water. Flammable, irritating vapor is produced. Freezing point is 53°F.
Keep people away. Avoid contact with liquid and vapor. Avoid inhalation. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Shut off ignition sources and call fire department. Stay upwind and use water spray to "knock down" vapor. Notify local health and pollution control agencies. Protect water intakes.		
Fire	FLAMMABLE. Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Extinguish with dry chemical, alcohol foam or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.	
Exposure	CALL FOR MEDICAL AID. VAPOR Irritating to eyes, nose and throat. Harmful if inhaled. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. 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, have victim induce vomiting. IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.	
Water Pollution	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.	

1. CORRECTIVE RESPONSE ACTIONS

Dilute and disperse
Stop discharge

2. CHEMICAL DESIGNATIONS

- 2.1 **CG Compatibility Group:** Currently not available; Ether
 2.2 **Formula:** CH₂CH₂OCH₂CH₂O
 2.3 **IMO/UN Designation:** 3.2/1165
 2.4 **DOT ID No.:** 1165
 2.5 **CAS Registry No.:** 123-91-1
 2.6 **NAERG Guide No.:** 127
 2.7 **Standard Industrial Trade Classification:** 51569

3. HEALTH HAZARDS

- 3.1 **Personal Protective Equipment:** Fresh air mask; rubber gloves; goggles; safety shower and eye bath.
 3.2 **Symptoms Following Exposure:** No significant irritation from brief exposure of skin; prolonged or repeated exposure may cause a rash or burn and absorption of toxic amounts leading to serious injury of liver and kidney. Chemical has poor warning properties; illness may be delayed. Moderately irritating to eyes; overexposure may cause corneal injury.
 3.3 **Treatment of Exposure:** INHALATION: promptly remove victim to fresh air, keep him quiet and warm, and call physician; start artificial respiration if breathing stops. INGESTION: if large amounts are swallowed, quickly induce vomiting and get medical attention; no specific antidote known. SKIN AND EYES: flush with plenty of water for 15 min.; remove contaminated clothing and wash before reuse; get medical attention for eyes and if ill effects occur from skin contact.
 3.4 **TLV-TWA:** 25 ppm
 3.5 **TLV-STEL:** Not listed.
 3.6 **TLV-Ceiling:** Not listed.
 3.7 **Toxicity by Ingestion:** Grade 2; LD₅₀ = 0.5 to 5 g/kg (guinea pig: 3.90 g/kg)
 3.8 **Toxicity by Inhalation:** Currently not available.
 3.9 **Chronic Toxicity:** Causes cancer in rats.
 3.10 **Vapor (Gas) Irritant Characteristics:** Vapors cause a slight smarting of the eyes or respiratory system if present in high concentration. The effect is temporary.
 3.11 **Liquid or Solid Characteristics:** Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
 3.12 **Odor Threshold:** 620 mg/m³
 3.13 **IDLH Value:** 500 ppm
 3.14 **OSHA PEL-TWA:** 100 ppm
 3.15 **OSHA PEL-STEL:** Not listed.
 3.16 **OSHA PEL-Ceiling:** Not listed.
 3.17 **EPA AEGL:** Not listed

4. FIRE HAZARDS

- 4.1 **Flash Point:** 74°F O.C. 54°F C.C.
 4.2 **Flammable Limits in Air:** 1.97%-22.5% by vol.
 4.3 **Fire Extinguishing Agents:** Alcohol foam, carbon dioxide, dry chemical
 4.4 **Fire Extinguishing Agents Not to Be Used:** Not pertinent
 4.5 **Special Hazards of Combustion Products:** Toxic vapors are generated when heated.
 4.6 **Behavior in Fire:** Vapor is heavier than air and may travel to a source of ignition and flash back.
 4.7 **Auto Ignition Temperature:** 356°F
 4.8 **Electrical Hazards:** Not pertinent
 4.9 **Burning Rate:** Currently not available
 4.10 **Adiabatic Flame Temperature:** Currently not available
 4.11 **Stoichiometric Air to Fuel Ratio:** 23.8 (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
 5.4 **Neutralizing Agents for Acids and Caustics:** Not pertinent
 5.5 **Polymerization:** Not pertinent
 5.6 **Inhibitor of Polymerization:** Not pertinent

6. WATER POLLUTION

- 6.1 **Aquatic Toxicity:** Currently not available
 6.2 **Waterfowl Toxicity:** Currently not available
 6.3 **Biological Oxygen Demand (BOD):** 0% (theor.), 10 days
 6.4 **Food Chain Concentration Potential:** None
 6.5 **GESAMP Hazard Profile:** Not listed

7. SHIPPING INFORMATION

- 7.1 **Grades of Purity:** Currently not available
 7.2 **Storage Temperature:** Ambient
 7.3 **Inert Atmosphere:** No requirement
 7.4 **Venting:** Open (flame arrester) or pressure-vacuum
 7.5 **IMO Pollution Category:** D
 7.6 **Ship Type:** 2
 7.7 **Barge Hull Type:** 2

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).....	1

 8.6 **EPA Reportable Quantity:** 100 pounds
 8.7 **EPA Pollution Category:** B
 8.8 **RCRA Waste Number:** U108
 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:** 88.11
 9.3 **Boiling Point at 1 atm:** 214.3°F = 101.3°C = 374.5°K
 9.4 **Freezing Point:** 53.2°F = 11.8°C = 285.2°K
 9.5 **Critical Temperature:** 597.2°F = 314°C = 587.2°K
 9.6 **Critical Pressure:** 755 psia = 51.4 atm = 5.21 MN/m²
 9.7 **Specific Gravity:** 1.036 at 20°C (liquid)
 9.8 **Liquid Surface Tension:** Not pertinent
 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):** 1.1
 9.12 **Latent Heat of Vaporization:** 178 Btu/lb = 98.6 cal/g = 4.13 X 10⁵ J/kg
 9.13 **Heat of Combustion:** -11,590 Btu/lb = -6440 cal/g = -269.6 X 10³ J/kg
 9.14 **Heat of Decomposition:** Not pertinent
 9.15 **Heat of Solution (est.):** -9 Btu/lb = -5 cal/g = -0.2 X 10⁵ J/kg
 9.16 **Heat of Polymerization:** Not pertinent
 9.17 **Heat of Fusion:** 34.85 cal/g
 9.18 **Limiting Value:** Currently not available
 9.19 **Reid Vapor Pressure:** 1.4 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
60	64.940	60	0.401	72	1.101		
70	64.520	70	0.405	74	1.098		N
80	64.110	80	0.408	76	1.095		O
90	63.690	90	0.411	78	1.092		T
100	63.280	100	0.415	80	1.088		
110	62.860	110	0.418	82	1.085		P
120	62.440	120	0.421	84	1.082		E
130	62.030	130	0.425	86	1.078		R
140	61.610	140	0.428	88	1.075		T
150	61.200	150	0.431	90	1.072		I
160	60.780	160	0.435	92	1.068		N
170	60.360	170	0.438	94	1.065		E
180	59.950	180	0.441	96	1.062		N
190	59.530	190	0.445	98	1.059		T
200	59.110	200	0.448	100	1.055		
210	58.700	210	0.451	102	1.052		
				104	1.049		
				106	1.045		
				108	1.042		
				110	1.039		
				112	1.035		
				114	1.032		
				116	1.029		

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	60	0.411	60	0.00650	0	0.216
	I	70	0.553	70	0.00856	25	0.229
	S	80	0.734	80	0.01117	50	0.241
	C	90	0.965	90	0.01442	75	0.253
	I	100	1.257	100	0.01844	100	0.266
	B	110	1.622	110	0.02337	125	0.278
	L	120	2.074	120	0.02837	150	0.290
	E	130	2.631	130	0.03662	175	0.302
		140	3.310	140	0.04530	200	0.314
		150	4.133	150	0.05564	225	0.326
		160	5.124	160	0.06788	250	0.338
		170	6.310	170	0.08226	275	0.349
		180	7.720	180	0.09906	300	0.361
		190	9.386	190	0.11860	325	0.372
		200	11.340	200	0.14120	350	0.384
		210	13.630	210	0.16710	375	0.395
		220	16.300	220	0.19680	400	0.406
		230	19.380	230	0.23070	425	0.417
		240	22.930	240	0.26900	450	0.429
		250	27.010	250	0.31240	475	0.440
		260	31.670	260	0.36120	500	0.451
						525	0.461
						550	0.472
						575	0.483
						600	0.493