

hydrazine, iodine, methane, oxomonosilane, potassium, silicon, hydrogen sulfide, water, carbon monoxide, sulfur dioxide, moisture and steam.

- The storage site should have a leak detection and alarm system.
- The storage area should be provided with proper fire extinguisher and facility for the emergency disposal of leaking chlorine.

During spillage and disposal

- Evacuate danger area around the incident site. Contact Emergency Response Centre or other Expert agency immediately.
- Stop or reduce leak if it is safe to do so and prevent material from entering sewers, waterways or confined spaces.
- Water jet should never be applied directly on liquid. Remove gas with fine water spray.
- Take away the container, if possible, from the combustible and reducing substances. Cool and keep in well ventilated room.
- Supply sufficient replacement air to make up for air removed by exhaust systems.
- The person should wear protective gloves, protective clothing, safety goggles, breathing apparatus as specified in this guideline.
- The personal protective goods should be made of specific plastic or rubber which is resistant to Chlorine.
- May be absorbed and neutralized in caustic soda or soda ash and placed in steel, cast iron or lead containers. Take precaution as this reaction can give off substantial amount of heat. The caustic solution can be hazardous.
- The cylinder may be allowed to empty through a reducing agent such as sodium bisulfide and sodium bicarbonate.
- It may be absorbed and neutralized in to caustic soda or soda ash solution and placed in steel, lead or cast iron contains.

Transport

- The transportation of chlorine should be in accordance with the Motor Vehicle Rules, 1989 (Rules 129 to 138).
- The vehicle carrying chlorine should have Emergency Information Panel (EIP) * on the side and back of the body of the vehicle.
- The driver of the vehicle must have TREMCARD (Transport Emergency Card) containing safety instructions and precautionary measures. The card should have minimum information about name and nature of chemical, protection device, spilling/fire/first aid information. Any

accident or untoward incident should be immediately notified to the police, fire brigade and ERC.



Sampling and Analysis

- Collection using fritted glass bubbler containing sulfamic acid solution (0.1%). Analysis using a chlorine ion specific electrode. Detection limit of 0.014 ppm (qualitative), 0.14 ppm (quantitative). (OSHA Method ID-101-OSHA analytical methods manual. 2nd edition, Part 2. Volume 1 US Department of Labor, August 1991).
- Collection on PTFE membrane pre-filter and silver membrane filter. Analysis of chloride ion by ion chromatography with a conductivity detector. Detection limit of 0.6 ug chloride ion. (NIOSH Method 6011-NIOSH manual of analytical methods. 4th edition. Volume 1).
- Direct Reading Instruments: Methods of detection in commercially available devices which may be suitable; Electrical conductivity analyzer, potentiometric analyzer, coulometric analyzer, colorimetric analyzer.
- Colorimetric detector tubes.

Abbreviations used :

ADRHN	- Agreement for International Carriage of Dangerous goods by Road Hazard Identification No.
BIS	- Bureau of Indian Standards
CAS No.	- Chemical Abstract Society Registration Number.
EU No.	- European Nation's Number.
HAZCHEM	- Hazardous Chemical
HR	- Hazard Rating
ICSC	- International Chemical Safety Card
IDLH	- Immediately Dangerous to Life and Health
OSHA	- Occupational Safety and Health Association
PEL	- Permissible Exposure Limit
RTECS	- Registry of Toxic Effects of Chemical Substances
SAR	- Supplied air respirator
TWA	- Time Weighted Average
UN No.	- United Nation's Number

SAFETY GUIDELINES FOR CHLORINE

CHLORINE		 NON FLAMMABLE COMPRESSED GAS	 POISON GAS
UN NO.	1017		
HAZCHEM	2XE		
IN EMERGENCY DIAL		SPECIALIST ADVICE: VAPOUR HEAVIER THAN AIR. STAY UPWIND. EVACUATE AREA. USE SELF-CONTAINED BREATHING APPARATUS. CONTAIN SPILLAGE. DISPERSE GAS WITH WATER SPRAY.	

EMERGENCY INFORMATION PANEL *



EMERGENCY RESPONSE CENTRE M.P. POLLUTION CONTROL BOARD

Paryawaran Parisar, E-5, Arera Colony, Bhopal-16 (INDIA)
 Tel. : +91-755-2469180; FAX : +91-755-2463742
 PBX : +91-755-2466191, 2464428,
 E-mail : ercbpl@sancharnet.in
 web : www.mppcb.org

ISSUED ON WORLD ENVIRONMENT DAY, 2003

Identification keys

- C.A.S. No. - 7782-50-5
- U.N. No. - 1017
- E.U. No. - 231-959-5
- ICSC No. - 0126
- RTECS No. - FO2100000
- ADR HI No. - 266
- HR - 3
- HAZCHEM Code - 2XE
- Molecular formula - Cl₂
- Also known as Bertholite, Chlor

Exposure limits

- OSHA PEL (TLV) - 1 PPM (3 mg/m³)
- IDLH - 10 PPM
- TWA limit - 1 PPM (For skin) (8 hours exposure)
- NIOSH-REL 0.5 PPM (1.45 mg/m³) (15 minutes exposure)

Physical data

Heavier than air, Greenish yellow gas with pungent and irritating odor. Non flammable but strong oxidizing and highly corrosive, very toxic to aquatic organisms and birds.

- Conversion 1 ppm = 2.89 mg/m³
- Solubility in water— - 0.7%
- Melting point — -101 °C
- Boiling point — -29 °C
- Freezing Point — -150 °F
- Vapor density — 2.48 g/litre
- Vapor pressure — 5.8 bar at 20 °C
- Sp. Gravity — 1.47 g/ml at 0°C
- Critical Temp. — 144 °C
- Critical pressure — 76.1 atm (7711 kPa)
- Triple point — 100.9°C
- Viscosity— 0.346 centipoise at 0°C (liq), -0.0134 centipoise at 0°C (gas)

Exposure Routes

- Skin, Eyes, Inhalation.

Incompatibility and reactivity

- It reacts explosively or forms explosive compounds with ammonia, fuel gas, ether, turpentine, acetylene, finely divided metals, hydrogen, alcohols etc. It reacts with water to form corrosive hydrochloric acid and hypochlorous acids. (Pls. also refer 'Storage').
- Dry chlorine is not corrosive to most common metals including steel, cast iron, nickel, copper, brass, bronze, lead, platinum and tantalum. Dry chlorine attacks aluminium, tin and titanium at ordinary temperature and is corrosive to most metals at high temperature 121 °C and up. Tantalum is the most stable metal to both dry and wet chlorine.

Symptoms on exposure

- Burning of eyes, nose, mouth, discharge of tears (lacrimation), discharge of thin nasal mucous (rhino-rrhea), cough, choking, nausea, vomiting, headache, dizziness, pulmonary edema, pneumonia, dermatitis, frostbite, reduced oxygen in the blood (hypoxemia)
- Effects of chlorine exposure may be delayed. It is corrosive and may be converted into hydrochloric acid in the lungs. Signs and symptoms of acute exposure may increase heart rate (tachycardia), hypertension followed by hypotension and cardiovascular collapse.
- Concentration of 1 to 2 ppm produces significant irritation, coughing, breathing problem and headache. Conc. of 1 to 4 ppm are considered unbearable. Even with severe exposure, complete recovery usually occurs within one to four weeks.

Target organs

Skin, Eyes, Respiratory system

Emergency life support system

- Compressed oxygen, forced oxygen mask, soap, water, normal saline, sodium bicarbonate, Ringer's lactate, isoproterenol inhaler.

Fire fighting

- In case of small fires use water only. Do not use dry chemical or carbon dioxide. Contain and let large fires involving chlorine burn. If fire must be fought, use water spray and fog. In such situation the cylinder should be kept cool by spraying water. Water jet should never be used directly otherwise reverse flow into cylinder may cause rupture.
- In other cases of fire conditions use dry chemical powder, carbon dioxide or foam. Evacuate area and fight fire from a safe distance. Approach fire from upwind to avoid hazardous vapour and toxic decomposition products.
- While entering the affected area wear specialized protective equipment and full body encapsulating body suit and self contained breathing apparatus. The normal protective clothing (Bunker Gear) will not provide adequate protection

Protective Clothing and Equipment

- Butyl rubber, Neoprene, Teflon™, Saranex™, Barricade™, CPF3™, Responder™, Viton™, Trelchem HPS™, Tychem 10000™ (Resistance to breakthrough longer than 8 hour)

- Nitrile rubber, 4H™ (Resistance to breakthrough longer than 4 hours).
- It is not recommended to use very thin natural rubber, neoprene, nitrile and PVC gloves of 0.3 mm or less.
- Polyethylene and polyvinyl chloride are also not recommended.
- Use SAR or chemical cartridge respirator with cartridge to protect against Cl₂ up to 5 ppm. Use SAR operated in a continuous flow mode with cartridge or full face piece chemical cartridge respirator with cartridge or gas mask with canister or full face piece SCBA or full face piece SAR to protect against chlorine up to 10 ppm.

First aid

- In case of inhalation try to get fresh air or artificial respiration. Check respiratory rate and note any trauma. In case if no pulse is detected, provide CPR. If not breathing, provide artificial respiration. If breathing is labored, administer oxygen or respiratory support.
- In case of skin exposure, remove the contaminated clothes immediately, rinse skin with plenty of water for at least 15 minutes and wash the skin with soap and water.
- In case of exposure to eyes, rinse the eyes with plenty of lukewarm water for at least 15 minutes. Contact doctors for medical aid.
- Do not allow the victim to drink alcohol or smoke.
- (Pl. also refer Emergency Life Support Equipment above).

Storage

- The Chlorine should be stored in cool, dry and well ventilated area away from direct sunlight and heat in tightly sealed containers with proper labeling.
- It should not be stored near elevators, corridors, loading docks, below ground level or in confined spaces.
- The containers of chlorine should be protected from exposure to weather, extreme temperature changes.
- Always chain or securely restrain the cylinders in an upright position to a wall, rack or other solid structure. Avoid storage of cylinders for more than six months. Use the oldest first. Keep the empty and full ones separately with proper labeling.
- It should be stored separately from flammable gases and vapors, combustible substances (like alcohols, hydrocarbons, acetylene, turpentine petroleum products, hydrogen, ammonia, sulfur etc.) reducing agents, finely divided metals, arsenic, bismuth, boron, calcium, activated carbon, carbon disulfide, glycerol,