By Lonnie Boller, Technical Assistant

Rechlorination – an Obvious Remedy to Improve Residuals for Many Water Systems

Ellsworth RWD No. 1 employees Quintin Vague and Josh Ranker (inside the pit) work with KRWA Tech Assistant Lonnie Boller in setting up rechlorination near Waldo, KS.

It is the primary concern of every public water system to ensure that the water provided to customers for drinking and cooking does not contain any disease-causing microorganisms that can cause sickness. The disinfection of the water provided by water systems is critical to ensuring public health.

Although several methods eliminate disease-causing microorganisms in water, chlorination is the most commonly used. Chlorination is effective against many types of bacteria. Combined with filtration in surface water treatment plants, chlorination is an excellent and efficient way to disinfect drinking water supplies. The level of chlorine in the drinking water is measured by the residual and the residual is the hallmark test of the safety of the drinking water.

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A case study – Osborne RWD 2

In the summer of 2014, the staff at Kansas Rural Water Association (KRWA) again worked with many water systems to help them improve chlorine residuals. In July, KRWA worked with the small rural water district, Osborne RWD 2. Located north of Hays, it sits on the very upper end of Ellsworth RWD 1 that supplies water to the district. Osborne RWD 2 is a very small system serving approximately 20 farmsteads and 30 agricultural connections. An average use is about 12,100 gallons per day. It is often higher during hot days or periods of drought. The contract between the supplier, Ellsworth RWD 1, and the purchaser, Osborne RWD 2, limits the water flow to only 25 gallons per minute.

This summer, as in many previous times, Osborne RWD 2 found its system having very little or no chlorine residual. KRWA was contacted and requested to help remedy the problem. Although not a new problem, this would be the first time that KRWA would assist with the installation of rechlorination in Ellsworth RWD 1. Prior assistance from KRWA required KRWA staff member Doug Guenther to sometimes climb the RWD's storage tank and add chlorine directly to the tank.

My opinion remains that the loss of residual was caused by biofilms in the distribution system and especially the standpipe. Other complicating factors include that the Osborne RWD 2 is limited to a very low flow from the supplying system that also experiences high usage and reaches peak capacity during summer months. It is virtually impossible for Osborne RWD 2 to consider flushing their storage tank with such a low flow rate available to refill the district's standpipe. It was for these reasons that KRWA suggested installing rechlorination.

Among the options that are normally considered are having the supplying system also flush water to improve chlorine residuals. However, it is not prudent for a system as large as Ellsworth RWD 1, which often operates at peak capacity, to flush treated surface water. There are five storage tanks in use in the Ellsworth RWD 1 system before the water supply reaches Osborne RWD 2. The distance from the water treatment plant at Kanopolis Reservoir to the point of connection for Osborne RWD 2 is more than 81 miles.

Due to the way the Osborne RWD 2 system was designed, with no booster station, KRWA found that installing rechlorination would not be easy. As Ellsworth RWD 1 also had low residuals in its distribution system, the decision was made to install a portable rechlorination station at a pressure booster station on the Ellsworth RWD 1 system in the area where the pipelines would supply Osborne RWD 2 and benefit some other customers of Ellsworth RWD 1 including other purchasing systems such as the small communities of Waldo and Paradise. The suggestion for rechlorination was supported by the Kansas Department of Health and Environment. Within a couple of days, the project was underway.


Few water system tech assistants pull a supply trailer and portable shop such as KRWA's Lonnie Boller does.

The rechlorination station that KRWA was able to provide for use is a five-foot wide by 10-foot long, all aluminum building. Having this building available was a project that was supported by previous staff members at the Bureau of Water. In addition to the enclosed building, the project would involve two feed pumps, some supply tanks, and a trailer loaded with parts and fittings to make the installation. The project was completed efficiently by KRWA staff with the assistance of staff members from Ellsworth RWD 1. The district staff excavated the pipeline so that taps could be made for the injection of ammonia and chlorine. Pumps were set and calibrated. Ellsworth RWD 1 provided an electrician who installed control wiring so the pumps could operate when the pressure booster pumps started. Clorox bleach, which is NSF approved, was added to the chlorine tank and ammonia sulfate was placed in the ammonia tank. The feed rates were calibrated to add 2 mg/l. The residuals from that point in the Ellsworth RWD 1 system improved

immediately. The boil water advisory was lifted in the Osborne RWD 2 system when good residuals were achieved.

Widespread problem

Many water systems, from big to small – cities and RWDs, have had difficulty maintaining chlorine residuals. Each system is unique to some extent and the remedies are not going to be universal. Some people will advocate adding a mixer to a storage tank. KRWA cautions systems on mixers because, while a mixer may prevent or reduce stratification in the tank, it will not improve residuals if the chlorine level is low or nonexistent in the tank. In fact, it may actually reduce the water quality that leaves the tank. The critical issue is whether there is actually chlorine residual in the tank at all.

Operators should check chlorine residuals at storage tanks to determine water quality. Residuals should be regularly taken and recorded to monitor the possible loss of chlorine. When chlorine loss occurs in a storage tank, an appropriate response is to thoroughly overflow the tank and check for chlorine residuals in the overflow. The overflow should continue until the residuals improve to 2 mg/l or greater. Having good residuals in the tank will in turn improve the chlorine residuals in the distribution system. Of course this doesn't apply to a tank that is designed to fill at the top and draw off of the bottom. But instead of "flushing the tank", it's more appropriate to consider overflowing the tank to remove the poorer quality water that is at the top of the tank.

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Chlorine loss is usually caused when nitrifying bacteria grow and form biofilms in the storage tanks and waterlines. These bacteria are not detected in the required bacteriological sampling and analyses that are conducted on water systems.

Rechlorination can be an option for many systems. Over the past few years I have set up many rechlorination systems to help improve chlorine residuals. It is needed when adequate chlorine residuals cannot be maintained either due to low flow rates in the distribution system causing long detention times or because of low residuals being provided from the supplying system.

It is also much easier to install rechlorination at a pump house than on a water line or in a storage tank. Most rechlorination can be easily installed at a pump house because there is a known flow rate.

The cost of installing a rechlorination system can vary. For a system with a pump house that was set up for chlorination, then adding the additional ammonia is minimal. I estimate the high-end cost of a rechlorination system to be $20,000. While that may still seem substantial, it is by far less than the cost of purchasing water that otherwise is flushed by many systems. Most of the rechlorination systems that KRWA staff have installed to improve chlorine residuals use positive displacement pumps with supply tanks.

If your system is experiencing low or no residual chlorine in your distribution system or water storage tanks and you are interested in assistance in solving the problem, please contact the Kansas Rural Water Association at 785-336-3760. KRWA staff are ready, willing and able to help with that or any other water or wastewater-related issue.

Lonnie Boller is a Technical Assistant at KRWA. He has been employed by KRWA since 2001. Lonnie is a Class II certified operator; he previously was Water Plant Supervisor for the City of Horton. He has also attended and completed training at the University of Kansas Law Enforcement Training Center.