SAFETY DATA SHEET

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

1. Identification

Product identifier	**Chlorine**
Other means of identification	Liquid Chlorine, Elemental Chlorine, Molecular chlorine, Cl_2
Recommended use	Production of chlorinated inorganic and organic chemicals, bleaching agent for paper, textiles and fabrics, used in water purification, sewage disinfection and food processing.
Recommended restrictions	None known

Manufacturer/Importer/Supplier/Distributor information

Manufacturer

Company name	ERCO Worldwide LP
Address	5050 Satellite Drive Mississauga, ON L4W 0G1 Canada
Telephone	(416) 239-7111 (M- F: 8:00 am – 5:00pm EST)
Website	http://www.ercoworldwide.com
E-mail	productinfo@ercoworldwide.com
Emergency phone number	Canada & USA: 1-800-424-9300 (CHEMTREC)
Supplier	Refer to Manufacturer

2. Hazard(s) Identification

Physical hazards	Oxidizing gases Gas Under Pressure – Liquefied Gas	Category 1
Health hazards	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)

Label elements

Signal word Danger

Hazard statement	May cause or intensify fire; oxidizer. Contains gas under pressure; may explode if heated. Fatal if inhaled. Causes severe skin burns and eye damage. May cause respiratory irritation. Very Toxic to aquatic life Causes damage to lungs through prolonged or repeated exposure.
Precautionary statement	
Prevention	Keep away from clothing and other combustible materials. Keep valves and fittings free from oil and grease. Do not breathe gas, mist, vapours or 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.
Response	**IF INHALED:** Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER/doctor. **IF SWALLOWED**: Rinse mouth. Do NOT induce vomiting. **IF ON SKIN** (or hair): Take off immediately all contaminated clothing. Rinse skin with water or 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. Immediately call a POISON CENTER or doctor. **In case of fire:** Stop leak if safe to do so.
Storage	Store in a well-ventilated place. Protect from sunlight. Keep container tightly closed. Store locked up.
Disposal	Dispose of contents and containers in accordance with local regulations.
Hazard(s) not otherwise classified (HNOC)	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

Chemical name	Common name and synonyms	CAS number	Conc. % By Weight
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_2).
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 and emergency procedures	Restrict access to area until completion of clean-up. Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. 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/m3 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/m3 0.5 ppm

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

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

Appearance	
Physical state	Gas or liquid (under pressure)
Form	Compressed liquefied gas
Colour	Amber color; liquefied gas under pressure, vaporizes to greenish yellow gas
Odor	Pungent suffocating odor
Odor threshold	0.06 ppm (detection) 0.2 ppm (perception)
pH	Not applicable (reacts with water to form an acidic solution)
Melting point	-149.8 °F (-101.5 °C)
Freezing point	Not Applicable
Initial boiling point and boiling range	-30.28 °F (-34.04 °C)
Flash point	Not Applicable

Evaporation rate	Not Applicable. Gas at normal temperatures.
Flammability (solid, gas)	This product is not flammable.
Upper/lower flammability or explosive limits	
Flammability limit – lower (%)	Not Applicable
Flammability limit – upper (%)	Not Applicable
Explosive limit – lower (%)	Not Available
Explosive limit – upper (%)	Not Available
Vapor pressure	638.4 kPa @ 20°C (68°F) 4788 mm Hg @ 20°C (68°F)
Vapor density	2.46 @ 0°C (32°F) (Air = 1)
Relative density	3.21 kg/m³ @ 0°C (32°F)
Solubility (ies)	
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
Partition coefficient (n-octanol/water)	Not Applicable (gas)
Auto-ignition temperature	Not Applicable
Decomposition temperature	Not Available
Viscosity	Not Available
Viscosity temperature	Not Applicable (Gas)
Other information	
Bulk density	Not Applicable
Critical temperature	290.75 °F (143.75 °C)
Explosive properties	290.75 °F (143.75 °C)
Molecular weight	70.91
Oxidizing properties	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.
Specific gravity	Not applicable (gas)

10. Stability and Reactivity

Reactivity

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.

Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	Will support or initiate combustion or explosion of organic matter and other oxidizable material. 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. 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 (>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.
Conditions to Avoid	Keep away from combustible materials. Avoid contact with incompatible materials. Keep away from heat. Do not use in areas without adequate ventilation.
Incompatible materials	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

Inhalation	Very toxic by inhalation. May cause severe irritation to the nose, throat, and respiratory tract. 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.
Skin contact	Not expected to be absorbed through the skin. 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.
Eye contact	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.
Ingestion	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.

Product	Species	Test Results
Chlorine (CAS 7782-50-5)		
Acute		
Dermal		
LD50		No data in literature.
Inhalation		
LC50	Rat	147 ppm, 4 Hours; 293 ppm exposure 1/hr.
	Mice	137 ppm exposure 1/hr.
Oral		
LD50		No data in literature.

Skin corrosion Category 1. Causes severe skin burns and eye damage.

Serious eye damage Category 1. Causes serious eye damage.

Respiratory or skin sensitization

Respiratory sensitization This product is not expected to cause respiratory sensitization.

Skin sensitizer This product is not expected to cause skin sensitization.

Germ cell mutagenicity Not expected to be mutagenic.

Carcinogenicity Carcinogenicity Designation A4 - Not classifiable as a human carcinogen.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050) Not listed.

Reproductive toxicity	This product is not expected to cause reproductive or developmental effects.
Specific target organ toxicity - single exposure	Category 3. May cause respiratory irritation.
Specific target organ toxicity - repeated exposure	May cause damage to organs.
Aspiration toxicity	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)			
Aquatic			
Acute			
Crustacea	EC50	Water flea (Daphnia magna)	0.005 mg/l, 48 hours (mg Free Available Chlorine/L)
Fish	LC50	Rainbow trout,donaldson trout (Oncorhynchus mykiss)	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.
Bio accumulative potential	Not expected to be bio accumulative
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.
Local disposal regulations	Dispose in accordance with all applicable regulations.
Hazardous waste code	The waste code should be assigned in discussion between the user, the producer and the waste disposal company.
Waste from residues / unused products	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).
Contaminated packaging	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

TDG

Shipping Name (TDGR)	UN Number	Hazard Class	Packing Group
Chlorine	UN 1017	2.3 (5.1) (8)	N/A

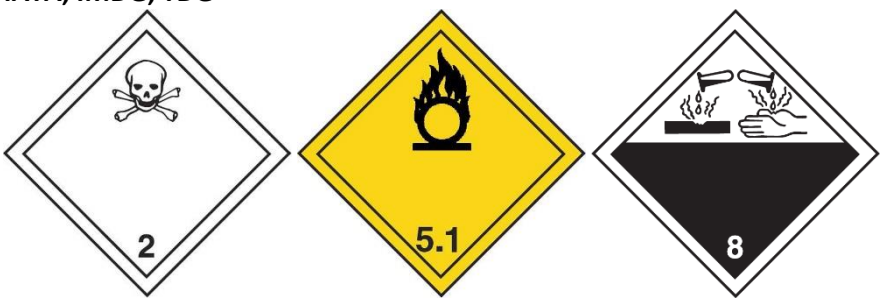
IATA

UN number	UN1017
UN proper shipping name	Chlorine
Transport hazard class(es)	
Class	2.3
Subsidiary risk	(5.1, 8)
Packing group	Not Applicable
ERG Code	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	Forbidden
Cargo aircraft only	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	This substance/mixture is not intended to be transported in bulk.

IATA; IMDG; TDG



Marine pollutant

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

15. Regulatory Information

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

Issue date	4/15/2022
Revision #	12
Revision Indicator	Company logo and address updated.

List of abbreviations

ACGIH: American Conference of Governmental Industrial Hygienists
CAS: Chemical Abstract Services
CFR: Code of Federal Regulations
DSL: Domestic Substance List
EINECS: European Inventory of Existing Commercial chemical Substances
EPA: Environmental Protection Agency
HSDB® - Hazardous Substances Data Bank
IARC: International Agency for Research on Cancer
IATA: International Air Transport Association
IBC: Intermediate Bulk Container
IMDG: International Maritime Dangerous Goods LC: Lethal Concentration
LD: Lethal Dose
NIOSH: National Institute of Occupational Safety and Health
NTP: National Toxicology Program
OECD: Organization for Economic Cooperation and Development
OSHA: Occupational Safety and Health Administration
PPE: Personal Protective Equipment
RTECS: Registry of Toxic Effects of Chemical Substances
SDS: Safety Data Sheet
TWA: Time Weighted Average
WHMIS: Workplace Hazardous Materials Information System

References

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