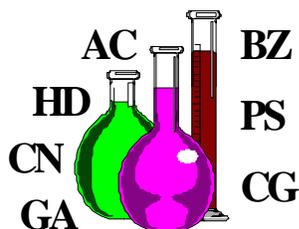


*U.S. Army Center for Health Promotion and Preventive Medicine*



*Detailed Facts About Choking Agent Phosgene  
(CG)*

218-01-1096

*Physical Properties of Phosgene*

<i>Chemical Structure</i>	$\begin{array}{c} \text{Cl}-\text{C}=\text{O} \\   \\ \text{Cl} \end{array}$
<i>Chemical Formula</i>	$\text{CCl}_2\text{O}$
<i>Description</i>	CG is foglike in its initial concentration, but it becomes colorless as it spreads; it has both a newly mown hay and highly toxic suffocating odor.
<i>Molecular Weight</i>	98.92
<i>Boiling Point</i>	7.6°C
<i>Vapor Pressure (mm Hg)</i>	1180 @ 20°C
<i>Freezing Point</i>	-128°C
<i>Density</i>	Liquid = 1.37@20°C Vapor = 3.4 (air = 1)
<i>Solubility</i>	Limited in water; decomposes immediately; completely miscible in most organic solvents.
<i>Flash Point</i>	Nonflammable
<i>Volatility</i>	528,000 mg/m <sup>3</sup> @ -40°C 2,200,000 mg/m <sup>3</sup> @ -10°C 4,300,000 mg/m <sup>3</sup> @ 7.6°C

### ***Toxicity Values***

IC <sub>t50</sub> (inhalation)	= 1,600 mg-min/m <sup>3</sup>
LCL <sub>0</sub> (inhalation, 5 min)	= 1,010 mg-min/m <sup>3</sup>
LCL <sub>0</sub> (inhalation, 30 min)	= 10,800 mg-min/m <sup>3</sup>
LC <sub>t50</sub> (inhalation)	= 3,200 mg/m <sup>3</sup>
TCL <sub>0</sub> (inhalation, 30 min)	= 3,030 mg-min/m <sup>3</sup>

### ***Exposure Limits***

Workplace Time-Weighted Average -	0.4 mg/m <sup>3</sup>
General Population Limits -	0.0025 mg/m <sup>3</sup>

## ***Toxic Properties of Phosgene***

*Phosgene was first used in the dye industry in the late 19th century to process colorfast materials. The Germans introduced CG in 1915 for use in World War I. By some estimates, more than 80 percent of all chemical agent fatalities in World War I were due to phosgene. In the late 1920s, many countries manufactured phosgene as a chemical warfare agent; it still remains in the chemical arsenals. Phosgene is also an important industrial compound used in the preparation and manufacture of many organic chemicals.*

### ***Overexposure Effects***

Phosgene is a corrosive, highly toxic gas used as a delayed-casualty agent resulting in fluid buildup in the lungs (“dryland drowning”). It affects the upper respiratory tract, skin, and eyes and causes severe respiratory damage as well as burns to the skin and eyes. Acute inhalation may cause respiratory and circulatory failure with symptoms of chills, dizziness, thirst, burning of eyes, cough, viscous sputum, dyspnea, feeling of suffocation, tracheal rhonchi, burning in throat, vomiting, pain in chest and cyanosis. Rapid progression to pulmonary edema and pneumonia, and death from respiratory and circulatory failure may occur. Pulmonary edema can suddenly occur up to 48 hours after exposure. Phosgene is a severe mucous membrane irritant. Chronic inhalation may cause irreversible pulmonary changes resulting in emphysema and fibrosis. Acute skin contact lesions similar to those of frostbite and burns; it is a severe skin irritant. Chronic skin contact may result in dermatitis. Acute eye contact may result in conjunctivitis, lacrimation, lesions similar to those of frostbite, and burns; chronic eye contact may result in conjunctivitis.

### ***Emergency and First Aid Procedures***

Inhalation: remove victim to fresh air; keep individual calm and avoid any unnecessary exertion or movement; maintain airway and blood pressure; trained persons should administer oxygen if breathing is difficult; give artificial respiration if victim is not breathing; seek medical attention immediately.

Eye Contact: flush eyes immediately with running water or normal saline for at least 15 minutes; hold eyelids apart during irrigation; do not delay rinsing to avoid permanent eye injury; seek medical attention immediately.

Skin Contact: unlikely that emergency treatment will be required; gently wrap affected part in blankets if warm water is not available or practical to use; allow circulation to return naturally; if adverse effects occur, seek medical attention immediately.

Ingestion: treat symptomatically and supportively; if vomiting occurs, keep head lower than hips to prevent aspiration; seek medical attention immediately.

### ***Protective Equipment***

Protective Gloves:	Wear appropriate protective gloves to prevent any possibility of contact with skin; Butyl and Neoprene rubber gloves are preferred.
Eye Protection:	Wear splash-proof or dust-resistant safety goggles and a faceshield to prevent contact with substance.
Other:	Wear respirators based on contamination levels found in the workplace; must not exceed the working limits of the respirator and must be jointly approved by NIOSH; employer should provide an eye wash fountain and quick drench shower for emergency use.

### ***Reactivity Data***

Stability:	Stable in steel containers of CG is dry.
Hazardous Polymerization:	Will not occur.
Incompatibilities:	Reacts explosively with thionyl chloride or potassium; reacts violently with hexafluoro isopropylidene, amino lithium, ammonia, and strong acids; reacts with tert-butyl azidoformate to form explosive carbide; reacts with 2,4-hexadiyn-1, 6-diol to form 2, 4-hexadiyn-1, 6-bischloroformate, a shock sensitive compound; reacts with isopropyl alcohol to form isopropyl chloroformate and hydrogen chloride; thermal decomposition may occur in the presence of iron salts and result in explosion.
Instability Conditions:	Reacts with vapors of sodium with luminescence at about 260°C.
Decomposition:	Moist phosgene is very corrosive; it decomposes in the presence of moisture to form hydrochloric acid and carbon monoxide; thermal decomposition may release toxic and/or hazardous gases.

***Persistency***

Short; however, vapor may persist for some time in low places under calm or light winds and stable atmospheric conditions (inversion).

***References***

1. Department of the Army Field Manual (DA FM) 3-9, *Potential Military Chemical/Biological Agents and Compounds*, 1990.
2. Department of the Army Technical Manual (DA TM) 3-250, *Storage, Shipment, Handling, and Disposal of Chemical Agents and Hazardous Chemicals*, 1969.
3. *The Merck Index, An Encyclopedia of Chemicals, Drugs, and Biologicals, Eleventh Edition*, Merck & Co., Inc, Rahway, New Jersey, 1989.
4. Somani, Satu M., *Chemical Warfare Agents*, Academic Press, Inc., San Diego, California, 1992.
5. U.S. Army Chemical Command Materiel Destruction Agency, *Site Monitoring Concept Study*, 15 September 1993.

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