

## SAFETY DATA SHEET

This SDS adheres to the standards and regulatory requirements of the United States and may not meet the regulatory requirements in other countries.

### 1. Identification

<b>Product identifier</b>	<b>Chlorine</b>	
<b>Other means of identification</b>	Liquid Chlorine, Elemental Chlorine, Molecular chlorine, Cl <sub>2</sub>	
<b>Recommended use</b>	Production of chlorinated inorganic and organic chemicals, bleaching agent for paper, textiles and fabrics, used in water purification, sewage disinfection and food processing.	
<b>Recommended restrictions</b>	None known	
<b>Manufacturer/Importer/Supplier/Distributor information</b>		
<b>Manufacturer</b>		
<b>Company name</b>	ERCO Worldwide	
<b>Address</b>	302 The East Mall Suite 200 Toronto, ON M9B 6C7 Canada	
<b>Telephone</b>	Information #: (416) 239-7111 (Monday – Friday 8:00 am – 5:00pm EST)	
<b>Website</b>	<a href="http://www.ercoworldwide.com">http://www.ercoworldwide.com</a>	
<b>E-mail</b>	productinfo@ercoworldwide.com	
<b>Emergency phone number</b>	Canada: 613-996-6666 (CANUTEC) USA: 1-800-424-9300 (CHEMTREC)	
<b>Supplier</b>	Refer to Manufacturer	

### 2. Hazard(s) Identification

<b>Physical hazards</b>	Oxidizing gases Gases under pressure	Category 1 Liquefied Gas
<b>Health hazards</b>	Acute toxicity, inhalation Skin corrosion Serious eye damage Specific target organ toxicity, single exposure Specific target organ toxicity, repeated exposure	Category 2 Category 1 Category 1 Category 3 respiratory tract irritation Category 1 (lung)
<b>Environmental hazards</b>	Not currently regulated by OSHA, refer to Section 12 for additional information.	
<b>OSHA defined hazards</b>	This mixture does not meet the classification criteria according to OSHA HazCom 2012.	

**Label elements**

**Signal word**

Danger

**Hazard statement**

Contains gas under pressure; may explode if heated.  
 Fatal if inhaled.  
 Causes severe skin burns and eye damage.  
 May cause respiratory irritation.  
 May cause or intensify fire; oxidizer.  
 Very Toxic to aquatic life.  
 Causes damage to organs through prolonged or repeated exposure.

**Precautionary statement**
**Prevention**

Do not breathe dust, fume, gas, mist, vapors, spray. Use only outdoors or in a well-ventilated area. Wear respiratory protection. Wash hands and face thoroughly after handling. Wear protective gloves, protective clothing, eye protection, face protection. Do not eat, drink or smoke when using this product. Keep/store away from clothing and other combustible materials. Keep reduction valves/valves and fittings free from oil and grease.

**Response**

Immediately call a POISON CENTER or doctor/physician.

IF INHALED: Remove person to fresh air and keep comfortable for breathing.  
 IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.  
 IF ON SKIN (OR HAIR): Take off immediately all contaminated clothing. Rinse skin with water/shower. Wash contaminated clothing before reuse.  
 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

In case of fire: Stop leak if safe to do so.

**Storage**

Protect from sunlight. Store in a well-ventilated place. Keep container tightly closed. Store locked up.

**Disposal**

Dispose of contents/container in accordance with local/regional/national/international regulations.

**Hazard(s) not otherwise classified (HNOC)**

No OSHA defined hazard classes.  
 Other hazards which do not result in classification:  
 Toxic fumes, gases or vapours may evolve on burning. Chlorine is extremely corrosive to most metals in the presence of moisture (>150 ppm water) or at high temperatures. Combines with water to produce hydrochloric and

hypochlorous acid. Severe, short-term exposures may cause long-lasting respiratory effects, e.g. Reactive Airways Dysfunction (RADs), due to the material's severe irritating properties. Contact with liquefied gas might cause frostbites, in some cases with tissue damage. Direct contact with liquefied gas may cause frostbite and corrosive injury to the eyes.

**Supplemental information**

Keep away from heat. Use smallest possible amounts in designated areas with adequate ventilation. Liquid chlorine lines must have suitable expansion chambers between block valves due to high coefficient of expansion. Establish written emergency plan and special training where chlorine is used. Regularly inspect and test piping and containers used for chlorine service.

**3. Composition/Information on Ingredients**

<b>Chemical name</b>	<b>Common name and synonyms</b>	<b>CAS number</b>	<b>Conc. % By Weight</b>
Chlorine	Liquid Chlorine, Elemental Chlorine, Molecular chlorine	7782-50-5	100 w/w%

**Chemical name of impurities, stabilizing solvents and/or additives:** None

**4. First-Aid Measures****Inhalation**

Remove person to fresh air and keep comfortable for breathing. If breathing is difficult, trained personnel should give oxygen. If breathing stops, provide artificial respiration. Induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Immediately call a POISON CENTER or doctor/physician. Fatal if inhaled. Immediately dangerous to life or health (IDLH) at 10 ppm.

**Skin Contact**

Avoid direct contact with this chemical. Wear appropriate personal protective equipment. Take off immediately all contaminated clothing. Flush the contaminated area with lukewarm, gently running water for at least 20 minutes. Do not rub area of contact. Gently remove clothing or jewelry. Carefully cut around clothing that sticks to the skin. Wash contaminated clothing before reuse. Immediately call a POISON CENTER or doctor/physician. Discard any shoes or clothing items that cannot be decontaminated. Use cold packs to reduce pain.

**Eye Contact**

Immediately flush the contaminated eye(s) with lukewarm, gently flowing water for at least 30 minutes, holding the eyelid(s) open. Remove contact lenses, if present and easy to do. Continue rinsing. Take care not to rinse contaminated water into the unaffected eye or onto the face. Do not rub eyes. Immediately call a POISON CENTER or doctor/physician.

**Ingestion**

Not an expected route of entry under normal conditions of use. If ingestion of a large amount does occur, call a poison control center immediately. DO

NOT GIVE ANYTHING BY MOUTH OR INDUCE VOMITING IF THE PATIENT IS UNCONSCIOUS. Never give anything by mouth if victim is rapidly losing consciousness, or is unconscious or convulsing. Have victim rinse mouth thoroughly with water. Have victim drink one cup of water to dilute material in stomach. If vomiting occurs naturally, rinse mouth and repeat administration of water. If breathing has stopped, trained personnel should begin artificial respiration or, if the heart has stopped, cardiopulmonary resuscitation (CPR) immediately (avoid mouth-to-mouth contact). Obtain medical attention immediately.

NOTE TO PHYSICIAN: Development of pulmonary edema may be delayed 48-72 hours.

**Most important symptoms/effects, acute and delayed**

May cause severe irritation to the nose, throat, and respiratory tract. Symptoms may include coughing, choking and wheezing. Could also cause tightness in the chest, a blue discoloration of the skin (cyanosis), severe headache, nausea, vomiting and fainting.

Inhalation could result in pulmonary edema (fluid accumulation). Symptoms of pulmonary edema (chest pain, shortness of breath) may be delayed.

Direct skin contact may cause corrosive skin burns, deep ulcerations and possibly permanent scarring. If product is sprayed directly on skin, symptoms of frostbite may be experienced including numbness, prickling and itching. Corrosive to the eyes and may cause severe damage including blindness. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. If product is sprayed directly into the eyes, could cause freezing of the eye.

**Indication of immediate medical attention and special treatment needed**

Immediate medical attention is required. Symptoms may be delayed. Keep victim under observation. Medical supervision for minimum 48 hours. Provide general supportive measures and treat symptomatically.

**General information**

First-aid procedures should be reviewed by appropriate personnel familiar with chlorine and its conditions of use in the workplace.

Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Show this safety data sheet to the doctor in attendance.

## 5. Fire-Fighting Measures

**Suitable extinguishing media**

Use water to keep fire-exposed containers cool. Use water spray to direct escaping gas away from workers if it is necessary to stop the flow of gas.

Extinguishing media - small fires: Dry chemicals. Carbon dioxide (CO<sub>2</sub>).

Extinguishing media - large fires: Water Spray or Fog. Foam.

Practical attempts should be made to reduce the available reactants through the isolation of the reaction from the chemical supply. This should be attempted only by properly trained personnel using the prescribed protective equipment.

**Unsuitable extinguishing media**

Use water with caution. May react with water. Water may increase the vaporization rate of liquid chlorine.

**Specific hazards arising from the chemical**

Chlorine does not burn but poses a serious fire and explosion risk due to its high reactivity. Pressurized container may explode when exposed to heat or flame. May react to cause fire and or explosion upon contact with many metals at elevated temperatures, ammonia, hydrogen and with many organic compounds. Chlorine will support the burning of most combustible materials. Toxic products are formed when combustibles burn in chlorine. Combines with water to produce hydrochloric and hypochlorous acid. Liquefied chlorine can accumulate static charge by flow or agitation, since it has a very low electrical conductivity. Chlorine containers or cylinders may vent rapidly or rupture violently, if exposed to fire or excessive heat for a sufficient period of time. Intense local heat (above 200° C) on the steel walls of chlorine cylinders can cause an iron/chlorine fire resulting in rupture of the container. Vapors are heavier than air and may spread along floors. Toxic fumes, gases or vapours may evolve on burning.

**Special protective equipment and precautions for firefighters**

Wear full protective clothing including self-contained breathing apparatus. Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA. A full-body chemical resistant suit should be worn.

**Firefighting equipment/instructions**

Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Move containers from fire area if you can do so without risk. Remove combustible materials. Stop the flow of gas before extinguishing fire, if safe to do so. Use water spray to direct escaping gas away from workers if it is necessary to stop the flow of gas. Cool containers exposed to heat with water spray and remove container, if no risk is involved. Stay away from ends of cylinders and withdraw immediately in case of rising sounds or discoloration of containers. Do not allow run-off from firefighting to enter drains or water courses. Dike for water control.

**Specific methods**

Use standard firefighting procedures and consider the hazards of other involved materials.

**General fire hazards**

The product itself does not burn. However, material is considered to be an oxidizing gas. Supporter of combustion and can intensify a fire.

## 6. Accidental Release Measures

**Personal precautions, protective equipment**

Restrict access to area until completion of clean-up. Keep unnecessary personnel away. Keep people away from and upwind of spill/leak.

**and emergency  
procedures**

Extinguish or remove all ignition sources and ventilate area. Do not touch spilled material. Consider initial downwind evacuation for at least 500 meters (1/3 mile). Ensure clean-up is conducted by trained personnel only. Ventilate closed spaces before entering them. Many gases are heavier than air and will spread along ground and collect in low or confined areas (sewers, basements, tanks). Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Wear appropriate protective equipment and clothing during clean-up. For personal protection, see section 8 of the SDS.

**Methods and materials  
for containment and  
cleaning up**

Stop the flow of material, if this is without risk. Use only non-sparking tools. Keep combustibles (wood, paper, oil, etc.) away from spilled material. Remove or isolate incompatible materials as well as other hazardous materials. Do not spray leak with water since a reaction producing corrosive hypochlorous and hydrochloric acids occurs, which can aggravate the leak. Stop or reduce leak if safe to do so. May be absorbed and neutralized into solutions of caustic soda, or lime and placed in polypropylene, polyvinyl chloride, fibreglass or lead containers. Since hypochlorites are formed, the solutions must be treated with a reducing agent such as sodium sulfite before disposal. Do not immerse container in caustic solution.

**Large Spills:** Large uncontrollable leaks require environmental considerations and possible evacuation of the surrounding area. When possible draw off chlorine to process or disposal system. Contact the proper local authorities. For waste disposal, see section 13 of the SDS.

**Environmental  
precautions**

Avoid release to the environment. Very toxic to aquatic life. Prevent entry into waterways, sewer, basements or confined areas. Contact local authorities in case of spillage to drain/aquatic environment.

## 7. Handling and Storage

**Precautions for safe  
handling**

Do not use near welding operations, flames or hot surfaces. Make sure valves on gas cylinders are fully opened when gas is used. Use smallest possible amounts in designated areas with adequate ventilation. Keep piping clean and dry. Have emergency equipment readily available. Establish written emergency plan and special training where chlorine is used. Use only outdoors or in a well-ventilated area. Wear respiratory protection. Wear protective gloves/clothing and eye/face protection. See Section 8 of the SDS for Personal Protective Equipment. Do not breathe gas. Avoid contact with eyes, skin, and clothing. Regularly inspect and test piping and containers used for chlorine service. Liquid chlorine lines must have suitable expansion chambers between block valves due to high coefficient of expansion. Keep away from heat. Keep/store away from clothing and other combustible materials. Keep valves and fittings free from grease and oil. Protect against physical damage. Wash hands after handling and before eating.

**Conditions for safe storage, including any incompatibilities**

Store in steel pressure cylinders in a cool, dry area outdoors or in well-ventilated, detached or segregated areas of non-combustible construction. Keep container tightly closed. Store locked up. Keep out of direct sunlight and away from heat and ignition sources. Cylinder temperatures should never exceed 51°C (125°F). Storage area should be clearly identified, clear of obstruction and accessible only to trained and authorized personnel. Do not store near combustible materials. Wood and other organic materials should not be used on floors, structural materials, or ventilation systems in the storage area. Store away from incompatible materials (see Section 10 of the SDS).

## 8. Exposure Controls/Personal Protection

**Occupational exposure limits**
**US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)**

Material	Type	Value
Chlorine (CAS 7782-50-5)	Ceiling	3 mg/m <sup>3</sup> 1 ppm

**US. ACGIH Threshold Limit Values**

Material	Type	Value
Chlorine (CAS 7782-50-5)	STEL	1 ppm
	TWA	0.5 ppm

**US. NIOSH: Pocket Guide to Chemical Hazards**

Material	Type	Value
Chlorine (CAS 7782-50-5)	Ceiling	1.45 mg/m <sup>3</sup> 0.5 ppm

**Biological limit values**

No biological exposure limits noted for the ingredient(s).

**Exposure guidelines**

The NIOSH IDLH concentration for Chlorine is 10 ppm.

**Appropriate engineering controls**

Engineering methods to control hazardous conditions are preferred. Methods include mechanical ventilation, process or personnel enclosure, control of process conditions and process modifications. Supply sufficient replacement air to make up for air removed by exhaust systems. Ensure adequate ventilation, especially in confined areas. Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits – consideration should be given to routing ventilation through a scrubber system to remove the chlorine. If exposure limits have been established, maintain

airborne levels to an acceptable level. In case of insufficient ventilation, wear suitable respiratory equipment.

**Individual protection measures, such as personal protective equipment****Eye/face protection**

Wear eye/face protection. Chemical goggles are recommended. Wear a full-face respirator, if needed. A full face shield may also be necessary. Eye wash fountains are required.

**Skin protection****Hand protection**

Wear appropriate chemical resistant gloves. Wear as appropriate: Butyl rubber. Neoprene. Polytetrafluoroethylene (PTFE), Viton™ rubber (fluor rubber).

Unsuitable material: Polyvinyl chloride (PVC). Polyethylene. The suitability for a specific workplace should be discussed with the producers of the protective gloves.

**Other**

Wear suitable protective clothing. Where contact is likely, wear chemical-resistant gloves, a chemical suit and rubber boots. Eye wash facilities and emergency shower must be available when handling this product.

**Respiratory protection**

Up to 5 ppm: A NIOSH/MSHA approved air-purifying respirator with the appropriate chemical cartridges or a positive-pressure, air-supplied respirator may be used to reduce exposure.

Up to 10 ppm: A SAR (supplied air respirator) operated in a continuous flow mode or powered air purifying respirator with cartridge(s); a full face piece chemical cartridge respirator with cartridge(s); a gas mask with canister; a full face piece SCBA (self-contained breathing apparatus); or a full face piece SAR may be used to reduce exposure.

EMERGENCY OR PLANNED ENTRY INTO UNKNOWN CONCENTRATIONS OR IDLH CONDITIONS: Positive pressure, full-face piece SCBA; or positive pressure full-face piece SAR with an auxiliary positive pressure SCBA. Respirators should be selected based on the form and concentration of contaminants in air, and in accordance with OSHA (29 CFR 1910.134). Advice should be sought from respiratory protection specialists. If contact with liquid or gas is possible, use of chemically protective gloves, coveralls and boots is required. Recommended protective clothing are: butyl rubber, neoprene, Teflon™, Responder™, Viton™.

**Thermal Hazards**

Wear appropriate thermal protective clothing, when necessary.

**General hygiene considerations**

Do not breathe gas. Avoid contact with eyes, skin and clothing. Handle in accordance with good industrial hygiene and safety



practice. Do not eat, drink or smoke when using the product. Wash hands before breaks and immediately after handling the product. Remove soiled clothing and wash it thoroughly before reuse. Inform laundry personnel of contaminant's hazards.

## 9. Physical and Chemical Properties

<b>Appearance</b>	
Physical state	Gas or liquid (under pressure)
Form	Compressed liquefied gas
Colour	Amber color; liquefied gas under pressure, vaporizes to greenish yellow gas
<b>Odor</b>	Pungent suffocating odor
<b>Odor threshold</b>	0.06 ppm (detection) 0.2 ppm (perception)
<b>pH</b>	Not applicable (reacts with water to form an acidic solution)
<b>Melting point</b>	-149.8 °F (-101 °C)
<b>Freezing point</b>	Not Applicable
<b>Initial boiling point and boiling range</b>	-30.28 °F (-34.6 °C)
<b>Flash point</b>	Not Applicable
<b>Evaporation rate</b>	Not Applicable. Gas at normal temperatures.
<b>Flammability (solid, gas)</b>	This product is not flammable.
<b>Upper/lower flammability or explosive limits</b>	
Flammability limit – lower (%)	Not Applicable
Flammability limit – upper (%)	Not Applicable
Explosive limit – lower (%)	Not Available
Explosive limit – upper (%)	Not Available
<b>Vapor pressure</b>	638.4 kPa @ 20°C (68°F) 4788 mm Hg @ 20°C (68°F)
<b>Vapor density</b>	2.49 @ 0°C (32°F) (Air = 1)
<b>Relative density</b>	3.21 kg/m <sup>3</sup> @ 0°C (32°F)
<b>Solubility (ies)</b>	
Solubility (water)	6.3 mg/l (Slightly soluble); 0.7 g/100 g of water at 20°C, 1 Atm, ( reacts to form hydrochloric and hypochlorous acids)
Solubility (other)	Soluble in dimethylformamide, disulfur dichloride, benzene, chloroform, carbon tetrachloride, hexachlorobutadiene, tetrachloroethane, pentachloroethane, chlorobenzene, nitrobenzene, glacial acetic acid (99.84%) and other chlorides
<b>Partition coefficient (n-octanol/water)</b>	Not Applicable (gas)
<b>Auto-ignition temperature</b>	Not Applicable
<b>Decomposition temperature</b>	Not Available
<b>Viscosity</b>	Not Available
<b>Viscosity temperature</b>	Not Applicable (Gas)
<b>Other information</b>	
Critical temperature	290.75 °F (143.75 °C)
Explosive properties	290.75 °F (143.75 °C)
Molecular weight	70.91

<b>Oxidizing properties</b>	Strong oxidizing agent because of its electron-transfer capabilities. Supporter of combustion and can intensify a fire. Note, that Chlorine does not yield oxygen or any other oxidizing substance.
<b>Specific gravity</b>	Not applicable (gas)

## 10. Stability and Reactivity

<b>Reactivity</b>	Highly reactive on contact with incompatible substances. Intense local heat above 215°C on steel container walls can cause steel to ignite chlorine. Do not spray water on chlorine leaks on steel vessels. Avoid proximity to flammable materials. Moist chlorine, primarily because of the hydrochloric and hypochlorous acids formed through hydrolysis, is very corrosive to most common metals. Chlorine will combine with carbon monoxide and sulphur dioxide to form phosgene and sulphuryl chloride respectively; the latter will hydrolyze to hydrochloric acid and sulphuric acids. Chlorine will react (burn) with hydrogen to form hydrogen chloride. This strongly exothermic reaction can be initiated by light.
<b>Chemical stability</b>	Material is stable under normal conditions.
<b>Possibility of hazardous reactions</b>	<p>Will support or initiate combustion or explosion of organic matter and other oxidizable material.</p> <p>Note, that Chlorine does not yield oxygen or any other oxidizing substance. Liquid or gaseous chlorine can react violently with many combustible materials, and other chemicals, including water.</p> <p>Metal halides, carbon, finely divided metals and sulphides can accelerate the rate of chlorine reactions. Chlorine reacts with carbon monoxide to produce toxic phosgene, and sulphur dioxide to produce sulfuryl chloride. Chlorine is extremely corrosive to most metals in the presence of moisture (&gt;150 ppm water) or at high temperatures. Intense local heat (above 200 deg C) on the steel walls of chlorine cylinders can cause an iron/chlorine fire resulting in rupture of the container. Hazardous polymerization does not occur.</p>
<b>Conditions to Avoid</b>	Keep away from combustible materials. Avoid contact with incompatible materials. Keep away from heat. Do not use in areas without adequate ventilation.
<b>Incompatible materials</b>	Combustible material. Organic compounds. Water. Alkyl metal halides. Powdered metal. Sulfides. Reducing agents. Keep away from organic materials such as turpentine, acetylene, hydrocarbons, ammonia, hydrogen, ether and powdered metals. Chlorine gas can react explosively with alcohols, ammonia and compounds, hydrocarbon gases (e.g. acetylene and ethylene), hydrogen, antimony trichloride and tetramethylsilane, aziridine, bromine pentafluoride, dioxygen difluoride, oxygen difluoride, fluorine, diborane, dichloro(methyl)arsine, disilyl oxide, ethylphosphine,

strong reducing agents, aqueous sulfamic acid, stibine, synthetic rubber, tetraselenium tetranitride and white phosphorus. Chlorine gas ignites on contact with mono and di-alkali metal acetylides, copper acetylides, halocarbons (e.g. dichloromethane), metals (e.g. finely powdered aluminum, brass and copper foil, iron, potassium, sodium, tin and titanium), non-metals (e.g. boron, active carbon, phosphorous and silicon), iron, uranium and zirconium carbides, diethyl ether, diethyl zinc, metal and non-metal hydrides, phosphorus compounds, sulfides, tellurium, trialkyl boranes and tungsten dioxide. Liquefied chlorine can react violently, explosively or ignite on contact with carbon disulfide and iron, bismuth, dibutyl phthalate, drawing wax, gasoline, glycerol, linseed oil, white phosphorus, polydimethylsiloxane, silicones, sodium hydroxide, tin, titanium and vanadium powder.

**Hazardous decomposition products** Hydrogen chloride gas. Hydrochloric acid. Hypochlorous acid.

## 11. Toxicological Information

### Information on likely routes of exposure

- |                     |  |
|---------------------|--|
| <b>Inhalation</b>   | Very toxic by inhalation. May cause severe irritation to the nose, throat, and respiratory tract.<br><br>Symptoms of overexposure include coughing, shortness of breath, chest pain, nausea, vomiting and dizziness. Pulmonary edema (swelling) and chemical pneumonia can develop hours after exposure. High concentrations may result in unconsciousness and death.                                      |
| <b>Skin contact</b> | Not expected to be absorbed through the skin.<br><br>Direct contact with liquid causes severe local irritation, blistering and burns. High concentrations can cause severe irritation. Symptoms include burning and prickling sensations, reddening and blisters. Direct contact with the liquefied gas escaping from its pressurized cylinder can also cause frostbite, in some cases with tissue damage. |
| <b>Eye contact</b>  | A severe irritant of the eyes. Symptoms include stinging and burning sensation with excessive tear production. Direct contact with liquid may cause burns, permanent damage and possible blindness. If product is sprayed directly into the eyes, could cause freezing of the eye.   |
| <b>Ingestion</b>    | Not an expected route of entry under normal conditions of use. Not applicable to gas. Liquid may cause pain, burning, thirst, abdominal cramps, nausea and vomiting. Irritation and swelling of the throat causes difficulty breathing. Direct contact with the liquefied gas can also cause frostbite.  |

**Symptoms related to the physical, chemical and toxicological characteristics**

Pre-existing disorders of the following organs or systems which may be aggravated by exposure to this material include: skin, respiratory system (including asthma and other breathing disorders). This material may cause the following effects: respiratory system damage.

Observations in animal studies include: immune system effects. The relevance of these observations to humans is not clear at this time. Depending upon level and duration of exposure, other possible signs and symptoms include: irritation of the nose, throat, airways, and lungs with cough and difficult breathing, chest pain, excess fluid in the lungs with difficult breathing, vomiting, muscle weakness, impaired sense of smell, and central nervous system depression with nausea, headache, dizziness, fatigue, drowsiness, or unconsciousness. Symptoms of skin contact include burning and prickling sensations, reddening and blisters. Symptoms of eye contact include a stinging and burning sensation with tearing.

**Delayed and immediate effects and chronic effects from short-term and long-term exposure****Effects of short-term (acute) exposure**

**Inhalation:** Chlorine is a severe nose, throat and lower & upper respiratory tract irritant. Slight itching of the nose can occur at 0.2 ppm. At 1.0 ppm, scratchiness and dryness of the throat, coughing and minor difficulty breathing can occur. Severe shortness of breath and violent headache occur after exposure at 1.3 ppm for 30 minutes. Immediately dangerous to life or health (IDLH) at 10 ppm. Above 30 ppm, intense coughing, choking, chest pain and vomiting occur. Bronchitis and accumulation of fluid in the lungs may develop after severe exposure. High concentrations may cause death.

**Effects of long-term (chronic) exposure**

Repeated and prolonged exposure at 5 ppm may cause drying and cracking of the skin, respiratory effects, inflammation of the nose, corrosion of tooth enamel, gum disorders and painless destruction of teeth. No evidence of carcinogenicity in human or animal studies. Chlorine is unlikely to accumulate in the body since it reacts with water and tissues. Limited occupational studies with long-term exposure to low concentrations, have not shown significant respiratory effects. Long-term animal studies confirm that chlorine is a severe irritant to the upper and lower respiratory tract.

**Information on toxicological effects****Acute toxicity**

Hazardous by OSHA criteria. Classification:  
Acute Toxicity (inhalation - gas) - Category 2. Fatal if inhaled.  
See below for individual ingredient acute toxicity data.

<b>Product</b>	<b>Species</b>	<b>Test Results</b>
Chlorine (CAS 7782-50-5)		
<b>Acute</b>		
<i>Dermal</i>		
LD <sub>50</sub>		No data in literature.
<i>Inhalation</i>		
LC <sub>50</sub>	Rat	147 ppm, 4 Hours; 293 ppm exposure 1/hr.
	Mice	137 ppm exposure 1/hr.
<i>Oral</i>		
LD <sub>50</sub>		No data in literature.
<b>Skin corrosion</b>	Hazardous by OSHA criteria. Category 1. Causes severe skin burns and eye damage.	
<b>Serious eye damage</b>	Hazardous by OSHA criteria. Category 1. Causes serious eye damage.	
<b>Respiratory or skin sensitization</b>		
<b>Respiratory sensitization</b>	This product is not expected to cause respiratory sensitization.	
<b>Skin sensitizer</b>	This product is not expected to cause skin sensitization.	
<b>Germ cell mutagenicity</b>	Not expected to be mutagenic.	
<b>Carcinogenicity</b>	This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA. See below for ingredients present on regulatory lists.	
<b>OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)</b>	Not listed.	
<b>Reproductive toxicity</b>	This product is not expected to cause reproductive or developmental effects.	
<b>Specific target organ toxicity - single exposure</b>	Hazardous by OSHA criteria. Category 3. May cause respiratory irritation.	
<b>Specific target organ toxicity - repeated exposure</b>	May cause damage to organs.	
<b>Aspiration toxicity</b>	Not likely, due to the form of the product. Not expected to be an aspiration hazard.	

## 12. Ecological Information

**Ecotoxicity** Very toxic to aquatic life. See below for individual ingredient ecotoxicity data.

Product	Species	Test Results
Chlorine (CAS 7782-50-5)		
<b>Aquatic</b>		
<i>Acute</i>		
Crustacea	EC <sub>50</sub> Water flea ( <i>Daphnia magna</i> )	0.005 mg/l, 48 hours (mg Free Available Chlorine/L)
Fish	LC <sub>50</sub> Rainbow trout, Donaldson trout ( <i>Oncorhynchus mykiss</i> )	0.014 mg/l, 96 hours

**Persistence and degradability** Not biodegradable (pertains to organic material capable of decomposition as a result of attack by microorganisms). However, chlorine will be converted to chloride by reducers present in natural environment, including biomass. Free chlorine is consumed upon contact with living tissues making measurement of biodegradation impossible and unnecessary.

**Bioaccumulative potential** Not expected to be bioaccumulative.

**Mobility in soil** The product itself has not been tested.

**Other adverse effects** Chlorine is a strong oxidizer and will react rapidly with oxidizable inorganic compounds. Chlorine will also oxidize organic compounds, but at a slower rate than inorganic compounds. Chlorine is gradually reduced to chloride. The presence of light accelerates the dissipation of chlorine in water. No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

## 13. Disposal Considerations

**Disposal instructions** Consult appropriate Federal, State/Provincial and local regulatory authorities. Chlorine gas will disperse to the atmosphere leaving no residue. Chlorine may be neutralized by introducing it into caustic soda, soda ash, or hydrated lime. Since hypochlorites are formed, the solutions must be treated with a reducing agent such as sodium sulfite before disposal. Do not immerse container in caustic solution. Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Dispose of contents and container in accordance with local/regional/national/international regulations.

<b>Local disposal regulations</b>	Dispose in accordance with all applicable regulations.
<b>Hazardous waste code</b>	The waste code should be assigned in discussion between the user, the producer and the waste disposal company.
<b>Waste from residues / unused products</b>	Dispose of in accordance with local regulations. Liquid and/or solid residues from neutralization must be disposed of in a permitted waste management facility. Consult Federal, state, provincial, or local disposal authorities for approved procedures. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
<b>Contaminated packaging</b>	Empty containers should be taken to an approved waste handling site for recycling or disposal. Since emptied containers may retain product residue, follow label warnings even after container is emptied.

## 14. Transport Information

### DOT

<b>UN number</b>	UN1017
<b>UN proper shipping name</b>	Chlorine
<b>Transport hazard class(es)</b>	
<b>Class</b>	2.3
<b>Subsidiary risk</b>	5.1, 8
<b>Label(s)</b>	2.3, 5.1, 8
<b>Packing group</b>	Not Applicable
<b>Environmental hazards</b>	
<b>Marine pollutant</b>	Yes
<b>Special precautions for user</b>	Read safety instructions, SDS and emergency procedures before handling. US CERCLA Reportable Quantity (RQ): 10 lbs / 4.54 kg
<b>Special provisions</b>	2, B9, B14, N86, T50, TP19
<b>Packaging exceptions</b>	None
<b>Packaging non bulk</b>	304
<b>Packaging bulk</b>	314, 315

### IATA

<b>UN number</b>	UN1017
<b>UN proper shipping name</b>	Chlorine
<b>Transport hazard class(es)</b>	
<b>Class</b>	2.3
<b>Subsidiary risk</b>	5.1, 8
<b>Packing group</b>	Not Applicable
<b>Environmental hazards</b>	Yes
<b>ERG Code</b>	2PX

**Special precautions for user**

Read safety instructions, SDS and emergency procedures before handling.  
Refer to Special Provision A2 for shipping information.

**Other information**

Passenger and cargo aircraft  
Cargo aircraft only

Forbidden  
Forbidden

**IMDG**

UN number

UN1017

UN proper shipping name

Chlorine

Transport hazard class(es)

Class

2.3

Subsidiary risk

5.1, 8

Packing group

Not Applicable

Environmental hazards

Marine pollutant

Yes

EmS

F-C, S-U

Special precautions for user

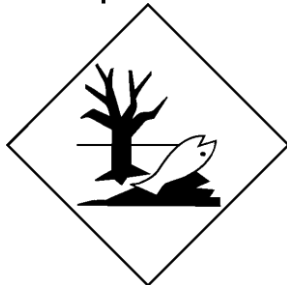
Read safety instructions, SDS and emergency procedures before handling.

Transport in bulk according to Annex II of  
MARPOL 73/78 and the IBC Code  
DOT

This substance/mixture is not intended to be transported in bulk.


**IATA; IMBG**




**Marine pollutant**

**General information**

This product meets the criteria for an environmentally hazardous mixture, according to the IMDG Code.

## 15. Regulatory Information

**US federal regulations**

This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

All components are on the U.S. EPA TSCA Inventory List.  
Not regulated.

**TSCA Section 12(b)  
Export Notification  
(40 CFR 707, Subpt.  
D)**
**CERCLA Hazardous  
Substance List (40  
CFR 302.4)**
**SARA 304  
Emergency release  
notification**
**OSHA Specifically  
Regulated  
Substances (29 CFR  
1910.1001-1050)**

Chlorine (CAS 7782-50-5)      Listed.

Chlorine (CAS 7782-50-5)      10 LBS

Not listed.

**Superfund Amendments and Reauthorization Act of 1986 (SARA)**
**Hazard categories**

Immediate Hazard - Yes  
Delayed Hazard - No  
Fire Hazard - Yes  
Pressure Hazard - Yes  
Reactivity Hazard - No

SARA 302 Extremely hazardous substance Chemical name	CAS number	Reportable quantity	Threshold planning quantity	Threshold planning quantity, lower value	Threshold planning quantity, upper value
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Chlorine	7782-50-5	10	100 lbs		
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<b>SARA 311/312</b>	Yes				
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**Hazardous chemical**

**SARA 313 (TRI reporting)**

Chemical name	CAS number	% by wt.
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Chlorine	7782-50-5	100
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#### Other federal regulations

**Clean Air Act (CAA) Section 112** Chlorine (CAS 7782-50-5)

**Hazardous Air Pollutants (HAPs) List**

**Clean Air Act (CAA) Section 112(r)** Chlorine (CAS 7782-50-5)

**Accidental Release Prevention (40 CFR 68.130)**

**Clean Water Act (CWA) Section 112(r) (40 CFR 68.130)** Hazardous substance

**Safe Drinking Water Act (SDWA)** 4 mg/l  
4.0 mg/l

#### US state regulations

**US. California** Not listed.

**Controlled Substances. CA Department of Justice (California Health and Safety Code Section 11100)**

**US. Massachusetts RTK - Substance List** Chlorine (CAS 7782-50-5)

**US. New Jersey Worker and Community Right-to-Know Act** Chlorine (CAS 7782-50-5)

**US. Pennsylvania Worker and** Chlorine (CAS 7782-50-5)

**Community Right-to-Know Law**
**US. Rhode Island RTK** Chlorine (CAS 7782-50-5)

**US. California Proposition 65** California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65): This material is not known to contain any chemicals currently listed as carcinogens or reproductive toxins.

**International Inventories**

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

\*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s).

A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

**16. Other Information**

<b>Issue date</b>	3/28/2018
<b>Revision #</b>	2
<b>Revision Indicator</b>	Minor revisions to text and new layout of Safety Data Sheet.
<b>List of abbreviations</b>	ACGIH: American Conference of Governmental Industrial Hygienists CAS: Chemical Abstract Services CERCLA: Comprehensive Environmental Response, Compensation and Liability Act of 1980 CFR: Code of Federal Regulations DOT: Department of Transportation EPA: Environmental Protection Agency EPCRA: Emergency Planning and Community Right-to-Know Act ERG: Emergency Response Guidebook

HSDB® - Hazardous Substances Data Bank  
IARC: International Agency for Research on Cancer  
IATA: International Air Transport Association  
IBC: Intermediate Bulk Container  
IDLH: immediately dangerous to life or health  
IMDG: International Maritime Dangerous Goods  
LC: Lethal Concentration  
LD: Lethal Dose  
NIOSH: National Institute of Occupational Safety and Health  
NOEC: No observable effect concentration  
NTP: National Toxicology Program  
OECD: Organization for Economic Cooperation and Development  
OEL: National occupational exposure limits  
OSHA: Occupational Safety and Health Administration  
PEL: Permissible exposure limit  
RCRA: Resource Conservation and Recovery Act  
RQ: Reportable Quantity  
RTECS: Registry of Toxic Effects of Chemical Substances  
SAR: supplied-air respirator  
SCBA: self-contained breathing apparatus  
SDS: Safety Data Sheet  
STEL: Short Term Exposure Limit  
TWA: Time Weighted Average  
UN: United Nations

**References**

ACGIH Documentation of the Threshold Limit Values and Biological Exposure Indices (2014)  
Canadian Centre for Occupational Health and Safety, CCIInfoWeb Databases, 2014 (Chempendium, RTECS, HSDB, INCHEM)  
International Agency for Research on Cancer Monographs (2014)  
Material Safety Data Sheet from manufacturer.  
OECD - The Global Portal to Information on Chemical Substances - eChemPortal, 2014.

**Disclaimer**

Information presented in this SDS is furnished in accordance with OSHA's Hazard Communication Standard (HCS) 2012.

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