By Lonnie Boller, Tech Assistant

The Kickapoo Tribe operates two standpipes. This is photo of the north tower standpipe, which has a capacity of 220,000 gallons.

Kickapoo Plant Upgrades Address Compliance Issues

Improvements are finally being implemented to address a long-time problem that found the Kickapoo Water Plant out of compliance with the disinfection byproducts rule (DBPR). The Kickapoo plant treats water from the Delaware River for the Tribal Community located west of Horton in extreme southern Brown County in northeastern Kansas.

The U.S. Environmental Protection Agency (EPA) and Indian Health Service (IHS) are assisting with funding for this large project to make sure that the Kickapoo Tribe can produce quality water in the future. Currently there is construction going on at the water treatment plant. The system is installing a twenty-four inch pipeline after the filters to provide the required free chlorine contact time. The reason the design consultants decided on installing a large diameter pipe for the contact time is that it can achieve a higher baffling factor versus a contact basin.

The plant will also have many analyzers installed throughout the treatment process. If an upset occurs, the SCADA program can shut down the plant and automatically call operators to check on the problem. Additionally, the SCADA system will allow remote control and monitoring of the facility. Other work includes significant modifications to integrate most unit operations into a supervisory control system, including these aspects: addition of a master control panel and programmable logic controller inside the present lab room; addition of several new control panels; a communications network for controlling and monitoring existing and new equipment from a new operator workstation; remote notifications, access, and control for operators not located at the water plant; monitoring of tank levels, pump on and off operations, flow rates, and chemical levels.

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Other improvements include replacing a filter with a conventional media to a sand-anthracite dual media. The dual media filters may help to address some of the current Total Organic Carbon (TOC) problems. A nonionic polymer will be used.

After moving the chlorine from the head of the plant to the contact basin, the plan is to feed sodium permanganate to oxidize the iron and manganese contained in the water. It is going to be dosed at the raw water line prior to the presed basin to allow adequate detention time.

This is one of three buildings at the Kickapoo Plant site; this facility contains the polymer feeding equipment and the filters.

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The plant will also be getting a complete new pipe gallery, which will have new valving and filter to waste. This will make the plant "operator friendly". Currently the valves are not operating properly causing a significant amount of water loss.

With the addition of ammonia, operators are going to have a challenge not only with keeping the ratios right but maintaining the residuals in the large distribution system in summer months. Currently the Tribe has a 300,000-gallon clear well, a 220,000-gallon storage tank and a 38,000-gallon standpipe. This is a large amount of storage for a system that uses an average of 100,000 gallons of water per day. The system is adding piping to fill at the top of the tanks and pull from the bottom. This will allow the water in the tanks to be circulated to help prevent stagnant water. KRWA, under contract with the Indian Health Service to provide assistance to the Tribe, is assisting with tank management such as running their levels to help better circulate the water.

Change from free chlorine to chloramines

The system has had trouble since 2004 meeting the disinfection byproduct rule. The maximum running annual average for compliance with the EPA standards is a total trihalomethane concentration of eighty parts per billion and sixty ppb for the sum of five major halo acetic acids. To address this issue, the first portion of the improvements was to modify the chlorination practices and to convert the disinfection residual from free chlorine to combined chlorine (chloramines) in an attempt to lower DBP formation.

This high chlorine concentration, fed early in the process, allows ample reaction time between the chlorine and natural organics in the water. The high chlorine dosages and long contact time encouraged high DBP formation. By delaying the chlorine dosage until after clarification (to reduce organics present in the water) and minimizing the contact time with free chlorine, a reduction in DBP formation was expected. The proposed CT calculations included adding approximately 220 linear feet of 24-inch SDR 21 PVC contact pipe after filtration to provide the required free chlorine contact time. Multiple chlorine feed points were designed to allow the system operators to have the additional flexibility for adjusting the

This photo shows the clarifier with metal cover. As a means to reduce contact time with free chlorine, feed points have been moved so that chlorine is no longer being fed ahead of the clarifiers. As a result, clarifier basins no longer contain chlorinated water. Some water systems have installed covers to prevent algae growth in the basins.

Surface water treatment plants should have jar testing equipment similar to this at the Kickapoo Plant to help optimize chemical usage. This is especially important with changes in raw water turbidity or temperature.

Amperometric titrators similar to this are used in surface water plants to accurately measure chlorine residuals. It is very important when feeding ammonia to form combined chlorine that accurate chlorine residual test results are obtained when trying to reach the proper ammonia to chlorine ratio.

chlorine dose and feed points on a seasonal basis. A chlorine feed point to the settled water was provided for use as needed for iron and manganese removal/oxidation. Once the CT is met, the free chlorine residual will be converted to chloramines (through the addition of ammonia) and discharged to the distribution system. Based on the lowest chemical costs and smallest building footprint, dry ammonium sulfate was the recommended chemical to be added at the plant.

Also the system is feeding sodium permanganate to remove iron and manganese. The system is also feeding a polymer aid to help improve filter performance.

Filter to waste was also installed to have the ability to send filter effluent to waste after backwashing; this is a standard method to help systems meet turbidity compliance criteria. Accordingly, the scope of work included installation of "filter-to-waste" piping and valves. Piping modifications further included complete replacement of piping in the basement of the filter building. There is quite an extensive amount of electrical modification also.

If you are thinking about plant improvements or would like some assistance, don't hesitate to contact KRWA. Call KRWA at 785-336-3760 or email me at lonnie@krwa.net.

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