

CARBON MONOXIDE

CMO

CAUTIONARY RESPONSE INFORMATION

Common Synonyms Monoxide	Compressed gas or liquefied compressed gas Colorless Odorless Liquid floats and boils on water. Poisonous, flammable visible vapor cloud is produced.
<p>KEEP PEOPLE AWAY. AVOID CONTACT WITH LIQUID AND VAPOR. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Shut off ignition sources. Call fire department. Evacuate area in case of large discharge. Notify local health and pollution control agencies.</p>	
Fire	<p>FLAMMABLE. Containers may explode in fire. Wear goggles and self-contained breathing apparatus. Let fire burn. Stop flow of gas if possible. Cool exposed containers and protect men effecting shutoff with water.</p>
Exposure	<p>CALL FOR MEDICAL AID.</p> <p>VAPOR POISONOUS IF INHALED. Move victim to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.</p> <p>LIQUID Will cause frostbite. Flush affected areas with plenty of water. DO NOT RUB AFFECTED AREAS.</p>
Water Pollution	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.

1. CORRECTIVE RESPONSE ACTIONS

Stop discharge
Chemical and Physical Treatment: Burn

2. CHEMICAL DESIGNATIONS

- 2.1 CG Compatibility Group: Not listed.
- 2.2 Formula: CO
- 2.3 IMO/UN Designation: 2/1016
- 2.4 DOT ID No.: 1016
- 2.5 CAS Registry No.: 630-08-0
- 2.6 NAERG Guide No.: 119
- 2.7 Standard Industrial Trade Classification: 52239

3. HEALTH HAZARDS

- 3.1 **Personal Protective Equipment:** Self-contained breathing apparatus; safety glasses and safety shoes; Type D or Type N canister mask.
- 3.2 **Symptoms Following Exposure:** Inhalation causes headache, dizziness, weakness of limbs, confusion, nausea, unconsciousness, and finally death. 0.04% conc., 2-3 hr. or .06% conc., 1 hr - headache and discomfort; with moderate exercise, 0.1-0.2% will produce throbbing in the head in about 1/2 hr., a tendency to stagger in about 1 1/2 hr., and confusion of the mind, headache, and nausea in about 2 hrs. 0.20-25% usually produces unconsciousness in about 1/2 hr. Inhalation of a 0.4% conc. can prove fatal in less than 1 hr. Inhalation of high concentrations can cause sudden, unexpected collapse. Contact of liquid with skin will cause frostbite.
- 3.3 **Treatment of Exposure:** INHALATION: remove from exposure; give oxygen if available; support respiration; call a doctor. SKIN: if burned by liquid, treat as frostbite.
- 3.4 TLV-TWA: 25 ppm
- 3.5 TLV-STEL: Not listed.
- 3.6 TLV-Ceiling: Not listed.
- 3.7 **Toxicity by Ingestion:** Not pertinent (gas with low boiling point)
- 3.8 **Toxicity by Inhalation:** Currently not available.
- 3.9 **Chronic Toxicity:** Toxicity from overexposure persists for many days.
- 3.10 **Vapor (Gas) Irritant Characteristics:** Currently not available
- 3.11 **Liquid or Solid Characteristics:** Currently not available
- 3.12 **Odor Threshold:** Odorless
- 3.13 **IDLH Value:** 1,200 ppm
- 3.14 **OSHA PEL-TWA:** 50 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 pertinent
- 4.2 **Flammable Limits in Air:** 12%-75%
- 4.3 **Fire Extinguishing Agents:** Let fire burn; shut off flow of gas and cool adjacent exposures with water. Extinguish (only if wearing self-contained breathing apparatus) with dry chemicals or carbon dioxide.
- 4.4 **Fire Extinguishing Agents Not to Be Used:** Not pertinent
- 4.5 **Special Hazards of Combustion Products:** Asphyxiation due to carbon dioxide production may result.
- 4.6 **Behavior in Fire:** Flame has very little color. Containers may explode in fire.
- 4.7 **Auto Ignition Temperature:** 1,128°F
- 4.8 **Electrical Hazards:** Currently not available
- 4.9 **Burning Rate:** Not pertinent
- 4.10 **Adiabatic Flame Temperature:** 2701. (Est.)
- 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:** 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:** 1.5 ppm/1-6 hr/minnows and sunfish/killed/fresh water
- 6.2 **Waterfowl Toxicity:** Currently not available
- 6.3 **Biological Oxygen Demand (BOD):** None
- 6.4 **Food Chain Concentration Potential:** None
- 6.5 **GESAMP Hazard Profile:** Not listed

7. SHIPPING INFORMATION

- 7.1 **Grades of Purity:** Liquid: 98.6+%; Gas: Research High Purity; CP (99.5%); Technical (99.0+%); Commercial (97.5+%)
- 7.2 **Storage Temperature:** Ambient (for gas); -312.7°F (for liquid)
- 7.3 **Inert Atmosphere:** No requirement
- 7.4 **Venting:** Safety relief
- 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:** Poison Gas
- 8.2 **49 CFR Class:** 2.3
- 8.3 **49 CFR Package Group:** Not pertinent
- 8.4 **Marine Pollutant:** No
- 8.5 **NFPA Hazard Classification:**

Category	Classification
Health Hazard (Blue).....	2
Flammability (Red).....	4
Instability (Yellow).....	0
- 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:** Gas
- 9.2 **Molecular Weight:** 28.0
- 9.3 **Boiling Point at 1 atm:** -312.7°F = -191.5°C = 81.7°K
- 9.4 **Freezing Point:** -326°F = -199°C = 74°K
- 9.5 **Critical Temperature:** -220°F = -140°C = 133°K
- 9.6 **Critical Pressure:** 507.5 psia = 34.51 atm = 3.502 MN/m²
- 9.7 **Specific Gravity:** 0.791 at -191.5°C (liquid)
- 9.8 **Liquid Surface Tension:** 9.8 dynes/cm = 0.098 N/m at -193°C
- 9.9 **Liquid Water Interfacial Tension:** Not pertinent
- 9.10 **Vapor (Gas) Specific Gravity:** Currently not available
- 9.11 **Ratio of Specific Heats of Vapor (Gas):** 1.3962
- 9.12 **Latent Heat of Vaporization:** 92.8 Btu/lb = 51.6 cal/g = 2.16 X 10⁵ J/kg
- 9.13 **Heat of Combustion:** -4,343 Btu/lb = -2,412 cal/g = -101 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:** 7.13 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
-326	49.870	-326	0.510	-309	0.949	-318	0.018
-325	49.830	-325	0.510	-308	0.942	-316	0.018
-324	49.800	-324	0.510	-307	0.935	-314	0.017
-323	49.760	-323	0.510	-306	0.928	-312	0.016
-322	49.730	-322	0.510	-305	0.922	-310	0.016
-321	49.690	-321	0.510	-304	0.915	-308	0.015
-320	49.660	-320	0.510	-303	0.908	-306	0.015
-319	49.630	-319	0.510	-302	0.902	-304	0.014
-318	49.590	-318	0.510	-301	0.895	-302	0.014
-317	49.560	-317	0.510	-300	0.888	-300	0.013
-316	49.520	-316	0.510	-299	0.881	-298	0.013
-315	49.490	-315	0.510	-298	0.875	-296	0.012
-314	49.450	-314	0.510	-297	0.868	-294	0.012
-313	49.420	-313	0.510	-296	0.861	-292	0.012
-312	49.380	-312	0.510	-295	0.855	-290	0.011
-311	49.350	-311	0.510	-294	0.848	-288	0.011
-310	49.310	-310	0.510	-293	0.841	-286	0.011
-309	49.280			-292	0.834	-284	0.010
-308	49.240			-291	0.828		
-307	49.210			-290	0.821		
-306	49.170			-289	0.814		
-305	49.140			-288	0.808		
-304	49.110			-287	0.801		
-303	49.070			-286	0.794		
-302	49.040			-285	0.787		
-301	49.000			-284	0.781		

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
32	0.004	-326	5.310	-326	0.10360	100	0.250
		-324	6.243	-324	0.12000	120	0.250
		-322	7.304	-322	0.13840	140	0.250
		-320	8.508	-320	0.15890	160	0.250
		-318	9.867	-318	0.18170	180	0.250
		-316	11.400	-316	0.20690	200	0.250
		-314	13.110	-314	0.23480	220	0.250
		-312	15.020	-312	0.26540	240	0.250
		-310	17.160	-310	0.29900	260	0.250
		-308	19.520	-308	0.33570	280	0.250
		-306	22.140	-306	0.37580	300	0.250
		-304	25.020	-304	0.41930	320	0.250
		-302	28.200	-302	0.46650	340	0.250
		-300	31.680	-300	0.51750	360	0.250
		-298	35.490	-298	0.57260	380	0.250
		-296	39.650	-296	0.63180	400	0.250
		-294	44.170	-294	0.69550	420	0.250
		-292	49.090	-292	0.76360	440	0.250