ERCO Worldwide

SAFETY DATA SHEET

REV. 2 Issued: July 25, 2016

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 Dioxide Solution**
Other means of identification	Chlorine Peroxide, ClO_2
Chemical Family	Inorganic compound
Formula	ClO_2
Recommended use	Pulp bleaching, water treatment, disinfection
Recommended restrictions	None known.
Manufacturer/Importer/Supplier/Distributor information	
Manufacturer	
Company name	ERCO Worldwide, A division of Superior Plus LP
Address	302 The East Mall Suite 200 Toronto, ON M9B 6C7 Canada
Telephone	Information #: (416) 239-7111 (Monday-Friday 8:00 am – 5:00pm EST)
Website	http://www.ercoworldwide.com
E-mail	info@ercoworldwide.com
Emergency phone number	24 Hr. #: Canada: 613-996-6666 (CANUTEC) USA: 1-800-424-9300 (CHEMTREC)
Supplier	Refer to Manufacturer

2. HAZARD(S) IDENTIFICATION

Physical hazards	Oxidizing Liquids	Category 1
Health hazards	Skin Corrosion/Irritation	Category 1
	Serious Eye Damage/Irritation	Category 1
	Acute Toxicity - Inhalation	Category 1

Environmental hazards Not currently regulated by the Canadian Hazardous Products Regulation (WHMIS 2015), refer to Section 12 for additional information.

Label elements

Signal word Danger

Hazard statement
May cause fire or explosion, strong oxidizer
Fatal if inhaled
Causes severe skin burns and serious eye damage

	May cause an explosion through a vigorous reaction of decomposition Causes severe damage to the respiratory tract
Precautionary statement	
Prevention	Wash exposed areas thoroughly after handling. Wear protective gloves and protective clothing. Do not eat, drink or smoke when using this product. Avoid breathing fume/gas/mist/vapors/spray. Use only outdoors or in a well-ventilated area.
Response	**IF ON SKIN:** Wash immediately using soap or mild detergent and water. Seek medical attention if irritation persists. Remove all contaminated clothing which should be laundered before reuse. **IF IN EYES:** Flush immediately with plenty of lukewarm water. Continue to wash for 20-30 minutes, lifting eyelids occasionally. Get immediate medical attention. **IF INHALED:** Move the victim to fresh air. If breathing is stopped, commence artificial respiration. Get immediate medical attention **IF INGESTED: DO NOT GIVE ANYTHING BY MOUTH OR INDUCE VOMITING IF THE PATIENT IS UNCONSCIOUS.** Give large amounts of water to dilute stomach contents. Get immediate medical attention. **IN CASE OF FIRE:** Water. DO NOT use dry chemical fire extinguishing agents containing ammonium compounds (such as some A:B:C agents) on oxidizers that contain chlorine, since an explosive compound (nitrogen trichloride) can be formed. DO NOT use Halon extinguishers or halocarbon extinguishers, because they can react with chlorine dioxide. DO NOT use carbon dioxide, dry chemical powder or other extinguishing agents that smother flames, since they are not effective in extinguishing fires involving oxidizers.
Storage	Solutions are stored in Fiberglass reinforced plastic (FRP) or tile-lined tanks. These tanks should be provided with adequate air-sweep to ensure that explosive concentrations of chlorine dioxide gas do not build up. The gas is unstable and it is not possible to store as a gas.
Disposal	Dispose of contents/container in accordance with local/regional/national/international regulations.
Hazard(s) not otherwise Classified (HNOC)	Physical hazards: Category 1 Health hazards: Category 1
Supplemental information	Not applicable.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Mixtures

Chemical name	Common name and synonyms	CAS number	Conc. % By Weight
Chlorine Dioxide	Chlorine Peroxide, ClO_2	10049-04-4	1.0 to 1.2 wt% (variable)
Water	H_2O	7732-18-5	Balance

Note: This chemical is normally handled as water solution, typically containing 10-12 g/L of chlorine dioxide. Gaseous chlorine dioxide can only be handled diluted with air or other inert gas, when it's partial pressure does not exceed decomposition limit, which depends on the temperature.

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

4. FIRST-AID MEASURES

Inhalation
Chlorine dioxide gas is very toxic, corrosive and poses a very serious inhalation hazard. It is unstable and highly reactive at concentrations above 10% in air, and is a strong oxidizing agent. In many cases, exposure is not to chlorine dioxide alone, but to a mixture of chemicals that can include toxic and corrosive chlorine and/or sulphur dioxide. Move the victim to fresh air. If breathing is stopped, commence artificial respiration. Get immediate medical attention.

Skin Contact
May cause redness and irritation. Wash immediately using soap or mild detergent and water. Seek medical attention if irritation persists. Remove all contaminated clothing which should be laundered before reuse.

Eye Contact
Strong irritant to the eyes. May cause redness, pain, blurred vision, tearing, corneal injury and burns.
Flush immediately with plenty of lukewarm water. Continue to wash for 20-30 minutes, lifting eyelids occasionally. Get immediate medical attention.

Ingestion
May cause irritation to the mucus membranes. DO NOT GIVE ANYTHING BY MOUTH OR INDUCE VOMITING IF THE PATIENT IS UNCONSCIOUS. Give large amounts of water to dilute stomach contents. Get immediate medical attention.

Most important symptoms/effects, acute and delayed
Chlorine dioxide irritates the nose, throat, trachea and bronchi at very low concentrations (less than 5 ppm) resulting in breathlessness, wheezing and coughing. Higher concentrations can cause inflammation in the upper respiratory tract, bronchial spasms and difficulty in breathing. A potentially fatal accumulation of fluid in the lungs (pulmonary edema) could occur. Symptoms of pulmonary edema (chest pain and shortness of breath) can be delayed for up to 24 or 48 hours after exposure. Long-term respiratory effects (e.g. sensitivity to respiratory irritants, chronic nasal inflammation, asthma, pulmonary emphysema and spastic bronchitis) have been noted in workers accidentally exposed to unspecified concentrations for a short time.

Indication of immediate medical attention and special treatment needed
None.

General information
No additional information available.

5. FIRE-FIGHTING MEASUSRES

Suitable extinguishing media
When combustibles are burning in the presence of chlorine dioxide (or other strong oxidizers) water is the only effective extinguishing medium.

Unsuitable extinguishing media
DO NOT use dry chemical fire extinguishing agents containing ammonium compounds (such as some A:B:C

agents) on oxidizers that contain chlorine, since an explosive compound (nitrogen trichloride) can be formed. DO NOT use Halon extinguishers or halocarbon extinguishers, because they can react with chlorine dioxide. DO NOT use carbon dioxide, dry chemical powder or other extinguishing agents that smother flames, since they are not effective in extinguishing fires involving oxidizers.

Specific hazards arising from the chemical

May react explosively with hydrocarbons (fuels). Thermally unstable. At concentrations greater than 10% in air and pressures greater than 10.1 kPa, there is a risk of explosion as a result of decomposition. Explosion may be caused by any source of initiation energy, such as sunlight, heat or electrostatic discharge, or contamination. Decomposes explosively under intense fire conditions to form corrosive and highly toxic chlorine and hydrogen chloride gases. Closed containers may rupture violently due to rapid decomposition, if exposed to fire or excessive heat for a sufficient period of time.

Special protective equipment and precautions for firefighters:

Wear a Self-Contained Breathing Apparatus (SCBA) with a full face piece operated in the “positive pressure demand” setting. Use SCBA in conjunction with appropriate chemically resistant personal protective gear.

Firefighting equipment/instructions:

When combustibles are burning in the presence of chlorine dioxide (or other strong oxidizers) water is the only effective extinguishing medium. DO NOT use dry chemical fire extinguishing agents containing ammonium compounds (such as some A:B:C agents) on oxidizers that contain chlorine, since an explosive compound (nitrogen trichloride) can be formed. DO NOT use Halon extinguishers or halocarbon extinguishers, because they can react with chlorine dioxide. DO NOT use carbon dioxide, dry chemical powder or other extinguishing agents that smother flames, since they are not effective in extinguishing fires involving oxidizers.

General fire hazards

Chloride dioxide solution is not flammable, but partial pressure of chlorine dioxide gas in the gas phase over solution is significant, especially at higher concentrations such as covered by this SDS. The hazards of the gaseous chlorine dioxide are therefore inherent to hazards of the solution. The gas is heavier than air and can accumulate in low-lying areas. Chlorine dioxide gas may decompose with a pink/violet flame which may ignite combustible materials. This flame can be extinguished by diluting and cooling with air. Chlorine dioxide gas may explode on heating. The products of chlorine dioxide decomposition in the gas phase include chlorine, oxygen, hydrogen chloride, chloric acid and perchloric acid. Chlorine dioxide gas is not flammable in the normal sense, as no air is required for it to burn. However, it is a powerful oxidizing agent (enhances the combustion of other substances) and is a serious fire and explosion risk, especially when contaminated with, or if it comes into contact with, oxidizable, combustible materials (e.g. cloth, grease, leather, oil and solvents, paper, sawdust, rubber, plastics and wood). In these situations, there may be spontaneous ignition and explosion.

Hazardous combustion products

Not applicable as chlorine dioxide is not combustible, but see "Hazardous Decomposition Products" in Section 10.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Chloride dioxide solution, especially at higher concentrations such as covered by this SDS, will release significant quantities of chlorine dioxide gas. The hazards of the gaseous chlorine dioxide are therefore inherent to hazards of the solution. A pale green liquid when dissolved in water, which is irritating to the eyes, skin and respiratory passages. The evolved gas is yellowish-green to orange in colour, is heavier than air and can accumulate in low-lying

areas. Accumulation of chlorine dioxide in gas phase must be prevented. The pungent odour has been described as chlorine-like or resembling that of a mixture of chlorine or ozone. **POWERFUL OXIDIZER**. Promotes combustion. Contact with combustible materials may cause a fire and/or explosion. **DANGEROUSLY REACTIVE**. Thermally unstable. The gas explodes violently at concentrations greater than 10% by volume in air at pressures above 10.1 kPa (76 mm Hg). May be initiated by light, shock, electrical discharge including static electricity, hot surfaces, open flames or contact with a variety of materials. **VERY TOXIC**. May be fatal if inhaled. Irritating to the respiratory tract at very low concentrations. Causes lung injury - effects may be delayed. **CORROSIVE** to the eyes, skin and respiratory tract.

Methods and materials for containment and cleaning up

Evacuate locations downwind from the leak. Restrict access to area until completion of clean-up. Ensure clean-up is conducted by trained personnel only. Wear adequate personal protective equipment. Ventilate area. Extinguish or remove all ignition sources. Remove or isolate flammable and combustible materials and other incompatible materials. The gas is heavier than air and can accumulate in low-lying areas. Notify government occupational health and safety and environmental authorities. Treating spilled solution with caustic will convert chlorine dioxide to chlorate and chlorite, stopping release of gas in 15-20 minutes. Release may be stopped faster by adding hydrogen peroxide or white liquor after the caustic has made the solution alkaline. Appropriate personal protective equipment should be worn prior to treatment.

Environmental precautions

Chlorine dioxide must not be discharged to the general environment but may be discharged to mill sewer if allowable, otherwise storage tanks and other equipment should be provided with a bund (berm) to retain solution in the event of rupture. Contained plant settling ponds containing organic matter will normally provide an environment in which residual chlorine dioxide will be reduced to harmless compounds quickly. Excessive amounts will kill bacteria used to treat wastes, necessitating restocking.

7. HANDLING AND STORAGE

Precautions for safe handling

Equipment manufacturer's recommendations for design, operation and maintenance of equipment must be followed.

Conditions for safe storage, including any incompatibilities

Solutions are stored in FRP or tile-lined tanks. These tanks should be provided with adequate air-sweep to ensure that explosive concentrations of chlorine dioxide gas do not build up. The gas is unstable and it is not possible to store as a gas.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational exposure limits

ACGIH	TWA 0.1 ppm
	STEL 0.3 ppm

Biological limit values

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

Appropriate engineering controls

Good ventilation should be provided, so that chlorine dioxide levels are maintained below TLV at all times.

Individual protection measures, such as personal protective equipment

Eye/face protection

Use eye protection. Use of contact lenses should not be permitted when there is the potential for exposure to this material.

Skin protection

Hand protection

Use impermeable gloves

Other

Use of full chemical protective suits if coming into contact with large volume of chlorine dioxide solution. In the event of a fire, use fire protective firefighting gear (including consideration of any other hazardous materials which may be present).

Respiratory protection

Persons in the vicinity of chlorine dioxide gas or solutions should carry a respirator suitable for escape purposes at all times, in case of accidental release of significant amounts of gas.

General hygiene considerations

No additional information available.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Solution: Pale yellow; Gas: Yellow/green.
Physical state	Normally used as solution in water. Pure chlorine dioxide is a gas at normal temperatures, but is unstable and will decompose violently unless diluted with an inert gas or handled at a reduced pressure.
Odor	Similar to Chlorine or Ozone
Odor threshold	For gaseous chlorine dioxide - not available. Characteristic smell at 0.3 ppm STEL. Reported odour threshold values {9.4 ppm (method not specified) and 15 ppm (method not specified) have not been evaluated. A detection level of 0.1 ppm though widely reported is not considered correct.
pH	2 to 3 (8 g/L solution.)
Melting point	Not applicable.
Freezing point	Not applicable for solution. For gas: - 59°C
Initial boiling point	Not applicable for the water solution. For gas 11°C
Flash point	Not combustible
Evaporation rate	Not applicable. Gaseous chlorine dioxide will escape from solution leaving behind water.
Flammability (solid, gas)	Not applicable.
Upper/lower flammability or explosive limits	
Flammability limit – lower (%)	Not applicable.
Flammability limit – upper (%)	Not applicable.
Explosive limit	Not applicable. Chlorine dioxide solution is not explosive. Chlorine dioxide gas which may evolve from chlorine dioxide solution, may spontaneously decompose with a mild energy release at concentrations of 10% in air or greater at standard temperature and pressure (76 mm Hg partial pressure)
Vapor pressure	Not available.
Vapor density	2.4 (air=1) (for 100% ClO_2)
Relative density (water = 1)	1.6 at 0°C (liquid)
Solubility (ies)	

Solubility (water)	The product is water solution of chlorine dioxide (the solubility depends on the temperature and partial pressure of the gas, e.g. 10 g/L @ 15°C and 74.5 mm Hg partial pressure is typical)
Partition coefficient (N-octanol/water)	Not available.
Coefficient of Water/Oil Distribution	Log P(oct) = -3.22 (estimated)
Auto-ignition temperature	Not applicable, but see "Chemical Stability", Section 10.
Mechanical Impact Sensitivity	Not available.
Static Discharge Sensitivity	Sensitive.
Decomposition temperature	Not available.
Viscosity	Not applicable.
Other information	
Bulk Density	Not applicable.
Molecular formula	ClO_2
Specific gravity	For solution - close to 1 g/L

10. STABILITY AND REACTIVITY

Reactivity
Gas is highly reactive on contact with incompatible materials, and will decompose upon exposure to ultraviolet light, heat or static discharge.

Chemical stability
Chloride dioxide solution 10-14 g/L is relatively stable and can be stored at low temperature for extended time, but partial pressure of chlorine dioxide gas in the gas phase over solution is significant, especially at higher concentrations such as covered by this MSDS. The hazards of the gaseous chlorine dioxide are therefore inherent to hazards of the solution. The gas is heavier than air and can accumulate in low-lying areas. Accumulation of chlorine dioxide in gas phase must be prevented. Chlorine dioxide gas is unstable even at low (i.e. 120 mm Hg) partial pressures. At partial pressures above about 120 mm Hg it will decompose spontaneously and explode. At higher pressures the explosions become more violent. If explosion relief is inadequate, rupture of the vessel may occur. These explosions can ignite combustible materials. Explosive decomposition occurs above 45°C at concentrations greater than 10% by volume in air at pressures above 10.1 kPa (76 mm Hg). Decomposition can be caused by light, sparking, electrical discharge including static electricity, rapid heating, hot surfaces or open flames, and by contact with most flammable organic solvents, oxidizable materials, or inorganic substances, e.g. mercury and sulphur. Chlorine dioxide gas is pressure sensitive and will decompose violently if it is compressed for storage or shipping. The transfer of gas chlorine dioxide from one container to another can cause an explosion.

Possibility of hazardous reactions
Material does not undergo hazardous polymerization.

Incompatible materials
There is only limited information on materials incompatible with chlorine dioxide solutions.
Corrosivity to Metals: Solutions of chlorine dioxide are acidic and oxidizing, therefore it can be expected that corrosion of common metals will occur. There is no information available on the corrosivity of chlorine dioxide gas to metals.
Corrosivity to Non-Metals: It is expected that chlorine dioxide solutions will attack non-metals similarly to chlorine dioxide gas, which attacks plastics, like polyvinylidene chloride, polypropylene, nylon, polyurethane,

high-density polyethylene, thermoset isophthalic acid polyester, and thermoset epoxy. It does not attack Teflon, acrylonitrile-butadiene-styrene (ABS), polyvinylidene fluoride, chlorinated polyvinyl chloride (CPVC), polyvinyl chloride (PVC) and vinyl ester.

Gaseous chlorine dioxide is incompatible with:

- COMBUSTIBLE MATERIALS (e.g. hydrocarbons (e.g. butadiene, ethane, ethylene, methane or propane), rubber, cork, sulphur, hydrogen sulphide, sugar, metallic dusts) - ignite on contact and may cause explosion.
- CARBON MONOXIDE - explode on mixing.
- NON-METALS (e.g. phosphorus) - ignite on contact and may cause explosion.
- DIFLUORAMINE or TRIFLUORAMINE - interaction in the gas phase is explosive.
- FLUORINE - reaction is explosive.
- HYDROGEN - mixtures detonate on sparking, or on contact with platinum sponge.
- MERCURY - chlorine dioxide gas explodes upon shaking with mercury.
- PHOSPHORUS PENTACHLORIDE and CHLORINE - mixture causes explosion.
- POTASSIUM HYDROXIDE - chlorine dioxide explodes in contact with solid potassium hydroxide or its concentrated solutions.

Hazardous decomposition products
Chlorine and oxygen are main decomposition products of gaseous chlorine dioxide.

11. TOXICOLOGOCAL INFORMATION

Information on likely routes of exposure

Inhalation	A severe respiratory irritant. May cause bronchospasm and pulmonary oedema, which may be delayed in onset. May also cause severe headache. All symptoms may be delayed and long-lasting. Long term exposure may cause chronic bronchitis.
Skin contact	Solutions are highly irritant. May be absorbed, causing tissue and blood cell damage.
Eye contact	Severely irritant. Exposure may cause visual disturbance, i.e. seeing haloes around lights.
Ingestion	Not applicable except for solutions, in which case the symptoms would be expected to parallel those for inhalation.

Most important symptoms/effects, acute and delayed
Chlorine dioxide irritates the nose, throat, trachea and bronchi at very low concentrations (less than 5 ppm) resulting in breathlessness, wheezing and coughing. Higher concentrations can cause inflammation in the upper respiratory tract, bronchial spasms and difficulty in breathing. A potentially fatal accumulation of fluid in the lungs (pulmonary edema) could occur. Symptoms of pulmonary edema (chest pain and shortness of breath) can be delayed for up to 24 or 48 hours after exposure. Long-term respiratory effects (e.g. sensitivity to respiratory irritants, chronic nasal inflammation, asthma, pulmonary emphysema and spastic bronchitis) have been noted in workers accidentally exposed to unspecified concentrations for a short time.

Information on toxicological effects
May have synergistic effects in conjunction with chlorine, other chlorine oxides, and chlorine fluorine compounds.

Acute toxicity

Product	Species	Test Results
Chlorine Dioxide Solution		
Acute		
Oral		
LD_{50}	Rat	292 mg/kg
Inhalation		
LC_{50}	Rat	32 ppm (inhalation 4 hour exposure)

Skin corrosion/irritation
Severe irritant.
Serious eye damage/eye irritation
Severe irritant.
Respiratory or skin sensitization
Respiratory sensitization
No information available.
Skin sensitizer
No information available.
Germ cell mutagenicity
No information available.
Carcinogenicity
This product is not considered to be a carcinogen by IARC or ACGIH.
Reproductive toxicity
No information available.
Specific target organ toxicity - single exposure
No information available.
Specific target organ toxicity - repeated exposure
No information available.
Aspiration toxicity
No information available.
Chronic effects
No information available.

12. ECOLOGICAL INFORMATION

Ecotoxicity
No data available.
Persistence and degradability
No data available. Term 'biodegradability' pertains to organic material capable of decomposition as a result of attack by microorganisms. However, chlorine dioxide will be converted to chloride by reducers present in natural environment, including biomass.

Bioaccumulative potential
No data available.
Mobility in soil
No data available.
Other adverse effects
No data available.

13. DISPOSAL CONSIDERATIONS

Disposal instructions
Chlorine dioxide solution should not be disposed into sewers and waterways. Chlorine dioxide solutions may be treated with sodium sulphite or bisulphite in a neutral to slightly alkaline solution to decompose the chlorine dioxide. The sodium chloride and sodium sulphate reaction products can then be disposed in a manner which complies with the Local, Provincial, and Federal 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 (see: Disposal instructions).
Contaminated packaging
Dispose of in accordance with local regulations (see: Disposal instructions).

14. TRANSPORT INFORMATION

TDG

Shipping Name (TDGR)	UN Number	Hazard Class	Packing Group
Chlorine Dioxide	Forbidden	Forbidden	Forbidden

IATA
Transportation is FORBIDDEN.

IMDG
Transportation is FORBIDDEN.

15. REGULATORY INFORMATION

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)	Yes
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, INCLUDING DATE OF PREPARATION OR LAST REVISION

Issue date 07-25-2016
Revision # 2
Revision Indicator **New safety data sheet.**
List of abbreviations

ACGIH: American Conference of Governmental Industrial Hygienists
CAS: Chemical Abstract Services
FRP: Fiberglass Reinforced Plastic
IARC: International Agency for Research on Cancer
IATA: International Air Transport Association
IMDG: International Maritime Dangerous Goods
LC: Lethal Concentration
LD: Lethal Dose
PPE: Personal Protective Equipment
SCBA: Self-Contained Breathing Apparatus
SDS: Safety Data Sheet
TDGR: Transport of Dangerous Goods Regulations
TSCA: Toxic Substances Control Act
UN: United Nations
WHMIS: Workplace Hazardous Materials Information System

Disclaimer

Information presented in this SDS is furnished in accordance with the Workplace Hazardous Materials Information System (WHMIS).

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