

Submitted by: David Eyman

OAKDALE PARK POOL REPORT

FY 2016

*This report contains pool safety, and budget for The Plunge
(Pool) at Oakdale Park*

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Somervell County Salon

To City Administrator City of Glen Rose, Texas

OAKDALE PARK REPORT FOR THE PLUNGE (POOL) DECK AND CHLORINATION SYSTEM

Oakdale Park is in violation of Texas state regulations concerning the pool deck. The understanding from reading the Texas State regulations is that there is to be no tripping hazard. The pool has several trip hazards. See photos included in this report. There is a step up and then a small step down. Should a person trip there is potential for great bodily injury or death.

Texas state regulations 265.185, 265.186(B), 265.189, 265.198. Texas state regulations are included in this report.

SAFETY CONCERNS:

The pool was built in 1925 and is part of the Historic Registry. Following the Texas state regulations the deck (walking area) needs to be 4' wide for pools built pre 1999. The pool does not meet this standard. There are multiple places that the deck is only 3' wide or less. The outer deck of the pool is to be smooth and free from tripping hazards. Please see the photos included in this report. Other safety concerns for the pool. There is a rock ledge that hangs over both the 1 foot deep toddler pool and the 3 foot deep section of the main pool. This ledge is a hazard with sharp edges; and has the potential to cause severe bodily injury and death (see the included photos of this ledge). Other safety concerns for the pool the wall built into the pool in the 10 foot deep section of the pool. While realizing that this is also part of the Historic nature of the pool this wall presents a safety hazard. 1- Potentially could be reached from the diving board. 2- The potential exists that this wall could be used as a "diving" platform into the much shallower 4 ½ foot deep portion of the pool.

THE PLUNGE (POOL) CHLORINATION SYSTEM

In understanding the OSHA regulations concerning Chlorine storage. Oakdale Park is in violation of OSHA regulations concerning the Chlorination of the pool. Oakdale Park is using Chlorine gas to chlorinate the pool. Using Chlorine gas is not the violation. The violation is the Chlorinating system is not in a covered ventilated building. Regardless if the pool is using gas, tablets or chlorine salt, chlorine has to be stored inside a ventilated building and kept out of the weather. Included in this report are the OSHA regulations concerning the storage of Chlorine. See page four of the included chlorine safety report. Also see the General Gas Chlorine Design. The Chlorination system that is being used at Oakdale Park is a severe health risk; as Chlorine gas is heavier than air and is exposed to the weather anyone that might be exposed to Chlorine gas is at risk for severe bodily injury or death. The potential for a leak into the atmosphere is greater as the system is not protected from the elements. Being exposed to the elements leads to hoses that contain Chlorine gas breaking and leaking Chlorine gas. The system as it is today is a hazard to the person changing the 150lb bottles. There is no room to work and there is no fall protection. Located directly behind the person changing the bottles is a 24 inch drop into a pit. Should the person changing the 150lb

CITY ADMINISTRATOR OF GLEN ROSE, TEXAS

bottle slip and fall while changing a bottle, there is the risk of serious bodily injury or death. See photos in section 6.

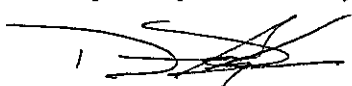
THE PLUNGE (POOL) BUDGET

Total budget for Oakdale Park pool is \$22,000.00 for FY 16. This is for pool maintenance, and supplies. For FY 16 Oakdale Park is not asking to amend the budgeted amount for the pool for FY 16.

Conclusion:

Oakdale Park and the City of Glen Rose must assume the worst case scenarios, and we must eliminate the risks of severe bodily injury and death. The City of Glen Rose Texas/Oakdale Park can't take out the human element we can engineer out the risks. The public does assume some risk from the inherent dangers of swimming in the pool. Should the City of Glen Rose, Texas/Oakdale Park not address these issues it would be considered negligence on the part of the City of Glen Rose, Texas and Oakdale Park, should anyone be severely injured.

Respectfully submitted 8, January 2016.



David A. Eyman



TEXAS

Department of State Health Services

These rules were adopted July 1, 2004, to be effective Sept. 1, 2004—except that Jan. 1, 2005 is the effective date under Section 265.290(e) for retrofitting suction outlets in pre-10-1-99 pools and spas with single main drains.

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(b) *Decks for pre-10/01/99 pools and spas.*

(1) Decks for pre-10/01/99 pools and spas shall comply with the construction and design requirements in existence at the time the pool was originally built.

(2) In decks of pre-10/01/99 pools and spas, access covers shall be provided for any valve pits in the decks.

(3) In pre-10/01/99 pools and spas, the usable pool deck (which can include flush coping) must be continuous and unobstructed and shall conform to the applicable minimum width in subparagraphs (A)-(E) of this paragraph. However, at a Class B, C, or D pool, as much as 35% of the deck in subparagraphs (A)-(E) of this paragraph may be replaced with other structures. Other structures must not restrict emergency access or create above-deck structures that may be used as diving platforms or create other safety or sanitary hazards.

(A) Class A pool deck widths shall meet standards of the appropriate sanctioning body that regulates the type of competitions to be held.

(B) Class B pool deck widths shall be a minimum of 4 feet.

(C) Class C pool deck widths shall be a minimum of 4 feet.

(D) Class D pool deck widths shall be a minimum of 4 feet.

(E) A minimum of 4 feet of deck width shall be provided on the sides and rear of any diving equipment. A deck clearance of 3 feet shall be provided around all other deck equipment.

(c) *Entries and exits for post-10/01/99 pools.* Post-10/01/99 pools shall have a minimum of two entry/exits, e.g., one serving the shallow end and one serving the deep end. Entry/exits may consist of ladders, steps, recessed treads, zero depth entries or combinations thereof. Ladders, steps, and recessed treads shall conform to the following:

(1) In post-10/01/99 pools, areas where the vertical distance from the bottom of the pool to the deck or walk is 18 inches or less at the pool wall may be considered as an entry/exit.

(2) In post-10/01/99 pools, if the deep portion of the pool is more than 30 feet wide, opposite sides of the deep portion must each have an entry/exit.

(3) A means of entry/exit for the shallow end of a post-10/01/99 pool shall be located between the shallow end wall and the cross section at Point C, while a means of entry/exit for the deep end shall be between the deep end wall and the cross section at Point B, refer to pool dimensions at paragraph (e)(6) of this subsection, or if not a diving pool, they shall be so located as to reasonably serve the respective areas.

(4) A means of entry/exit shall be provided at a minimum of every 75 linear feet of wall or fraction thereof, in a post-10/01/99 pool.

(5) Steps, ladders, and recessed treads in a post-10/01/99 pool shall be located so as not to interfere with racing lanes if applicable.

(6) Steps, ladders, and recessed treads in a post-10/01/99 pool shall have slip-resistant surfaces.

(7) Steps in a post-10/01/99 pool shall comply with the following:

(A) Steps shall have a minimum unobstructed horizontal depth (i.e., horizontal run) of 12 inches and a minimum width of 20 inches.

(B) Risers for steps shall have a maximum uniform height of 10 inches, with the

(E) The vertical distance between the pool coping edge, deck, or step surface and the uppermost recessed tread shall be a maximum of 12 inches.

(F) The recessed treads shall have a minimum depth of 4.5 inches and a minimum width of 12 inches.

(G) The recessed treads shall drain into the pool but not be sloped more than 1/2 inch per foot, to prevent the accumulation of dirt and debris.

(10) Swimouts in the pool walls of post-10/01/99 pools shall comply with the following:

(A) Swimouts shall be completely outside the perimeter shape of the pool.

(B) When used as an entry/exit access, swimouts shall be provided with step(s) to meet the pool step requirements as stated in paragraph (7) of this subsection.

(C) When steps are used in swimouts, they shall be visually set apart with a horizontal solid or broken stripe at least 1 inch wide on the top surface along the leading edge of horizontal surfaces of each step. The stripe shall be plainly visible to persons on the pool deck. The stripe shall be a contrasting color to the background on which it is applied, and the color shall be permanent.

(D) Swimouts are allowed in the deep or shallow areas of the pool.

(E) The horizontal surface shall be a maximum of 20 inches below the design water level unless steps are provided in the swimout.

(F) Pools that do not utilize a perimeter overflow system shall provide a wall return inlet or outlet in the swimout to maintain sufficient circulation.

(d) **Entries and exits for pre-10/01/99 pools.**

(1) Entries and exits in pre-10/01/99 pools shall comply with good public health engineering practices for construction of newly-built pools and spas prevailing at the time of original construction as required by Health and Safety Code, §341.064(g), and shall comply with these rules except as expressly provided otherwise.

(2) Pre-10/01/99 pools shall have a minimum of two entry/exits, one serving the shallow end if the vertical distance from the bottom of the pool to the deck is over 2 feet and one serving the deep end. Two entry/exits, one on each side of the deep end, shall be installed in the deep end if the pool is over 30 feet wide. Entry/exits may consist of ladders, steps, recessed treads, zero depth entries or combinations thereof.

(3) Pre-10/01/99 pools shall comply with applicable requirements for disability access for pools under federal, state, and local fair housing and handicap access laws. A handrail serving all treads of stepped entry shall be provided in pools for which a lifeguard is required under these rules. When provided, handrails shall be installed in such a way that they cannot be removed without the use of tools.

(e) **Diving facilities in post-10/01/99 pools.** Except for diving facilities in pools covered by subsection (g) of this section, diving facilities in post-10/01/99 pools shall comply with the following:

(1) Post-10/01/99 pools with diving facilities in excess of 3 meters in height or pools designed for platform diving, shall comply with the pool dimension design requirements of one of the organizations listed in subsection (g) of this section.

(2) Post-10/01/99 Class B and C pools with diving areas shall conform to the minimum water depths, areas, slopes, and other dimensions shown in paragraph (6) of this subsection. Diving equipment on post-10/01/99 Class B and C pools shall have a fixed fulcrum unless the design and construction of the pools meets

have dual guardrails that are approximately 18 inches and 36 inches above the diving board. A means shall be provided on platforms or diving equipment higher than 1 meter to prevent slips or falls through the equipment onto the deck surface.

(12) On post-10/01/99 pools, diving equipment shall have slip-resistant tread surfaces.

(13) On post-10/01/99 pools, diving equipment shall be permanently anchored to the pool deck.

(14) At post-10/01/99 pools, the top of the diving board from the deck end to the tip shall be level or have an upward slope of 5/8 inch per foot maximum, provided elevation difference shall not exceed 6 inches from the deck end to the tip of the board.

(15) At post-10/01/99 pools, the maximum construction tolerances for the installation of diving equipment shall be plus or minus 2 inches to allow for construction variances only on Class B and C pools.

(f) **Diving facilities in pre-10/01/99 pools.** Except for diving facilities in pools covered by subsection (g) of this section, diving facilities in pre-10/01/99 pools shall comply with the following:

(1) Diving areas for pre-10/01/99 Class A, B, and C pools shall conform to the minimum water depths, areas, slopes, and other dimensions in Figure: 25 TAC §265.186(e)(6).

(2) In pre-10/01/99 pools, new diving stands higher than 21 inches measured from the deck to the top butt end of the board shall have steps or a ladder and handrails. Step treads shall be self-draining.

(3) When other types of equipment or devices are provided for water entry at pre-10/01/99 pools, installation of the equipment or devices shall be in accordance with the manufacturer's instructions regarding location, size, and depths of the required water envelope.

(g) **Platform or diving facilities in post-10/01/99 and pre-10/01/99 pools.** Post-10/01/99 Class A, B, and C pools containing platform or diving facilities shall be designed and constructed according to dimensions specified by either the Federation Internationale De Natation Amateur - 2002, the United States Swimming Association - 2002, the United States Diving Association - 2002, the National Federation of State High School Association - 2002, or the National Collegiate Athletic Association - 2003. Pre-10/01/99 Class A, B, and C pools containing platform or deck diving facilities shall conform to one of the above standards.

(h) **Starting blocks in post-10/01/99 and pre-10/01/99 pools.** In post-10/01/99 and pre-10/01/99 pools:

(1) Starting blocks shall be installed to meet the standards, depth specifications and other requirements of the national competitive pool organization having jurisdiction over the competition.

(2) Starting blocks shall only be used during official competition or when there is direct supervision by the team coach or another qualified instructor.

(3) Starting blocks shall be removed or secured to prevent inadvertent use when use of the starting blocks is not directly supervised.

(i) **Play equipment for post-10/01/99 and pre-10/01/99 pools.** Playground equipment that is installed on or after October 1, 1999 in a post-10/01/99 and pre-10/01/99 pool yard or spa yard and that is not covered by the Amusement Ride Safety Inspection and Insurance Act, Chapter 2151, Texas Occupations Code, shall be designed and installed according to the CPSC "Handbook for Public Playground Safety," No. 325-1997, or the ASTM "Standard Consumer Safety Performance Specification for Playground Equipment for Public Use," No. F1487-1995. (See subsection (k) of this section.)

(j) **Slides for post-10/01/99 and pre-10/01/99 pools.** Slides at post-10/01/99 and pre-10/01/99 pools

(14) Pool and spa skimmer baskets shall not be used as chemical feeders.

(b) **Chemical feeders at post-10/01/99 and pre-10/01/99 pools and spas.** Chemical feeders at post-10/01/99 and pre-10/01/99 pools and spas shall:

- (1) be installed, maintained and operated in accordance with the manufacturer's instructions;
- (2) be installed so that the gas or solution is introduced downstream from the filter and heater and, if possible, at a point lower than the heater outlet fitting or according to manufacturer's instructions;
- (3) incorporate failure-proof features so that the chemical cannot feed into the pool or spa, the pool or spa piping system, water supply system, or the pool and spa enclosure if equipment or power fails; and chemical feed pumps shall be wired so they cannot operate unless there is adequate return flow to properly disburse the chemical throughout the pool or spa as designed;
- (4) be regulated to ensure constant feed with varying supply or back pressure;
- (5) be designed to prevent siphoning from the recirculation system to the solution container and to prevent the siphoning of the chemical solution into the pool or spa;
- (6) have a graduated and clearly marked dosage adjustment to provide flows from full capacity to 10% of such capacity and be capable of continuous delivery within 10% of the dosage at any setting;
- (7) be provided with make-up water supply lines to chemical feeder solution containers that have an air gap or other acceptable cross-connection control; and
- (8) comply with ANSI/NSFI 50 - 1996, "Circulation System Components and Related Materials for Swimming Pools, Spas/Hot Tubs" except as otherwise noted in §265.190(h) of this title (relating to Suction Outlets and Return Inlets at Post-10/01/99 and Pre-10/01/99 Pools and Spas). Chemicals used in a disinfection system for a post-10/01/99 or pre-10/01/99 pool or spa should be those complying with the instructions of the system's manufacturer and shall not be of a type or used in a manner that would invalidate the ANSI/NSFI 50 - 1996 rating for the system equipment.

Section 265.198. Gas Chlorination for Post-10/01/99 and Pre-10/01/99 Pools and Spas.

(a) **No gas chlorination to be installed after September 1, 2004.** Gas chlorination equipment shall not be installed on post-10/01/99 pools or spas constructed after September 1, 2004.

(b) **Gas chlorination in pools and spas constructed before September 1, 2004.** Post-10/01/99 pools and spas constructed before September 1, 2004, and pre-10/01/99 pools and spas using gas chlorination shall comply with the following:

- (1) Trained personnel shall be provided to comply with §265.197(b)(3) of this title (relating to Disinfecting Equipment and Chemical Feeders for Post-10/01/99 and Pre-10/01/99 Pools and Spas).
- (2) Two persons trained in the performance of routine chlorination operation and emergency procedures shall be readily available during normal operating hours.
- (3) Pool personnel shall be informed about leak control procedures.
- (4) Only trained designated personnel shall operate the chlorinator and change chlorine cylinders.
- (5) Chlorination equipment shall be located so that failure or malfunction will have minimum effect on evacuation of pool users in an emergency.

(c) **Chlorinators on post-10/01/99 pools and spas constructed before September 1, 2004, and pre-10/01/99 pools and spas.** On post-10/01/99 pools and spas constructed before September 1, 2004, and pre-10/01/99 pools and the spas the chlorinator's regulator shall attach to the gas cylinder so that the injector is located at the point of injection. The vacuum line taking suction at the regulator shall deliver gas to the vacuum injector. They shall be designed to prevent the suction of water into the chlorination system if the booster pump fails to operate.

(d) **Booster pumps on post-10/01/99 pools and spas constructed before September 1, 2004, and pre-10/01/99 pools and spas.** The booster pump water supply for the gas chlorinator injector on post-10/01/99 pools and spas constructed before September 1, 2004, and pre-10/01/99 pools and spas shall be capable of producing the flow rate and pressure required by the manufacturer's instructions for proper operation of the equipment.

(1) Elemental chlorine feeders (chlorinators) shall be activated by a booster pump using recirculated water supplied via the recirculation system.

(2) The booster pump shall be interlocked to the filter pump to prevent feeding of chlorine when the recirculation pump is not running.

(e) **Housing of chlorinators, cylinders of chlorine and associated equipment at post-10/01/99 pools and spas constructed before September 1, 2004, and pre-10/01/99 pools and spas.** The chlorinator, cylinders of chlorine, and associated equipment at post-10/01/99 pools and spas constructed before September 1, 2004, and pre-10/01/99 pools and spas shall be housed in a separate corrosion-resistant reasonably gas-tight room with a floor area adequate to the purpose. The following shall apply to housing structures:

(1) All enclosures shall be located at or above ground level.

(2) The enclosure shall:

(A) have ducts from the bottom of the enclosure to the atmosphere in an unrestricted area, and a motor-driven louvered exhaust fan capable of producing at least one air change per minute near the top of the enclosure for admitting fresh air; or

(B) have negative pressure ventilation as long as the facility also has gas containment and treatment equipment and procedures as prescribed by the Uniform Fire Code (UFC).

(3) A warning sign shall be posted on the exterior side of the doors that states in 4-inch letters, "DANGER CHLORINE."

(4) The doors to the chlorine room shall open away from the pool and open outward and have panic hardware.

(5) Electrical switches for the control of artificial lighting and ventilation shall be on the outside of the enclosure adjacent to the door. Adequate lighting shall be provided.

(6) At least one door shall have a view port to permit the operators to look into the room before entering.

(7) The door shall be kept locked when the chlorine room is not being serviced.

(f) **General gas chlorine safety features at post-10/01/99 pools and spas constructed before September 1, 2004 and pre-10/01/99 pools and spas.** The following gas chlorination safety features shall be required at post-10/01/99 pools and spas constructed before September 1, 2004 and pre-10/01/99 pools and spas:

(1) Two full-face self-contained breathing apparatus (SCBA) or supplied air respirators that meets Occupational Safety and Health Administration (OSHA) or Mine Safety Health Administration (MSHA) standards shall be provided for protection against chlorine in the event of a leak. This equipment shall have sufficient capacity for the purpose intended. All applicable local, state, or federal requirements concerning the proper handling of chlorine shall be followed.

(2) Containers may be stored indoors or outdoors. Full and empty cylinders shall be segregated and appropriately tagged. Cylinders, empty or full, shall always be stored in an upright position and properly secured. Cylinders shall be chained to a wall or scale support. Storage conditions shall:

- (A) minimize external corrosion;
- (B) be clean and free of trash;
- (C) be away from elevator shafts or intake vents; and
- (D) be away from elevated temperatures or heat sources.

(3) Chlorine cylinders shall be handled with care. Valve protection and outlet caps shall be in place at all times except when the cylinder is connected for use. Cylinders shall be used on a first-in, first-out basis. Post-10/01/99, approved washers shall be used each time a cylinder is connected.

(4) As soon as a container is empty, the valve shall be closed and the lines disconnected. The outlet cap shall be applied promptly and the valve protection hood attached. The open end of the disconnected line shall be plugged or capped promptly to keep atmospheric moisture out of the system. A chlorine valve shut off wrench shall be kept on the cylinder valve stem of the cylinder that is in use.

(5) Contents of a chlorine cylinder can be determined only by weight; therefore, facilities shall include a scale suitable for weighing the cylinders. Changing cylinder(s) shall be accomplished only after weighing proves contents of cylinder to be exhausted. Care shall be taken to prevent water suck-back into the cylinder by closing the cylinder valve.

(6) The telephone number of the chlorine supplier, and the fire department or agency trained in the handling of chlorine spills shall be posted on the outside of the chlorine room door. In the event of a chlorine leak, the fire department or an agency trained in the handling of chlorine spills shall be immediately contacted.

(7) The chlorinator and all line and tank fittings shall be checked for leaks at regular intervals and after every tank exchange. A small bottle of fresh ammonia solution (or approved equivalent) for testing for chlorine leakage shall be provided and accessible outside the chlorinator room when chlorine gas is used.

(8) Tanks and cylinders shall be secured as necessary to prevent spills.

Section 265.199. Specific Safety Features for Post-10/01/99 and Pre-10/01/99 Pools and Spas.

(a) *Handholds and coping for post-10/01/99 and pre-10/01/99 pools and spas.* A post-10/01/99 pool or spa shall be provided with a handhold around its perimeter in areas where depths exceed 42 inches and there is no seat bench, swimout, or lounge area below the perimeter area in question. Handholds shall be provided no farther apart than 2 feet to include, but not limited to, one or a combination of the following items:

(1) Handholds for post-10/01/99 and pre-10/01/99 pools and spas may be coping, rope, railing, ledge, deck, negative edge, or similar construction along the immediate top edge of the pool that provides a slip-resistant surface or grip and shall be at least 4 inches minimum horizontal width and located at or not more than 9 inches above the design water level. Any overhang of coping or decking shall not exceed 2 inches.

GENERAL GAS CHLORINE DESIGN

The design of gas chlorine facilities should consider operator and public safety as well as maintaining long-term plant reliability and operation. Chlorination facilities shall be designed such that chlorine gas can be contained in the chlorine storage room. Doors and windows should be gas-tight to minimize escape of gaseous chlorine to the exterior atmosphere or building interior. In general, the following can be considered to be acceptable design:

1. All chlorine cylinders shall be contained in the chlorine storage room. Vacuum regulators should be located on individual chlorine cylinders in service. The use of pressurized chlorine gas lines and manifolds is strongly discouraged and, if utilized, must be contained in the chlorine storage room.
2. All chlorine cylinders shall be adequately restrained.
3. Chlorinators should be housed in a room separate from but adjacent to the chlorine storage room. This is to minimize the need to enter the storage room to adjust feed rates and to minimize the potential for equipment damage caused by chlorine leaks. A gas-tight shatter resistant window shall be present for viewing the storage and chlorinator rooms from an interior wall of the plant.
4. The chlorine storage room shall only be accessible from the outside. The exterior access door for the chlorine storage area must open outward, being equipped with panic bar hardware on the interior. A small viewing window should be present in the door or adjacent to the door in the exterior wall to allow operator examination of the room before entry. Loading dock doors shall also open outward and be equipped with the appropriate moldings, gaskets, and weather stripping to minimize gas leakage to the exterior. Inside access to the chlorinator room shall be acceptable if chlorine gas is supplied under vacuum.
5. All access doors should be properly labeled with appropriate warning signs.
6. Chlorinator room temperature should be maintained at 60 degrees Fahrenheit and protected from excessive heat. The chlorine storage room shall be maintained at a temperature 5 to 10 degrees Fahrenheit cooler than the chlorinator room to minimize the potential for re-liquification of the gas.
7. A pressure relief valve shall be located on the chlorine vacuum line within the vacuum regulator to prevent gas pressurization of the chlorinator. This valve should be vented to the chlorine storage room or to the outside if appropriate.
8. All openings between the chlorine storage room and other parts of the building shall be sealed such that chlorine leaks can be contained within the storage room.

9. There shall be no exterior windows to chlorine storage rooms other than the small viewing window at the entrance. (This is to minimize the potential for heat build-up from the sun and to minimize vandalism.)
10. Scales shall be constructed of durable material to withstand the aggressive environment and situated such that they can be easily and accurately read through a viewing window or use of a remote readout. This type of design will minimize the need to enter the chlorine storage area to take readings.
11. Separate light and ventilation switches shall be located outside of the chlorine storage room near the entrance door and interior viewing window. Lighting fixtures within the chlorine storage area shall be suitable for use in an aggressive environment and, if possible, designed to operate during a chlorine gas release.
12. Electrical components within the chlorine storage area should be minimized. Motors for louvers, cylinder cranes, and ventilation equipment shall be suitable for use in an aggressive environment. Convenience electrical components, such as outlets, should be avoided. All electrical systems for the chlorine storage area shall be on dedicated circuits.
13. The chlorine storage room shall be equipped with ventilation equipment capable of one complete air exchange per minute. This equipment shall be located such that it will draw suction near the floor as far away as practical from the entrance door and air inlet. Exhaust shall be located away from the door and other air intakes. Exhaust discharge shall be located as not to contaminate other air inlets to any rooms or structures. Air intakes should be through louvers near the ceiling. Louvers for intakes and exhaust shall facilitate airtight closure.
14. Chemical scrubbing systems should be considered for treating the exhaust from a chlorine release where such exhaust may otherwise represent a health or environmental hazard to the surrounding area.
15. All ventilation and duct work within a chlorine storage room shall be separated from domestic building ventilation systems. All chlorine room duct work should be gas tight and not pass through other rooms or areas of the building.
16. Leak detectors shall be located 1 foot above the floor of the chlorine storage room and shall activate an alarm when a chlorine leak occurs. It is preferable that the detector be capable of differentiating between two or more chlorine concentrations to alert personnel of the severity of the release. This would help determine the appropriate procedure for entrance to the room, ventilation, or other solutions.
17. Self contained breathing apparatus (SCBA) shall not be located within the chlorine storage room. It is preferable that this equipment be located in a convenient location where personnel can easily access it in the event of an emergency.

18. Service water to operator injectors/eductors shall be of adequate supply and pressure to operate feed equipment within the needed chlorine dosage range for the proposed system. All service water shall be properly protected by the appropriate cross connection control device.
19. Placement of injectors/eductors should be carefully evaluated. Current system operation and chlorination practices should also be reviewed before design. In some cases, it may be appropriate to locate the injector/eductor in the chlorinator room with distribution of highly chlorinated water to the point of application. In other situations, it may be best to locate the eductor/injector can at the point of application with distribution of chlorine gas through plastic tubing under vacuum to the point of application.
20. A chlorine cylinder repair kit with leak detection bottle should be supplied within each chlorine storage room.
21. Floor drains should not be designed within the chlorine storage area.
22. Combustible materials should not be stored in chlorine rooms.
23. Fire sprinkling systems should not be installed in chlorine rooms.
24. Chlorine room location should be on the prevailing downwind side of the building, away from entrances, windows, louvers, walkways, etc.
25. Ammonia storage shall be in rooms separate from the chlorine storage room.

REFERENCE TEN STATES STANDARDS*

*These sheets provide general information on the design and construction of some of the physical requirements for gas chlorine facilities. More information can be obtained by referencing the latest edition of Recommended Standards for Water Works construction. In addition, regulations such as: EPA - Risk Management, OSHA - Process Safety Management, Clean Air Act and Uniform Fire Code should be thoroughly reviewed for additional requirements.

JJP 1/25/99

Hazard Summary—Created in April 1992; Revised in January 2000

Chlorine is a commonly used household cleaner and disinfectant. Chlorine is a potent irritant to the eyes, the upper respiratory tract, and lungs. Chronic (long-term) exposure to chlorine gas in workers has resulted in respiratory effects, including eye and throat irritation and airflow obstruction. No information is available on the carcinogenic effects of chlorine in humans from inhalation exposure. A National Toxicology Program (NTP) study showed no evidence of carcinogenic activity in male rats or male and female mice, and equivocal evidence in female rats, from ingestion of chlorinated water. EPA has not classified chlorine for potential carcinogenicity.

Please Note: The main sources of information for this fact sheet are EPA's Integrated Risk Information System (IRIS), which contains information on oral chronic toxicity and the RfD, The California Environmental Protection Agency's (CalEPA's) Technical Support Document for the Determination of Noncancer Chronic Reference Exposure Levels, and EPA's Drinking Water Criteria Document for Chlorine, Hypochlorous Acid and Hypochlorite Ion.

Uses

- Chlorine is a commonly used household cleaner and disinfectant. It is widely used as an oxidizing agent in water treatment and chemical processes. It is also used in the bleaching process of wood pulp in pulp mills. (8)

Sources and Potential Exposure

- Workers may be exposed to chlorine in industries where it is produced or used, particularly in the food and paper industries. In addition, persons breathing air around these industries may be exposed to chlorine. (1)
- Exposure to chlorine may also occur through drinking water and swimming pool water, where it is used as a disinfectant. (2)
- Accidental releases are another potential source of chlorine exposure. (3)

Assessing Personal Exposure

- No data were located regarding detection of personal exposure to chlorine.

Health Hazard Information

Acute Effects:

- Chlorine is a potent irritant in humans to the eyes, the upper respiratory tract, and the lungs. Several acute (short-term) studies have reported the following effects: tickling of the nose at 0.014 to 0.054 parts per million (ppm); tickling of the throat at 0.04 to 0.097 ppm; itching of the nose and cough, stinging, or dryness of the nose and throat at 0.06 to 0.3 ppm; burning of the conjunctiva and pain after 15 minutes at 0.35 to 0.72 ppm; and discomfort ranging from ocular and respiratory irritation to coughing, shortness of breath, and headaches above 1.0 ppm. (4)

- Higher levels of chlorine have resulted in the following effects in humans: mild mucous membrane irritation at 1 to 3 ppm; chest pain, vomiting, dyspnea, and cough at 30 ppm; and toxic pneumonitis and pulmonary edema at 46 to 60 ppm. (3)
- Chlorine is extremely irritating to the skin and can cause severe burns in humans. (3)
- Acute animal tests in rats and mice have shown chlorine to have high acute toxicity via inhalation. (6)

Chronic Effects (Noncancer):

- Workers chronically exposed to chlorine gas have exhibited respiratory effects, such as eye and throat irritation, and airflow obstruction. (8)
- Animal studies have reported decreased body weight gain, eye and nose irritation, and nonneoplastic lesions and respiratory epithelial hyperplasia from chronic inhalation exposure to chlorine. (4,8)
- The Reference Dose (RfD) for chlorine is 0.1 milligrams per kilogram body weight per day (mg/kg/d) based on no observed adverse effects in rats. The RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious noncancer effects during a lifetime. It is not a direct estimator of risk but rather a reference point to gauge the potential effects. At exposures increasingly greater than the RfD, the potential for adverse health effects increases. Lifetime exposure above the RfD does not imply that an adverse health effect would necessarily occur. (2)
- EPA has medium confidence in the RfD based on (1) medium to high confidence in the principal study because relevant endpoints in two animal species were examined after prolonged exposure by an appropriate route, but an effect level was not observed in this study and higher levels may not be practicable due to taste aversion, and (2) medium confidence in the database because information is available for rats and mice on the noncarcinogenic toxicity of oral exposure to chlorine for subchronic periods. Developmental and reproductive toxicity of chlorine have been examined in rats and mice, but with suboptimal studies; due to the chemical relationship between chlorine and monochloramine, reproductive and developmental studies for monochloramine may be used to satisfy data gaps for chlorine. (2)
- EPA has not established a Reference Concentration (RfC) for chlorine. (2)
- CalEPA has established a chronic reference exposure level of 0.00006 milligrams per cubic meter (mg/m³) based on respiratory epithelial lesions in rats. The CalEPA reference exposure level is a concentration at or below which adverse health effects are not likely to occur. (8)

Reproductive/Developmental Effects:

- No information is available on the developmental or reproductive effects of chlorine in humans or animals via inhalation exposure.
- Animal studies have demonstrated no evidence of reproductive or developmental effects from ingestion exposure to chlorine. (2)
- Since chlorine is highly reactive, uptake at sites such as the ovaries and testes which are remote from the respiratory tract, is anticipated to be minimal. (2)

Cancer Risk:

- No information is available on the carcinogenic effects of chlorine in humans from inhalation exposure.
- Several human studies have investigated the relationship between exposure to chlorinated drinking water and cancer. These studies were not designed to assess whether chlorine itself causes cancer, but whether trihalomethanes or other organic compounds occurring in drinking water as a result of chlorination are

associated with an increased risk of cancer. These studies show an association between bladder and rectal cancer and chlorination byproducts in drinking water. (5)

- An NTP study reported no evidence of carcinogenic activity in male rats or male and female mice, and equivocal evidence, based on an increase in mononuclear cell leukemia, in female rats, from ingestion of chlorinated or chloraminated water. (9)
- EPA has not classified chlorine for carcinogenicity. (2)

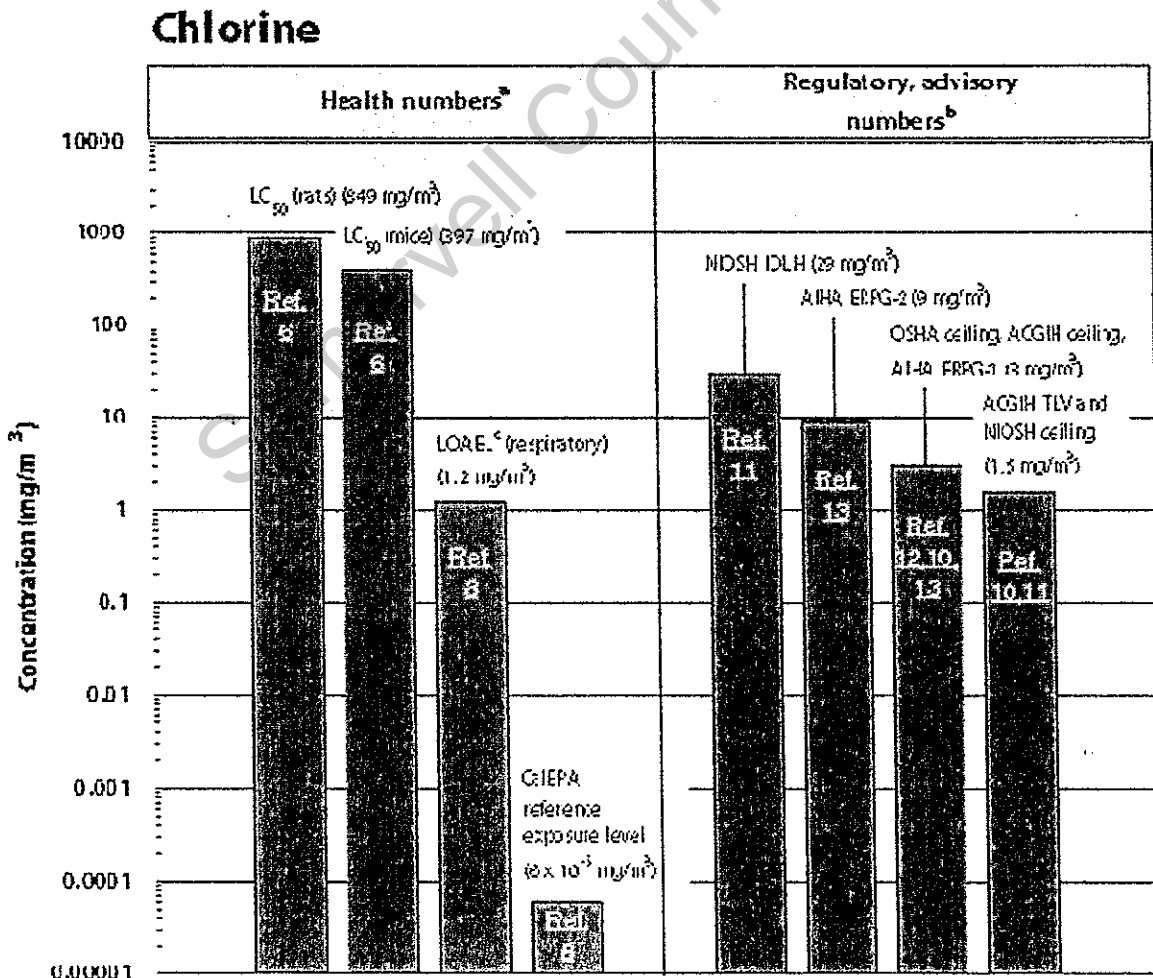
Physical Properties

- Chlorine is a greenish-yellow gas that is slightly soluble in water. (4)
- Chlorine has a suffocating odor; the odor threshold is 0.31 ppm. (7)
- The chemical formula for chlorine is Cl₂, and its molecular weight is 70.90 g/mol. (4)

Conversion Factors:

To convert concentrations in air (at 25°C) from ppm to mg/m³: $mg/m^3 = (ppm) \times (\text{molecular weight of the compound}) / (24.45)$. For chlorine: 1 ppm = 2.9 mg/m³.

Health Data from Inhalation Exposure



AIHA ERPG--American Industrial Hygiene Association's emergency response planning guidelines. ERPG 1 is the maximum airborne concentration below which it is believed nearly all individuals could be exposed up to one hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor; ERPG 2 is the maximum airborne concentration below which it is believed nearly all individuals could be exposed up to one hour without experiencing or developing irreversible or other serious health effects that could impair their abilities to take protective action.

ACGIH TLV--American Conference of Governmental and Industrial Hygienists' threshold limit value expressed as a time-weighted average; the concentration of a substance to which most workers can be exposed without adverse effects.

ACGIH ceiling--American Conference of Governmental and Industrial Hygienists' threshold limit value ceiling; the concentration of a substance that should not be exceeded during any part of the working exposure.

LC₅₀ (Lethal Concentration₅₀)--A calculated concentration of a chemical in air to which exposure for a specific length of time is expected to cause death in 50% of a defined experimental animal population.

LOAEL--Lowest-observed-adverse-effect level.

NIOSH IDLH -- National Institute of Occupational Safety and Health's immediately dangerous to life or health concentration; NIOSH recommended exposure limit to ensure that a worker can escape from an exposure condition that is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from the environment.

NIOSH ceiling--National Institute of Occupational Safety and Health's recommended exposure limit ceiling; the concentration that should not be exceeded at any time.

OSHA ceiling--Occupational Safety and Health Administration's permissible exposure limit ceiling value; the concentration of a substance that should not be exceeded at any time.

The health and regulatory values cited in this factsheet were obtained in December 1999.

Health numbers are toxicological numbers from animal testing or risk assessment values developed by EPA.

^b Regulatory numbers are values that have been incorporated in Government regulations, while advisory numbers are nonregulatory values provided by the Government or other groups as advice. OSHA numbers are regulatory, whereas NIOSH, ACGIH, and AIHA numbers are advisory.

^c This LOAEL is from the critical study used as the basis for California EPA's reference exposure level.

References

1. U.S. Environmental Protection Agency. *Drinking Water Criteria Document for Chlorine, Hypochlorous Acid and Hypochlorite Ion*. (External Review Draft.) Environmental Criteria and Assessment Office, Office of Health and Environmental Assessment, Cincinnati, OH. 1992.
2. U.S. Environmental Protection Agency. *Integrated Risk Information System (IRIS) on Chlorine*. National Center for Environmental Assessment, Office of Research and Development, Washington, DC. 1999.
3. U.S. Department of Health and Human Services. Hazardous Substances Data Bank ([HSDB, online database](#)). National Toxicology Information Program, National Library of Medicine, Bethesda, MD. 1993.
4. E.J. Calabrese and E.M. Kenyon. *Air Toxics and Risk Assessment*. Lewis Publishers, Chelsea, MI. 1991.
5. R.D. Morris, A. Audet, I.F. Angelillo, T. C. Chalmers, and F. Mosteller. Chlorination, Chlorination by-products, and cancer: A meta-analysis. *American Journal of Public Health*, 82(7):955-977. 1992.
6. U.S. Department of Health and Human Services. Registry of Toxic Effects of Chemical Substances ([/li](#))
7. J.E. Amore and E. Hautala. Odor as an aid to chemical safety: Odor thresholds compared with threshold limit values and volatilities for 214 industrial chemicals in air and water dilution. *Journal of Applied Toxicology*, 3(6):272-290. 1983.
8. California Environmental Protection Agency (CalEPA). *Air Toxics Hot Spots Program Risk Assessment Guidelines: Part III. Technical Support Document for the Determination of Noncancer Chronic Reference Exposure Levels*. SRP Draft. Office of Environmental Health Hazard Assessment, Berkeley, CA. 1999.

9. National Toxicology Program (NTP). *Toxicology and Carcinogenesis Studies of Chlorinated Water (CAS Nos. 7782-50-5 and 7681-52-9) and Chloraminated Water (CAS No. 10599-90-3) (Deionized and Charcoal-Filtered) in F344/N Rats and B6C3F1 Mice (Drinking Water Studies)*. TR-392. 1992.
10. American Conference of Governmental Industrial Hygienists (ACGIH). *1999 TLVs and BEIs. Threshold Limit Values for Chemical Substances and Physical Agents. Biological Exposure Indices*. Cincinnati, OH. 1999.
11. National Institute for Occupational Safety and Health (NIOSH). *Pocket Guide to Chemical Hazards*. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention. Cincinnati, OH. 1997.
12. Occupational Safety and Health Administration (OSHA). Occupational Safety and Health Standards, Toxic and Hazardous Substances. *Code of Federal Regulations*. 29 CFR 1910.1000. 1998.
13. American Industrial Hygiene Association (AIHA). *The AIHA 1998 Emergency Response Planning Guidelines and Workplace Environmental Exposure Level Guides Handbook*.

Somervell County Salon

Somervell County Salon

Chlorine (Cl₂)

SS-415

last updated: **January 2015**

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This publication provides practical loss control and safety information to assist you in making your workplace safer. It is not legal advice. SAIF Corporation has made every effort to bring significant Oregon Occupational Safety and Health Administration (OR-OSHA) regulations to your attention. Nonetheless, compliance with OR-OSHA remains your responsibility. You should read and understand all relevant OR-OSHA regulations that apply to your job safely. You may want to consult with your own attorney regarding aspects of OR-OSHA that may affect you.

Note: The information in this publication is not a contract. Do not rely upon this document if its publication date is more than one year old. Please check the Employer Guide "Safety" section of our web site at www.saif.com/safety for a more current, or at least stay-to-date, list of other valuable safety information designed to help your business prevent injuries and control costs.

What is it?

Chlorine (Cl₂) is a greenish-yellow gas, 2.5 times heavier than air, normally shipped and stored as liquid in cylinders or tank cars. It may also be formed when some chemicals such as household bleaches are mixed with other chemicals such as ammonia or acids. It is very reactive and corrodes many metals. Moisture increases its reactivity.

Uses and where chlorine is found

Uses

- Purification of water supplies and industrial wastes
- Bleaching agent in paper and textile mills
- Purification of metal in foundries and metallurgical plants
- Chemical processes

Where chlorine is found

- Chlorination areas in water works, sewage plants, and swimming pools
- Foundries, especially those working with aluminum
- Metallurgical plants
- Chemical Industries

Health effects and symptoms of chlorine exposure

Cl₂ is a potent irritant of the eyes, mucous membrane, skin and respiratory system. Mild mucous membrane irritation may begin to occur at 0.2 parts per million (ppm). Eye irritation can happen at levels as low as 1 to 2 ppm with some studies showing irritation at 7 to 8 ppm; throat irritation at 15 ppm. Death can occur within minutes after exposure of 400 to 1,000 ppm. Chronic exposure of 1 ppm can cause a moderate, but permanent, reduction in pulmonary function.

The range of reported odor threshold for Cl₂ gas is 0.03 to 3.5 ppm; however, because of odor fatigue, the odor does not always serve as an adequate warning of exposure. Some individuals will not notice the odor until it is more than three times the exposure limit. The location and severity of the respiratory tract involvement are functions of both the concentration and duration of exposure. With significant exposures, acute pulmonary conditions such as tracheal bronchitis, pneumonitis, and pulmonary edema may develop.

Occupational exposure limits

The Oregon OSHA exposure limit for Cl₂ is very low due to the extreme irritation hazard and is noted as a ceiling value. The exposure limit of 1 part per million (ppm) should never be exceeded and is an instantaneous limit. Therefore, it is not averaged over an eight-hour period.

The American Conference of Governmental Industrial Hygienists recommends an eight-hour Time Weighted Average (TWA) of 0.5 ppm and 15 minute Short Term Exposure Limit (STEL) of 1 ppm to minimize the potential for eye, mucous membrane and respiratory irritation.

The National Institute for Occupational Safety and Health (NIOSH) has set a Recommended Exposure Limit (REL) of 0.5 ppm as a ceiling limit not to be exceeded as a 15 minute average. The immediately dangerous to life and health (IDLH) value is 10 ppm for Cl₂. IDLH is defined as exposure to airborne contaminants that is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such an environment.

Testing for chlorine exposure levels

Air monitoring for Cl₂ can be done in several ways:

1. Colorimetric tubes or direct reading tubes can be used to get an estimate of the eight-hour averages and for the excursion limits. It is important to note the limitations of this method. Colorimetric tubes are regarded as +/- 35 percent accurate with measurements down to one half the exposure limit and +/- 25 percent accurate up to five times the exposure limit.
2. Active air sampling using personal sampling pumps and cassettes with filters according to NIOSH method 6011. This technology meets or exceeds OSHA requirements for accuracy and can be used to determine both eight-hour time weighted average exposures or 15 minute short term exposures.
3. Direct reading instruments (portable or fixed) with Cl₂ sensors on a person or in an area. These instruments record Cl₂ levels over longer time periods and can estimate the eight-hour TWA exposures and short term or peak exposure levels.

Recommendations

Storage

- Cylinders and containers should be stored in a cool, dry, well ventilated, and relatively isolated area protected from weather, extreme temperatures, and physical damage.
- Cylinders should be stored separately from flammable gases, vapors, and combustible substances such as gasoline, petroleum products, alcohol-based products, ammonia, sulfur, hydrocarbons, and acetylene.

- Cylinders (100 and 150 pound) should be stored upright and secured so they cannot fall. One ton containers should be chocked to prevent rolling.
- Valve outlet caps or hoods should be in place at all times except when containers or cylinders are connected.

Emergency procedures

- Personnel handling Cl₂ should be informed of its properties and trained in safe operating procedures.
- If splashed into eyes, flush with copious amounts of water for at least 15 minutes. Lift the upper and lower eyelids frequently to ensure complete washing. Call a physician.
- If splashed on skin or clothing, wash under a safety shower for at least 15 minutes. Remove contaminated clothing if necessary.
- If breathing has slowed or ceased, remove the worker from the exposure and start artificial respiration. Have someone else call a physician.

Protective and safety equipment

Clothing

Avoid skin contact with Cl₂. Wear protective gloves and chemical-resistant clothing. Keep clothing clean and free of oils and grease.

Eye protection

Wear splash-proof chemical goggles and a face shield when working with liquid Cl₂, unless full face-piece respiratory protection is worn. Gas-proof goggles with a face shield should be worn when there is Cl₂ gas exposure or risk for a gas exposure.

Respiratory protection

Respiratory protection should be NIOSH approved specifically for Cl₂ and used in accordance with the OSHA Respiratory Protection Standard, 29 CFR (Code of Federal Regulations) 1910.134. Under routine exposures where the ambient concentration of Cl₂ exceeds 0.5ppm, an air purifying, full-face respirator equipped with chemical cartridges appropriate for Cl₂ should be used. For Cl₂ exposures of unknown concentrations, such as uncontrolled releases, only a pressure-demand SCBA (self-contained breathing apparatus) is appropriate. Respirator use must be limited to individuals who have been adequately trained and fitted for the respirator face piece.

General hazard information

Leaks may be detected by using strong ammonia or direct reading instrumentation. Leaks need prompt attention because they will increase. Do not use water on a leak because it may worsen it. Use proper respiratory equipment if Cl₂ is suspected to be present in the air. Heat lamps or spot heaters should not be used on Cl₂ cylinders or containers. The fusible safety plug melts at about 160°F. Cl₂ piping should be dry before being hooked up. Lines should be plugged when disconnected in order to keep moist air out. Do not clean lines with aliphatic solvents (naphtha).

Operators should be properly instructed in operating procedures, testing for leaks, use of protective equipment and emergency procedures.

Additional requirements

There are a variety of specific requirements dealing with Cl₂ that go beyond the scope of this guide. Companies are referred to 29 CFR 1910.119, Process Safety Management of Highly Hazardous Chemicals Standard. Cl₂ presents a potential for a catastrophic event at or above the threshold quantity of 1,500 pounds according to the "List of Highly Hazardous Chemicals, Toxics and Reactives" (Mandatory) in 29 CFR 1926.64 Appendix A.

Resources

Copies of the Oregon Occupational Safety and Health Division (Oregon OSHA) regulations are available on the web at:
<http://www.cbs.state.or.us/external/osha/>

The Chlorine Institute Inc. is a trade association founded in 1924 for companies and organizations dealing with Cl₂. They offer a variety of safety information and training materials through their online bookstore. Their web site is:
<http://www.chlorineinstitute.org>

OSHA Occupational Chemical Database (Federal OSHA)
<https://www.osha.gov/chemicaldata/chemResult.html?RecNo=650>

Pocket guide to chemical hazards (NIOSH)
<http://www.cdc.gov/niosh/npg/npgd0115.html>

Fact sheet: Chlorine (CDC)
<http://www.bt.cdc.gov/agent/chlorine/basics/pdf/chlorine-facts.pdf>

Chlorine: *Documentation of the Threshold Limit Values for Chemical Substances and Physical Agents*, 7th Edition, American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio, 2001



May 2010
DOH 331-364

How to Handle Chlorine Gas Safely

Exposure to chlorine is irritating to the eyes, nose, throat, and mucous membranes. At high levels, exposure could cause serious injury or death.

Chlorine gas is greenish-yellow and smells like bleach. It is highly corrosive and reacts violently with petroleum products such as gasoline, diesel, oil, solvents, and turpentine. Chlorine can also react with carbon monoxide and other combustion products to make highly toxic and corrosive gases. Chlorine gas weighs about 2.5 times more than air and will settle in low-lying areas unless there is sufficient wind to disperse it.

Despite these hazards, proper training can help reduce the risk for those who handle it. This publication is not a substitute for formal training. It does discuss chlorine handling and safety practices, especially for small water systems.



Emergency Help

Make a list of all relevant contact numbers and keep it posted at several locations in the plant and office (See page 4). Be sure to include the fire department that will respond to your facility, police department, county emergency management office, and your Department of Health Office of Drinking Water regional office. This list will be particularly important if you don't have 9-1-1 service in your area. Keep the numbers updated.

Inform local police and fire departments about the chemicals used in your plant, especially chlorine, so they can be prepared if an emergency occurs. You should organize escape plans from areas where there might be a chlorine release. Taking short cuts could be deadly.

Protective equipment for water systems that use chlorine gas

Respiratory equipment where employees handle chlorine: Your equipment should meet National Institute for Occupational Safety and Health requirements. It should use compressed air, have at least a 30-minute capacity, and be:

- Available where employees handle chlorine gas.
- Kept in a convenient location, but not inside any room where chlorine is used or stored.
- Compatible with—or identical to—the units your fire department uses.
- Tested and refilled regularly. Ask your fire department to inspect and test the unit(s).



HELPING TO ENSURE SAFE AND RELIABLE DRINKING WATER

Other equipment:

- Each operator should have rubber gloves, a protective apron or other protective clothing, and goggles or a facemask.
- A deluge shower and eye washing station where operators use or store strong acids or alkalis. Provide warm water for the shower.

The Buddy System

It's wise to have a second person present when you change or handle chlorine. If one operator is incapacitated, the other can call for help. Do not work alone!

Separate Chlorine Room

It's important to have a separate room for chlorine gas. Check with local building officials, the fire marshal, and the Chlorine Institute about safe storage and use requirements for chlorine.

The chlorine storage and feed rooms should be:

- Enclosed, sealed, and separated from other operating areas.
- On the downwind side of the building, away from entrances, windows, louvers, walkways, and other occupied areas.
- At least 60° F, but protected from extreme heat or direct sunlight.

The room should have:

- A shatter-resistant inspection window mounted in an interior wall of the plant.
- Doors equipped with panic hardware that provide an easy escape by opening outward to the building exterior.
- A ventilating fan that exchanges the air at least once a minute. Run the fan whenever the room is occupied.
- An air intake near the ceiling and an exhaust near the floor. Make sure the fan exhausts outdoors and moves air as far as possible away from doors, air inlets, or occupied areas.
- Motorized louvers that provide airtight closure.
- Individual vandal-proof switches for the fan and lights located both outside the chlorine room and at the inspection window. Provide signal lights if you can control the fan from more than one location.
- A nonslip floor. Floor drains are a bad idea. If your chlorine room does have a floor drain, seal it or make sure it discharges outdoors away from air inlets, doors, or occupied areas. The drain should not connect to other internal or external drainage systems.



Chlorine Leak Detection

The chlorine room should have continuous leak-detection equipment with audible and visual alarms employees throughout the treatment plant can see and hear. Follow the manufacturer's recommendation for calibrating and testing the equipment. Record your findings.

You can use a rag soaked in concentrated ammonia solution to locate gas leaks at fittings and pipe connections. A white cloud or vapor indicates a leak.

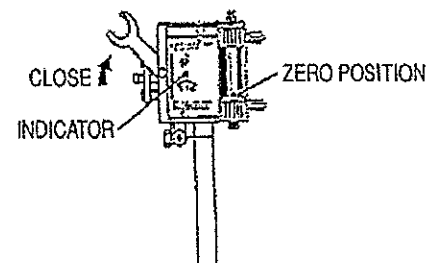
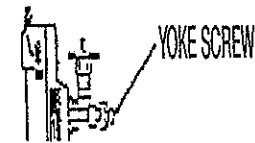
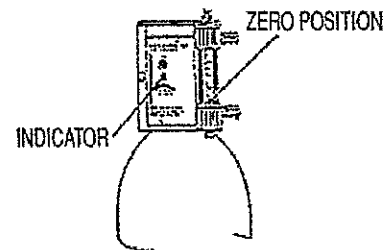
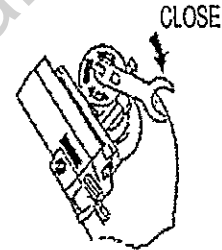
Make sure workers have a Chlorine Institute-approved leak repair kit (Kit A for cylinders and Kit B for containers).

Safety Tips for 100- and 150-Pound Cylinders and Ton Containers

- Take shallow breaths in the chlorine room until you are sure there is no chlorine leak.
- Never lift a cylinder by its hood.
- Always keep the hood in place, except when the cylinder is in use.
- Never expose a cylinder to heat or direct sunlight.
- Never drop a cylinder, or knock a cylinder over.
- Always keep empty cylinders separate from full ones.
- Always secure empty and full cylinders with a cable or chain.
- Never tamper with a fusible plug.
- Never store chlorine with ammonia.
- Don't move full ton containers with equipment designed to handle less than two tons.
- Don't connect liquid valves of two or more containers to a common manifold.
- Never store combustible or flammable materials near chlorine containers.
- Never attempt to weld an "empty" chlorine pipeline without purging it with air.
- Don't spray water on a leaking container. It will make the leak worse.

Changing 100- and 150-Pound Cylinders

1. Turn valve stem clockwise to close cylinder valve.
2. Allow float in flow meter to drop to zero. Indicator on front of gas feeder should indicate no gas.
3. Wait about one minute. Float should remain at zero. If the float flutters or does not drop to zero, the valve is not closed tightly. Make sure the valve is closed before proceeding.
4. Turn off ejector, and make certain the gas supply indicator stays in the "No Gas" position by turning the "Reset" knob. If the indicator resets, either gas pressure is still present or there is an air leak in the system. Refer to instruction manual if an air leak is evident.
5. Loosen gas feeder yoke screw. Remove gas feeder from valve.
6. Replace gas cylinder. Be sure to use a chain or cable to secure the new cylinder properly.
7. Remove old lead gasket. Inspect and clean mating surfaces of gas feeder and valve. Install new lead gasket.
8. Position gas feeder on new gas cylinder and tighten yoke screw. Do not tighten excessively.
9. Crack open gas cylinder valve and close quickly.
10. Use ammonia solution to check for leaks. If a white cloud or vapor appears, turn on ejector and repeat steps 2, 3, 4, and correct leaks.
11. After you verify there are no leaks, open gas cylinder valve, about 1/4-turn only, and leave cylinder wrench on valve.
12. Turn on the ejector.



- Notes:*
- A. See your gas feeder manufacturer's guide for more detailed instructions.
 - B. Immediately contact your gas supplier if the cylinder valve or cylinder is defective.

Chlorine Reporting Requirements

100 pounds or more: The Emergency Planning and Community Right-to-Know Act requires facilities that store 100 pounds or more of chlorine to report to the Washington State Emergency Response Commission and local agencies. The U. S. Environmental Protection Agency (EPA) may take action against facilities that fail to report. The Department of Ecology represents the State Emergency Response Commission. Reporting requirements, forms, and software are online at <http://www.ecy.wa.gov/epcra/>

1,500 pounds or more: The federal Occupational Safety and Health Administration (OSHA) and, in Washington, the state Department of Labor and Industries regulate chlorine quantities of 1,500 pounds or more. For requirements in Washington, call (360) 902-5478.

2,500 pounds or more: EPA regulates chlorine quantities of 2,500 pounds or more.

Chlorine First Aid

Inhalation

- Remove victim from contaminated area.
- Keep victim warm, in a reclining position with head and shoulders elevated.
- Give artificial respiration, if necessary.
- Administer oxygen as soon as possible.
- Call a physician immediately.

Skin Contact

- Shower victim, removing all contaminated clothing.
- Wash affected area with soap and water.

Eye Contact

- Irrigate eyes with water for 15 minutes, holding eyelids wide apart.
- Call a physician immediately.
- Irrigate a second 15-minute period if physician is not immediately available.

Health Effects

- Low concentrations: Burning eyes, nose and throat; redness in the face; sneezing and coughing.
- High concentrations: Tightness in the throat and difficulty breathing.
- 1,000 parts per million (ppm) is fatal after a few breaths.
- Even an hour later, 35-51 ppm can be fatal.

Emergency Numbers

Post relevant contact numbers at several locations in the plant and office. Keep them up to date.

Fire:

Police:

County Emergency Management Office:

Department of Health Office of Drinking Water:

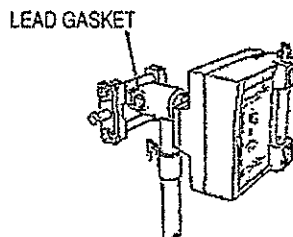
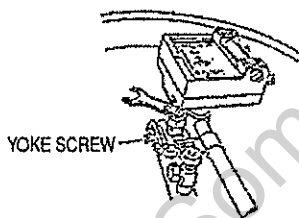
Eastern Region, Spokane
(509) 329-2100

Northwest Region, Kent
(253) 395-6750

Southwest Region, Tumwater
(360) 236-3030

Changing Ton Containers

1. Turn the valve stem clockwise to close ton container valve.
2. Allow float in flow meter to drop to zero. Indicator on front of gas feeder should show red indicating no gas. All liquid must be vaporized from the trap.
3. Wait about one minute. Float should remain at zero. If float flutters or does not drop to zero, valve may not be closed tightly. Make certain valve is closed before proceeding.
4. Turn off ejector and make certain the gas supply indicator stays in the "No Gas" position by turning the "Reset" knob. If the indicator resets, either gas pressure is still present or there is an air leak in the system. Refer to instruction manual if an air leak is evident.
5. Loosen gas feeder yoke screw. Remove gas feeder from valve.
6. Replace ton container. Make sure the full container is oriented with the valves in the vertical position, one valve above the other. The top valve will always supply gas chlorine and the bottom valve will give liquid chlorine.
7. Remove old lead gasket. Inspect and clean mating surfaces of gas feeder and valve. Install new unused lead gasket.
8. Position gas feeder on new gas cylinder and tighten yoke screw. Do not tighten excessively.
9. Be sure heater is plugged in and operating. An operating heater provides heat to vaporize any trapped liquid.
10. Crack open gas cylinder valve and reclose quickly. Check for leaks. If leaks exist, turn on ejector and repeat steps 2, 3, 4, and correct leaks.
11. Leak test solutions: Chlorinator/Sulfonator- Ammonia: Ammoniator-Bleach.
12. Open ton container valve slowly about ¼-turn only and leave cylinder wrench on valve.
13. Turn on ejector.



Notes:

- A. Refer to gas feeder instructions bulletin for more gasket detailed instructions.
- B. Contact your gas supplier if the cylinder valve or cylinder is considered to be defective.

For more information

The Chlorine Institute Get information on safe chlorine handling online at <http://www.chlorineinstitute.org/> (Go to bookstore and click on "Free titles about chlorine packaging" in the right column). The Chlorine Institute, Inc., Headquarters Office, 1300 Wilson Blvd., Arlington, VA 22209. Phone (703)741-5760 Fax (703)741-6068

National Institute for Occupational Safety and Health (NIOSH) Find chlorine resources online at <http://www.cdc.gov/niosh/topics/chlorine/> NIOSH, Centers for Disease Control and Prevention, 1600 Clifton Rd., Atlanta, GA 30333. Phone (800) CDC-INFO (800-232-4636), TTY: (888) 232-6348, 24-hours a day, e-mail cdcinfo@cdc.gov

Occupational Safety and Health Administration (OSHA) Find OSHA's guide to chlorine online at <http://www.osha.gov/SLTC/healthguidelines/chlorine/recognition.html> OSHA, 200 Constitution Avenue, NW, Washington, DC 20210

Recommended Standards for Water Works: Ten State Standards Published by Health Research Inc., Health Education Services Division, P.O. Box 7126, Albany, NY 12224. To order, call (518) 439-7286 or visit the Web site at <http://www.hes.org/HES/ten.html>

Special Recognition

Parts of this document were adapted with permission from an article that appeared in the fall 2006 *On Tap* newsletter, published by the National Environmental Services Center. Zane Satterfield, P. E., NESC engineering scientist, was the original author, and James Bouquot was the original graphic designer.

Chlorine

Section 1. Identification

GHS product identifier : Chlorine
 Chemical name : chlorine
 Other means of identification : Cl₂; Bertholite; Chloor; Chlor; Chlore; Chlorine mol.; Cloro; Molecular chlorine; UN 1017
 Product use : Synthetic/Analytical chemistry.
 Synonym : Cl₂; Bertholite; Chloor; Chlor; Chlore; Chlorine mol.; Cloro; Molecular chlorine; UN 1017
 SDS # : 001015
 Supplier's details : Airgas USA, LLC and its affiliates
 259 North Radnor-Chester Road
 Suite 100
 Radnor, PA 19087-5283
 1-610-687-5253

 Emergency telephone number (with hours of operation) : 1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).
 Classification of the substance or mixture : OXIDIZING GASES - Category 1
 GASES UNDER PRESSURE - Compressed gas
 ACUTE TOXICITY (inhalation) - Category 2
 SKIN CORROSION/IRRITATION - Category 1
 SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 1
 SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Respiratory tract irritation) - Category 3
 AQUATIC HAZARD (ACUTE) - Category 1

GHS label elements

Hazard pictograms



Signal word

: Danger

Hazard statements

: May cause or intensify fire; oxidizer.
 Contains gas under pressure; may explode if heated.
 May cause frostbite.
 Fatal if inhaled.
 Causes severe skin burns and eye damage.
 Corrosive to respiratory tract.
 Very toxic to aquatic life.

Precautionary statements

Date of issue/Date of revision : 4/26/2015. Date of previous issue : 10/15/2014. Version : 0.03 1/14

Section 2. Hazards identification

- General** : Read and follow all Safety Data Sheets (SDS'S) before use. Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand. Close valve after each use and when empty. Use equipment rated for cylinder pressure. Do not open valve until connected to equipment prepared for use. Use a back flow preventative device in the piping. Use only equipment of compatible materials of construction. Open valve slowly. Use only with equipment cleaned for Oxygen service. Always keep container in upright position.
- Prevention** : Wear protective gloves. Wear eye or face protection. Wear respiratory protection. Keep away from clothing, incompatible materials and combustible materials. Keep reduction valves free from grease and oil. Use only outdoors or in a well-ventilated area. Avoid release to the environment. Do not breathe gas. Wash hands thoroughly after handling. Use and store only outdoors or in a well ventilated place.
- Response** : Collect spillage. In case of fire: Stop leak if safe to do so. IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Immediately call a POISON CENTER or physician. IF SWALLOWED: Immediately call a POISON CENTER or physician. Rinse mouth. Do NOT induce vomiting. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water or shower. Wash contaminated clothing before reuse. Immediately call a POISON CENTER or physician. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or physician.
- Storage** : Store locked up. Protect from sunlight. Protect from sunlight when ambient temperature exceeds 52°C/125°F. Store in a well-ventilated place.
- Disposal** : Dispose of contents and container in accordance with all local, regional, national and international regulations.
- Hazards not otherwise classified** : In addition to any other important health or physical hazards, this product may displace oxygen and cause rapid suffocation.

Section 3. Composition/information on ingredients

- Substance/mixture** : Substance
- Chemical name** : chlorine
- Other means of identification** : Cl₂; Bertholite; Chloor; Chlor; Chlore; Chlorine mol.; Cloro; Molecular chlorine; UN 1017

CAS number/other identifiers

- CAS number** : 7782-50-5
- Product code** : 001015

Ingredient name	%	CAS number
chlorine	100	7782-50-5

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

- Eye contact** : Get medical attention immediately. Call a poison center or physician. Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Chemical burns must be treated promptly by a physician.

Section 4. First aid measures

- Inhalation** : Get medical attention immediately. Call a poison center or physician. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.
- Skin contact** : Get medical attention immediately. Call a poison center or physician. Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Chemical burns must be treated promptly by a physician. Wash clothing before reuse. Clean shoes thoroughly before reuse.
- Ingestion** : As this product is a gas, refer to the inhalation section.

Most important symptoms/effects, acute and delayed

Potential acute health effects

- Eye contact** : Causes serious eye damage.
- Inhalation** : Fatal if inhaled. May cause respiratory irritation.
- Skin contact** : Causes severe burns.
- Frostbite** : Try to warm up the frozen tissues and seek medical attention.
- Ingestion** : May cause burns to mouth, throat and stomach. As this product is a gas, refer to the inhalation section.

Over-exposure signs/symptoms

- Eye contact** : Adverse symptoms may include the following:
pain
watering
redness
- Inhalation** : Adverse symptoms may include the following:
respiratory tract irritation
coughing
- Skin contact** : Adverse symptoms may include the following:
pain or irritation
redness
blistering may occur
- Ingestion** : Adverse symptoms may include the following:
stomach pains

Indication of immediate medical attention and special treatment needed, if necessary

- Notes to physician** : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.
- Specific treatments** : No specific treatment.
- Protection of first-aiders** : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

- Suitable extinguishing media** : Use an extinguishing agent suitable for the surrounding fire.
- Unsuitable extinguishing media** : None known.
- Specific hazards arising from the chemical** : Contains gas under pressure. Oxidizing material. This material increases the risk of fire and may aid combustion. Contact with combustible material may cause fire. In a fire or if heated, a pressure increase will occur and the container may burst or explode. This material is very toxic to aquatic life. Fire water contaminated with this material must be contained and prevented from being discharged to any waterway, sewer or drain.
- Hazardous thermal decomposition products** : Decomposition products may include the following materials: halogenated compounds
- Special protective actions for fire-fighters** : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Contact supplier immediately for specialist advice. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool. If involved in fire, shut off flow immediately if it can be done without risk.
- Special protective equipment for fire-fighters** : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

- For non-emergency personnel** : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Shut off all ignition sources. No flares, smoking or flames in hazard area. Do not breathe gas. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.
- For emergency responders** : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".
- Environmental precautions** : Ensure emergency procedures to deal with accidental gas releases are in place to avoid contamination of the environment. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air). Water polluting material. May be harmful to the environment if released in large quantities. Collect spillage.

Methods and materials for containment and cleaning up

- Small spill** : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment.
- Large spill** : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

- Protective measures** : Put on appropriate personal protective equipment (see Section 8). Contains gas under pressure. Do not get in eyes or on skin or clothing. Do not breathe gas. Avoid release to the environment. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Keep away from clothing, incompatible materials and combustible materials. Keep reduction valves free from grease and oil. Empty containers retain product residue and can be hazardous. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.
- Advice on general occupational hygiene** : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.
- Conditions for safe storage, including any incompatibilities** : Store in accordance with local regulations. Store in a segregated and approved area. Store away from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Store locked up. Separate from acids, alkalis, reducing agents and combustibles. Keep container tightly closed and sealed until ready for use. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
chlorine	<p>ACGIH TLV (United States, 3/2012). STEL: 2.9 mg/m³ 15 minutes. STEL: 1 ppm 15 minutes. TWA: 1.5 mg/m³ 8 hours. TWA: 0.5 ppm 8 hours.</p> <p>NIOSH REL (United States, 1/2013). CEIL: 1.45 mg/m³ 15 minutes. CEIL: 0.5 ppm 15 minutes.</p> <p>OSHA PEL (United States, 6/2010). CEIL: 3 mg/m³ CEIL: 1 ppm</p> <p>OSHA PEL 1989 (United States, 3/1989). STEL: 3 mg/m³ 15 minutes. STEL: 1 ppm 15 minutes. TWA: 1.5 mg/m³ 8 hours. TWA: 0.5 ppm 8 hours.</p>

- Appropriate engineering controls** : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.
- Environmental exposure controls** : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Section 8. Exposure controls/personal protection

Individual protection measures

- Hygiene measures** : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.
- Eye/face protection** : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles and/or face shield. If inhalation hazards exist, a full-face respirator may be required instead.
- Skin protection**
- Hand protection** : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.
- Body protection** : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
- Other skin protection** : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
- Respiratory protection** : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

- Physical state** : Gas. [GREENISH-YELLOW GAS WITH SUFFOCATING ODOR]
- Color** : Colorless. Green. Yellow.
- Molecular weight** : 70.9 g/mole
- Molecular formula** : Cl₂
- Boiling/condensation point** : -34°C (-29.2°F)
- Melting/freezing point** : -101°C (-149.8°F)
- Critical temperature** : 143.85°C (290.9°F)
- Odor** : Pungent.
- Odor threshold** : Not available.
- pH** : Not available.
- Flash point** : [Product does not sustain combustion.]
- Burning time** : Not applicable.
- Burning rate** : Not applicable.
- Evaporation rate** : Not available.
- Flammability (solid, gas)** : Extremely flammable in the presence of the following materials or conditions: reducing materials, combustible materials, organic materials and alkalis.

Section 9. Physical and chemical properties

Lower and upper explosive (flammable) limits	: Not available.
vapor pressure	: 85.3 (psig)
vapor density	: 2.5 (Air = 1)
Specific Volume (ft ³ /lb)	: 5.4054
Gas Density (lb/ft ³)	: 0.185
Relative density	: Not applicable.
Solubility	: Very slightly soluble in the following materials: cold water.
Solubility in water	: 7.41 g/l
Partition coefficient: n-octanol/water	: Not available.
Auto-ignition temperature	: Not available.
Decomposition temperature	: Not available.
SADT	: Not available.
Viscosity	: Not applicable.

Section 10. Stability and reactivity

Reactivity	: No specific test data related to reactivity available for this product or its ingredients.
Chemical stability	: The product is stable.
Possibility of hazardous reactions	: Hazardous reactions or instability may occur under certain conditions of storage or use. Conditions may include the following: contact with combustible materials Reactions may include the following: risk of causing fire
Conditions to avoid	: No specific data.
Incompatibility with various substances	: Extremely reactive or incompatible with the following materials: reducing materials, combustible materials, organic materials and alkalis.
Hazardous decomposition products	: Under normal conditions of storage and use, hazardous decomposition products should not be produced.
Hazardous polymerization	: Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
chlorine	LC50 Inhalation Gas.	Rat	293 ppm	1 hours

Irritation/Corrosion

Not available.

Sensitization

Section 11. Toxicological information

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Name	Category	Route of exposure	Target organs
chlorine	Category 3	Not applicable.	Respiratory tract irritation

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

- Eye contact : Causes serious eye damage.
- Inhalation : Fatal if inhaled. May cause respiratory irritation.
- Skin contact : Causes severe burns.
- Ingestion : May cause burns to mouth, throat and stomach. As this product is a gas, refer to the inhalation section.

Symptoms related to the physical, chemical and toxicological characteristics

- Eye contact : Adverse symptoms may include the following:
pain
watering
redness
- Inhalation : Adverse symptoms may include the following:
respiratory tract irritation
coughing
- Skin contact : Adverse symptoms may include the following:
pain or irritation
redness
blistering may occur
- Ingestion : Adverse symptoms may include the following:
stomach pains

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Section 11. Toxicological information

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Not available.

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.

Bioaccumulative potential

Not available.

Mobility in soil

Soil/water partition coefficient (K_{oc}) : Not available.

Other adverse effects : No known significant effects or critical hazards.



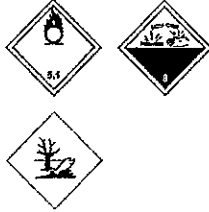
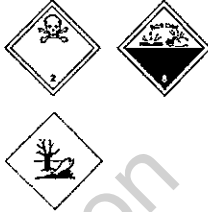
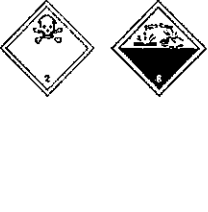
Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Empty Airgas-owned pressure vessels should be returned to Airgas. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is

Section 13. Disposal considerations

not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Do not puncture or incinerate container.

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1017	UN1017	UN1017	UN1017	UN1017
UN proper shipping name	CHLORINE	CHLORINE	CHLORINE	CHLORINE	CHLORINE
Transport hazard class(es)	2.3 (5.1, 8) 	2.3 (5.1, 8) 	2.3 (5.1, 8) 	2.3 (8) 	2.3 (8) 
Packing group	-	-	-	-	-
Environment	No.	No.	No.	Yes.	No.
Additional information	<p>Inhalation hazard zone B</p> <p>The marine pollutant mark is not required when transported on inland waterways in sizes of ≤5 L or ≤5 kg or by road, rail, or inland air in non-bulk sizes.</p> <p>Reportable quantity 10 lbs / 4.54 kg Package sizes shipped in quantities less than the product reportable quantity are not subject to the RQ (reportable quantity) transportation requirements.</p> <p>Limited quantity Yes.</p> <p>Packaging instruction Passenger aircraft Quantity limitation: Forbidden.</p> <p>Cargo aircraft Quantity limitation: Forbidden.</p> <p>Special provisions 2, B9, B14, T50, TP19</p>	<p>The marine pollutant mark is not required when transported by road or rail.</p> <p>Explosive Limit and Limited Quantity Index 0</p> <p>ERAP Index 500</p> <p>Passenger Carrying Ship Index Forbidden</p> <p>Passenger Carrying Road or Rail Index Forbidden</p>	-	<p>The marine pollutant mark is not required when transported in sizes of ≤5 L or ≤5 kg.</p>	<p>The environmentally hazardous substance mark may appear if required by other transportation regulations.</p> <p>Passenger and Cargo Aircraft Quantity limitation: 0 Forbidden Cargo Aircraft Only Quantity limitation: 0 Forbidden</p>

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Chemical

Section 14. Transport information

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code : Not available.

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 8(a) CAIR:** chlorine
TSCA 8(a) CDR Exempt/Partial exemption: Not determined
United States inventory (TSCA 8b): This material is listed or exempted.
Clean Water Act (CWA) 311: chlorine

Clean Air Act (CAA) 112 regulated toxic substances: chlorine

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

Name	%	EHS	SARA 302 TPQ		SARA 304 RQ	
			(lbs)	(gallons)	(lbs)	(gallons)
chlorine	100	Yes.	100	-	10	-

SARA 304 RQ : 10 lbs / 4.5 kg

SARA 311/312

Classification : Sudden release of pressure
 Immediate (acute) health hazard

Composition/information on ingredients

Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
chlorine	100	No.	Yes.	No.	Yes.	No.

SARA 313

Section 15. Regulatory information

	Product name	CAS number	%
Form R - Reporting requirements	chlorine	7782-50-5	100
Supplier notification	chlorine	7782-50-5	100

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

State regulations

- Massachusetts : This material is listed.
New York : This material is listed.
New Jersey : This material is listed.
Pennsylvania : This material is listed.
Canada inventory : This material is listed or exempted.

International regulations

- International lists : **Australia inventory (AICS):** This material is listed or exempted.
China inventory (IECSC): This material is listed or exempted.
Japan inventory: Not determined.
Korea inventory: This material is listed or exempted.
Malaysia Inventory (EHS Register): This material is listed or exempted.
New Zealand Inventory of Chemicals (NZIoC): This material is listed or exempted.
Philippines inventory (PICCS): This material is listed or exempted.
Taiwan inventory (CSNN): Not determined.

- Chemical Weapons Convention List Schedule I Chemicals : Not listed

- Chemical Weapons Convention List Schedule II Chemicals : Not listed

- Chemical Weapons Convention List Schedule III Chemicals : Not listed

Canada

- WHMIS (Canada) : Class A: Compressed gas.
Class D-1A: Material causing immediate and serious toxic effects (Very toxic).
Class E: Corrosive material
CEPA Toxic substances: This material is not listed.
Canadian ARET: This material is not listed.
Canadian NPRI: This material is listed.
Alberta Designated Substances: This material is not listed.
Ontario Designated Substances: This material is not listed.
Quebec Designated Substances: This material is not listed.

Section 16. Other information

- Canada Label requirements : Class A: Compressed gas.
Class D-1A: Material causing immediate and serious toxic effects (Very toxic).
Class E: Corrosive material

Hazardous Material Information System (U.S.A.)

Health | 3

Date of issue/Date of revision : 4/26/2015. Date of previous issue : 10/15/2014. Version : 0.03 12/14

Section 16. Other information

Flammability 0

Instability/Reactivity 2

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings are not required on SDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.)



Reprinted with permission from NFPA 704-2001, Identification of the Hazards of Materials for Emergency Response Copyright ©1997, National Fire Protection Association, Quincy, MA 02269. This reprinted material is not the complete and official position of the National Fire Protection Association, on the referenced subject which is represented only by the standard in its entirety.

Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

History

Date of printing	: 4/26/2015.
Date of issue/Date of revision	: 4/26/2015.
Date of previous issue	: 10/15/2014.
Version	: 0.03
Key to abbreviations	: ATE = Acute Toxicity Estimate BCF = Bioconcentration Factor GHS = Globally Harmonized System of Classification and Labelling of Chemicals IATA = International Air Transport Association IBC = Intermediate Bulk Container IMDG = International Maritime Dangerous Goods LogPow = logarithm of the octanol/water partition coefficient MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution) UN = United Nations ACGIH – American Conference of Governmental Industrial Hygienists AIHA – American Industrial Hygiene Association CAS – Chemical Abstract Services CEPA – Canadian Environmental Protection Act CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act (EPA) CFR – United States Code of Federal Regulations CPR – Controlled Products Regulations DSL – Domestic Substances List GWP – Global Warming Potential IARC – International Agency for Research on Cancer ICAO – International Civil Aviation Organisation

Date of issue/Date of revision : 4/26/2015. Date of previous issue : 10/15/2014. Version : 0.03 13/14

Section 16. Other information

Inh – Inhalation
LC – Lethal concentration
LD – Lethal dosage
NDSL – Non-Domestic Substances List
NIOSH – National Institute for Occupational Safety and Health
TDG – Canadian Transportation of Dangerous Goods Act and Regulations
TLV – Threshold Limit Value
TSCA – Toxic Substances Control Act
WEEL – Workplace Environmental Exposure Level
WHMIS – Canadian Workplace Hazardous Material Information System

References : Not available.

☑ Indicates information that has changed from previously issued version.

Notice to reader

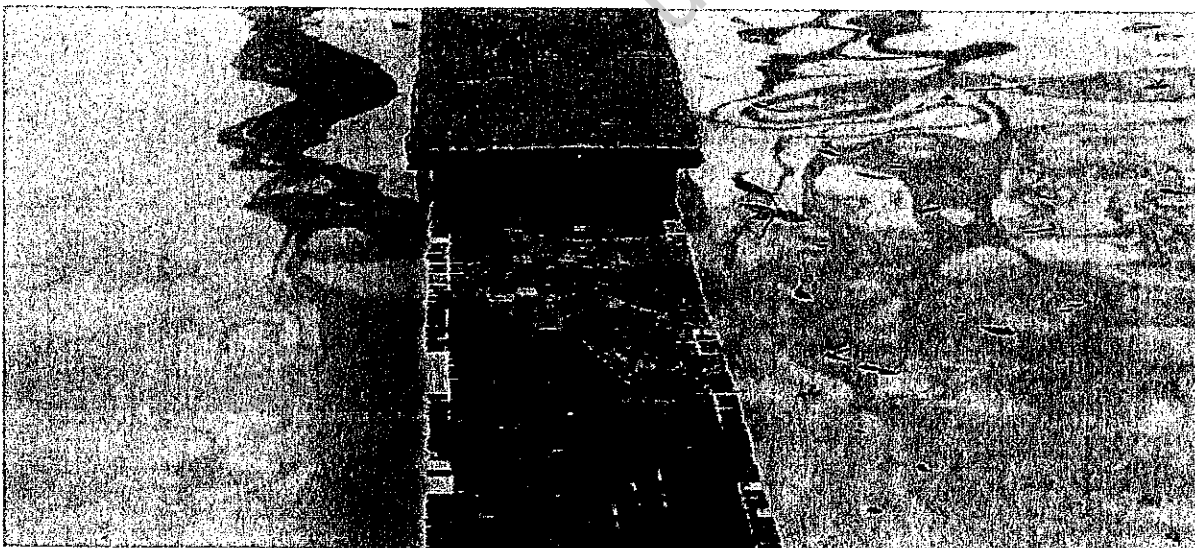
To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

CITY ADMINISTRATOR OF GLEN ROSE, TEXAS



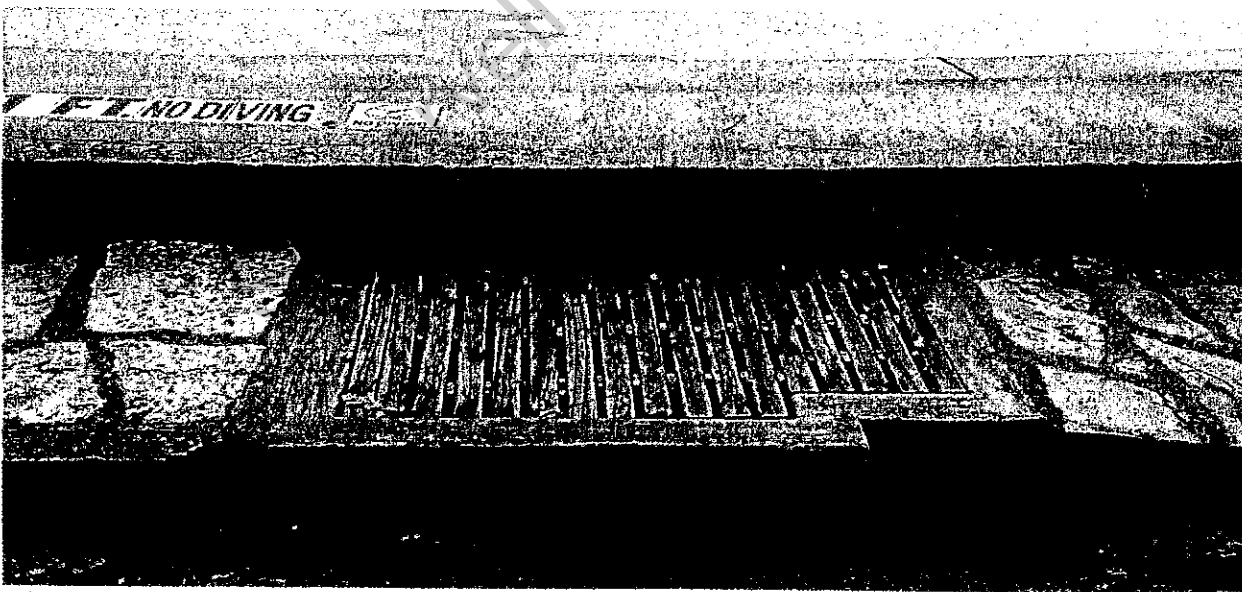
Slipping and tripping hazard



Rock ledge hanging over from the toddler pool into the main pool. Head trauma hazard. Sharp edges and corners

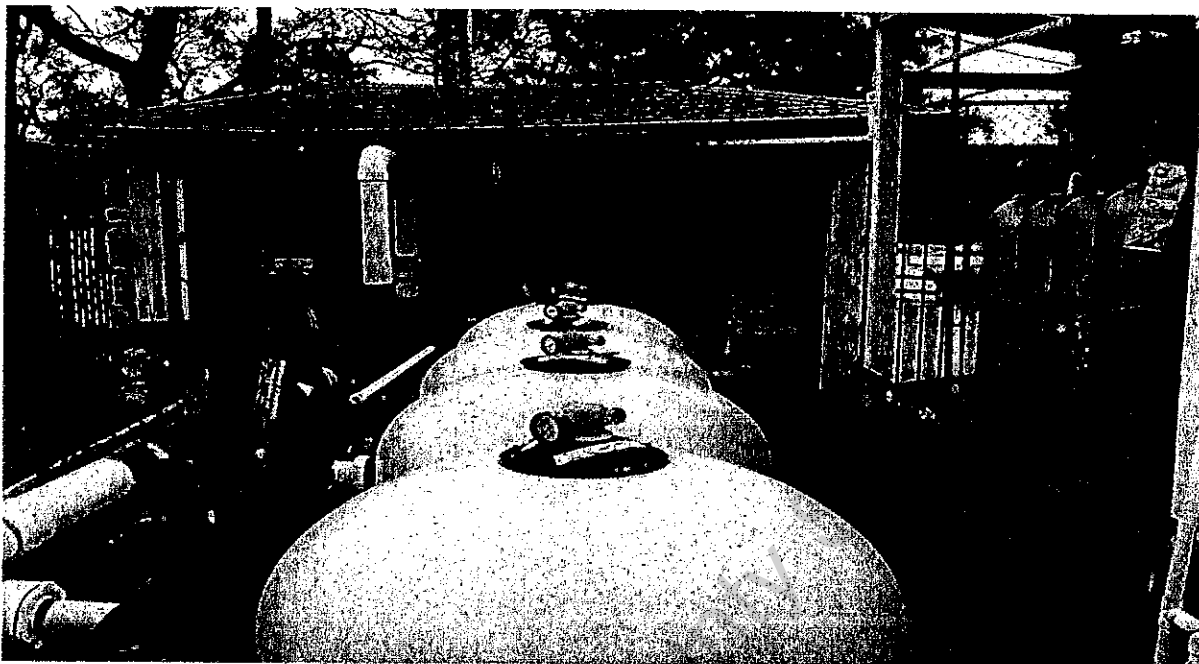


Tree and tree root system causing damage to pool deck and causing a tripping hazard

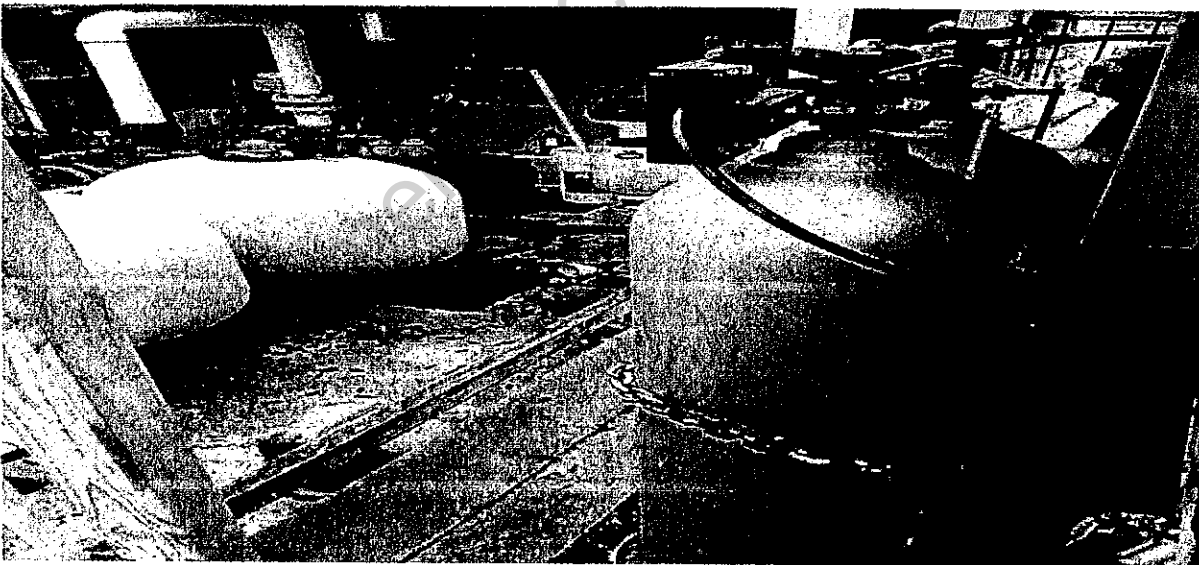


Tripping hazard at the toddler pool

CITY ADMINISTRATOR OF GLEN ROSE, TEXAS

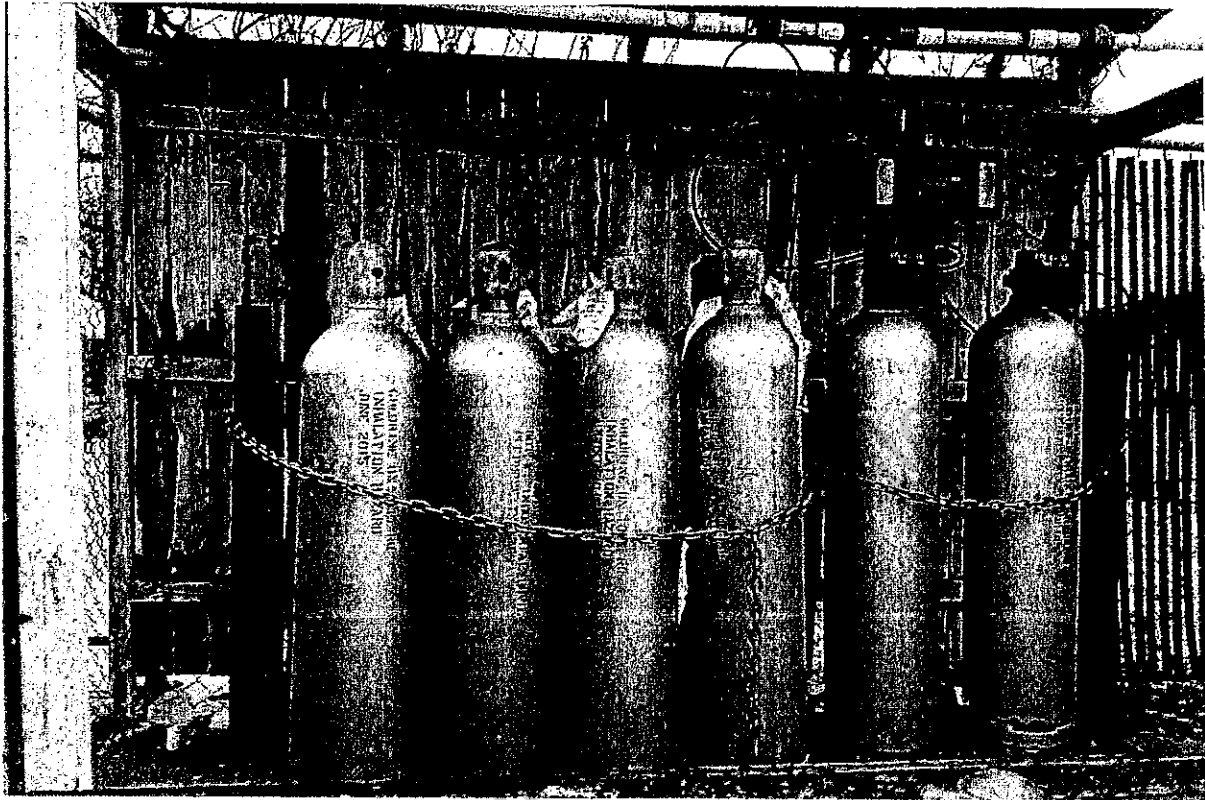


150lb Chlorine Gas cylinders with 24" dop into pump area. Bagged Chlorine salt partially exposed to elements



Working area to change out 150lb Chlorine Gas cylinders

CITY ADMINISTRATOR OF GLEN ROSE, TEXAS



150lb Chlorine cylinders exposed to elements

Somervell