

MATERIAL SAFETY DATA SHEET

MSDS No. 01-03
According to REACH Regulation No.1907/2006



CHLORINE

Revision: 5

Last up date: July 16, 2008

Date issued: July 21, 1999

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**Class 2.3
Toxic gases**



**Class 8
Corrosive substances**

T



Toxic

N



**Dangerous for the
environment**

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

1.1. Identification of the substance/preparation

Trade Name	CHLORINE -Liquefied Gas
Chemical Name	Chlorine
Common Synonyms	-
Chemical Formula	Cl ₂
Molecular Weight	70.914

1.2. Uses of the substance/preparation

Chlorine is used in a number of industrial applications. Its largest use is as a raw material in the production of ethylene dichloride, an intermediate for vinyl chloride monomer and polyvinyl chloride (PVC) resins. Chlorine is also used in the paper industry to bleach pulp, in the production of chlorinated solvents and chlorofluorocarbons (CFCs), as a disinfectant or fungicide for a variety of purposes, including water purification, cooling systems, meat, fish, vegetable, and fruit processing, foot baths, dairy equipment, laundries, and dishwater, as well as for shrink-proofing wool, in special batteries (with lithium or zinc), and in the manufacture of propylene oxide and pesticides.

1.3. Company/undertaking identification

OLTCHIM S.A.

Address	1 Uzinei Street, 240050 - Ramnicu Valcea, Romania
Telephone	+40/250/701200
Fax	+40/250/735446
e-mail	oltchim @oltchim.ro

1.4. Emergency telephone number +40 / 250/738141

2. HAZARD IDENTIFICATION

Elaborated by: Technical&Development Department

CHLORINE
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EC Classification according to Directive 67/548/CEE, Annex I

T; R23, N;R50
Xi; R36/37/38

Toxic by inhalation.

Very toxic to the aquatic life.

Highly Corrosive in moist conditions

Strong Oxidizer

Health effects: Chlorine is irritating to nose, throat, skin and eyes.also tearing, coughing and chest pain. Higher levels burn the lungs and can cause a build up of fluid in the lungs (pulmonary edema) and death. Contact can severely burn the eyes and skin. Repeated exposures or a single high exposure may permanently damage the lungs. It can also damage the teeth and causes a skin rash.

Environmental effects: Chlorine is classified as dangerous for environmental as specified in Directive 67/548/EEC, Annex I. Degradation in air and water is mediated by exposure to UV components of sunlight, with daytime halflives generally < 6 hours. Chlorine hydrolyzes very rapidly in water. In fresh and waste water at pH > 6, complete hydrolysis occurs with the formation of hypochlorous acid and chloride ion. Chlorine may react with soil components to form chlorides. Depending on their water solubility these chlorides are easily washed out from the soil. Free chlorine reacts rapidly with inorganics such as bromide and more slowly, with organic material present in natural water. These reactions yield chlorides, oxidized organics, chlororganics (including trihalomethanes), oxygen, nitrogen, chlorates, bromates and bromorganics. There is no potential for the bioaccumulation or bioconcentration of chlorine.

Emergency Overview: Chlorine is a greenish yellow gas (or amber liquid) with an irritating odor. High concentration of chlorine gas may cause an oxygen-deficit atmosphere. Chlorine is an oxidizer, which can act to initiate and sustain the combustion of flammable materials. Chlorine is heavier than air and pockets of this gas can accumulate in low-lying areas.

3. COMPOSITION/ INFORMATION ON INGREDIENTS

Hazardous components /constituents	Concentration % (v/v)	CAS No.	EC No.	Annex I Index No.	Hazard Symbol	Risk phrases
Chlorine	>99.5	7782-50-5	231-959-5	017-001-00-7	T Xi N	23 36/37/38 50

4. FIRST - AID MEASURES

Seek medical attention immediately in all cases of exposure!

In case of frostbite place the frostbitten part in warm water. Do not use the hot water! If warm water is not available wrap the affected parts gently in blankets. Encourage victim to gently exercise the affected part while being warmed. Seek immediate medical attention.

Inhalation: Toxic and irritating. Exposure to chlorine gas may cause severe irritation of mucous membranes of the nose, throat and respiratory tract followed by severe coughing, burning, chest pain, vomiting, headache, anxiety and feeling of suffocation.

Remove victim(s) to fresh air, as quickly as possible. If breathing was stopped, trained personnel should administer supplemental oxygen and/or artificial respiration. Keep the affected person warm at rest. In mild cases, give milk to relieve throat irritation. Get medical attention as soon as possible.

Skin contact: Contact with liquid chlorine may cause serious burns, blistering and tissue destruction. If liquid chlorine or high concentrations of chlorine gas gets on the skin, immediately flush the contaminated skin with water for at least 15 minutes. If liquid chlorine or high concentration of chlorine gas penetrates through the clothing, remove clothing under a safety shower and continue to wash the skin for at least 15 minutes. If irritation is present after washing, get medical attention. Do not apply greases unless ordered by a physician.

Eyes contact: May cause severe chemical burns to cornea.

If liquid chlorine or high concentrations of chlorine gas get into the eyes, flush eyes immediately with a direct stream of water for at least 15 minutes, forcibly holding eyelids apart to ensure complete irrigation of all eye and lid tissue. Do not attempt chemical neutralization of any kind. Get medical attention immediately. Contact lenses should not be worn when working with chlorine.

NOTE: Do not use anything other than clean fresh water, or sterile saline on the eye.

Ingestion: Ingestion is not considered a potential route of exposure. Never give anything by mouth to an unconscious person. If swallowed do not induce vomiting. Give large quantities of water. If vomiting occurs spontaneously, keep air way clear and give more water. Get medical attention immediately.

Note to physician: No known antidote. Treatment for inhalation is symptomatic and supportive. Keep patient at rest until respiratory symptoms subside. Sedation for apprehension or restlessness may be considered as well as diuretics and antibiotics to alleviate edema and protect against secondary infection. Administer oxygen under exhalation pressure not exceeding 4 cm water for 15 minutes each hour until symptoms subside (except in presence of impeding or existing cardiovascular failure). Steroid therapy, if given early, has been reported effective in preventing pulmonary edema.

5. FIRE - FIGHTING MEASURES

Suitable extinguishing media: Water spray, fog or foam. Large fire: flood with fine water spray. Use water to keep fire - exposed containers cool and continue until well after fire is out.

Unsuitable extinguishing media: Do not use carbon dioxide or halogenated extinguishing agents.

Exposure hazards: Although non-flammable, chlorine is a strong oxidizer and will support the burning of most combustible materials. Flammable gases and vapors can form explosion mixtures with chlorine. Moist chlorine can react violently when in contact with many materials and generate heat with possible flammable and explosive vapor. Chlorine gas is heavier than air and will collect in low-lying areas. Wet chlorine is very corrosive.

Protection of fire-fighters: Fire-fighters must use self-contained breathing apparatus operated in positive pressure mode, eye protection and full protective clothing when fighting fire in which chlorine is involved.

Hazardous combustion products: None, but combustible materials burn in chlorine as they do in oxygen.

6. ACCIDENTAL RELEASE MEASURES

Personal precaution: Restrict access to the area until completion of the clean-up. Keep unnecessary and unprotected personnel away from entering. Issue a warning: Poison Gas, Do not touch spilled Liquide.

Wear self-contained breathing apparatus and full protective equipment. Use general or local ventilation to keep the noxes in the requirements limits. Minimum Personal Protective Equipment should be Level A: *triple gloves (rubber gloves and nitrile gloves, over latex gloves), fully-encapsulating chemical resistant suit and boots, hard-hat, and self contained breathing apparatus.*

Warning! Direct contact of liquid chlorine with any personal protective equipment item can rapidly destroy the equipment, leading to injury and death.

Environmental precautions: Isolate area until gas has dispersed. Uncontrollable leaks may require evacuation of surrounding area. Keep material out off water courses and sewers. Use water spray to reduce vapor but do not apply water to point leak or spill area. Use general or local exhaust ventilation. Keep combustibles (such as wood, paper, oil) away from spilled material.

Methods of cleaning up: If source of leak is a cylinder and the leak cannot be stopped in place, remove the leaking cylinder to a safe place in the open air and repair the leak or allow the cylinder to empty through a reducing agent such as caustic soda, soda ash, or hydrated lime solutions. Chlorine gas will disperse to the atmosphere leaving no residue. One volume of liquid chlorine released from a container at ambient temperature and pressure will dissipate into approximately 500 volumes of gaseous chlorine. Therefore, if a chlorine container is leaking, if possible, try to position it so that gas, rather than liquid leaks out. Chlorine vapours are heavier than air, and pockets of chlorine are likely to be trapped in low lying areas.

Use water fog to dampen a chlorine cloud and reduce vapours. Do not spray water directly on the leak or chlorine container.

Liquid or solid residues must be disposed of in a permitted waste management facility. Dispose according to all applicable federal, state, or local environmental regulations.

7. HANDLING AND STORAGE

Handling: Special attention is required when chlorine containers are handled. Use only in well ventilated areas. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinders movement. Protect cylinders and containers from physical damage. Keep containers tightly closed when not in use. For handling chlorine is necessary specially trained, assigned personnel with approved equipment and clothing. Chlorine emergency equipment should be available near the point of use.

Storage: Store chlorine containers and cylinders in cool, dry, well ventilated areas of non-combustible construction away heavily trafficked areas and emergency exit. Do not allow temperature where cylinders are stored to exceed 45°C. Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. *Full and empty cylinders should be segregated.* Full cylinders should not be stored for more than six months. Liquid levels should be less than 85 % of container or cylinder capacity. Use only compatible materials for cylinder, process maintenance activity. Chrome and aluminum are not suitable materials for chlorine cylinders manufacture. Periodic inspections of process equipment by knowledgeable persons should be made to ensure that the equipment is used appropriately and the system is kept in suitable operating condition.

Store away from finely divided aluminium, brass, copper, manganese, tin, steel and iron, which can react vigorously and violently with chlorine. Nitrogen compounds (ammonia, ammonium compounds and urea) react with chlorine to form highly explosive nitrogen chloride. Phosphorus, boron, activated carbon and silicon can ignite on contact with gaseous chlorine at room temperature. Chlorine is highly corrosive to most metals in the presence of moisture – copper may burn spontaneously. Chlorine will react with most metals at elevated temperatures.

Special precautions for handling:

Regularly test and inspect piping and containment used for chlorine service.

Loading and unloading operations must be attended, at all times. Valves and hoses must be verified to be in the correct positions, before starting the transfer operations. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Use a pressure reducing regulator when connecting cylinder to lower pressure (<250 psig) piping or system. Do not heat cylinder by any means to increase rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into cylinder. Regulators or manual control valves for chlorine are designed to accommodate only specifically matched cylinder outlets and will not fit the outlets of incompatible gases. The use of adaptor defeats this built in safety measure.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

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General information

Appearance Greenish-yellow gas/ amber liquid with pungent

Odor Pungent and irritating odor

Important health, safety and environmental information

pH Not applicable

Boiling point -34°C at 1 atm.

Flash point NA

Flammability non flammable

Explosive properties explosive under influence of a flame; may form explosive mixtures with a few substances (oxygen, hydrogen and other explosives gases)

Oxidizing properties vigorous reaction in preliminary test

Vapor pressure, 20 °C 17 mmHg at 20°C

Specific density (water=1) 1.406 g/cm³ at 20°CGas density 3,04 g/cm³ at 15 °C

Solubility in water 0.7% at 20°C

Partition coefficient (log K_{ow}) Not applicable

Vapor pressure 6.3 atm at 20°C

Vapor desity (air=1) 2.45

Viscosity, 20°C 0.01327 cP

Other information

Melting point -101°C

Autoignition temperature NA

Critical temperature (for gas) 144 °C

Critical pressure (for gas) 77 bar

10. STABILITY AND REACTIVITY

Chemical stability: Chlorine, loaded in cylinders or containers (special destined for chlorine) is stable under ordinary conditions of temperature and pressure. It is not corrosive at normal temperature and moisture absence; may attack iron and stainless steel at high temperature and moisture.

Conditions to avoid: Heat, moisture and incompatible substances.

Materials to avoid: Chlorine is a powerful oxidizing agent which reacts violently with a variety of substances over a broad range of conditions including reducing agents and combustible materials. It should be kept away from materials such as acetylene, turpentine, other hydrocarbons, ammonia, hydrogen, ether, powdered metals, sulfur and aluminum. Chlorine reacts with hydrogen sulfide and water forming hydrochloric acid. It combines with carbon monoxide and sulfur dioxide to form phosgene and sulfuryl chloride respectively, which are toxic and corrosive substances.

Hazardous decomposition products: Chlorine does not decompose but reacts violently to form hydrochloric acid and other potentially toxic and/ or corrosive substances. Dry chlorine is stable in

steel containers at room temperature. Intense local heat on steel walls can cause the steel to react and glow in presence of chlorine.

11. TOXICOLOGICAL INFORMATION

Animal toxicity data

LC ₅₀ /inhalation, rat	293 ppm /1 hr.
LC ₅₀ /inhalation, mouse	37 ppm /1 hr.
LC ₅₀ /inhalation, guinea pig	30 ppm / 7 hr.
LC ₅₀ /inhalation, rabbit	660 ppm / 4 hr.

Inhalation: Major potential route of exposure. Exposure to chlorine gas may cause severe irritation of mucous membranes of the nose, throat and respiratory tract followed by severe coughing, burning, chest pain, vomiting, headache, anxiety and feeling of suffocation. Severe breathing difficulties may occur which may be delayed in onset. Severe exposure may lead to chemical pneumonitis and pulmonary edema and may be fatal. Repeated or prolonged exposure may result in reduced pulmonary capacity and dental erosion.

Ingestion: Ingestion of liquid chlorine may result in severe irritation or ulceration of the mouth, throat and digestive tract which may be displayed by nausea, pain, vomiting and in severe cases, collapse, shock and death.

Eye contact: Exposure to chlorine gas may cause severe eye damage. Direct contact of the eyes with liquid chlorine will produce serious eye burns even blindness.

Skin contact: Contact with liquid chlorine may cause serious burns, blistering and tissue destruction. Chlorine vapors can cause irritation, burning and blisters. Contact with rapidly expanding gas poses a frostbite hazard.

Chronic effects: Chlorine is a primary irritant to the mucous membranes of the eyes, nose, and throat and to the linings of the entire respiratory tract. The major target organs for the subchronic/chronic toxicity of chlorine in humans are the respiratory tract and the blood. The major target organs for the subchronic/chronic toxicity of chlorine in animals are the immune system, the blood, the cardiovascular system and the respiratory tract. EPA has derived an oral RfD (reference dose) of 0.1 mg/kg/day for chlorine, based on a no-observed-adverse-effect level of 14.4 mg/kg/day in a chronic drinking water study in rats. In one case study, exposure to 0.015 mg/L of chlorine, 8 h/day for 6 years resulted in dyspnea, marked emphysema of both lower lung lobes, and reduced respiratory mobility.

CMR effects

Carcinogenicity: No conclusion on the carcinogenicity of chlorine can be made based on the limited information available from human and animal studies. Not classifiable as a Human Carcinogen.

Mutagenicity: Chlorine has not been reported to cause mutagenic effect in humans.

Teratogenicity and Embryotoxicity: No data available.

12. ECOTOXICOLOGICAL INFORMATION

Ecotoxicity

Fish	<i>Oncorhynchus mykiss</i>	LC ₅₀ = 0.13 - 0.29 mg/ l/ 96 hr
	<i>Gambusia affinis</i>	LC ₅₀ = 1.59 mg/l/30 min.
	<i>Lepomis cyanellus</i>	LC ₅₀ = 3 mg/l/24 hr
Daphnia	<i>Daphnia magna</i>	LC ₅₀ =0.076 - 0.16 mg/ l/24hr

Mobility: Chlorine carried in the air absorbs some wave lengths of ultraviolet and visible sunlight and undergoes rapid chemical reactions in the atmosphere. The chlorine atoms produced will then react with organic compounds (mainly alkanes in polluted urban areas) to form hydrogen chloride and organochlorine compounds. Though chlorine is only slightly soluble in water, even in low concentrations is detrimental to aquatic life.

Persistence and degradability: The atmospheric half-life and lifetime of chlorine due to these reactions is estimated to be about 10 minutes and 14 minutes, respectively. Chlorine is non-persistent in water with a half -life of less than 2 days.

Bioaccumulative potential: There is no potential for bioaccumulation or bioconcentration of chlorine.

Other adverse effects:

May cause pH changes in aqueous ecological system. Toxic to aquatic organism. Low level chlorination (0.05 to 0.15 mg/L) results in significant shifts in the species composition of marine phytoplankton communities

13. DISPOSAL CONSIDERATIONS

Waste treatment: Any disposal practice must be in compliance with all local, regional and national regulations. Do not discharge into any place whwre its accumulation could be dangerous. Toxic and corrosive gases formed during combustion should be scrubbed before discharge to atmosphere. Avoid discharge to atmosphere.

Packaging treatment: The chlorine containers/cylinders are dedicated packaging which are used only in conformity with the specific legal regulation. Until each refilling chlorine containers/cylinders must be checked by authorized laboratories.

14. TRANSPORT INFORMATION

Chlorine (liquefied gas) can be shipped according to transport regulations for dangerous goods, hazard class 2.3, Toxic gases; subsidiary risk class 8 Corrosive.

Transport labeling



**Class 2.3
Toxic gases**



**Class 8
Corrosive**

RID/ADR

UN Number	1017
Proper shipping name	Chlorine
Hazard class	2.3
Subsidiary risk	8
Packing group	-
Classification code	2TC

Danger panel 268/1017 (268 Hazard Identification No.)
(1017 UN No.)

IMDG/IMO



Marine pollutant

UN No.	1017
Hazard class	2.3
Subsidiary risk	8
Packing group	-
Proper shipping name	Chlorine
EmS	F-C, S-U
Marine pollutant	Yes

IATA/IT-ICAO

Proper shipping name Forbiden

Transport Precautions

Transport in open ventilated vehicle, cylinders upright and secured, drum placed lengthwise in the truck tray, with the valve end facing away from the vehicle. Do not transport in confined spaces like refrigerated compartments of vehicles, truck cabs or in passenger compartments. Shipment of a compressed gas cylinder which has not been filled by the owner or with his/her (written) consent is a violation of transport regulations.

15. REGULATORY INFORMATION

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Chlorine is classified and labeled under Directive 67/548/EC, Annex I. This product is listed on EINECS.

EC Classification EC Index No 017-001-00-7
T; R23
Xi; R36/37/38
N; R50

EC Labeling

EC label name	Chlorine	
EC No.	231-959-5	
Hazard Symbol	T	Toxic
	N	Dangerous for environment
R Phrases	R23	Toxic by inhalation.
	R 36/37/38	Irritating to eyes, respiratory system and skin.
	R 50	Very toxic to aquatic life.
S Phrases	S 7/ 9	Keep container tightly closed in a well-ventilated place.
	S 45	In case of accident or if you feel unwell, seek medical immediately (show the label whenever possible).
	S 61	Avoid release to the environment. Refer to Special instructions/safety data sheets.

16. OTHER INFORMATION

List of relevant R-phrases (see chapter 3)

R23 Toxic by inhalation.
R 36/37/38 Irritating to eyes, respiratory system and skin.
R 50 Very toxic to aquatic life.

Precautions to be taken in handling and storing: Keep well ventilated the areas where chlorine is stored and handled.

Users of breathing apparatus must be trained.

Ensure operators understand the toxicity hazard.

Ensure all national/local regulations are observed.

Before using this product in any new process or experiment, a thorough material compatibility and safety study should be carried out.

The amount of chlorine remaining in a cylinder, or drum, should be determined by weight, since the cylinder pressure will remain constant as long as liquid remains in the cylinder, or drum.

Compressed gas cylinders shall not be refilled without the express written permission of the owner.

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Work hygienic practices: Avoid direct contact of substance with skin/eyes. Avoid the exposure of personnel with lung and hart affections.

Interdictions: **Do not drink or eat** in working area.

Do not smoke in or near working area.

The use of open flame in working areas is prohibited.

MSDS Revisions: This Material Safety Data Sheet is made in accordance to European Regulations and will replace the previous version 4 dated January, 10 2008.

Revised information:

TÜV mark for Quality-Environmental Integrated System was replaced with the new one, remitted by TÜV Management GmbH.

Sources of key data uses to compile the data sheet:

EC Directive 67/548/EC resp. 99/45/EC as amended in each case.

EC Directive 2001/58/EC as amended in each case.

EC Directive 2000/39/EC as amended in each case.

National Threshold Limit Values of corresponding countries as amended in each case.

Transport regulations according to ADR, RID, IMDG, IATA as amended in each case.

This MSDS has been elaborated in accordance with Regulation (EC) No.1907/2006 REACH

The information contained here in is based on the present state of our knowledge. It characterizes the product with regard to the appropriate safety precautions. It does not represent a guarantee of the properties of the product.

This MSDS cannot cover all possible situations which the user may experience during handling and processing. Each aspect of the user's operation should be examined to determine if, or where, additional precautions may be necessary. All health and safety information contained within this MSDS should be provided to the user's employees or customers.