

SAFETY MATERIAL DATA SHEET

CHLORINE

I. COMPANY INFO
TAU CHEMICAL 25511 BUDDE RD. STE. 1503 THE WOODLANDS, TX. 77380. USA TEL. 832-482-9504; FAX 832-592-9546 For emergency transportation information, call CHEMTEL INC. 1-800-255-3924

II. IDENTIFICATION OF THE SUBSTANCE		
CHEMICAL NAME: CHLORINE	MARKET NAME: LIQUID CHLORINE	SINONYIMS: None
CHEMICAL FORMULA: Cl	MOLECULAR FORMULA: Cl ₂	DEVELOPED FORMULA: Cl-Cl
CHEMICAL GROUP, FAMILY: VIIA, HALOGEN GASES	MOLECULAR WEIGHT: 70.906 lb/lbmol	IDENTIFICATION: UN 1017, CAS 7782-50-5, EINEC 231-959-5, RTECS F02100000

III. IDENTIFICATION OF DANGEROUS COMPONENTS												
NAME	% WEIGHT	UN	CAS	CPT mg/m ³	CCT mg/m ³	P mg/m ³	IDLH mg/m ³	RISK OF LEVEL				
								S	I	R	ESP	PERSONAL EQUIPMENT PROTECTION
CHLORINE	99.5	1017	7782-50-5	3	9	9	30	4	0	0	OXY	SCBA, Chemical suit

IV. PHYSICAL AND CHEMICAL PROPERTIES			
1. PHYSICAL STATE	gas / liquid	13. HEAT CAPACITY	0.473 KJ / Kg °C
2. COLOR	greenish yellow / amber	14. DENSITY OF VAPOR (air = 1)	2.482 (0° C, 1 atm)
3. ODOR	Spicy scent – irritating	15. RELATIVE DENSITY (agua = 1)	1.468 (0° C)
4. BOILING POINT	-34.05 °C at 1 atm	16. DRY GAS DENSITY	3.209 gr / cc (0° C, 1 atm)
5. MELTING POINT	-101.0 °C at 1 atm	17. DENSITY OF LIQUID	1.468 gr / cc (0° C, 1 atm)
6. FLASH POINT	-34.05 °C at 1 atm	18. GAS / LIQUID RELATION	463.8 liter (0° C, 1 atm)
7. SELF IGNITION TEMPERATURE	-101.0 °C at 1 atm	19. COEFFICIENT OF EXPANSION	21.9 %
8. UPPER EXPLOSIVE LIMIT	Chlorine is not a flammable gas in air, but it sustains any combustion. It makes explosive mixtures with hydrogen.	20. SOLUBILITY IN WATER	7.1 gr / l (20° C, 1 atm)
9. LOWER EXPLOSIVE LIMIT		21. VAPOR PRESSURE	6.62 atm (25° C)
10. HEAT OF COMBUSTION		22. % OF VOLATILITY	100 %
11. HEAT OF VAPORIZATION		68.8 cal/gr (-34.05° C, 1 atm)	23. VEL. OF EVAPORATION
12. HEAT OF FUSION	22.8 cal/gr at (-34.05° C)	24. TEMPERATURE OF DECOMPOSITION	Doesn't Apply

V. FIRE FIGHTING MEASURE
A. FIRE FIGHTING AGENT: CO ₂ : <input checked="" type="checkbox"/> WATER FOG: FOAM: <input checked="" type="checkbox"/> DRY CHEMICAL: <input checked="" type="checkbox"/> OTHER (specify): NONE
B. PERSONAL PROTECTIVE EQUIPMENT: The firemen should use autonomous breathing equipment (SCBA) and chemical protective suit (level A) of nylon recovered with butyl rubber, tyvek or of equivalent material with chemical resistance to the chlorine.

C. PROCEDURE AND SPECIAL CAUTIONS IN THE COMBAT FIRES: If fire is present or imminent, chlorine containers and equipment should be moved away from fire, if possible. If a no leaking container or equipment cannot be moved, it should be kept cool by applying water on it. Water should not be used directly on a chlorine leak. Chlorine and water react to form acids, and the leak will quickly get worse. However, where several containers are involved and some are leaking, it may be prudent to use water spray to help prevent over pressurization on the no leaking containers. Whenever containers have been exposed to flames, cooling water should be applied until well after the fire is out and the container are completely cooled

D. CONDITION THAT THEY DRIVE TO ANOTHER SPECIAL RISK: Never to use water when a container or tank cars are either escaping chlorine. In this case it uses the Chlorine Institute Emergency Kits, (Kit C, for tank cars).

E. PRODUCTS OF THE COMBUSTION TOXICS OR NOXIOUS FOR THE HEALT: None.

VI. STABILITY AND REACTIVITY

A. SUBSTANCE: STABLE: UNSTABLE: **X** EXTREMELY UNSTABLE

B. CONDITION TO AVOID: Chlorine dry gas is very reagent with the Ti or the Sn. Store cylinders and containers in fresh, ventilated place, indoors, and free of humidity, far from incompatible materials and sources of heat. Remember that chlorine is highly reagent in presence oh humidity.

C. INCOMPATIBILITY (substances to avoid): Chlorine reacts generating heat, fire or explosion with the following ones violent compound: Turpentine, ether, ammonia gas, hydrocarbons, hydrogen, powdered and hot metals, polidimetilsiloxano, propylene, polypropylene, ethylene, acetylene, ethylene oxide, fats mineral, sulfamic acid, As₂(CH₃)₄, UC₂, acetaldehyde, alcohols, alquil-isotiourea salt, alquil-phosphins, Al, Sb, As, As₂, AsH₃, Ba₃P₂, C₆H₆, Bi, B, BPI₂, B₂S₃, latón, BrF₅, Ca, Ca₂+KOH, Ca(CIO₂)₂, Ca₃N₂, Ca₃P₂, C, CS₂, Cs, CsHC₂, Co₂O, Cs₃N, C+Cr(CIO)₂, Cu, CuH₂, CuC₂, dialquilphosphines, diboran, dibutylphtalate, Zn(C₂H₅)₂, C₂H₆, etilenimyn, C₂H₅PH₂, F₂, Ge, glicerol, (NH₂)₂, H₂O+KOH, I₂, hydroxylamine, Fe, FeC₂, Li, Li₂C₂, Li₆C₂, Mg, Mg₂P₃, Mn, Mn₃P₂, HgO, HgS, Hg, Hg₃P₂, CH₄, Nb, NI₃, OF₂, H₂SiO, OF₂+Cu, PH₃, P, P(SNC)₃, P₂O₃, PCB's, K, KHC₂, KH, Ru, RuHC₂, Si, SiH₂, Ag₂O, Na, NaHC₂, Na₂C₂, SnF₂, SbH₃, Sr₃P, Te, Th, Sn, WO₂, U, V, Zn, ZrC₂.

D. DANGEROUS PRODUCTS OF THE DECOMPOSITION: Chlorine is a chemical element, doesn't break down.	SPONTANEOUS POLYMERIZATION: IT CAN HAPPEN: NO CONDITION TO AVOID: It doesn't apply.
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VII. RISK FOR THE HEALT (TOXICITY)

VII.1 Exposure Level and their Health Effects

Exposure Limits	ppm	mg/m ³	Type of Organisms that underwent the chemical agent's exhibition
TLV: CPT or TWA	1	3	Exhibition 8-hour time weighted average without adverse effects to the health
TLV: CCT or STEL	3	9	Exhibition at short time (15 min) in 8-hour time weighted average without adverse effects to the health
TLV: P or C	3	9	Instantaneous maximum Exhibition that it should not be surpassed for human beings
IDLH: CT _{low} or TC _{LO}	10	30	Low toxic concentration for inhalation reported for human beings in a hour of exhibition, value not web established, some bibliographies report up to 25 ppm
IDLH: CT _{low} or TC _{LO}			Low toxic concentration for inhalation reported for human beings in a hour of exhibition, value not web established, some bibliographies report up to 25 ppm
LC _{LO INNL}	430	1,247	Low lethal concentration for inhalation reported for human beings in 30 exhibition min.
LD _{LO}			
LC _{50 INHL}	293	849	Lethal concentration for inhalation for 50% of the rats in a hour of exhibition.

Potential Route of Ingress to the Organism				
<p>A. INHALATION: It is the main exposure way. Chlorine gas is primarily a respiratory irritant. It is so intensely irritating that low concentrations in the air (well below 1 ppm) are detectable by most people . At chlorine concentration above 5 ppm the gas is very irritating, and it is unlikely that any person would remain in such an exposure for more than a very brief time unless the person was trapped or unconscious. The effects of exposure generally are evident first in the respiratory system and then in the eyes. The impact of exposure to chlorine is both concentration and time dependent. Exposure level of 1-10 ppm it can cause irritation of the eyes and mucous membranes of upper respiratory tract; severity of symptoms depends on concentrations and length of exposure.</p>				
<p>B. INGESTION: The ingestion of liquid chlorine can cause severe burns in the mouth, esophagus and stomach, being able to happen nauseas, pain and vomit.</p>				
<p>C. EYES (eye contact): The contact with chlorine liquid can cause severe chemical burns. The contact with chlorine gas can cause irritation, blushing, strong eye shed tear or burns.</p>				
<p>D. SKIN (contact and absorption): The contact with liquid chlorine can cause severe chemical burns and blisters. The contact with chlorine gas can cause irritation, skin damage or burns</p>				
VII.2 Effects to the health for chronic exposure				
CHEMICAL RATED AS:	CARCINOGEN: NO	TERATOGEN: NO	MUTAGEN: NO	OTHER: Toxic, irritant, Corrosive
FOR THE DEPENDENCE OR ORGANISM:	STPS (NOM-010-STPS-1999): X	OSHA: X	NIOSH: X ACGIH: X	OTHER: EPA
VII.3 Complementary Information				
<p>The inhalation of any irritating gas may lead t delayed reactions such pulmonary edema. Since physical exercise appears to have some relation to the incidence of delayed reaction, it is recommended that any patient who has had severe inhalation exposure should be kept at rest for a period of observation.</p>				
VII.4 First Aids Measures				
<p>A. INHALATION: Move the individual to fresh air. If an exposed person has stopped breathing, begin cardiopulmonary resuscitation immediately. If an exposed person is still breathing, trained personnel should administer humidified oxygen as soon as possible. Keep the person warm and at rest. Call a physician as soon as possible</p>				
<p>B. INGESTION: If an exposed person is conscious, gives to drink water to dilute. Don't induce the vomit, but if this happens wash and give to drink but it dilutes. Keep the person warm and at rest. Call a physician as soon as possible</p>				
<p>C. EYE CONTACT: If the eyes have been exposed to any concentration of chlorine in excess of the personal. The eyelids</p>				

should be held apart while being flushed to ensure contact of the water with all accessible tissues of the eyes and lids. Medical assistance must be obtained as soon as possible. If such assistance is not immediately available, eye irrigation should be continued for a second 15 minute period

D. SKIN CONTACT: If liquid chlorine has contaminated the skin or clothing, an emergency shower should be used immediately, and contaminated clothing should be removed while under the shower. Flush contaminated skin with copious amounts of running water for 15 minutes or longer. Do not attempt neutralization or apply any salves or ointments to damaged skin. Call a physician as soon as possible.

E. OTHER RISK FOR THE HEALT: Chlorine is a potential irritant to the eyes, the skin and mucous membranes, and the respiratory system

F. ANTIDOTE: There is no known specific antidote for acute chlorine exposure. However, prompt medical assessment and supportive measures are necessary to obtain good therapeutic results.

G. DATA FOR THE PHYSICIAN: All individuals who have developed symptoms as a result of acute overexposure to chlorine gas by inhalation should be placed under the supervision of medical. Alleviate anxiety by communicating with the patient the various procedures undertaken and elicit his or her cooperation, especially in breathing exercises. Position the patient in a chair; in severe cases, have the patient lie down with his or her head and trunk elevated to a 40-50° position

VIII.- PERSONAL PROTECTIVE EQUIPMENT FOR CHLORINE EMERGENCY

A. BREATHING PROTECTION: 1-10 ppm to use full face air purifying respirator, of 11-25 ppm to use positive pressure, full face self-contained breathing apparatus. For liquid chlorine, to use protective clothing including the following items: chemical protective suit, footwear or footwear cover hood and undergarments to provide thermal protection for exposure to liquid chlorine.

B. SKIN PROTECTION: Use gloves for thermal protection and to use protective clothing including the following items: chemical protective suit, footwear or footwear cover hood and undergarments to provide thermal protection for exposure to liquid chlorine.

C. EYES PROTECTION: Use goggles or mask during the connection operations and disconnection of pipes or when operating valves.

D. HYGIENE: Avoid the contact with the skin or the eyes as web as to breathe the vapors. Not to eat, to drink or to smoke in the work areas. Wash your hands before eating, to drink or to go to the bathroom.

E. VENTILATION: The necessary one to maintain the concentration of chlorine in the smallest atmosphere to 1.0 ppm. System of direct ventilation to the exterior and to be independent placed in the low parts of the buildings.

F. OTHER MEASURES OF CONTROL AND PROTECTION: To determine the level of the workers exhibition a regular monitoring it should be made and register according to the NOM-010-STPS-1999 and Method of Analysis 24 of the same norm, or method of analysis NIOSH 6011.

IX.- ACCIDENTAL REALESE MEASURES

In the event of a spill or leak involving chlorine, persons not wearing protective equipment and fully-encapsulating, vapor-protective clothing should be restricted from contaminated areas until cleanup has been completed. The following steps should be undertaken following a spill or leak:

A. Notify safety personnel.

- B. Remove all sources of heat and ignition.
- C. Keep all combustibles (wood, paper, oil, etc.) away from the leak.
- D. Ventilate potentially explosive atmospheres.
- E. Evacuate the spill area for at least 50 feet in all directions.
- F. Find and stop the leak if this can be done without risk; if not, move the leaking container to an isolated area until gas dispersed. The cylinder may be allowed to empty through a reducing agent such as sodium bisulfide and sodium bicarbonate. Leaks that may occur in chlorine tank cars usually involve the angle valves or pressure relief devices and can be controlled with the Institute's Emergency Kit C. An Emergency Kit C should be on site in a location sufficiently away from the tank car so it will be accessible during an emergency.
- G. Use water spray to reduce vapors; do not put water directly on the leak or spill area.

X.- TRANSPORT INFORMATION

- A. CAUTIONS FOR TRANSPORTATION: Use single units authorized for the transportation of hazardous materials that complete with the regulation of the USA Standards, support the DOT Regulations. For transportation-related incident in the U.S, please call CHEMTEL INC. 1-800-255-3924.

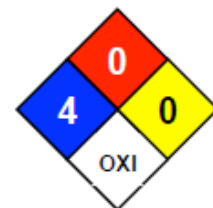
B. SCT or DOT CLASSIFICATION :

C. BOTTLING OR PACKAGING MARKS:

D. PLACARD WHIT IDENTIFICATION NUMBER: **UN 1017**

E. PLACARD TO SISTEM OF HAZARD COMMUNICATION

Toxic Gas, Poisonous
Class 2
Division 3



XI.- ECOLOGY AND DISPOSITIONS WASTE

- A. The chlorine liberated to the atmosphere will be dispersed without leaving residuals.
- B. The Normas Oficiales Mexicanas (Official Mexican Standards) often referred to as Normas or NOMs, support the Mexican Hazardous Materials Land Transportation Regulation. The Mexican Secretariat for Communications and Transport is responsible for publishing and applying the NOMs. The Mexican NOMs are fairly consistent with those of the United Nations

Recommendations on the Transport of Dangerous Goods (UN Recommendations) and TC and DOT regulations. In addition to federal requirements, state provincial or local requirements might affect these operations.

C. EPA considers a waste to be hazardous if it exhibits any of the following characteristics: ignitability, corrosively, reactivity or toxicity.

D. Their handling and final disposition should be in agreement to the General Law of the Ecological Balance and Protection to the Atmosphere, Regulation of the LGEEPA, in matter of Dangerous Residuals, the NOMs, NOM-052-ECOL/93 and NOM-053-ECOL/93, other legal technical classifications federal, state or municipal applicable.

XII.- HANDLING AND STORAGE

Chlorine should be stored in a cool, dry, well-ventilated area in tightly sealed containers. Containers of chlorine should be protected from exposure to weather, extreme temperatures changes, and physical damage, and they should be stored separately from flammable gases and vapors, combustible substances.

Workers handling and operating chlorine containers, cylinders, and tank cars should receive special training in standard safety procedures for handling compressed corrosive gases. All pipes and containers of chlorine should have secured protective covers on their valves and should be handled appropriately.

All pipes of liquid chlorine should clean of organic matter, powder, humidity, mineral fats, etc, before being used.

All pipes of liquid chlorine should have expansion cameras due to their high expansion coefficient.

XIII.- OTHER INFORMATION

CHLORINE IN COMMERCE: Chlorine has both a liquid and a gas phase when transported in tank cars. Chlorine is classified for transportation as Class 2.3 (poison gas) with a subsidiary corrosive hazard.

In Canada, chlorine has a secondary classification as a Class 5, Division 5.1, oxidizer.

The classification in Mexico is the same as that in the U.S. The United Nations identification number for chlorine is U.N 1017.