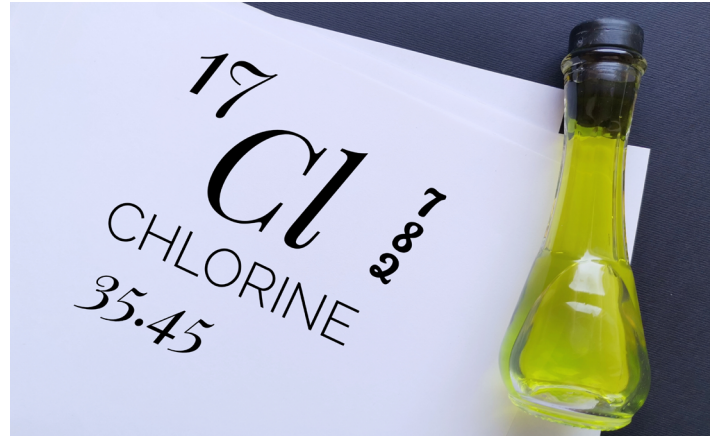


Many industrial and household products contain chlorine, including bleaches, cleaning products, and water purification tablets. Exposure to chlorine can irritate the skin, eyes, nose, and mucous membranes. If swallowed or inhaled, a chlorine-based product is toxic and can create a medical emergency. However, chlorine is safe when properly handled.



Chlorine

Chlorine is sometimes in the form of poisonous gas. Chlorine gas can be pressurized and cooled to change it into a liquid so that it can be shipped and stored. When liquid chlorine is released, it quickly turns into a gas that stays close to the ground and spreads rapidly.¹ Chlorine gas weighs about 2.5 times more than air and settles in low-lying areas unless sufficient wind disperses it.²

Chlorine gas is greenish-yellow at room temperature and the liquid is clear amber. Both have the distinctive smell of 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 is typically supplied in 150-pound or ton (2000-pound) containers. Liquid chlorine comes typically in 100-pound or 150-pound cylinders. Chlorine cylinders contain a fusible plug, located on the rear of the cylinder valve, which is designed to melt and release pressure should the temperature reach 158-165°F (70-74°C).



Safe Handling

These guidelines can help prevent injury and illness when handling chlorine:

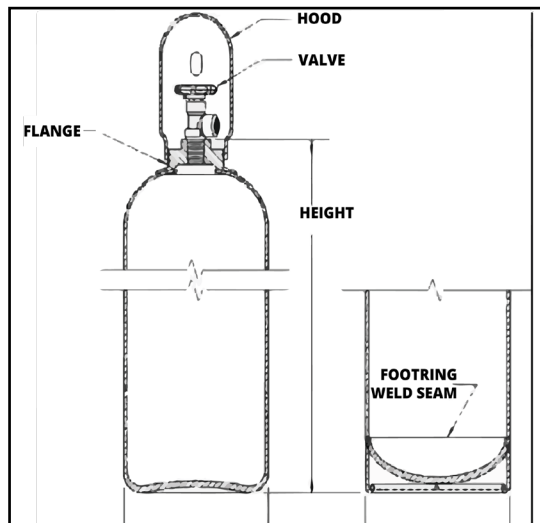
- **Provide training**
If a worker must handle chlorine, the worker needs training and supervision on chlorine safety. (See OSHA Standards [1910.1200](#) and [1910.119](#).)



- **Use respiratory protection.**
Ensure that workers wear an approved [self-contained breathing apparatus](#) in areas where chlorine is stored or used. (See OSHA Standard [1910.134](#).)
- **Store respiratory protection away from chlorine.**
Keep all breathing apparatus stored outside the chlorine area.
- **Prepare an escape plan.**
Have an emergency strategy in place should there be a chlorine emission. Remember to move uphill and upwind.
- **Never store chlorine near flammable materials.**
Chlorine is especially dangerous to place next to gasoline or other combustibles. It can spontaneously explode and create a toxic fire.
- **Never apply heat directly to a chlorine container.**
Chlorine plugs will melt at temperatures between 158°-165° F, resulting in a chlorine leak.³
- **Purge chlorine pipelines before welding.**
Chlorine reacts with many substances, usually as heat increases. For example, iron and steel ignites in chlorine at about 450°-500° F.⁴ To avoid combustion, never weld an empty chlorine pipeline without purging it with air first.
- **Install safety wash stations nearby.**
Ensure emergency showers and eyewash stations are located near chlorine equipment.
- **Use at least two people when handling chlorine.**
It is wise to use a buddy system when changing or handling chlorine. If one operator falls victim to hazardous vapors, the other can call for help. Do not work alone!
- **Avoid spraying water on leaking chlorine containers.**
Water and chlorine can create hydrochloric and hypochlorous acids.⁵ This mixture is corrosive and potentially oxidizing, which can make the leak worse.
- **Take shallow breaths.**
When entering an equipment area, breathe shallow breaths around the containers until sure a chlorine leak is not present.



- **Never drop or knock over a cylinder.**
Move chlorine cylinders with care using a hand truck that has restraint chains to secure the cylinder. Avoid contact between cylinders. Once the cylinder is in place, secure it with chains, chocks, or trunnions to prevent the cylinder from falling.
- **Check the weight rating on moving equipment.**
Do not move filled containers with equipment designed to handle less than two tons.
- **Avoid connecting more than two cylinders or containers to a common, non-automatic manifold.**
Non-automatic manifolds cannot mechanically open and close the valves to correct pressure. Therefore, placing more than two cylinders on a common manifold or connecting the valves of two or more containers to a non-automatic manifold can overload the capacity of the manifold, increasing the chances for accidental leaks.
- **Never tamper with a fusible plug.**
Fusible plugs (also called melt plugs) are activated by temperature, not pressure. If not tampered with, they can with relative safety, release gas before a hazardous reaction can begin.
- **Never lift cylinders by the hood.**
Always keep the hood in place, except when the cylinder is being used.





Personal Protective Equipment

Use chlorine in well-ventilated areas. Eyewashes, showers, and oxygen should be available and nearby. Self-contained breathing apparatus or canister-type respirators should be accessible. In addition, the following personal protective clothing should be worn:

- full face shield and non-ventilated chemical goggles;
- chemically-resistant rubber gloves;
- apron or jacket;
- long sleeves;
- long pants; and
- closed-toe shoes.



Safe Storage

It is important to have a separate room for chlorine. 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, walkways, and other occupied areas; and
- at least 60°F, but protected from extreme heat or direct sunlight.

In addition, the storage 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 runs whenever the room is occupied) that exchanges the air at least once a minute;
- an air intake near the ceiling that exhausts to the outside;
- 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; and
- a nonslip floor *without* a floor drain that could connect to other internal or external drainage systems.



Health Effects

- A low concentration of chlorine can result in burning eyes, nose, and throat; sneezing and coughing; and redness in the face.
- High concentrations of chlorine can result in tightness in the throat and difficulty breathing:
 - ◆ 1,000 parts per million (ppm) is fatal after a few breaths and
 - ◆ 35-51 ppm can be fatal even an hour later.⁶



Changing Cylinders⁷

Post the following instructions near the chlorinator. (These are generic instructions. Customize these instructions as needed.)

1. Turn the chlorine cylinder valve off (clockwise). **BE SURE THE CHLORINE CYLINDER VALVE IS CLOSED AND NOT STUCK IN AN OPEN POSITION.**
2. The chlorinator rate valve should be open about three turns.
3. Turn on the ejector water to produce a vacuum. The ball in the meter tube should drop to the bottom. The indicator should show red if the cylinder valve is closed tight.
4. Turn off the ejector water supply and wait five minutes until the indicator flag drops to show red. If the flag does not drop to show red, the likely cause is that the cylinder valve is not closed enough to create a vacuum-tight system.
5. **VERIFY** that the chlorine cylinder valve is closed before removing the chlorinator. Slowly turn the yoke screw loose to carefully remove the chlorinator from the cylinder valve. Place the cap and hood on the empty cylinder.
6. Secure a new full cylinder using a chain. Remove the hood and slowly remove the cap to be sure the new cylinder was closed properly.
7. Remove the masking tape from the chlorinator inlet (on new units only). Be careful not to let filter material and the Teflon disc and screen drop out of the inlet assembly.
8. Remove the old lead gasket and install a **NEW** lead gasket on the chlorinator inlet. Reusing the lead gasket will cause leaks!
9. With the new lead gasket in place, put the chlorinator on the cylinder and tighten the yoke screw with the provided wrench. (Do not use excessive force.)



Changing Cylinders (Continued)

10. Open the chlorine cylinder valve $\frac{1}{4}$ turn and CLOSE IMMEDIATELY. Check for leaks with ammonia using a plastic squeeze bottle to direct ammonia fumes around the lead gasket, cylinder valve, and two fittings on the chlorinator. If a leak is present, the ammonia will create white smoke. To repair a leak, connect the tubing from the ejector to the top fitting on the chlorinator. Then, turn on the ejector so the chlorine can be pulled through the ejector to the process water. **CORRECT LEAKS BEFORE PROCEEDING:**
 - a. Hook up the vacuum tubing from the ejector to the top chlorinator fitting.
 - b. Hook up the vacuum tubing from the chlorinator bottom fitting to vent to a safe outside location (not near walkways or ventilation intakes).
11. If no leaks are detected, open the chlorine cylinder valve $\frac{1}{4}$ turn and recheck for leaks (keeping the wrench on the cylinder valve).
12. Turn on the water supply to the ejector. The chlorinator meter should indicate chlorine flow. (It may be necessary to break the vacuum by removing the poly tubing from the top fitting on the chlorinator and reconnecting it.)
13. Adjust the feed rate using the rate valve on top of the chlorinator and test for free or total chlorine.



Changing Ton Containers⁸

Post the following instructions near ton containers. (It is not necessary to remove the regulator from the ton adapter when changing ton containers. If it is removed, a new lead gasket must be used on the regulator inlet adapter every time it is reinstalled on the ton adapter.)

1. Using a cylinder wrench, turn the ton container valve stem clockwise to close it. Be certain the valve is closed before removing the regulator/ton adapter combination.
2. With the water supply set to ejector (vacuum to regulator), ensure that the rotameter ball drops to zero, meaning there is no residual gas flowing through the regulator.
3. If no gas flow exists, remove the regulator/ton adapter assembly by loosening the ton adapter yoke handle and lifting the assembly from the ton container valve. Turn off the water supply to the ejector.
4. Replace the empty ton container with a full one. Remove the protective hood and MAKE SURE the container valves are



Changing Ton Containers

(Continued)

- aligned vertically. VERIFY the upper (gas) valve is closed and remove the valve cap. Make sure the valve outlet is clean and free of dirt and residue.
5. REMOVE THE OLD LEAD GASKET FROM THE TON ADAPTER INLET AND DISCARD IT. Replace it with a new lead gasket. NEVER re-use an old lead gasket.
 6. Position the regulator/ton adapter assembly on the gas (upper) valve making sure the lead gasket is in place. Tighten the ton adapter yoke handle until secure and the lead gasket is slightly compressed.
 7. Open the cylinder valve slightly and quickly re-close it.
 8. Test for gas leaks using accepted procedures.
 9. If a leak is detected MAKE SURE the gas valve is closed and repeat steps #2 and #3 of this procedure. Then remove the regulator/inlet adapter assembly and correct the problem causing the leak. Once the problem is corrected, start with step #5 of this procedure and continue through the remaining steps.
 10. After ensuring no leaks exist and the regulator/inlet adapter assembly is properly installed, open the ton container valve approximately 1/4 turn. Always keep the cylinder wrench on the container valve when in use.
 11. Turn on the ejector water supply and set the proper feed rate on the regulator.



First Aid⁹

Inhalation

- Remove the victim from the contaminated area.
- Keep the victim warm and in a reclined position with head and shoulders elevated.
- Give artificial respiration if needed.
- Give oxygen as soon as possible.
- Call emergency personnel or a physician immediately.

Skin Contact

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



First Aid

(Continued)

Eye Contact

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



Emergency Numbers

Post emergency contact numbers at several locations in the plant and office. Include contact information for the local fire department, police, and County Emergency Management Office.

To report the release of a hazardous substance, contact the Texas Emergency Oil Spill and Hazardous Substance 24-Hour Reporting Service at **800-832-8224**. This phone number is supported by several Texas emergency reporting agencies including the [Texas General Land Office](#), [Texas Commission on Environmental Quality](#), and [Railroad Commission of Texas](#).

For additional resources on chemical or hazard communications safety, download or stream any of DWC's free [publications](#) or [workplace safety videos](#).

References

- ¹ Centers for Disease Control and Prevention, "Facts about Chlorine," Webpage. <https://emergency.cdc.gov/agent/chlorine/basics/facts.asp>. Accessed December 21, 2021.
- ² Washington State Department of Health, Division of Environmental Health, Office of Drinking Water, "How to Handle Chlorine Gas Safely," PDF. <https://www.doh.wa.gov/portals/1/Documents/pubs/331-364.pdf>. Accessed December 21, 2021.
- ³ Hydro Instruments, "Chlorine Handling Manual," p. 9, PDF. <http://www.hydroinstruments.com/files/Chlorine%20Handling%20Manual%202016%2005%2006.pdf>. Accessed December 21, 2021.
- ⁴ Workers Compensation Board, WorkSafeBC, "Safe Work Practices for Chlorine," p. 21, PDF. <https://www.worksafebc.com/en/resources/health-safety/books-guides/safe-work-practices-chlorine?lang=en&direct>. Accessed December 21, 2021.
- ⁵ CAMEO Chemicals, "Chlorine," Website. <https://cameochemicals.noaa.gov/chemical/2862>. Accessed December 21, 2021.
- ⁶ Washington State Department of Health, Division of Environmental Health, Office of Drinking Water, "How to Handle Chlorine Gas Safely," PDF. <https://www.doh.wa.gov/portals/1/Documents/pubs/331-364.pdf>. Accessed December 22, 2021.
- ⁷ Hydro Instruments, "Changing Cylinders Safely," PDF. <http://www.hydroinstruments.com/files/Changing%20Cylinders.pdf>. Accessed December 22, 2021.
- ⁸ Chlorinators Incorporated, "Ton Container Changing Procedure for Chlorinators," PDF. https://d2fjil0fhjuhkd.cloudfront.net/regal/pdfs/ton_cont_changing.pdf. Accessed December 22, 2021.
- ⁹ Washington State Department of Health, Division of Environmental Health, Office of Drinking Water, "How to Handle Chlorine Gas Safely," PDF. <https://www.doh.wa.gov/portals/1/Documents/pubs/331-364.pdf>. Accessed December 22, 2021.



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