

# Atchison Cons. RWD 5 typical of systems trying to maintain adequate chlorine residuals

One of the major responsibilities and requirements of any water supply system is to maintain chlorine residuals in the distribution system. A chlorine residual is important because its presence is an indicator that contamination has not occurred and the water is safe to drink. State regulation requires that a minimum of 1.0 mg/l combined chlorine residual or 0.2 mg/l of free chlorine residual be maintained throughout and at the far ends of the distribution system. This can be a difficult challenge when a consecutive system does not have direct control over chlorination of its water. All water supply systems are required to take at least one daily chlorine residual in the distribution system. These residuals should be taken at different locations, rotating throughout the system to ensure that all parts of the distribution system have adequate chlorine residuals. These residuals should be recorded in a log or other suitable manner so that it is documented that the residuals were taken and were adequate. These records must be maintained by the utility for at least ten years as required by state regulations. The Atchison Cons. RWD 5 has two online chlorine analyzers and also tests out in the distribution system.

Atchison Cons. RWD 5 is a public water system that purchases or otherwise receives all of its finished water from the city of Atchison public water supply system. Most consecutive systems do not chlorinate, that is, rechlorinate the water they receive from their supplying system. Because Cons. RWD 5 has had problems keeping chlorine in its distribution system, the district began to rechlorinate in the spring of 2008 to gain some control over the amount of chlorine in the water.

Over the last two years, Atchison Cons. RWD 5 has experienced reduction in chlorine residuals during summer months. In 2008, the city of Atchison chose not to do a free chlorine burn-out. This may have caused more biofilms to form, which in turn, reduced water quality. In most situations, the major cause of loss of chlorine residual in the distribution system and storage facilities is due to biofilms.

**Most consecutive systems do not chlorinate, that is, rechlorinate the water they receive from their supplying system.**



This photo shows the rechlorination system at Atchison Cons. RWD 5. The system adds six percent bleach to increase the chlorine residual. Ammonia is also added.

Biofilms are microorganisms that grow on the inside surfaces of water lines and storage tanks. Chlorine loss occurs when the chlorine reacts with the biofilms. Although this loss of chlorine residual due to biofilms can happen at any time, it is much more likely to occur when the water is warmer. Systems using water from a surface source are particularly susceptible during the summer and early fall months. Also, the problem most likely first occurs, and may only occur, in storage tanks where the water is not exchanged enough and warms. Biofilms are also more likely to occur if ammonia has been added to the water. Under certain conditions ammonia can provide a source of food for the growth of nitrifying bacteria biofilms; the process is called nitrification. Also, ozone changes the form of natural organics in the surface water to a more biodegradable form (called assimilable organic carbon or

AOC) that is more readily used as a food source for aerobic bacteria biofilms.

In 2009, Atchison Cons. RWD 5 began feeding chlorine and ammonium sulfate solution at both pump houses to increase chlorine in the system. Working with the operator and manager Dwight Scholz, we mixed one pound of dry ammonia sulfate per gallon of water. This solution was added to the water entering the pumping station. This solution was injected with a LMI pump. The amount of ammonia fed is determined by the desired increase in the residual from rechlorination. It was decided to add the ammonia to the water entering the pump station – that is, the ammonia is added before rechlorination. Whenever possible, it is important in rechlorination to add the ammonia before the chlorine is added. Otherwise, the chlorine added might be in excess of the free ammonia available to react before ammonia is added. In that case, the resultant chlorine residual may in fact be lower than the overall residual that would be expected with that level of chlorine added. Since beginning the addition of ammonia to the water, the combined chlorine residuals have been increased enough to maintain required chlorine residuals in Atchison Cons. RWD 5. Also the ability to maintain constant residuals has been gained. The district also feeds 6% bleach to increase the chlorine after the ammonia is added.

**Atchison Cons. RWD 5 has installed continuous chlorine analyzers and recorders to monitor the residuals at its pump house.**

Atchison Cons. RWD 5 has for years had a part-time operator. At the time this article was being prepared (October 2009), the district's board was close to deciding on the employment of a full-time operator.

Regaining a chlorine residual in a sprawling distribution system requires days of flushing, overflowing tanks, etc. to try to increase the residual. That flushed water has to be purchased at \$1.56 per thousand. We flushed three million gallons to increase the residual.

With a full-time operator, I believe the increased oversight of the operations will allow the district to intervene in a developing problem much earlier. Doing so should reduce the severity of the problem and save water that often needs to be flushed.

Please give KRWA a call if you have concerns about loss of chlorine residual in your system or any other system operation or maintenance questions.

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### Rechlorination can be a challenge

Recently the city of Atchison started a free chlorine burn-out; this maintenance continued for six weeks. A burn-out occurs when a free chlorine residual, instead of the regular combined chlorine residual, is maintained in the distribution system and storage. Free chlorine residual is a stronger disinfectant and kills the biofilms much better than the combined chlorine residual. This has helped the city increase the chlorine residual. However, Atchison Cons. RWD 5 still plans on adding ammonia and chlorine to increase the chlorine residual to ensure it is adequate to the far ends of the district's pipelines. The RWD hopes it will not need to rechlorinate during winter months.

Rechlorination of combined chlorine residual is a difficult and somewhat complex process. The chemical reactions must be understood. Equipment and feed rates must be correct. The process must be monitored daily and adjusted if necessary. Operators who understand this know that it is not "merely adding chlorine to the water." Atchison Cons. RWD 5 has installed continuous chlorine analyzers and recorders to monitor the residuals at its pump house.

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