Chlorine gas has a characteristic bleach odor and is yellowish in color. 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 it also can form sulfuryl chloride (a toxic corrosive gas) in the presence of sulfur dioxide from auto exhaust.

Despite its 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 how-to article discusses chlorine handling and safety practices, particularly for small water treatment systems.
**Emergency Help**

Don’t wait until you need a phone number and then 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. These phone numbers should include the fire department, police department, county emergency management office, and state regulatory agency. Posting these numbers is especially important if you don’t have 911 service in your area. Keep the numbers updated.

Inform the local police and fire departments of the possible hazards of all of 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**

Your water system should provide each operator at least one pair of rubber gloves, a dust respirator that meets the National Institute for Occupational Safety and Health (NIOSH) requirements, an apron or other protective clothing, and goggles or face masks. 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 will allow water to come to room temperature in the water line feeding the deluge shower and eye-washing device.

The system also should make sure that respiratory protection equipment, meeting NIOSH requirements, is 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 units used by the fire department responsible for responding to the water treatment plant. The unit(s) should also be tested and refreshed on a regular basis. Ask the local fire department that will respond to any emergency to inspect and test the unit(s).

**The Buddy System**

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

**Separate Room Please**

A separate room for chlorine, especially gas chlorine, is important and most states require it. This room should be enclosed, sealed, and separated from other operating areas. It also should have a shatter-resistant inspection window mounted in an interior wall that is constructed so that all openings between the chlorine room and the remainder of the plant are sealed. However, the room should have doors equipped with panic hardware assuring a ready means of escape. These doors should open outward to the building exterior.

The system should locate the chlorine room on the downwind side of the building—away from entrances, windows, louvers, walkways, etc. It must equip the room 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. Also, louvers should facilitate airtight closure for air intake and exhaust.

Locate separate switches for the fan and lights outside of 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 as not to contaminate air inlets or entrance doors to any rooms or structures. The room should be heated to at least 60 degrees F and be 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. Where ton containers are used, a leak repair kit, approved by the Chlorine Institute should be provided.

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 or knock over a cylinder.
- Never tamper with a fusible plug.
- Always keep empty cylinders separate from the full ones.
- Always secure the 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.
- Spraying water on leaking containers will make the leak worse.
- When entering the chlorine room, take shallow breaths until you are sure that there is not a chlorine leak.

Fire:

Police:

County Emergency Management Office:

State Regulatory Agency:

Don’t wait until you need a phone number and then 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.
Changing 100- and 150-Pound Cylinders

1. Turn valve stem clockwise to close cylinders valve.
2. Allow float in flow meter to drop to zero. Indicator on front of gas feeder should indicate no gas.
3. Wait approximately 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 gas cylinder
7. Remove old lead gasket. Inspect and clean mating surfaces of gas feeder and valve. Install new unused lead gasket.
9. Crack open gas cylinder valve and close quickly. Check for leaks. If leaks exist, turn on ejector and repeat steps number 2, 3, 4, and correct leaks.


10. Open gas cylinder valve, approximately one-quarter of a turn only, and leave cylinder wrench on valve.
11. 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.
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 approximately 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.
7. Remove old lead gasket. Inspect and clean mating surfaces of gas feeder and valve. Install new unused lead gasket.
9. Be sure heater is plugged in and operating. An operating heater provides the heat of vaporization to any trapped liquid.
10. Crack open gas cylinder valve and reclose quickly. Check for leaks. If leaks exist turn on ejector and repeat steps number 2, 3, 4, and correct leaks.


11. Open ton container valve slowly approximately 1.4 turn only and leave cylinder wrench on valve.
12. 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.

References:
Public Water System Design Standards, 64CSR77, West Virginia Bureau For Public Health, Office of Environmental Health Services, Environmental Engineering Division, Section 7.
Occupational Safety & Health Bureau, Montana Department of Labor & Industry. Chlorine Safety.

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