Praxair Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name:	Chlorine	**Trade Name:**	Chlorine
Product Use:	Many		
Chemical Name:	Chlorine	**Synonym:**	Dichlorine, Molecular chlorine, Betholite
Chemical Formula:	Cl_2	**Chemical Family:**	Halogen
Telephone:	**Emergencies:** * 1-800-363-0042	**Supplier /Manufacture:**	Praxair Canada Inc. 1 City Centre Drive Suite 1200 Mississauga, ON L5B 1M2
		Phone:	905-803-1600
		Fax:	905-803-1682

**Call emergency numbers 24 hours a day only for spills, leaks, fire, exposure, or accidents involving this product. For routine information, contact your supplier or Praxair sales representative.*

2. Hazards Identification

Emergency Overview


DANGER! **Toxic, corrosive, oxidizing liquid and gas under pressure. Harmful or fatal if inhaled. Causes eye, skin, and respiratory tract burns. Can support combustion. Self-contained breathing apparatus must be worrn by rescue workers. Odour: Pungent, irritating, choking.**

ROUTES OF EXPOSURE: Absorbed through skin. Eye contact. Inhalation. Ingestion.

EFFECTS OF A SINGLE (ACUTE) OVEREXPOSURE:

INHALATION: Overexposure to vapour concentrations moderately above the Threshold Limit Value (TLV) of 1 ppm is irritating to the eyes and upper respiratory tract. Very brief exposure to a concentration of 1000 ppm may be fatal. Inhalation of high concentration (e.g., greater than 15 ppm) causes choking, coughing, burning of the throat, and severe irritation of the upper respiratory tract; additionally, there is the possibility of pulmonary edema, general lung injury, and pneumonitis. Lack of oxygen can cause death. STEL: 1 ppm (ACGIH, OSHA)

SKIN CONTACT: May cause severe irritation and chemical burns with ulceration and scarring of the skin. Repeated exposure of the skin may result in cumulative dermatitis.

SKIN ABSORPTION: Prolonged or widespread skin contact with the liquid may result in the absorption of harmful amounts of material.

SWALLOWING: An unlikely route of exposure. This product is a gas at normal temperature and pressure, but burns of the mouth, esophagus, and stomach may result.

EYE CONTACT: Exposure as low as 3 - 6 ppm may cause redness, pain, blurred vision, or lacrimation. High concentrations or liquid contact may cause severe chemical burns with permanent damage or blindness.

EFFECTS OF REPEATED (CHRONIC) OVEREXPOSURE:

Repeated exposure may cause progressive lung dysfunction. Exposure may also corrode the teeth and may cause a chloracne-like condition.

OTHER EFFECTS OF OVEREXPOSURE:

None known.

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE:

Inhalation may aggravate asthma and inflammatory or fibrotic pulmonary disease, as well as heart disease. Skin contact may aggravate an existing dermatitis.

SIGNIFICANT LABORATORY DATA WITH POSSIBLE RELEVANCE TO HUMAN HEALTH HAZARD EVALUATION:

May cause severe inflammation of the conjunctiva, corneal opacity, iris atrophy, and lens injury.

CARCINOGENICITY:

A4 (Not classifiable for human or animal.) by ACGIH. Not listed as carcinogen by OSHA, NTP or IARC.

3. Composition and Information on Ingredients

COMPONENTS	CAS NUMBER	CONCENTRATION % by Mole
Chlorine	7782-50-5	100

4. First Aid Measures

INHALATION:

Remove to fresh air. Give artificial repiration if not breathing. (Rescuer may receive chemical burns as a result of giving mouth-to-mouth.) Oxygen may be given when necessary. Keep patient warm. Call a physician.

SKIN CONTACT:

If exposed to liquid, avoid breathing vapour. Immediately warm frostbite area with warm water (not to exceed 40 C). Immediately flush affected areas with plenty of warm water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse; discard contaminated shoes. Get medical attention immediately.

SWALLOWING:

An unlikely route of exposure; this product is a gas at normal temperature and pressure.

EYE CONTACT:

Immediately flush eyes with water for a least 15 minutes. The eyelids must be held open and away from the eyeball to ensure that all surfaces are flushed thoroughly. See a physician, preferably an ophthalmologist, immediately.

NOTES TO PHYSICIAN:

Victims of overexposure should be kept under medical observation for 24 to 48 hours or 72 hours if exposure was severe. The hazards of this material are due mainly to its severe irritant and corrosive properties on the skin and mucosal surfaces. There is no specific antidote; and treatment should be directed at the control of symptoms and clinical condition.

5. Fire Fighting Measures

FLAMMABLE : No. **IF YES, UNDER WHAT CONDITIONS?** Vigorously accelerates combustion.

EXTINGUISHING MEDIA:

Oxidizing agent. May accelerate combustion. Use media appropriate for surrounding fire.

PRODUCTS OF COMBUSTION:

Burning may produce toxic fumes of chlorides.

PROTECTION OF FIREFIGHTERS:

DANGER! Evacuate all personnel from danger area. Do not approach area without self-contained breathing apparatus and protective clothing. Immediately cool containers with water spray from maximum distance until cool, then move cylinders away from fire area if without risk. If containers are leaking, reduce vapours with water spray or fog. Do not spray water directly on leak as this may cause leak to increase. Shut off leak if without risk. Move containers away from fire area if without risk.

SPECIFIC PHYSICAL AND CHEMICAL HAZARDS:

Oxidizing agent, may accelerate combustion. Contact with flammable materials may cause fire or explosion. Container may rupture due to heat of fire. No part of a container should be subjected to a temperature higher than 52 C. Most containers are provided with a pressure relief device designed to vent contents when they are exposed to elevated temperatures.

SENSITIVITY TO IMPACT:

Avoid impact against container.

SENSITIVITY TO STATIC DISCHARGE:

Firefighters should wear self-contained breathing apparatus, if indicated, and full fire-fighting turnout gear.

PROTECTIVE EQUIPMENT AND PRECAUTIONS FOR FIREFIGHTERS:

Firefighters should wear self-contained breathing apparatus and full fire-fighting turnout gear.

FLAMMABLE LIMITS IN AIR, % by volume:

LOWER: Not applicable. **UPPER:** Not applicable.

FLASH POINT: Not applicable.

AUTOIGNITION TEMPERATURE: Not applicable.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:

Personal Precautions:

DANGER! Immediately evacuate all personnel from danger area. DANGER: Corrosive, toxic gas. Do not approach area without self-contained breathing apparatus and protective clothing. Contact with flammable materials may cause fire or explosion (See Section V). Reduce vapours with fog or fine water spray. Do not spray water directly on leak as this may cause leak to increase. Reverse flow into cylinder may cause rupture. Shut off leak if without risk. Ventilate area of leak or move leaking container to well ventilated area. Prevent runoff from contaminating surrounding evironment. Corrosive, toxic vapours may spread from spill. Before entering area, especially confined areas, check atmosphere with appropriate device.

Environmental Precautions:

Prevent waste from contaminating the surrounding environment. Keep personnel away. Discard any product, residue, disposable container, or liner in an environmentally acceptable manner, in full compliance with federal, provincial, and local regulations. If necessary, call your local supplier for assistance.

7. Handling and Storage

PRECAUTIONS TO BE TAKEN IN HANDLING:

Protect cylinders from damage. Use a suitable hand truck to move cylinders; do not drag, roll, slide, or drop. Never attempt to lift a cylinder by its cap; the cap is intended solely to protect the valve. Never insert an object (e.g., wrench, screwdriver, pry bar) into cap openings; doing so may damage the valve and cause a leak. Use an adjustable strap wrench to remove over-tight or rusted caps. Open valve slowly. If valve is hard to open, discontinue use and contact your supplier. For other precautions, see Section 16.

For additional information on storage and handling, refer to Compressed Gas Association (CGA) pamphlet P-1, *Safe Handling of Compressed Gases in Containers*, available from the CGA. Refer to Section 16 for the address and phone number along with a list of other available publications.

PRECAUTIONS TO BE TAKEN IN STORAGE:

Store and use with adequate ventilation. **Oxidizer**. Store away from flammable materials. Firmly secure cylinders upright to keep them from falling or being knocked over. Screw valve protection cap firmly in place by hand. Store only where temperature will not exceed 125°F(52°C). Store full and empty cylinders separately. Use a first-in, first-out inventory system to prevent storing full cylinders for long periods. Keep away from oil, grease, and other hydrocarbons. Keep away from oil, grease, and other hydrocarbons.

OTHER HAZARDOUS CONDITIONS OF HANDLING, STORAGE, AND USE:

Toxic, corrosive liquid and gas under pressure. Do not breathe gas. Do not get vapour in eyes, on skin, or on clothing. Have safety showers and eyewash fountains immediately available. Use only in a closed system. Use piping and equipment adequately designed to withstand pressures to be encountered. Store and use with adequate ventilation. Close valve after each use; keep closed even when empty. ***Prevent reverse flow.*** Reverse flow into cylinder may cause rupture. Use a check valve or other protective device in any line or piping from the cylinder. ***When returning cylinder to supplier,*** be sure valve is closed, then install valve outlet plug tightly. ***Never work on a pressurized system.*** If there is a leak, close the cylinder valve. Vent the system down in a safe and environmentally sound manner in compliance with all federal, provincial, and local laws; then repair the leak. ***Never place a compressed gas cylinder where it may become part of an electrical circuit.***

RECOMMENDED PUBLICATIONS:

Additional information on storage, handling, and use of this product is provided in **NFPA 55: *Standard for the Storage, Use, and Handling of Compressed and Liquefied Gases in Portable Cylinders***, published by the National Fire Protection Association.

See also Praxair publication P-14-153, *Guidelines for Handling Gas Cylinders and Containers*. Obtain from your local supplier.

8. Exposure Controls/Personal Protection

INGREDIENTS	CAS NUMBER	LD_{50} (Species & Routes)	LC_{50} (Rat, 4 hrs.)	Exposure Limits
Chlorine	7782-50-5	Not available.	147 ppm	0.5 ppm; 1 ppm, 15 min STEL

IMMEDIATELY DANGEROUS TO LIFE AND HEALTH (IDLH):

VENTILATION/ENGINEERING CONTROLS:

LOCAL EXHAUST: A corrosion-resistant system is acceptable.
See SPECIAL.

MECHANICAL (General): Inadequate.
See SPECIAL.

SPECIAL: Use only in a closed system.
A corrosion-resistant, forced-draft fume hood is preferred.

OTHER: See SPECIAL.

PERSONAL PROTECTION:

RESPIRATORY PROTECTION: For concentrations up to 10 times the applicable exposure limit any NIOSH/MSHA approved supplied air respirator is recommended. Up to 50 times the TLV, a NIOSH/MSHA approved respirator with a full face piece or self-contained breathing apparatus is recommended. For higher concentrations use only self-contained breathing apparatus operated in the pressure demand mode.

Select in accordance with provincial regulations, local bylaws or guidelines. Selection should also be based on the current CSA standard Z94.4, "Selection, Care and Use of Respirators". Respirators should also be approved by NIOSH and MSHA.

SKIN PROTECTION: Neoprene gloves.

EYE PROTECTION: Select in accordance with the current CSA standard Z94.3, "Industrial Eye and Face Protection", and any provincial regulations, local bylaws or guidelines.

OTHER PROTECTIVE EQUIPMENT: Metatarsal shoes for cylinder handling. Protective clothing where needed. Cuffless trousers should be worn outside the shoes. Select in accordance with the current CSA standard Z195, "Protective Foot Wear", and any provincial regulations, local bylaws or guidelines.

9. Physical and Chemical Properties

PHYSICAL STATE:	Gas.	**FREEZING POINT:**	-101.13°C (-149.85°F)	**pH:**	Not applicable.
BOILING POINT	-34.03°C (-29.25°F)	**VAPOUR PRESSURE**	689.2 kPa (@ 20°C)	**MOLECULAR WEIGHT:**	70.906 g/mole
SPECIFIC GRAVITY: LIQUID (Water = 1)	1.22 (Water = 1)	**SOLUBILITY IN WATER,**	6269.5 ppm (wt) @ 25 C		
SPECIFIC GRAVITY: VAPOUR (air = 1)	2.473 g/mL @ 0 C	**EVAPORATION RATE** (Butyl Acetate=1):	>1 compared to (Butyl Acetate=1)	**COEFFICIENT OF WATER/OIL DISTRIBUTION:**	Not applicable.
VAPOUR DENSITY:	0.0032 g/mL @ 0 C	**% VOLATILES BY VOLUME:**	100% (v/v).	**ODOUR THRESHOLD:**	> 1.0 ppm

APPEARANCE & ODOUR: Greenish-yellow Odour: Pungent. Irritating and choking. (Strong.)

10. Stability and Reactivity

STABILITY: This material is stable as shipped and stored under normal conditions, i.e., 70 F (21.1 C) so long as exposure to air, water, moisture, and other incompatible materials is avoided.

CONDITIONS OF CHEMICAL INSTABILITY: Not available.

INCOMPATIBILITY (materials to avoid):

	Chlorine reacts with most materials, especially flammable materials, other reducing agents, and nearly all metals. At temperatures below 250 F (251 C) certain common metals, e.g., iron, copper, steel, lead, nickel, resist reaction with dry chlorine, but others (e.g., aluminum, arsenic, gold, mercury, tin, titanium) react. Moist chlorine is highly corrosive except to glass, stoneware, porcelain, and certain alloys and only at low pressure. Titanium ignites spontaneously on contact with dry chlorine. Carbon steel ignites in chlorine at temperatures above 483 F (251 C).
HAZARDOUS DECOMPOSITION PRODUCTS:	Burning may produce toxic fumes of chlorides.
HAZARDOUS POLYMERIZATION:	Will not occur.
CONDITIONS TO AVOID:	Elevated temperatures; contact with air, moisture and incompatible materials.
CONDITIONS OF REACTIVITY:	Forms explosive compounds in presence of: alcohols, alkyl isothiourea salts, ammonia, aziridine, calcium chlorite, diethyl ether, ethylene imine, s-ethyl isothiourea sulfate, oxygen difluoride, sulfamic acid. Reacts vigorously with phosphorous isocyanate, dimethylformamide solution, hydrochloric acid and dinitroaniline mixtures, and iodine.

11. Toxicological Information

ACUTE DOSE EFFECTS: LC50, 1 hr, rat = 293ppm

STUDY RESULTS:

Exposures to 30 ppm have been reported to cause intense coughing fits and exposure to 40 to 60 ppm for 30 to 60 minutes or more may cause serious damage. A concentration of 34 to 51 ppm has been reported to be lethal in 1 to 1.5 hours while 14 to 21 ppm has been suggested as being dangerous with 0.5 to 1 hour.

12. Ecological Information

No adverse ecological effects expected. This product does not contain any Class I or Class II ozone-depleting chemicals. The components of this mixture are not listed as marine pollutants by TDG Regulations.

13. Disposal Considerations

WASTE DISPOSAL METHOD: Do not attempt to dispose of residual or unused quantities. Return cylinder to supplier.

14. Transport Information

TDG/IMO SHIPPING NAME: Chlorine

HAZARD CLASS:	CLASS 2.3: Toxic gas. Class 8: Corrosive material	**IDENTIFICATION #:**	UN1017	**PRODUCT REPORTABLE QUANTITY(PRQ):** Any accidental release in a quanitity that could pose a danger to public safety or any sustained release of 10 minutes or more.

SHIPPING LABEL(s): Toxic gas, Corrosive

PLACARD (When Required): Toxic gas.

SPECIAL SHIPPING INFORMATION:

Cylinders should be transported in a secure position, in a well-ventilated vehicle. Cylinders transported in an enclosed, non-ventilated compartment of a vehicle can present serious safety hazards.

15. Regulatory Information

The following selected regulatory requirements may apply to this product. Not all such requirements are identified. Users of this product are solely responsible for compliance with all applicable federal, provincial, and local regulations. This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

WHMIS (Canada): Class A: Compressed gas.
Class C: Oxidizing material.
Class D-1A: Material causing immediate and serious toxic effects (Very toxic).
Class E: Corrosive gas.
This product is on the DSL list.

International Regulations:

EINECS: Not available.

DSCL (EEC): R8- Contact with combustible material may cause fire.
R26- Very toxic by inhalation.

International Lists: No products were found.

16. Other Information

MIXTURES:

When two or more gases, or liquefied gases are mixed, their hazardous properties may combine to create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an Industrial Hygienist, or other trained person when you make your safety evaluation of the end product. Remember, gases and liquids have properties which can cause serious injury or death.

HAZARD RATING SYSTEM:

HMIS RATINGS:

HEALTH	**3**
FLAMMABILITY	**0**
PHYSICAL HAZARD	**2**

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

THREADED:	CGA-660 limited-standard for Specialty Gas Industry
PIN-INDEXED YOKE:	Not available.
ULTRA-HIGH-INTEGRITY CONNECTION:	CGA-728

Use the proper CGA connections. **DO NOT USE ADAPTERS.** Additional limited-standard connections may apply. See CGA pamphlets V-1 and V-7 listed below.

Ask your supplier about free Praxair safety literature as referred to in this MSDS and on the label for this product. Further information about this product can be found in the following pamphlets published by the Compressed Gas Association, Inc. (CGA), 4221 Walney Road, 5th Floor, Chantilly, VA 20151-2923, Telephone (703) 788-2700, Fax (703) 961-1831, website: www.cganet.com.

AV-1	Safe Handling and Storage of Compressed Gas
P-1	Safe Handling of Compressed Gases in Containers
P-14	Accident Prevention in Oxygen-Rich, Oxygen-Deficient Atmosphere
SB-2	Oxygen-Deficient Atmospheres
V-1	Compressed Gas Cylinder Valve Inlet and Outlet Connections
V-7	Standard Method of Determining Cylinder Valve Outlet Connections for Industrial Gas Mixtures
---	Handbook of Compressed Gases, Fifth Edition

Praxair asks users of this product to study this MSDS and become aware of product hazards and safety information. To promote safe use of this product, a user should (1) notify employees, agents, and contractors of the information in this MSDS and of any other known product hazards and safety information, (2) furnish this information to each purchaser of the product, and (3) ask each purchaser to notify its employees and customers of the product hazards and safety information.

PREPARATION INFORMATION:

DATE:	**October 15, 2013**
DEPARTMENT:	**Safety and Environmental Services**
TELEPHONE:	**905-803-1600**

The opinions expressed herein are those of qualified experts within Praxair Canada Inc. We believe that the information contained herein is current as of the date of this Material Safety Data Sheet. Since the use of this information and the conditions of use of the product are not within the control of Praxair Canada Inc., it is the user's obligation to determine the conditions of safe use of the product.

Praxair Canada Inc. requests the users of this product to study this Material Data Sheet (MSDS) and become aware of product hazards and safety information. To promote safe use of this product, a user should (1) notify its employees, agents and contractors of the information on this MSDS and any product hazards and safety nformation, (2) furnish this same information to each of its customers for the product, and (3) request such customers to notify their employees and customers for the product of the same product hazards and safety information.

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