



Safety Data Sheet

Issuing Date
13-September-10

Revision Date
27-September-12

Revision Number
2

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name	Chlorine
UN-No	UN1017
Recommended use	Uses for Chlorine include: oxidizer for titanium bearing ores; sanitation of water; treatment of sewage and industrial waste; bleaching agent for paper; cleaning products (e.g. bleach); preparation of chlorides, chlorinated solvents, pesticides, polymers, synthetic rubbers, and refrigerants.
Manufactured by	National Titanium Dioxide Company, Ltd. P.O. Box 13586 Jeddah 21414, Kingdom of Saudi Arabia Telephone: +966(0)2-652-9966 Fax: +966(0)2-652-9933
Other Information	E-mail contact: cldemille@cristal.com
Emergency Telephone Number	SGS +966-3-362-21-93 (Al-Jubail)

2. HAZARDS IDENTIFICATION

Emergency Overview

*Very toxic by inhalation, in contact with skin and if swallowed.
May cause burns of eyes, skin and mucous membranes.
DANGER! Liquified, nonflammable gas under pressure.
A greenish-yellow gas or amber liquid with a pungent odor.
Immediately dangerous to life and health (IDLH) concentration = 10 ppm.*

Appearance
Amber liquid; green-yellow gas

Physical State
Liquid or gas

Odor
Pungent

Potential Health Effects

Acute Toxicity

Skin	Causes burns. Chlorine vapors can cause irritation, burning and blisters.
Inhalation	Inhalation is the major potential route of exposure. Chlorine is a respiratory irritant. Chlorine is irritating and can be corrosive to the eyes, skin, and mucous membranes. Symptoms of exposure include burning of eyes, nose, and mouth. Other symptoms of overexposure can include nausea, vomiting, dizziness, shortness of breath and chest pain. Exposures to higher concentrations can cause unconsciousness and death. Pulmonary edema and chemical pneumonia can develop and may occur hours after exposure. Chlorine has an IDLH (Immediately Dangerous to Life or Health) concentration of 10 ppm.
Ingestion	Chlorine is gas at room temperature. Ingested liquid chlorine can cause severe burns of mouth, esophagus and stomach. Nausea and vomiting are likely to occur.

Eyes Causes burns. Contact with eyes may cause irritation. Vapor concentrations of 1 ppm can cause redness, tearing and irritation of eyes.

Chronic Toxicity

Chronic effects Numerous studies have been conducted to determine the potential chlorine has to cause chronic effects. In rats exposed to concentrations up to 9 ppm for 6 hours a day, 5 days a week for 6 weeks, decreases in body weight and inflammation of the respiratory tract were observed. At exposures of 3 and 9 ppm, changes in the liver and kidneys were also noted. Rabbits and guinea pigs exposed to 1.7 ppm for 9 months showed weight loss and a decreased resistance to disease. No adverse effects were observed in rabbits and guinea pigs at levels of 0.7 ppm. Guinea pigs exposed to 1.6 ppm for 5 hours a day, for 47 days and injected with tuberculosis (bacteria) displayed shorter life cycles, than those exposed to just one of the agents. Rats with pulmonary disease showed an increased response to chlorine. Rhesus monkeys exposed to concentrations up to 2.3 ppm for 6 hours a day, 5 days a week for one year did not exhibit any signs of chronic toxicity, except for eye irritation. A study of 600 diphragm cell workers from 25 plants with an average duration of exposure of 11 years exposed to 0.006 to 1.42 ppm, showed no statistically significant increase in abnormal chest x-rays, EKGs or pulmonary function tests.

Aggravated Medical Conditions Asthma, bronchitis, emphysema and other lung diseases, and chronic nose, sinus or throat conditions.

Interactions with Other Chemicals Smokers may be more sensitive to respiratory effects of chlorine.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS-No.	Weight %
Chlorine	7782-50-5	

4. FIRST AID MEASURES

Eye contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. If symptoms persist, call a physician.

Skin contact Wash off immediately with plenty of water for at least 15 minutes. Remove and wash contaminated clothing before re-use.

Inhalation Move to fresh air. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Call a physician immediately. Keep body warm with blankets.

Ingestion Do NOT induce vomiting. Rinse mouth with water and afterwards drink plenty of water or milk. Never give anything by mouth to an unconscious person.

Notes to physician Monitor closely for delayed onset of pulmonary edema and chemical pneumonia. Provide treatment as is medically required.

5. FIRE-FIGHTING MEASURES

Flammable Properties Not flammable. Combustible liquid.

Flash Point None.

Instructions to Firefighters	Approach fire from upwind. If no chlorine is escaping, apply water spray to keep fire-exposed containers cool. Do not apply water to leaking containers. Remove chlorine containers from fire zone if possible. Extinguish fire using agent suitable for surrounding fire. Flame impingement on steel chlorine container will result in iron/chlorine fire causing rupture of the container.
Suitable Extinguishing Media	Use extinguishing agent suitable for surrounding fire.
Hazardous Combustion Products	Nonflammable, but is a strong oxidizer. Most combustibles will burn in chlorine forming toxic gasses.
Health Hazard	4
Flammability	0
Reactivity	0
Specific Hazard	OX

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions	Ensure adequate ventilation.
Methods for Containment	Prevent further leakage or spillage if safe to do so. Use dyking or absorbant to prevent run-off from entering waterways.
Methods for Cleaning Up	Pick up and transfer to properly labeled containers.
Other information	Evacuate unprotected personnel upwind or crosswind for at least 200 feet (300 feet for large spills) out of danger area. Wear one-piece, total encapsulating suite of Butyl coated nylon or equivalent with self-contained breathing apparatus. Isolate leak to whatever extent possible. If a chlorine container is leaking, try to position it so that gas rather than liquid leaks; apply emergency kit device if possible. For other than minor leaks, immediately implement predetermined emergency plan.

7. HANDLING AND STORAGE

Handling	<p>Avoid contact with skin and avoid breathing vapors. Use only with adequate ventilation. Do not get in eyes or on skin or on clothing. Wash thoroughly after handling. Do not eat, drink, or smoke in work area. Wash hands prior to eating, drinking, or using restroom. Any clothing or shoes which become contaminated with chlorine should be removed immediately and thoroughly laundered before wearing again.</p> <p>Follow protective controls set forth in Section 8 when handling this product. Vapors are heavier than air and will collect in low areas. Do not enter confined spaces such as tanks or pits without following proper entry procedures as required by 29 CFR 1910.146.</p>
Storage	<p>Keep away from heat and open flame. Store properly labeled containers in a cool, dry, well-ventilated area away from incompatible materials (See Section 10) and away from basements, pits, etc. Isolate from acetylene, ammonia, hydrogen, hydrocarbons, ether, turpentine, and finely divided metals. Make daily inspections for leaks. Room vents should be located at floor level. Do not apply heat to a chlorine container. Do not remove or deface label or tags.</p> <p>Chlorine piping and equipment must be thoroughly cleaned of organics and moisture before use. Keep chlorine piping and handling equipment clean and dry. Liquid chlorine lines must have suitable expansion chambers between block valves due to the high coefficient of expansion.</p> <p>INCOMPATIBLE MATERIALS FOR STORAGE OR TRANSPORT Dry chlorine will react violently with titanium. Dry chlorine will also react with aluminum and tin. Moist chlorine will react with most metals. Stainless steel can fail due to chloride ion stress corrosion cracking if used in the presence of moisture.</p>

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Chemical Name	ACGIH TLV	OSHA PEL
Chlorine 7782-50-5		(vacated) TWA: 0.5 ppm (vacated) TWA: 1.5 mg/m ³ (vacated) STEL: 1 ppm (vacated) STEL: 3 mg/m ³ Ceiling: 1 ppm Ceiling: 3 mg/m ³

Engineering measures Provide ventilation as necessary to maintain vapor concentrations below 1 ppm, at all times.

Personal Protective Equipment

Eye/Face Protection	Wear safety glasses. Contact lenses should not be worn. Chemical goggles should be worn when operating valves and connecting or disconnecting chlorine lines.
Skin and Body Protection	Wear cotton or leather gloves during normal operations to avoid freeze burns.
Respiratory Protection	Where vapor concentration exceeds or is likely to exceed 0.5 ppm, a NIOSH approved full face chlorine type respirator with acid gas canister is acceptable. A NIOSH approved self-contained breathing apparatus, with full facepiece, is required for vapor concentrations above 10 ppm and for leaks and/or emergencies. Follow any applicable respirator use standards and regulations.
Hygiene Measures	Handle in accordance with good industrial hygiene and safety practice.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Amber liquid; green-yellow gas	Odor	Pungent
Physical State	Liquid or gas	pH	Not applicable
Flash Point	None	Autoignition Temperature	No information available
Boiling Point/Range	-34 °C / -29.3 °F	Melting Point/Range	Not applicable
Explosion Limits	Not applicable	Flammability Limits in Air	Not flammable
Specific Gravity	Liquid = 1.467 @ 0°C	Water Solubility	Slightly soluble
Solubility	Insoluble in ether	Evaporation Rate	Not applicable
Vapor Pressure	71 psig @ 15°C / 59°F	Vapor Density	2.5 (Air = 1)
VOC Content(%)	None		

10. STABILITY AND REACTIVITY

Stability	Stable under recommended storage conditions.
Incompatible Products	Ammonia, elemental metals, certain metal hydrides, carbides, nitrides, oxides, phosphides and sulfides, easily oxidized materials, organic materials (e.g. petrochemicals, oils, greases) and unstable and reactive compounds.
Conditions to avoid	Dry chlorine is highly reactive with titanium and tin. Reacts with most metals at high temperatures. Reacts with water to produce hydrochloric and hydrochlorous acids, which are corrosive to most metals.
Hazardous decomposition products	Will not decompose.
Hazardous Reactions	Refer to Incompatible Products.
Hazardous Polymerization	Hazardous polymerization does not occur.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity

Product information

Concentrations of 3-6 ppm can cause irritation of the nose and mucous membrane of the upper respiratory tract followed by headache and coughing. 10 ppm can cause severe irritation of respiratory tract with 15-20 ppm causing intense cough. Exposures to concentrations above 25 ppm can cause unconsciousness and death.

Exposure to humans to 0.5 ppm for 8 hours and 1 ppm for 4 hours have caused transient decreased pulmonary capacity, as measured by pulmonary function tests. In persons exposed to acute, non-lethal levels, decreased pulmonary capacity is followed by a gradual return to normal. In some cases long lasting effects have been observed.

Animal Toxicology

Inhalation LC50: 293 ppm - 1 hr (rat)
137 ppm - 1 hr (mouse)

Chemical Name	LD50 Oral	LD50 Dermal	LC50 Inhalation
Chlorine			Per CGA P20: 293 ppm/ 1 hr. (Rat)

Chronic effects

Numerous studies have been conducted to determine the potential chlorine has to cause chronic effects. In rats exposed to concentrations up to 9 ppm for 6 hours a day, 5 days a week for 6 weeks, decreases in body weight and inflammation of the respiratory tract were observed. At exposures of 3 and 9 ppm, changes in the liver and kidneys were also noted. Rabbits and guinea pigs exposed to 1.7 ppm for 9 months showed weight loss and a decreased resistance to disease. No adverse effects were observed in rabbits and guinea pigs at levels of 0.7 ppm. Guinea pigs exposed to 1.6 ppm for 5 hours a day, for 47 days and injected with tuberculosis (bacteria) displayed shorter life cycles, than those exposed to just one of the agents. Rats with pulmonary disease showed an increased response to chlorine. Rhesus monkeys exposed to concentrations up to 2.3 ppm for 6 hours a day, 5 days a week for one year did not exhibit any signs of chronic toxicity, except for eye irritation. A study of 600 diphragm cell workers from 25 plants with an average duration of exposure of 11 years exposed to 0.006 to 1.42 ppm, showed no statistically significant increase in abnormal chest x-rays, EKGs or pulmonary function tests.

Carcinogenicity

One study has been conducted to evaluate chlorine's ability to cause cancer in experimental animals. Seven generations of rats were exposed by ingestion to highly chlorinated water daily (100 mg/liter). No increased incidences of tumors were observed.

Chlorine is not listed on the IARC, NTP or OSHA carcinogen lists.

Reproductive toxicity

Two studies have been conducted to assess the ability of chlorine to cause reproductive effects. Rabbits exposed by inhalation to concentrations up to 1.5 ppm and rats exposed by ingestion to highly chlorinated drinking water daily for seven generations did not display any adverse reproductive effects.

Target organ effects

Respiratory system. Eyes. Skin.

12. ECOLOGICAL INFORMATION

Ecotoxicity

Very toxic to aquatic life

Ecotoxicity effects

Acute LC50 (96 Hours) for Fathead Minnow: 0.07 - 0.15 ppm
Acute LC50 (96 Hours) for Bluegill: 0.44 mg/L

Chemical Name	Toxicity to Algae	Toxicity to Fish	Microtox	Daphnia Magna (Water Flea)
Chlorine		LC50= 0.014 mg/L Oncorhynchus mykiss 96 h LC50= 0.08 mg/L Pimephales promelas 96 h LC50= 0.44 mg/L Lepomis macrochirus 96 h		EC50 = 0.017 mg/L 48 h

13. DISPOSAL CONSIDERATIONS

Waste Disposal Methods

Liquid and/or solid residues from neutralization may be disposed of in a permitted waste management facility. All disposals of this material must be done in accordance with local, state and federal regulations. Waste characterization and compliance with disposal regulations are the responsibilities of the waste generator.

Contaminated packaging

Dispose of in accordance with local regulations.

Chemical Name	California Hazardous Waste Status
Chlorine	Toxic; Corrosive; Ignitable; Reactive

Additional Notes:

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.

14. TRANSPORT INFORMATION

DOT

Hazard Class 2.3
Subsidiary Class 5.1, 8
UN-No UN1017
Reportable Quantity (RQ) Chlorine, RQ kg = 4.54
Description UN1017, Chlorine, 2.3, (5.1, 8), , Marine Pollutant, RQ, Poison-Inhalation Hazard, Zone B, Poison
Note PLACARD REQUIRED: Poison Gas, 1017, Class 2 IMO REQUIREMENTS: Ems No.: 2-08 MFAG Table No.: 740 Marine Pollutant IMDG Code Page: 2116

TDG

Proper Shipping Name Chlorine
Hazard Class 2.3
Subsidiary Class (8)
UN-No UN1017
Description CHLORINE(CHLORINE),2.3,UN1017,Marine Pollutant

MEX

Proper Shipping Name Chloro
Hazard Class 2.3
Subsidiary Class 8
UN-No UN1017
Description UN1017 Chloro,2.3,

ICAO

UN-No UN1017
Proper Shipping Name Chlorine
Hazard Class 2.3
Subsidiary Class 5.1, 8
Description UN1017, Chlorine

IATA

Proper Shipping Name	Chlorine
Hazard Class	2.3
Subsidiary Class	5.1, 8
ERG Code	2CP
Description.	UN1017,Chlorine ,2.3(5.1, 8)

IMDG/IMO

Hazard Class	2.3
Subsidiary Class	5.1, 8, P
UN-No	UN1017
EmS No.	F-C, S-U
Description	UN1017, Chlorine(Chlorine),2.3(5.1, 8, P),Marine Pollutant

RID

Proper Shipping Name	Chlorine
Hazard Class	2
UN-No	UN1017
Classification Code	2TOC
Description	UN1017Chlorine,2,RID
ADR/RID-Labels	2.3 + 5.1 + 8 (+13)

ADR

Proper Shipping Name	Chlorine
Hazard Class	2
UN-No	UN1017
Classification Code	2TOC
Description	UN1017 Chlorine,2,
ADR/RID-Labels	.3 5.1 8

ADN

Proper Shipping Name	Chlorine
Hazard Class	2
Classification Code	2TOC
Description	UN1017 Chlorine,2,
Hazard Labels	2.3 + 5.1 + 8
Limited Quantity	LQ0
Ventilation	VE02

15. REGULATORY INFORMATION

International Inventories

Approved for use in Japan, but not listed on ENCS inventory.

USA (TSCA)	Complies
Canada (DSL)	Complies
European Union (EINECS)	Complies
Japan (ENCS)	Does not Comply
China (IECSC)	Complies
Korea (KECL)	Complies
Philippines (PICCS)	Complies
Australia (AICS)	Complies
New Zealand (NZIoC)	Complies

Federal Regulations

SARA 313

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.

Chemical Name	CAS-No.	Weight %	SARA 313 - Threshold Values %
Chlorine	7782-50-5		1.0

SARA 311/312 Hazard Categories

Acute Health Hazard	Yes
Chronic Health Hazard	Yes
Fire Hazard	No
Sudden Release of Pressure Hazard	Yes
Reactivity Hazard	Yes

Clean Water Act

This product contains the following substances which are regulated pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42).

Component	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants	CWA - Hazardous Substances
Chlorine 7782-50-5 ()	10 lb			X

Clean Air Act, Section 112 Hazardous Air Pollutants (HAPs) (see 40 CFR 61)

This product contains the following substances which are listed hazardous air pollutants (HAPS) under Section 112 of the Clean Air Act

Chemical Name	CAS-No.	Weight %	HAPS data	VOC Chemicals	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Chlorine	7782-50-5					

CERCLA

This product, as supplied, contains any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355).

Chemical Name	Hazardous Substances RQs	Extremely Hazardous Substances RQs
Chlorine	10 lb	10 lb

U.S. State Regulations**U.S. State Right-to-Know Regulations**

Chemical Name	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Chlorine	X	X	X	X	X

Other International Regulations

Chemical Name	Carcinogen Status	Exposure Limits
Chlorine		Mexico: TWA= 1 ppm Mexico: TWA= 3 mg/m ³ Mexico: STEL= 3 ppm Mexico: STEL= 9 mg/m ³

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

WHMIS Hazard Class

- A Compressed gases
- C Oxidizing materials
- D1A Very toxic materials
- E Corrosive material

Chemical Name	NPRI
Chlorine	X

16. OTHER INFORMATION

Revision Date 27-September-12

Reason for revision Company Logo.

Disclaimer

The information provided on this SDS is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of SDS