

**MATERIAL SAFETY DATA SHEET**

REV. 6 Issued: January 30, 2015

**1. Chemical Product And Company Information**

**Chemical Name :** Chlorine  
**Synonyms/Trade Names :** Liquid Chlorine, molecular chlorine, elemental chlorine  
**Chemical Family :** Chemical element, halogen  
**Formula :** Cl<sub>2</sub>  
**Molecular Weight :** 70.9  
**CAS No.:** 7782-50-5  
**Uses:** Production of chlorinated inorganic and organic chemicals ;  
bleaching agent for paper, textiles and fabrics; used in water  
purification, sewage disinfection and food processing .

**Manufacturer & Supplier:**

ERCO Worldwide, a division of Superior Plus LP  
302 The East Mall, Suite 200  
Toronto, ON, M9B 6C7

Wanuskewin Rd. & 71st Street  
Saskatoon, Saskatchewan S7K 3R3  
(306) 931-7767

*and/ or*

ERCO Worldwide (USA) Inc.  
101 Highway 73 South  
Nekoosa, Wisconsin 54457  
(715) 887-4000

**Transportation Emergency Telephone Numbers :**

CANADA: (613) 996-6666  
CANUTEC

USA 1-800-424-9300  
CHEMTREC

**Emergency Information:**

Call toll-free 24 hours a day:  
866-855-6947

**Canadian WHMIS Classification (s):**

A - Compressed Gas

E- Corrosive

D1A- Very Toxic



**2. Composition / Information On Ingredients**

**Name:**

**Conc. % By Weight**

**CAS No.**

### 3. Hazard Identification

#### Emergency Overview :

Greenish-yellow gas or clear amber liquid (under pressure) with a pungent odour. Compressed gas. Strong oxidizer. Contact with combustible material may cause fire or explosion . Combines with water to form corrosive hydrochloric and hypochlorous acids . Corrosive to the respiratory tract, eyes and skin. Very toxic. Can cause immediate death.

#### Routes of Entry :

##### INHALATION :

Breathing this material is harmful and may cause death . Harmful effects include burns and permanent damage to the airways, including the nose, throat, and lungs.

##### SKIN:

Causes skin burns and permanent skin damage. Skin contact with compressed liquid or escaping gas can cause frostbite injury.

##### EYE:

Causes burns and permanent injury to eye tissue. May cause blindness. Eye contact with compressed liquid or escaping gas can cause frostbite injury .

##### INGESTION :

Chlorine is a gas at room temperature. Swallowing this material is unlikely .

##### MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE :

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).

##### EFFECTS FOLLOWING REPEATED EXPOSURE :

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 .

##### CARCINOGENICITY :

Chlorine is not listed on the IARC, NTP or OSHA carcinogen lists. See Section 11 for additional information.

##### MUTAGENICITY :

This material has tested positive in one or more *in vitro* mutagenicity assays.

#### Symptoms of Exposure :

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 .

#### EFFECTS OF SHORT -TERM (ACUTE) EXPOSURE:

INHALATION: Chlorine is a severe nose, throat and 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 respiratory effects, inflammation of the nose and corrosion of tooth enamel. No evidence of carcinogenicity in human or animal studies . Chlorine is unlikely

to accumulate in the body since it reacts with water and tissues .

#### **4. First Aid Measures**

##### **Skin:**

Avoid direct contact with this chemical . Wear appropriate personal protective equipment . Flush the contaminated area with lukewarm , gently running water for at least 20 minutes . Remove contaminated clothing . Obtain medical attention immediately . Use cold packs to reduce pain .

##### **Eyes:**

Immediately flush the contaminated eye(s) with lukewarm , gently flowing water for at least 30 minutes , holding the eyelid(s) open . Take care not to rinse contaminated water into the non-affected eye . Obtain medical attention immediately .

##### **Inhalation :**

Take proper precautions to ensure your own safety before attempting rescue : eg. wear appropriate protective equipment . Remove source of chlorine or move victim to fresh air . Oxygen may be beneficial if administered by a person trained in its use . 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 .

##### **Ingestion :**

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 .

##### **NOTES TO PHYSICIAN**

Development of pulmonary edema may be delayed 48-72 hours .

#### **5. Fire-Fighting Measures**

##### **Conditions Of Flammability :**

Chlorine does not burn but poses a serious fire and explosion risk due to its high reactivity . Most combustible materials will ignite and/or burn in chlorine atmospheres .

##### **Means To Extinguish :**

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 . For small fires , dry chemical or carbon dioxide can be used . For large fires , water spray , fog or foam is used . 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 .

##### **Hazardous Combustion Products :**

Toxic products are formed when combustibles burn in chlorine .

##### **UNUSUAL FIRE AND EXPLOSION HAZARDS :**

May react to cause fire and or explosion upon contact with many organic compounds , ammonia , hydrogen and with many metals at elevated temperatures . Chlorine will support the burning of most combustible

materials. Firefighters must wear full protective clothing and SCBA, when fighting a fire involving Chlorine.

**Flash Point & Method:** Not applicable  
**Upper Flammability Limit :** Not applicable  
**Lower Flammability Limit :** Not applicable  
**Auto-Ignition Temperature :** Not applicable  
**Mechanical Impact Sensitivity :** Not available  
**Static Discharge Sensitivity :** Not available

## **6. Accidental Release Measures**

### **Leak Or Spill Procedures :**

Restrict access to area until completion of clean-up. Ensure clean-up is conducted by trained personnel. Wear adequate personal protective equipment. Extinguish or remove all ignition sources and ventilate area. Do not touch spilled material. 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. Prevent material from entering sewers or confined spaces. May be absorbed and neutralized into solutions of caustic soda, or lime and placed in polypropylene, polyvinyl chloride, fibreglass or lead containers. Large uncontrollable leaks require environmental considerations and possible evacuation of the surrounding area. When possible draw off chlorine to process or disposal system.

### **Waste Control Procedures :**

Consult appropriate Federal, State/Provincial and local regulatory authorities. Gaseous chlorine can be absorbed in alkaline solutions of sodium hydroxide or 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.

## **7. Handling Storage**

### **Handling Procedures And Equipment :**

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. Liquid chlorine lines must have suitable expansion chambers between block valves due to high coefficient of expansion. Have emergency equipment readily available. Establish written emergency plan and special training where chlorine is used. Regularly inspect and test piping and containers used for chlorine service.

### **Storage:**

Store in steel pressure cylinders in a cool, dry area outdoors or in well-ventilated, detached or segregated areas of non-combustible construction. Keep out of direct sunlight and away from heat and ignition sources. Cylinder temperatures should never exceed 51°C (125°F).

## 8. Exposures Controls / Personal Protection

### Protective Equipment :

Up to 5 ppm - Chemical cartridge respirator with cartridge(s) to protect against Chlorine, or supplied air respirator. Up to 10 ppm - SAR (supplied air respirator) operated in a continuous flow mode or powered air purifying respirator with cartridge(s) to protect against Chlorine; or full facepiece chemical cartridge respirator with cartridge(s) to protect against Chlorine; or gas mask with canister to protect against Chlorine; or full facepiece SCBA (self contained breathing apparatus) ; or full facepiece SAR. Emergency or planned entry in unknown concentration or IDLH conditions : positive pressure full facepiece SCBA, or positive pressure full facepiece supplied air respirator with auxiliary positive pressure SCBA . 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™ .

### 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.

## 9. Physical And Chemical Properties

**State:** Gas or liquid (under pressure)  
**Odour:** Pungent suffocating odour  
**Odour Threshold :** 0.06 ppm (detection) 0.2 ppm (perception)  
**Boiling Point :** -34.04 °C  
**Melting Point :** -101.5°C  
**Freezing Point :** Not applicable  
**pH:** Not applicable  
**Coefficient Of Water /Oil Distribution :** Not available  
**Appearance:** Amber colour, liquefied gas under pressure, vaporizes to greenish yellow gas.  
**Specific Gravity :** Not applicable (gas)  
**Vapour Pressure :** 638.4 kPa (4788 mmHg) at 20°C  
**Vapour Density :** ~2.46 (air = 1) @ 0°C  
**Evaporation Rate :** Not applicable. Gas at normal temperatures.  
**Solubility In Water :** 0.7 g/100 g of water at 20°C, 1 Atm, ( reacts to form hydrochloric and hypochlorous acids)  
**Bulk Density :** Not applicable

## 10. Stability And Reactivity

### Chemical Stability :

Stable

### Reactivity Conditions :

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 . It will react with water to produce hydrochloric acid and hypochlorous acid. 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 acid . Chlorine will react (burn) with hydrogen to form hydrogen chloride. This strongly exothermic reaction can be initiated by light.

### Incompatible Substances :

Chlorine is a powerful oxidizing agent, and reacts violently with reducing agents and combustible materials. 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 :

Chlorine is a chemical element therefore does not decompose.

## 11. Toxicological Information

**Skin Contact :** High concentrations can cause severe irritation . Symptoms include burning and prickling sensations , reddening and blisters .  
Direct contact with liquid causes severe local irritation , blistering and burns . Direct contact with the liquefied gas escaping from its pressurized cylinder can also cause frostbite .

**Skin Absorption :** May be absorbed, causing tissue and blood cell 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 .

**Inhalation :** Chlorine is irritating 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 .

**Ingestion :** 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 .

**LD<sub>50</sub> :** Not applicable

**LC<sub>50</sub> :** 293 ppm exposure 1/hr (rat)  
137 ppm exposure 1/hr (mice)

**Exposure Limits :** ACGIH TLV (United States, 1/2009).  
STEL: 2.9 mg/m<sup>3</sup> 15 minute(s).

STEL: 1 ppm 15 minute(s).

TWA: 1.5 mg/m<sup>3</sup> 8 hour(s).

TWA: 0.5 ppm 8 hour(s).

NIOSH REL (United States, 6/2009).

CEIL: 1.45 mg/m<sup>3</sup> 15 minute(s).

CEIL: 0.5 ppm 15 minute(s).

OSHA PEL (United States, 11/2006).

CEIL: 3 mg/m<sup>3</sup>

CEIL: 1 ppm

OSHA PEL 1989 (United States, 3/1989).

STEL: 3 mg/m<sup>3</sup> 15 minute(s).

STEL: 1 ppm 15 minute(s).

TWA: 1.5 mg/m<sup>3</sup> 8 hour(s).

TWA: 0.5 ppm 8 hour(s).

**Irritancy :** Chlorine is a corrosive gas and a severe irritant to the upper and lower respiratory tract .

**Sensitization :** Not available .

**Carcinogenicity :** Not listed by IARC or ACGIH, Carcinogenicity Designation A4 - Not classifiable as a human carcinogen .

**Teratogenicity & Mutagenicity :** Chlorine is not known to cause developmental toxicity .

**Reproductive Toxicology :** Chlorine is not known to cause reproductive toxicity .

**Toxicological Synergism :** Not available

## 12. Ecological Information

### Ecological Information :

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 .

### Biodegradability :

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.

### Aquatic Toxicity :

Chlorine in water is toxic to aquatic species .

Result	Species	Exposure
LC50 0.07 - 0.15 ppm	Fathead Minnow	96 hours
LC50 0.44 mg/L	Bluegil	96 hours
Acute LC50 0.75 mg/L Marine water	Crustaceans -Blue crab - Callinectes sapidus – Adult	48 hours
Acute LC50 838 ug/L Fresh water	Crustaceans -Aquatic sowbug - Asellus racovitzai	2 days
Acute LC50 752 to 33400 ug/L Fresh water	Crustaceans -Aquatic sowbug - Asellus racovitzai	2 days
Acute LC50 380 to 3390 ug/L Fresh water	Crustaceans -Aquatic sowbug - Asellus racovitzai	2 days
Acute LC50 354 to 488 ug/L Fresh water	Crustaceans -Aquatic sowbug - Asellus racovitzai	2 days
Acute LC50 150 ug/L Fresh water	Daphnia - Water flea - Daphnia magna	48 hours
Acute LC50 136 ug/L Fresh water	Crustaceans -Aquatic sowbug - Asellus racovitzai	2 days
Acute LC50 130 ug/L Fresh water	Daphnia - Water flea - Daphnia magna	48 hours
Acute LC50 120 ug/L Fresh water	Daphnia - Water flea - Daphnia magna	48 hours
Acute LC50 116 ug/L Fresh water	Daphnia - Water flea - Daphnia magna	48 hours
Acute LC50 110 ug/L Fresh water	Daphnia - Water flea - Daphnia pulex	48 hours
Acute LC50 107 to 110 ug/L Fresh water	Fish - Brook trout - Salvelinus fontinalis - Juvenile (Fledgling, Hatchling, Weanling) - 7.5 to 10 cm	96 hours
Acute LC50 102 to 124 ug/L Fresh water	Fish - Brook trout - Salvelinus fontinalis Juvenile (Fledgling, Hatchling, Weanling) - 10 to 15 cm	96 hours
Acute LC50 91 ug/L Fresh water	Daphnia - Water flea - Daphnia pulex	48 hours
Acute LC50 90 ug/L Marine water	Fish - Spot - Leiostomus xanthurus	96 hours
Acute LC50 85 to 5670 ug/L Fresh water	Crustaceans -Aquatic sowbug - Asellus racovitzai	2 days



Acute LC50 85 ug/L Fresh water	Daphnia - Water flea - Daphnia magna	48 hours
Acute LC50 75 ug/L Fresh water	Daphnia - Water flea - Daphnia pulex	48 hours
Acute LC50 40 ug/L Fresh water	Daphnia - Water flea - Daphnia pulex	48 hours
Acute LC50 37 ug/L Marine water	Fish - Atlantic silverside - Menidia menidia	96 hours
Acute LC50 37 to 220 ug/L Marine water	Fish - Northern pipefish - Syngnathus fuscus	96 hours
Acute LC50 30 ug/L Fresh water	Daphnia - Water flea - Daphnia pulex	48 hours
Acute LC50 29 ug/L Fresh water	Fish - Rainbow trout, Donaldson trout - Oncorhynchus mykiss	96 hours
Acute LC50 14 ug/L Fresh water	Fish - Rainbow trout, Donaldson trout Oncorhynchus mykiss	96 hours
Acute LC50 13.6 ug/L Fresh water	Crustaceans - Aquatic sowbug - Asellus racovitzai	2 days
Acute LC50 2.03 ug/L Fresh water	Crustaceans - Aquatic sowbug - Asellus racovitzai	2 days
Acute LC50 4720 ug/L Fresh water	Crustaceans - Aquatic sowbug - Asellus racovitzai	2 days

### 13. Disposal Considerations

#### Disposal Considerations :

All disposals of this material must be done in accordance with Federal , state and local regulations . Waste characterization and compliance with disposal regulations are the responsibilities of the waste generator .

#### SPILL RESIDUES

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.

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 .

### 14. Transportation Information

<b>Shipping Name (TDGR)</b> Chlorine	<b>UN Number</b> UN 1017	<b>Hazard Class</b> 2.3 ( 8 )	<b>Packing Group</b> N/A
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## **15. Regulatory Information**

**This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all of the information required by the CPR .**

### **Safety:**

#### **WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WHMIS) CLASSIFICATION**

WHMIS Classifications applicable to this product :

A (Compressed Gas) based on vapor pressure

D-1A (Very Toxic Material) based on inhalation toxicity.

D-2A very toxic base on other effects

E (Corrosive Material) based on assignment to TDG Class 2, Division 4

#### **UNITED STATES FEDERAL REGULATIONS : (not a comprehensive list)**

TOXIC SUBSTANCES CONTROL ACT (TSCA): Chlorine is listed on the inventory .

OSHA: Hazardous Substance under 29 CFR Section 1910, Subpart Z.

CERCLA: Hazardous Substance under 40 CFR Part 302, RQ = 10 lbs.

SARA 313: Toxic Chemical subject to the reporting requirements of 40 CFR Part 372

SARA 311/312 EPA HAZARD CATEGORIES: Immediate (Acute) Health, Sudden Release of Pressure

SARA 302: Extremely Hazardous Substance, Threshold Planning Quantity = 100 lbs.

#### **Environmental :**

##### **U S FEDERAL REGULATIONS**

##### **REPORTABLE QUANTITY (RQ)**

Reportable Quantity (RQ) is 10 lbs.

##### **TOXIC SUBSTANCES CONTROL ACT**

Listed on TSCA Inventory

##### **SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) TITLE III**

Chlorine is subject to the reporting requirements of Section 313 of Title III of the 1986 Superfund Amendments and Reauthorization Act (SARA) and 40 CFR Part 372.

##### **SARA HAZARD CATEGORIES (40 CFR 370.2)**

HEALTH: Immediate Health    PHYSICAL: Fire, Sudden Release of Pressure

##### **CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA)**

All components of this product are on the Domestic Substances List (DSL).

##### **CALIFORNIA PROPOSITION 65**

Chlorine does not appear on the California Proposition 65 list.

#### **Transportation :**

Transportation in Canada is governed by Transport Canada . Refer to the Transportation of Dangerous Goods (TDG) Regulations for special shipping requirements .

Transport in the U.S. is governed by the Department of Transportation (DOT). Refer to DOT regulations (49 CFR) for special shipping requirements . (UN 1017)

## 16. Other Information

### Prepared By:

ERCO Worldwide, A division of Superior Plus LP.  
Toronto, ON  
416-239-7111

### Summary of Changes Made in this Revision :

Removed D1B WHMIS classification - not shown on CCOHS web site.

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

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