Rural Water Training & Tech Assistance Program For SDWA Compliance

Small Water System Case Study

★ City of Effingham

City of Effingham Superintendent James Ellis and KRWA Technical Assistant Lonnie Boller add sodium hypochlorite to Well No. 5 to treat an iron bacteria problem.

City of Effingham, Kansas
Jefferson County
Population Served: 540

Water System Maintenance
Quality and Quantity

Background

The city of Effingham is located in northeast Kansas. Its population is approximately 540; the city has approximately 250 water service connections. The city's water source is three groundwater wells, which produce water that has high iron concentrations. In addition to chlorine, the city adds a polyphosphate, which sequesters iron and manganese to help prevent "red water" at the customers' taps and scale formation in the waterlines.

Water Well Maintenance

Water wells that have high iron concentrations tend to stimulate bacterial growths that build up on the well screen and in the aquifer near the screen. This buildup can become excessive and reduce the production capacity. Also, the bacterial buildup can create conditions that may result in microbial-induced corrosion of well screens, well casings, pumps, and motors. Additionally, discolored water or water having an odor of spoiled eggs can also result. The problem can then also be transferred to the distribution system where iron and manganese deposits result in complaints by the customers served by the water system.

This report is an example of the type of assistance provided by the Kansas Rural Water Association and funded through a contractual agreement between the Environmental Protection Agency and administered by the National Rural Water Association.

This photo shows discolored water being pumped during extended flushing of Well No. 5 following super-chlorination.

Superintendent Ellis checks chlorine residuals in flushed well water. Well No. 5 was flushed until no chlorine residual was detected.

Well maintenance programs can eliminate and reduce the bacterial buildup and its resultant corrosion. Thus, such maintenance activities help to keep well production capacity from decreasing and reduce corrosion over the longer term. Regular well maintenance increases longevity and efficiency by reducing costly repairs, downtime, and eventual well replacements.

Assistance by Kansas Rural Water Association

On November 30, 2015, Kansas Rural Water Association (KRWA) Technical Assistant Lonnie Boller traveled to the city at the request of City Superintendent James Ellis. The water system was losing production capacity from Well No. 5. During normal operation, Well No. 5 should pump approximately 48 gallons per minute (GPM). The production from Well No. 5 had decreased to 38 GPM. KRWA Tech Lonnie Boller suspected that there was iron bacteria buildup on the well screen and that this bacteria was restricting groundwater flow through the screen and causing loss of production capacity. Lonnie recommended that the well be super-chlorinated to kill and remove the bacteria on the screen.

On December 4 and 11, 2015, Lonnie returned to Effingham to assist with setting up Well No. 5 for super-chlorination. He also assisted with maintenance activities including cleaning and re-tubing the continuous chlorine monitoring equipment.

On December 17, 2015, Lonnie and City Superintendent Jim Ellis began super-chlorinating Well No. 5 by introducing 30 gallons of 12.5 percent sodium hypochlorite into the well. Next they added 1,000 gallons of water on top of the sodium hypochlorite in order to push the solution to the well screen and into the aquifer near and around the well screen. After allowing this chlorine solution to sit in the well for six days, they began flushing the well water to waste. Flushing continued until chlorine residuals were undetected.

As a result of the super-chlorination of Well No. 5, production capacity increased and returned to the design rate of 48 GPM. Lonnie recommended to the city that they super-chlorinate their wells on an annual basis to reduce the amount of iron bacteria buildup to maintain well production capacity. City Superintendent Ellis informed Lonnie that in 2011, the city had hired a contractor to treat the wells to remove iron bacteria buildup. The city paid approximately $3,000 to $4,000 per well for that treatment. Lonnie and Superintendent Ellis agreed that super-chlorinating the wells once per year would be a much less expensive option and it can be accomplished on a schedule that fits the local workload with future assistance if necessary by the Kansas Rural Water Association.

Short- and Long-term Benefits

The city of Effingham benefited in the short-term in that the loss of capacity from Well No. 5 was stopped and that the production was returned to “pre-loss” capacity. The long-term benefit is that bacterial induced corrosion has been reduced and, if regular well maintenance is continued, repairs and well replacement may be put off for many decades in the future. This will save the city considerable money by performing regular maintenance activities. As some would say, “an ounce of prevention is worth a pound of cure”.