

Phosgene

Incident management

Key Points

Fire

- Non-combustible
- Toxic vapours emitted
- In the event of a fire involving phosgene, use fine water spray and liquid-tight protective clothing with breathing apparatus

Health


- Toxicity due to inhalation, skin and ocular exposure
- Very toxic and corrosive
- There may be a delay of several hours between inhalation exposure and onset of signs and symptoms
- Inhalation causes nose and throat irritation and coughing. At higher concentrations breathlessness, nausea and vomiting may occur
- Dermal exposure causes skin irritation and burns
- Ocular irritation causes irritation, lacrimation and corneal perforation

Environment

- Avoid release into the environment
- Inform Environment Agency of substantial release incidents

Hazard Identification

Standard (UK) Dangerous Goods Emergency Action Codes^(a)

UN		1076	Phosgene	
EAC		2XE	Use fine water spray. Wear liquid-tight chemical protective clothing in combination with breathing apparatus*. Spillages and decontamination run-off should be prevented from entering drains and watercourses. There may be a public safety hazard outside the immediate area of the incident**.	
APP		B	Gas-tight chemical protective suit with breathing apparatus***.	
Hazards	Class	2.3	Toxic gas	
	Sub risks	8	Corrosive substance	
HIN		268	Toxic gas, corrosive	

UN – United Nations number; EAC – Emergency Action Code; APP – Additional Personal Protection; HIN - Hazard Identification Number



* Liquid-tight chemical protective clothing (BS 8428) in combination with self-contained open circuit positive pressure compressed air breathing apparatus (BS EN 137).

** People should stay indoors with windows and doors closed, ignition sources should be eliminated and ventilation stopped. Non-essential personnel should move at least 250 m away from the incident.

*** Gas-tight chemical protective clothing (BS EN 943 part 2) in combination with self-contained open circuit positive pressure compressed air breathing apparatus (BS EN 137).




^a Dangerous Goods Emergency Action Code List, HM Fire Service Inspectorate, Publications Section, The Stationery Office, 2009.

Chemical Hazard Information and Packaging for Supply Classification^(a)

Classification	T+	Very toxic	
	C	Corrosive	
Risk phrases	R26	Very toxic by inhalation	
	R34	Causes burns	
Safety phrases	S1/2	Keep locked up and out of the reach of children	
	S9	Keep container in a well ventilated place	
	S26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice	
	S36/37/39	Wear suitable protective clothing, gloves and eye/face protection	
	S45	In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible)	

^a Annex VI to Regulation (EC) No 1272/2008 on Classification, Labelling and Packaging of Substances and Mixtures- Table 3.2.
<http://esis.jrc.ec.europa.eu/index.php?PGM=cla> (accessed 11/2011)

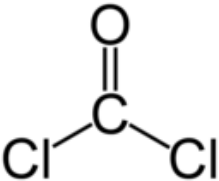
Globally Harmonised System of Classification and Labelling of Chemicals (GHS)^(a)

Hazard Class and Category	Press. Gas	Compressed gas	
	Acute Tox. 2	Acute toxicity (inhalation), category 2	
	Skin Corr 1B	Skin corrosion, category 1B	
Hazard Statement	H330	Fatal if inhaled.	
	H314	Causes severe skin burns and eye damage	
Signal Words	DANGER		

Implemented in the EU on 20 January 2009.

^a Annex VI to Regulation (EC) No 1272/2008 on Classification, Labelling and Packaging of Substances and Mixtures- Table 3.1.
<http://esis.jrc.ec.europa.eu/index.php?PGM=cla> (accessed 11/2011)

Physicochemical Properties

CAS number	75-44-5
Molecular weight	99
Empirical formula	CCl ₂ O
Common synonyms	Carbonic dichloride; Carbonyl chloride; Chloroformyl chloride
State at room temperature	Gas
Volatility	Vapour pressure = 1,215 mm Hg at 20 °C
Specific gravity	1.4 at 0 °C (water = 1)
Vapour density	3.5 at 20 °C (air = 1)
Flammability	Non flammable
Lower explosive limit	Data not available
Upper explosive limit	Data not available
Water solubility	Slightly soluble
Reactivity	May react violently with water, ammonia and primary amines
Reaction or degradation products	Reacts with water to form hydrochloric acid and carbon dioxide. Carbon monoxide and chlorine also produced
Odour	Freshly mown or musty hay odour
Structure	

References^(a,b,c)

^a WHO / UN / ILO International Programme on Chemical Safety: International Chemical Safety Card (ICSC) 0007: Phosgene, 2002.

^b The Dictionary of Substances and their Effects. Ed. S Gangolli. Second Edition, Volume 6, 1999.

^c The Merck Index (14th Edition), Entry 7335: Phosgene, 2006

Threshold Toxicity Values

EXPOSURE VIA INHALATION		
ppm	mg m ⁻³	SIGNS AND SYMPTOMS
3 – 5	12 – 20	Irritation of eyes, throat and upper respiratory system
62	251	Fatal (30 minute exposure)
500	2022	Fatal (1 minute)

Reference^(a)

^a Phosgene (MEDITEXT® Medical Management). In: Klasco RK (Ed): TOMES® System. Thomson Micromedex, Greenwood Village, Colorado (accessed 02/2010).

Published Emergency Response Guidelines

Emergency Response Planning Guideline (ERPG) Values^(a)

	Listed value (ppm)	Calculated value (mg m ⁻³)
ERPG-1*	-	-
ERPG-2**	0.5	2.02
ERPG-3***	1.5	6.07

* Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hr without experiencing other than mild transient adverse health effects or perceiving a clearly defined, objectionable odour.

** Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hr without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action.

*** Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hr without experiencing or developing life-threatening health effects.

Acute Exposure Guideline Levels (AEGs)^(b)

	ppm				
	10 min	30 min	60 min	4 hr	8 hr
AEG-1[†]	-	-	-	-	-
AEG-2^{††}	0.60	0.60	0.30	0.08	0.04
AEG-3^{†††}	3.6	1.5	0.75	0.20	0.09

[†] The level of the chemical in air at or above which the general population could experience notable discomfort.

^{††} The level of the chemical in air at or above which there may be irreversible or other serious long-lasting effects or impaired ability to escape.

^{†††} The level of the chemical in air at or above which the general population could experience life-threatening health effects or death.

^a American Industrial Hygiene Association (AIHA). 2010 Emergency Response Planning Guideline Values and Workplace Environmental Exposure Level Guides Handbook, Fairfax, VA (accessed 01/2011).

^b U.S. Environmental Protection Agency. Acute Exposure Guideline Levels, <http://www.epa.gov/oppt/aegl/pubs/chemlist.htm> (accessed 01/2011)

Exposure Standards, Guidelines or Regulations

Occupational standards

WEL^(a)	LTEL(8 hour reference period): 0.02 ppm (0.08 mg m ⁻³)
	STEL(15 min reference period): 0.06 ppm (0.25 mg m ⁻³)

Public health guidelines

DRINKING WATER QUALITY GUIDELINE^(b)	No guideline value specified
AIR QUALITY GUIDELINE	No guideline value specified
SOIL GUIDELINE VALUE AND HEALTH CRITERIA VALUES	No guideline value specified

WEL – Workplace exposure limit; LTEL - Long-term exposure limit; STEL – Short-term Exposure Standards, Guidelines or Regulations

^a List of approved workplace exposure limits (as consolidated with amendments October 2007). <http://www.hse.gov.uk/cosHH/table1.pdf> (An update to EH40/2005: Workplace Exposure Limits 2005. The Stationery Office, London) (accessed 01/2011).

^b The Water Supply (Water Quality) Regulations 2000 (England) and the Water Supply (Water Quality) Regulations 2001 (Wales) (accessed 01/2011)..

Health Effects

Major route of exposure^(a)

- Due to its gaseous nature, inhalation and ocular exposure are most likely.
- Dermal features usually only occur from splashes of liquefied material.
- Ingestion is unlikely.

Immediate signs or symptoms of acute exposure^(a,b)

- Inhalation of 3 ppm causes nose, throat irritation and 4.8 ppm causes coughing. Higher concentrations (>30 ppm) cause pain in the chest and breathlessness; nausea and vomiting may occur. Continued exposure to phosgene concentrations above 100 ppm may be rapidly fatal. Following initial symptoms there may be an asymptomatic period before the onset of non-cardiogenic pulmonary oedema with severe breathlessness and a productive cough.
- The presence or absence of initial symptoms does not reflect the severity of poisoning as non-cardiogenic pulmonary oedema may still develop up to 24 hours (rarely 72 hours) later in individuals who show minimal or no immediate effects. However, non-cardiogenic pulmonary oedema is more likely to develop the greater the exposure (>150 ppm) to phosgene. Rarely, in very severe cases, circulatory collapse may follow the development of non-cardiogenic pulmonary oedema.
- Dermal exposure to 3 ppm causes skin irritation and splashes from liquefied material may cause burns.
- Ocular exposure causes irritation at 3 ppm and may also cause lacrimation. Splashes from liquefied material may cause corneal opacification, conjunctival adhesions and perforation.

TOXBASE - <http://www.toxbase.org> (accessed 01/2011)

^a TOXBASE: Phosgene, 08/2001.

^b TOXBASE: Phosgene – medical briefing.

Decontamination and First Aid

Important Notes

- Ambulance staff, paramedics and emergency department staff treating chemically-contaminated casualties should be equipped with Department of Health approved, gas-tight (Respirex) decontamination suits based on EN466:1995, EN12941:1998 and prEN943-1:2001, where appropriate.
- Decontamination should be performed using local protocols in designated areas such as a decontamination cubicle with adequate ventilation.
- Phosgene is a volatile substance and secondary contamination is unlikely to occur.

Dermal exposure^(a,b)

- Remove patient from exposure.
- The patient should remove all clothing and personal effects.
- Double-bag soiled clothing and place in a sealed container clearly labelled as a chemical hazard.
- Brush away any adherent solid particles and gently blot away any adherent liquid from the patient.
- Wash hair and all contaminated skin with copious amounts of water (preferably warm) and soap for at least 10-15 minutes. Decontaminate open wounds first and avoid contamination of unexposed skin.
- Pay special attention to skin folds, axillae, ears, fingernails, genital areas and feet.

Ocular exposure^(c)

- Remove patient from exposure.
- Remove contact lenses if necessary and immediately irrigate the affected eye thoroughly with water or 0.9% saline for at least 10-15 minutes.
- Patients with corneal damage or those whose symptoms do not resolve rapidly should be referred for urgent ophthalmological assessment.

Inhalation^(a)

- Remove patient from exposure.
- Ensure a clear airway and adequate ventilation.
- Give oxygen to symptomatic patients.
- Exposed individuals should be assessed at hospital irrespective of the presence or severity of symptoms.
- Apply other measures according to the patient's clinical condition.

Ingestion

- Not applicable.

This document will be reviewed not later than 3 years or sooner if substantive evidence becomes available.

TOXBASE - <http://www.toxbase.org> (accessed 01/2011)

^a TOXBASE: Phosgene, 08/2001.

^b TOXBASE: Skin decontamination – corrosives, 2002.

^c TOXBASE: Chemicals splashed or sprayed into the eyes, 2007.