

BROMINE

BRX

CAUTIONARY RESPONSE INFORMATION

Common Synonyms	Watery liquid Reddish-brown Sharp irritating odor
	Sinks in water. Irritating brown vapor is produced.
	<p>Restrict access. Evacuate. AVOID CONTACT WITH LIQUID AND VAPOR. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Notify local health and pollution control agencies. Protect water intakes.</p>
Fire	<p>Not flammable. May cause fire on contact with combustibles. POISONOUS GASES ARE PRODUCED IN FIRE. Cool exposed containers with water. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).</p>
Exposure	<p>CALL FOR MEDICAL AID.</p> <p>VAPOR Irritating to eyes, nose and throat. If inhaled, will cause coughing, difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration (but NOT mouth to mouth). If breathing is difficult, give oxygen.</p> <p>LIQUID Will burn 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>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. 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

Dilute and disperse
Stop discharge
Collection Systems: Pump; Dredge
Chemical and Physical Treatment:
Absorb

2. CHEMICAL DESIGNATIONS

2.1 CG Compatibility Group: Not listed.
2.2 Formula: Br₂
2.3 IMO/UN Designation: 8.0/1744
2.4 DOT ID No.: 1744
2.5 CAS Registry No.: 7726-95-6
2.6 NAERG Guide No.: 154
2.7 Standard Industrial Trade Classification: 52225

3. HEALTH HAZARDS

- 3.1 **Personal Protective Equipment:** Chemical safety goggles, face shield; self-contained air-line canister mask; rubber suit.
- 3.2 **Symptoms Following Exposure:** SKIN: contact with liquid or vapor may cause acne and slow-healing ulcers. INHALATION: induces severe irritation of the respiratory passages and pulmonary edema. Probable lethal oral dose for an adult is 1 ml. A brief exposure to 1000 ppm may be fatal.
- 3.3 **Treatment of Exposure:** SKIN AND EYES: wash well with water and sodium bicarbonate solution. RESPIRATORY SYSTEM: if there is obstruction to breathing establish airway by pulling tongue forward, inserting an airway tube, or doing a tracheostomy; begin artificial respiration; if difficulty in breathing is a result of pulmonary edema, treatment should be carried out with the patient in the sitting position. Administration of oxygen is most important; INGESTION: do not induce vomiting. Have victim drink water and milk.
- 3.4 TLV-TWA: 0.1 ppm
3.5 TLV-STEL: 0.2 ppm
3.6 TLV-Ceiling: Not listed.
3.7 Toxicity by Ingestion: Not pertinent
3.8 Toxicity by Inhalation: Currently not available.
3.9 Chronic Toxicity: None
3.10 **Vapor (Gas) Irritant Characteristics:** Causes severe eye or throat irritations which can cause eye or lung injury; cannot be tolerated even at low concentrations.
3.11 **Liquid or Solid Characteristics:** Severe skin irritant. Causes second- and third-degree burns on short contact; very injurious to the eyes.
3.12 **Odor Threshold:** 3.5 ppm
3.13 IDLH Value: 3 ppm
3.14 OSHA PEL-TWA: 0.1 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:** Not flammable
4.2 **Flammable Limits in Air:** Not flammable
4.3 **Fire Extinguishing Agents:** Use water spray to cool exposed containers and to wash away spills.
4.4 **Fire Extinguishing Agents Not to Be Used:** Not pertinent
4.5 **Special Hazards of Combustion Products:** Toxic and irritating gases are generated when heated or in fires.
4.6 **Behavior in Fire:** Not pertinent
4.7 **Auto Ignition Temperature:** Not flammable
4.8 **Electrical Hazards:** Not pertinent
4.9 **Burning Rate:** Not flammable
4.10 **Adiabatic Flame Temperature:** Currently not available
4.11 **Stoichiometric Air to Fuel Ratio:** Not pertinent
4.12 **Flame Temperature:** Currently not available
4.13 **Combustion Molar Ratio (Reactant to Product):** Not pertinent
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:** Reacts violently with aluminum. May cause fire in contact with wood, cotton, straw. Iron, steel, stainless steel, and copper are corroded by bromine and are especially subject to attack by wet bromine. Of the plastics, only those which are highly fluorinated resist bromine attack.
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:**
10 ppm/10 hr/cladophora/killed/fresh water
10 ppm*/fish/irritant/salt water
*Time period not specified.
6.2 **Waterfowl Toxicity:** Currently not available
6.3 **Biological Oxygen Demand (BOD):** Not pertinent
6.4 **Food Chain Concentration Potential:** None
6.5 **GESAMP Hazard Profile:**
Bioaccumulation: 0
Damage to living resources: 3
Human Oral hazard: 2
Human Contact hazard: II
Reduction of amenities: XX

7. SHIPPING INFORMATION

- 7.1 **Grades of Purity:** Commercial, technical
7.2 **Storage Temperature:** Cool but above 20°F to prevent freezing
7.3 **Inert Atmosphere:** Currently not available
7.4 **Venting:** Currently not available
7.5 **IMO Pollution Category:** Currently not available
7.6 **Ship Type:** Currently not available
7.7 **Barge Hull Type:** Currently not available

8. HAZARD CLASSIFICATIONS

- 8.1 **49 CFR Category:** Corrosive material
8.2 **49 CFR Class:** 8
8.3 **49 CFR Package Group:** I
8.4 **Marine Pollutant:** No
8.5 **NFPA Hazard Classification:**
- | Category | Classification |
|---------------------------|----------------|
| Health Hazard (Blue)..... | 4 |
| Flammability (Red)..... | 0 |
| Instability (Yellow)..... | 0 |
| Special (White)..... | OX |
- 8.6 **EPA Reportable Quantity:** Not listed.
8.7 **EPA Pollution Category:** Not listed.
8.8 **RCRA Waste Number:** Not listed
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:** 159.81
9.3 **Boiling Point at 1 atm:** 138°F = 58.8°C = 332°K
9.4 **Freezing Point:** 19°F = -7.2°C = 266°K
9.5 **Critical Temperature:** Not pertinent
9.6 **Critical Pressure:** Not pertinent
9.7 **Specific Gravity:** 3.12 at 20°C (Liquid)
9.8 **Liquid Surface Tension:** 41 dynes/cm = .041 N/m at 20°C
9.9 **Liquid Water Interfacial Tension:** Currently not available
9.10 **Vapor (Gas) Specific Gravity:** 5.5 at 20°C
9.11 **Ratio of Specific Heats of Vapor (Gas):** 1.3
9.12 **Latent Heat of Vaporization:** 80.6 Btu/lb = 44.8 cal/g = 1.88 X 10⁵ J/kg
9.13 **Heat of Combustion:** Not pertinent
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:** 16.1 cal/g
9.18 **Limiting Value:** Currently not available
9.19 **Reid Vapor Pressure:** Currently not available

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	198.699	56	0.107	45	0.880	24	1.312
40	198.199	58	0.107	50	0.875	26	1.294
45	197.599	60	0.107	55	0.871	28	1.277
50	197.000	62	0.107	60	0.867	30	1.259
55	196.400	64	0.107	65	0.862	32	1.242
60	195.799	66	0.107	70	0.858	34	1.226
65	195.199	68	0.107	75	0.854	36	1.209
70	194.599	70	0.107	80	0.849	38	1.194
75	194.000	72	0.107	85	0.845	40	1.178
80	193.400	74	0.107	90	0.841	42	1.163
85	192.799	76	0.107	95	0.836	44	1.148
90	192.299	78	0.107	100	0.832	46	1.133
95	191.699	80	0.107	105	0.828	48	1.119
		82	0.107	110	0.823	50	1.105
		84	0.107	115	0.819	52	1.091
		86	0.107			54	1.078
		88	0.107			56	1.065
		90	0.107			58	1.052
		92	0.107			60	1.039
		94	0.107			62	1.027
		96	0.107			64	1.014
		98	0.107			66	1.002
		100	0.107			68	0.991
		102	0.107			70	0.979
		104	0.107			72	0.968
		106	0.107			74	0.957

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
77	3.500	20	0.892	20	0.02769	100	0.055
		25	1.035	25	0.03180	120	0.055
		30	1.198	30	0.03642	140	0.055
		35	1.382	35	0.04158	160	0.055
		40	1.589	40	0.04735	180	0.055
		45	1.823	45	0.05378	200	0.055
		50	2.086	50	0.06092	220	0.055
		55	2.380	55	0.06883	240	0.055
		60	2.708	60	0.07759	260	0.055
		65	3.075	65	0.08724	280	0.055
		70	3.482	70	0.09788	300	0.055
		75	3.935	75	0.10960	320	0.055
		80	4.436	80	0.12240	340	0.055
		85	4.990	85	0.13640	360	0.055
		90	5.602	90	0.15170	380	0.055
		95	6.275	95	0.16840	400	0.055
		100	7.015	100	0.18660	420	0.055
						440	0.055
						460	0.055
						480	0.055
						500	0.055
						520	0.056
						540	0.056
						560	0.056
						580	0.056
						600	0.056