



# How to Handle Chlorine Gas Safely

Chlorine gas is greenish-yellow and smells like bleach. It is highly corrosive and irritating to the eyes, nose, throat, and mucous membranes. It reacts violently with petroleum products such as gasoline, diesel, oil, solvents and turpentine. Chlorine gas is about 2.5 times heavier than air and will settle in low-lying areas unless there is sufficient wind for dispersal. It can form phosgene (a toxic and corrosive gas) in the presence of carbon monoxide from a fire, and sulfuryl chloride (a toxic corrosive gas) in the presence of sulfur dioxide from auto exhaust.

Despite these hazards, chlorine does not have to be a serious risk to those who handle it if they are properly trained. Although not a substitute for formal training, this publication discusses chlorine handling and safety practices, particularly for small water treatment systems.



## Emergency Help

Don't wait until you need a phone number and find yourself scrambling through phonebooks or scraps of paper. Make a list of all relevant contact numbers and keep them posted at several locations in the plant and office. (See page 3.) Your list should 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. Posting these numbers is especially important if you don't have 911-service in your area. Keep the numbers updated.

Inform local police and fire departments of the possible hazards associated with all the chemicals used in your plant, especially chlorine, so they can be prepared in the event of an emergency. Organize escape plans from areas where there might be chlorine emission. Taking short cuts may not only be dangerous, they could be deadly.

## Protective Equipment

Systems using gas chlorine should have respiratory protection equipment that meets National Institute for Occupational Safety and Health requirements available where chlorine gas is handled. This equipment should be stored at a convenient location but not inside any room where chlorine is used or stored. The unit(s) should use compressed air, have at least a 30-minute capacity and be compatible with – or exactly the same – as the units used by the fire department that will respond to your water treatment plant. The unit(s) should also be tested and refreshed on a regular basis. Ask your fire department to inspect and test the unit(s).

You should also give each operator at least one pair of rubber gloves, an apron or other protective clothing, and goggles or facemasks. The system should install a deluge shower and eye-washing device where strong acids and alkalins are used or stored. In addition, the system should have a water-holding tank that allows water to come to room temperature in the water line feeding the deluge shower and eye-washing device.

### **The Buddy System**

Having a second person at the plant when changing or handling chlorine is ideal. If one operator is incapacitated, the other can call for help. If you are working alone, let someone know when you are handling chlorine. Right before going into the chlorine room, call someone familiar with your work and location and then, when finished, call back so they know that you are all right.

### **Separate Chlorine Room**

A separate room for chlorine, especially gas chlorine, is important. Check with local building officials and the Chlorine Institute for requirements on inside storage and use of chlorine. The chlorine room should be enclosed, sealed and separated from other operating areas. It should have a shatter-resistant inspection window mounted in an interior wall that is built to seal all openings between the chlorine room and the remainder of the plant. The room should have doors equipped with panic hardware that opens outward to the building exterior providing an easy escape.

Locate the chlorine room on the downwind side of the building—away from entrances, windows, louvers, walkways and so on. The room must be equipped with a ventilating fan that provides one complete air exchange per minute when the room is occupied. The fan should move air as far as practical from the door and air inlet, and discharge to the outside atmosphere. In addition, louvers should facilitate airtight closure for air intake near the ceiling and exhaust near the floor.

Locate separate switches for the fan and lights outside the chlorine room and at the inspection window. Protect outside switches from vandalism. Provide a signal light indicating fan operation at each entrance when the fan can be controlled from more than one point.

The floor of the room should be finished in a non-slip surface, and floor drains are discouraged. If a floor drain is used, it should discharge to the outside of the building and should not be connected to other internal or external drainage systems. The end of the drain should discharge to the outside atmosphere, above-grade, so it does not contaminate air inlets or entrance doors to any rooms or structures. The room should be at least 60° F and protected from excessive heat.



### **Chlorine Leak Detection**

The room should have continuous leak detection equipment with sound and visual warnings that can be heard and seen throughout the treatment plant. This unit should be calibrated and tested at regular intervals and documented. A bottle of ammonium hydroxide, 56 percent ammonia solution, should be available for chlorine leak detection. A leak repair kit approved by the Chlorine Institute should be provided (Kit A for cylinders and Kit B for containers).

## Safety tips for 100- and 150-pound cylinders and one-ton containers

- Never lift a cylinder by its hood.
- Always keep the hood in place, except when the cylinder is being used.
- Never expose cylinder to heat or direct sunlight.
- Never drop a cylinder, or knock a cylinder over.
- Never tamper with a fusible plug.
- Always keep empty cylinders separate from full ones.
- Always secure empty and full cylinders with a cable or chain.
- Never store liquid or gas chlorine with ammonia.
- Do not move full one-ton containers with equipment designed to handle less than two tons.
- Do not 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.
- Do not spray water on a leaking container. It will make the leak worse.
- Take shallow breaths in the chlorine room until you are sure there is not a chlorine leak.

### 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:

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#### Police:

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#### County Emergency Management Office:

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#### Department of Health Office of Drinking Water:

**Eastern Region, Spokane**  
(509) 456-3115

**Northwest Region, Kent**  
(253) 395-6750

**Southwest Region, Tumwater**  
(360) 236-3030

## Chlorine Resources

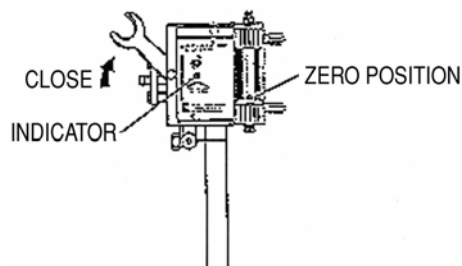
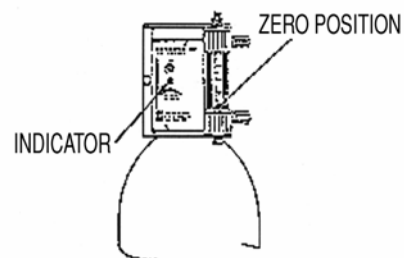
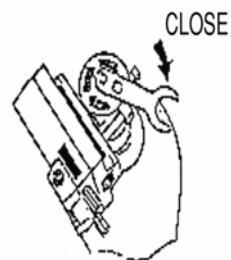
**1,500 pounds or more:** The federal Occupational Safety and Health Administration (OSHA) and, in Washington, the state Department of Labor and Industries (L&I) regulate chlorine quantities of 1,500 pounds or more. For more information on requirements in Washington, call L&I at (360) 902-5478.

**2,500 pounds or more:** The U.S. Environmental Protection Agency regulates chlorine quantities of 2,500 pounds or more.

**The Chlorine Institute** has a variety of 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.)

## 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 float flutters or does not drop to zero, the valve may not be 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.
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. Crack open gas cylinder valve and close quickly. Check for leaks. If leaks exist, turn on ejector and repeat steps 2, 3, 4, and correct leaks.
10. Leak test solutions: Chlorinator/Sulfonator- Ammonia: Ammoniator-Bleach.
11. Open gas cylinder valve, about ¼-turn only, and leave cylinder wrench on valve.
12. Turn ejector.

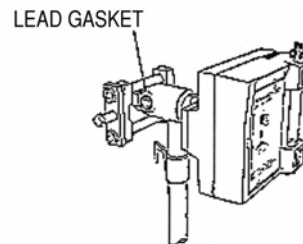
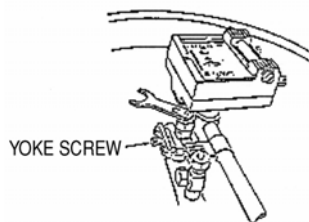


### Notes:

- 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.

## Changing Ton Cylinders

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.

## Special Recognition

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