DEVIOUS DYE DELIVERY

Chlorine tank improvements increase efficiency of

Linda Garcia

Western Municipal Water District, located in Riverside, Calif. (about 50 miles southeast of Los Angeles) needed to improve chlorine contact tanks to increase the contact time and reduce hypochlorite use.

The district owns and operates the Western Water Recycling Facility, an 11,356-m^3/d (3-mgd) tertiary water resource recovery facility (WRRF). The district provides water and wastewater service to about 23,000 retail customers and eight retail agencies and cities. The WRRF is located near the former March Air Reserve Base in western Riverside County. Due to the economic downturn, the WRRF has been operating far below capacity at 3217.6 m^3/d (0.85 mgd), and has only one of its four chlorine tanks is in operation.

Building baffles

To obtain better treatment efficiency and reduce chlorine use, the operators are experimenting with additional baffling. The baffles are designed in-house, using stainless steel angle brackets and 2×4 lumber. Installation was quick and modifications will be fairly simple. After a final configuration has been determined, more robust materials will be used for the permanent baffles.

Depth dyeing

The operators ran a set of simplified dye tests to observe flow around and under the baffles. Food-grade dye, purchased at a bulk warehouse, is easy to pour on the water's surface. However, the operators needed a way to release the dye from specific depths.

Because these tests were meant as informal checks, they required a low- or no-cost solution. The dye was to be released underwater so the dyed portion of the flow could be visualized as it moved through the tank. Various ideas were considered.

The first attempt used a 76 mm (3-in.) plastic pipe marked at 305 mm (1-ft) intervals. Operators lifted the bottom of the pipe to the desired depth and poured dye into the top. Unfortunately, because the dye was the same density as water, it stayed in the pipe and did not flow out until the pipe was lifted above the water surface.

OPERATORS AT THE WESTERN MUNICIPAL WATER DISTRICT (RIVERSIDE, CALIF.) INVENTED A FEW SIMPLE DYE DELIVERY DEVICES TO QUICKLY TEST HOW ADDING NEW BAFFLES AFFECTED THEIR CHLORINE CONTACT TANKS. A SIMPLE COFFEE CUP AND LID TAPED TOGETHER AND SMASHED ON THE BOTTOM OF THE TANK WAS A GOOD STARTING POINT.

THE OPERATORS FOUND SUCCESS USING A DIPPER POLE ATTACHED TO A BACTERIOLOGICAL SAMPLE CONTAINER. BY OPENING THE HINGED LID AT A DESIRED DEPTH, THE WATER MIXED WITH THE DYE. THE OPERATORS ALSO USED THIS DEVICE TO COLLECT SAMPLES AT VARYING DEPTHS; THOSE SAMPLES WERE TESTED FOR CHLORINE RESIDUAL TO CONFIRM MORE FORMALLY THE MIXING THAT THE DYE TESTS SHOWED.

All photos courtesy of Linda Garcia

Next, operators tried a paper coffee cup with a sip lid. After filling the cup with dye, the lid was attached, the sipper opening was taped shut, and the cup was taped upside-down to the bottom of the PVC pipe. The cup was crushed at the bottom of the tank, and then lifted a few inches and shaken side to side. The dye could be observed as it surfaced. The facility chose red dye, and the crushed cup looked like a crime scene.

Although this worked well, it worked only at the tank bottom. Operators wanted dye tests at mid-depth, too. Additionally, once baffle performance was verified, operators planned on chlorine residual sampling, collecting samples at various depths and locations along the tank.

Bottling up a solution

A dipper pole used for holding a bacteriological sample container showed promise. The cylindrical sample bottles have a hinged lid. The lid opens when the dipper clip is pulled away. And the district had plenty on hand.

Operators marked the pole at 305 mm (1-ft) intervals and attached a dye-filled bottle. Two people worked together to release the dye; one held the pole and the other pulled the string to open the lid. The district also upgraded to fluorescent sewer tracing dye for better visibility.

The bacterial sample bottles worked so well to release dye that the operators used the same technique to collect the chlorine residual samples. The bottles did not contain sodium thiosulfate pills, so no reactions with chlorine occurred.

Baffling results

In addition to creating a new dye delivery and sample collection tool, this project showed that the baffles helped increase mixing and contact time. The facility reduced its chlorine use by about 10%. Both solutions needed creative thinking, a lot of ingenuity, and teamwork. Much credit goes to Luis Sahagun, former senior operations technician, and Edmund Tyser, operations technician II.

These efforts led to the project team – Sahagun, Tyser, and Linda Garcia – earning The Team That Really Mixes It Up Award for Resourcefulness in the WEFTEC® 2014 Operator Ingenuity Contest.

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AN OPERATOR AT THE WESTERN MUNICIPAL WATER DISTRICT (RIVERSIDE, CALIF.) DELIVERS A DOSE OF DYE TO QUICKLY TEST HOW ADDING NEW BAFFLES AFFECTED THE CHLORINE CONTACT TANKS.

THE RED DYE USED IN THE EARLY TESTS WAS READILY VISIBLE AS IT BEGAN TO SPREAD.

THE DISTRICT FOLLOWED UP THESE DYE TESTS WITH CHLORINE RESIDUAL SAMPLES TO ENSURE THE MIXING IMPROVEMENTS.

AFTER DYE TESTING AND CHLORINE RESIDUAL SAMPLES PROVE THE BAFFLES PROVIDE BETTER MIXING, THE TEMPORARY STAINLESS STEEL ANGLE BRACKETS AND 2X4 LUMBER BAFFLES WILL BE REPLACED WITH MORE ROBUST, PERMANENT MATERIALS.