ERCO Worldwide

CHLORINE DIOXIDE SOLUTION
WHMIS CONTROLLED PRODUCT
Date Issued:04/23/2012
Revision #:1

MATERIAL SAFETY DATA SHEET

REV. 1 Issued: April 23, 2012

1. Chemical Product And Company Information

Chemical Name: Chlorine Dioxide Solution
Synonyms/Trade Names: Chlorine Peroxide; ClO_2
Chemical Family: Inorganic compound
Formula: ClO_2
Molecular Weight: 67.45
CAS No.: 0049-04-4
Uses: Pulp bleaching; water treatment; disinfection

Manufacturer & Supplier:
ERCO Worldwide
2001 Neebing Avenue
Thunder Bay, Ontario, P7B 6T9
Canada

Transportation Emergency Telephone Numbers :
not applicable - Shipment FORBIDDEN

Canadian WHMIS Classification (s):

D1A (Very Toxic)

E (Corrosive)

F (Dangerously Reactive)

C (Oxidizing Material)

2. Composition / Information On Ingredients

Name:	Conc. % By Weight	CAS No.
Chlorine Dioxide	1.0 to 1.2 wt% (variable)	10049-04-4
Water	Balance	7732-18-5

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.

3. Hazard Identification

Emergency Overview:

Note: Chloride dioxide solution, especially at higher concentrations such as covered by this MSDS , 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.

Routes of Entry:

Skin, Eyes, Inhalation, Injestion

Symptoms of Exposure:

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.(1) 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.

Chlorine dioxide irritates the nose, throat, trachea and bronchi at very low concentrations (less than 5 ppm) resulting in breathlessness, wheezing and coughing. Higher concentrtions 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.

Skin Contact:

May cause redness and irritation

Eye Contact:

Strong irritant to the eyes. May cause redness, pain, blurred vision, tearing, corneal injury and burns.

Ingestion:

May cause irritation to the mucus membranes.

4. First Aid Measures

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.

Eyes:
Flush immediately with plenty of lukewarm water. Continue to wash for 20-30 minutes, lifting eyelids occasionally. Get immediate medical attention.

Inhalation:
Move the victim to fresh air. If breathing is stopped, commence artificial respiration. Get immediate medical attention

Ingestion:
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.

5. Fire-Fighting Measures

Conditions Of Flammability:
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 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.
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. 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.

Means To Extinguish:
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.

Hazardous Combustion Products:
Not applicable, but see "Hazardous Decomposition Products", Section 10.

Flash Point & Method:	Not combustible
Upper Flammability Limit:	Not applicable
Lower Flammability Limit:	Not applicable
Auto-Ignition Temperature:	Not applicable, but see "Chemical Stability", Section 10.
Mechanical Impact Sensitivity:	Not available
Static Discharge Sensitivity:	Sensitive

6. Accidental Release Measures

Leak Or Spill Procedures:
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.

Waste Control Procedures:
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 Storage

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

Storage:
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 not stored as such, as it is unstable.

8. Exposures Controls / Personal Protection

Protective Equipment:
Use eye protection and impermeable gloves. Use of contact lenses should not be permitted when there is the potential for exposure to this material. 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.

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

9. Physical And Chemical Properties

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.

Odour: Similar to Chlorine or Ozone

Odour 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.

Boiling Point: not applicable for the water solution; for gas 11°C

Melting Point: Not applicable

Freezing Point: not applicable for solution; for gas: - 59°C

pH: 2 to 3 (8 g/L solution.)

Coefficient Of Water/Oil Distribution: Log P(oct) = -3.22 (estimated)

Appearance: Solution: Pale yellow
Gas: Yellow/green.

Specific Gravity: For solution - close to 1 g/L

Vapour Pressure: Not available

Vapour Density: 2.4 (air=1) (for 100% ClO_2)

Evaporation Rate: Not applicable. Gaseous chlorine dioxide will escape from solution leaving behind water.

Solubility In 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 presssure is typical)

Bulk Density: Not applicable

10. Stability And Reactivity

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 higer cocentrations 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.

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

Incompatible Substances:
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. Toxicological Information

Skin Contact: Solutions are highly irritant.
Skin Absorption: May be absorbed, causing tissue and blood cell damage.
Eye Contact: Severely irritant. Exposure may cause visual disturbance, i.e. seeing haloes around lights.
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.
Ingestion: Not applicable except for solutions, in which case the symptoms would be expected to parallel those for inhalation.
LD_{50}: 292 mg/kg (rat, oral)
LC_{50}: 32 ppm (rat, inhalation 4 hour exposure)
Exposure Limits: ACGIH 1992-93: TWA 0.1 ppm, STEL 0.3 ppm. Most legal limits are similar.
Irritancy: Severe
Sensitization: No information is available.
Carcinogenicity: Not listed by IARC or ACGIH
Teratogenicity & Mutagenicity: Information not available.
Reproductive Toxicology: Information not available.
Toxicological Synergism: May have synergistic effects in conjunction with chlorine, other chlorine oxides, and chlorine fluorine compounds.

12. Ecological Information

Ecological Information:
no data available

Biodegradability:
no data available

Aquatic Toxicity:
no data available

13. Disposal Considerations

Disposal Considerations:
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.

14. Transportation Information

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

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:

WHMIS Classification:
C - Oxidizing material
D1A - Poisonous and infectious material - Immediate and serious effects - Very toxic
E - Corrosive material
F - Dangerously reactive material

OSHA Hazard Communication Evaluation :
Meets criteria for hazardous material, as defined by 29 CFR 1910.1200.

Environmental:
In compliance with Canada DSL and US Federal Regulations,

- Not subject to SARA Section 302, or Section 311/312,
- Subject to Sara Section 313
- Not subject to California Proposition 65
- Not subject to CERCLA
-

Transportation:
Transportation is FORBIDDEN

16. Other Information

Prepared By:

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Summary of Changes Made in this Revision :

This MSDS was revised to contain information applicable for aqueous solution (~10 - 12 gpl chlorine dioxide) as this is what is supplied by ERCO. The previous version characterized chlorine dioxide gas.