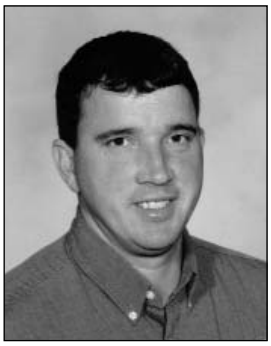
By Lonnie Boller

Practice safe handling, operation for all forms of chlorine

All cities and RWDs in Kansas that produce water from wells or have a treatment plant have been required for many decades by the State to chlorinate drinking water for full-time disinfection. Recently, a few systems have started adding ozone or chlorine dioxide as the primary disinfection. However, all systems are still required to have a chlorine residual in the distribution system. It is this residual that makes chlorination uniquely better than other disinfection processes. Regardless of the choice to achieve disinfection of potable drinking water, safe handling and use of the chemicals and process equipment warrant full-time attention.



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The three forms of chlorine added to the water for chlorination are gas chlorine, liquid sodium hypochlorite, and solid/powder calcium hypochlorite. Gas chlorine and liquid hypochlorite are the most common forms of chlorine used in Kansas. Gas chlorine is mainly used by larger water systems because of the cost savings. Liquid sodium hypochlorite is used by smaller systems to avoid the safety hazards involved with gas chlorine. Also, the increased costs for small systems of the liquid sodium hypochlorite are very small as compared to gas chlorine.

Liquid sodium hypochlorite comes in two commonly used strengths. An approximate 10% solution can be purchased from a chemical supplier. Also, common household bleach can be purchased in strengths of approximately 5.25%. Either strength works well. The selection of which strength to use should be based on costs, sizing of chemical feed pump, and usage.

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Because of the risks involved with gas chlorination, some small systems that used gas chlorine have switched to sodium hypochlorite. Sodium hypochlorite is as effective as gas chlorine when used to disinfect water, yet there are fewer safety concerns than with gas chlorine. Also, a sodium hypochlorite spill is more easily handled because the spill can be quickly cleaned up by simply diluting it with water.

Small systems that chlorinate low producing wells of less than 100 GPM capacities are good candidates for switching from gas chlorine to liquid sodium

Manager Dwight Scholz, Atchison Cons. RWD 5 at Lancaster, stands next to the chlorination equipment at the RWD's main booster station. The RWD is switching from gas chlorine to liquid.

hypochlorite. Also, consecutive systems that rechlorinate water purchased from another water system may also want to consider using liquid sodium hypochlorite rather than gas chlorine.

Chemical feed pumps

Adding sodium hypochlorite for disinfecting water requires the use of liquid chemical feed pumps. The two types of pumps commonly used are piston and diaphragm pumps; both provide accurate delivery. Another type of pump that can be effectively used is the peristaltic pump. See the July 2005 issue of *The Kansas Lifeline* for more information on those types of pumps.

The pumping capacity of the chemical feed pump and the chemical dosage rate are used to determine whether the liquid chemical is fed with or without dilution with water.

The chemical feed pump should be adjusted to provide a chemical dosage that gives a chlorine residual of 1.0 - 3.0 mg/l at the point of application. Also, if a system is rechlorinating water that has a combined chlorine residual from another water system, additional attention must be given to ensure that over-chlorination does not occur.

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Advantages/disadvantages of sodium hypochlorite

Advantages

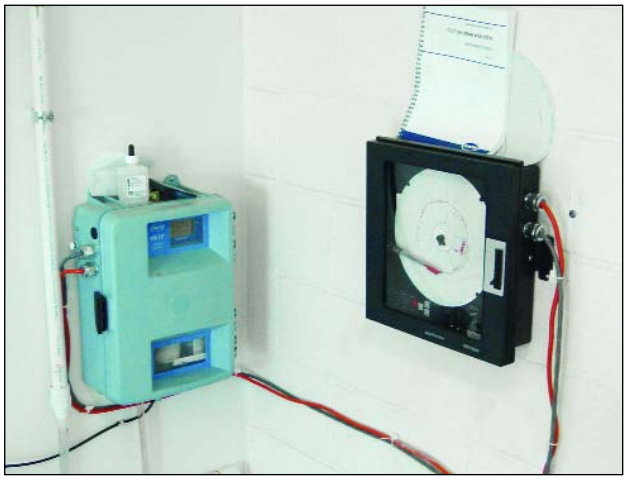
Sodium hypochlorite can be easily and safely transported and stored. It can be purchased at a local grocery store or discount store as chlorine bleach at 5.25% solution strength. Feeding is simple with chemical feed pumps that are much less expensive and much less complicated than gas chlorination equipment. Sodium hypochlorite is as effective as chlorine gas for disinfection. It does not have the extreme corrosive effect on metal and electrical equipment that gas chlorine leaks or releases have. Most of all, it is much, much safer for the operators handling the chemical as opposed to gas chlorine.

Disadvantages

Sodium hypochlorite must be handled safely; it is corrosive. While working with sodium hypochlorite, safety measures such as eye protection and rubber gloves should be taken to protect

workers against spill. Sodium hypochlorite solutions deteriorate at various rates depending on strength of the solution or presence of metal especially iron. The stronger solutions deteriorate faster than weaker solutions. Higher temperatures increase the deterioration rate. The presence of metal increases the rate sodium hypochlorite deteriorates.

Solutions should be kept away from direct sunlight, preferably in the dark. Solutions should be purchased in quantities so as to limit the storage to no longer than 40 days. Solution strengths no greater than 10% should be purchased. For example, a new 10% solution could loose one-fifth its strength in the first 60 to 80 days after production. Beyond that timeframe, the rate of strength loss decreases. Stronger solutions have a much greater rate of loosing strength.



When this chlorine monitor detects a chlorine residual of less than 2.0 mg/l, the feed pump turns on to add sodium hypochlorite to bring the residual up to 3.0 mg/l.

Assistance with change-overs

Recently, KRWA assisted Atchison Cons. RWD 5 in changing from a gas chlorine system to a sodium hypochlorite system. RWD 5 purchases water from the City of Atchison. The RWD was concerned about issues of safety and corrosion with its use of gas chlorine. When the gas chlorination system began having operational problems, the district decided to make the change.

The RWD's large elevated storage tank many miles out in the system looses chlorine residual especially during the months of late summer and early fall. The district has a booster station nearby where a rechlorination system is located.

A liquid chemical feed pump, solution tank, and a chlorine analyzer chart recorder were installed to replace the gas chlorination system. When the analyzer detects a chlorine residual of less than 2.0 mg/l, the feed pump will add sodium hypochlorite to bring the residual up to 3.0 mg/l.

In another case, Pottawatomie County RWD 2, recently had an emergency with a chlorine gas leak at its chlorination building. Fortunately, the leak was not in a populated area. When KRWA received a call about the situation, I responded to assist them.

After putting on a self-contained breathing apparatus, I went into the chlorination building to shut-off the chlorine gas cylinder that was being used for chlorination and to remove the chlorine regulator. I then moved this cylinder outside. After checking this cylinder, regulator, and associated piping for a leak with ammonia vapor, I determined

Chlorine safety training seminars popular

The topic of safe handling of chlorine and operation of chlorination systems is critical to water and wastewater utility operators. KRWA attempts to address the need to education and information about chlorination by providing a variety of training courses. From March 1, 2006 to July 1, 2006, KRWA has provided three sessions on the subject of chlorine safety. These sessions were attended by 61 people, representing 26 cities and 12 RWDs or other public water systems.

Future training sessions will include the topic of chlorination, chlorine safety and Safe Drinking Water Act regulations. Check out KRWA's training calendar which is posted on the KRWA Web site at www.krwa.net, then under "training".

KRWA appreciates presentations by Randy Dye of Brenntag Southwest, Nowata, Okla. on the topic of chlorine safety. Sessions were conducted at La Cygne, Marysville and Cimarron in 2006.

that none of these were leaking chlorine gas.

I then checked the stored gas chlorine cylinders and found one of them was leaking. I moved the leaking chlorine gas cylinder outside. The leaking cylinder was by then almost empty.

Leaking chlorine gas is a big safety issue for small systems such as Pottawatomie RWD 2 which has only one operator. Anytime an operator is working with chlorine gas there should be another person present for assistance if an emergency develops. Operators for Kansas water systems have had to be hospitalized because of accidents involving the inhalation of chlorine gas.

KRWA assisted Pottawatomie RWD 2 in changing from injecting gas chlorine to adding sodium hypochlorite. Although there are safety issues with sodium hypochlorite; its use is much, much safer than chlorine gas.

For system operators and others wanting more information on the topics discussed here call KRWA at 785/336-3760 or e-mail krwa@krwa.net. To register for training sessions mentioned in the sidebar at the left go to www.krwa.net, click on "training" to find the calendar and registration page.