International Chemical Safety Cards

CHLORINE DIOXIDE

ICSC: 0127

Chlorine oxide
Chlorine peroxide
Chlorine(IV)oxide
ClO_2
Molecular mass: 67.5

ICSC # 0127
CAS # 10049-04-4
RTECS # FO3000000
EC # 006-089-00-2

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Not combustible but enhances combustion of other substances. Many reactions may cause fire or explosion.	NO contact with combustibles.	In case of fire in the surroundings: water in large amounts, water spray.
EXPLOSION	Risk of fire and explosion: see Chemical Dangers.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Do NOT expose to friction or shock.	In case of fire: keep drums, etc., cool by spraying with water. Combat fire from a sheltered position.
EXPOSURE		AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
•INHALATION	Cough. Headache. Laboured breathing. Nausea. Shortness of breath. Sore throat. Symptoms may be delayed (see Notes).	Closed system and ventilation.	Fresh air, rest. Half-upright position. Refer for medical attention.
	Redness. Pain.	Protective gloves. Protective clothing.	First rinse with plenty of water, then remove

			contaminated clothes and rinse again. Refer for medical attention.
•EYES	Redness. Pain.	Safety goggles or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION			

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Evacuate danger area! Consult an expert! Ventilation. Remove gas with fine water spray. (Extra personal protection: complete protective clothing including self-contained breathing apparatus).	Fireproof if in building. Separated from combustible and reducing substances. Cool. Keep in the dark. Ventilation along the floor.	O symbol T+ symbol N symbol R: 6-8-26-34-50 S: 1/2-23-26-28-36/37/39-38-45-61

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0127

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 2000. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

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I M P O R T A N	**PHYSICAL STATE; APPEARANCE:** RED-YELLOW GAS , WITH PUNGENT ODOUR. **PHYSICAL DANGERS:** The gas is heavier than air. **CHEMICAL DANGERS:** May explode on heating, on exposure to sunlight or if subjected to shock or sparks. The substance is a strong oxidant and reacts violently with combustible and reducing materials. Reacts	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation. **INHALATION RISK:** A harmful concentration of this gas in the air will be reached very quickly on loss of containment. **EFFECTS OF SHORT-TERM EXPOSURE:** The substance irritates severely the eyes, the skin and the respiratory tract. Inhalation of gas may cause lung oedema (see

A T A	**OCCUPATIONAL EXPOSURE LIMITS:** TLV (as TWA): 0.1 ppm; (ACGIH 1999). TLV (as (STEL)): 0.3 ppm; (ACGIH 1999). OSHA PEL: TWA 0.1 ppm (0.3 mg/m^3) NIOSH REL: TWA 0.1 ppm (0.3 mg/m^3) ST 0.3 ppm (0.9 mg/m^3) NIOSH IDLH: 5 ppm	**EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:** The substance may have effects on the lungs , resulting in chronic bronchitis.
PHYSICAL PROPERTIES	Boiling point: 11°C Melting point: -59°C Relative density (water = 1): 1.6 at 0°C (liquid) Solubility in water, g/100 ml at 20°C: 0.8	Vapour pressure, kPa at 20°C: 101 Relative vapour density (air = 1): 2.3 Explosive limits, vol% in air: 10
ENVIRONMENTAL DATA	 This substance may be hazardous to the environment; special attention should be given to water organisms.	

N O T E S

The symptoms of lung oedema often do not become manifest until a few hours have passed and they are aggravated by physical effort. Rest and medical observation are therefore essential. Immediate administration of an appropriate spray, by a doctor or a person authorized by him/her, should be considered. Rinse contaminated clothes (fire hazard) with plenty of water.

ADDITIONAL INFORMATION

ICSC: 0127 **CHLORINE DIOXIDE**

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

NIOSH Pocket Guide to Chemical Hazards

Chlorine dioxide			**CAS** 10049-04-4
ClO_2			**RTECS** FO3000000
Synonyms & Trade Names Chlorine oxide, Chlorine peroxide			**DOT ID & Guide** 9191 143 (hydrate, frozen)
Exposure Limits	NIOSH REL: TWA 0.1 ppm (0.3 mg/m^3) ST 0.3 ppm (0.9 mg/m^3)		
	OSHA PEL†: TWA 0.1 ppm (0.3 mg/m^3)		
IDLH 5 ppm See: 10049044		**Conversion** 1 ppm = 2.76 mg/m^3	
Physical Description Yellow to red gas or a red-brown liquid (below 52°F) with an unpleasant odor similar to chlorine and nitric acid.			
MW: 67.5	BP: 52°F	FRZ: -74°F	Sol(77°F): 0.3%
VP: >1 atm	IP: 10.36 eV	RGasD: 2.33	Sp.Gr: 1.6 (Liquid at 32°F)
Fl.P: NA (Gas) ? (Liquid)	UEL: ?	LEL: ?	
Flammable Gas/Combustible Liquid			
Incompatibilities & Reactivities Organic materials, heat, phosphorus, potassium hydroxide, sulfur, mercury, carbon monoxide [Note: Unstable in light. A powerful oxidizer.]			
Measurement Methods OSHA ID202 See: NMAM or OSHA Methods			
Personal Protection & Sanitation Skin: Prevent skin contact (liquid) Eyes: Prevent eye contact (liquid) Wash skin: When contaminated (liquid) Remove: When wet (flammable) Change: No recommendation Provide: Eyewash (liquid), Quick drench (liquid)		**First Aid** (See procedures) Eye: Irrigate immediately (liquid) Skin: Soap wash immediately (liquid) Breathing: Respiratory support Swallow: Medical attention immediately (liquid)	

Respirator Recommendations NIOSH/OSHA
Up to 1 ppm: (APF = 10) Any chemical cartridge respirator with cartridge(s) providing protection against the compound of concern/(APF = 10) Any supplied-air respirator
Up to 2.5 ppm: (APF = 25) Any supplied-air respirator operated in a continuous-flow mode£/(APF = 25) Any powered, air-purifying respirator with cartridge(s) providing protection against the compound of concern£
Up to 5 ppm: (APF = 50) Any chemical cartridge respirator with a full facepiece and cartridge(s) providing protection against the compound of concern/(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/(APF = 50) Any self-contained breathing apparatus with a full facepiece/(APF = 50) Any supplied-air respirator with a full facepiece
Emergency or planned entry into unknown concentrations or IDLH conditions: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure- demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern¿/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion (liquid), skin and/or eye contact

Symptoms Irritation eyes, nose, throat; cough, wheezing, bronchitis, pulmonary edema; chronic bronchitis

Target Organs Eyes, respiratory system

See also: INTRODUCTION See ICSC CARD: 0127 See MEDICAL TESTS: 0045

Chlorine dioxide

IDLH Documentation

CAS number: 10049044

NIOSH REL: 0.1 ppm (0.3 mg/m^3) TWA, 0.3 ppm (0.9 mg/m^3) STEL

Current OSHA PEL: 0.1 ppm (0.3 mg/m^3) TWA

1989 OSHA PEL: 0.1 ppm (0.3 mg/m^3) TWA, 0.3 ppm (0.9 mg/m^3) STEL

19931994 ACGIH TLV: 0.1 ppm (0.28 mg/m^3) TWA, 0.3 ppm (0.83 mg/m^3) STEL

Description of Substance: Yellow to red gas or a redbrown liquid (below 52 F) with an unpleasant odor similar to chlorine and nitric acid.

LEL: . . Unknown

Original (SCP) IDLH: 10 ppm

Basis for original (SCP): IDLH AIHA [1958] reported that rats exposed repeatedly to about 10 ppm for 4 hours daily died, whereas those exposed to about 0.1 ppm, 5 hours daily for 10 weeks, showed no detectable effects [Dalhamn 1957]. AIHA [1958] also reported that animals survived 2hour exposures to 20 ppm, though some species exhibited symptoms [Gloemme and Lundgren 1957]. Elkins [1950] stated that 5 ppm is definitely irritating and 2 cases of illness (1 fatal) resulted from exposure to less than 19 ppm. AIHA [1958] reported that delayed deaths occur in animals after single exposures to 150 to 200 ppm for less than 1 hour [Gloemme and Lundgren 1957]. Based on the data cited above, an IDLH of 10 ppm is chosen.

Shortterm exposure guidelines None developed

ACUTE TOXICITY DATA

Lethal concentration data:

Species	**Reference**	**LC_{50} (ppm)**	**LC_{Lo} (ppm)**	**Time**	**Adjusted 0.5-hr LC (CF)**	**Derived value**

Rat	Dalhamn 1957	-----	260	2 hr	416 ppm (1.6)	42 ppm

Lethal dose data:

Species	**Reference**	**Route**	**LD_{50} (mg/kg)**	**LD_{Lo} (mg/kg)**	**Adjusted LD**	**Derived value**
Rat	Abdel-Rahman et al. 1982	oral	292	-----	729 ppm	73 ppm

Human data: It has been reported that 5 ppm is definitely irritating and that 19 ppm caused the death of one worker inside a tank (time of exposure was not specified) [Elkins 1950].

Revised IDLH: 5 ppm

Basis for revised IDLH: The revised IDLH is 5 ppm based on acute inhalation toxicity data in humans [Elkins 1950].

REFERENCES:

1. AbdelRahman MS, Gerges SE, Alliger H [1982]. Toxicity of alcide. J Appl Toxicol 2(3):160164.

2. AIHA [1958]. Chlorine dioxide. In: Hygienic guide series. Am Ind Hyg Assoc J 19:261262.

3. Dalhamn T [1957]. Chlorine dioxide: toxicity in animal experiments and industrial risks. AMA Arch Ind Health 15(2):101107.

4. Elkins HB [1950]. Chlorine dioxide, ClO_2. In: The chemistry of industrial toxicology. New York, NY: John Wiley & Sons, Inc., pp. 8788.

5. Gloemme J, Lundgren KD [1957]. Health hazards from chlorine dioxide. AMA Arch Ind Health 16:169176.