

Treatment Loss Reduction



Lake Manatee's WTP has faced taste and odor issues, as well as challenges meeting regulatory requirements.

By Phil Locke

Typically, reverse osmosis (RO) membrane water treatment facilities lose at least 15% to 20% of their feedwater via reject or concentrate. A pilot study completed in Manatee County, Fla., however, shows that treatment losses can be reduced to approximately 5% of total water plant flows by treating the concentrate stream to blend with the permeate stream for finished water.

Award-winning pilot study demonstrates membrane technology's potential

The Lake Manatee Water Treatment Plant (LMWTP) includes a 54-million-gal-per-day surface water treatment train that draws and treats raw surface water from Lake Manatee. The system uses conventional chemical coagulation-sedimentation-filtration treatment designed primarily for the removal of solids.

Because Lake Manatee is subject to seasonal fluctuations in water quality, Manatee County has experienced taste and odor issues as well as challenges in meeting regulatory requirements due to seasonal turbidity excursions. The county also faces the likelihood of more stringent regulatory requirements and increased operation and maintenance costs in order to address these issues. Additionally, the LMWTP is the county's only drinking water facility and is located within the Southern Water Use Caution Area, which limits water withdrawals in the region. Treatment loss minimization, therefore, is essential in implementing improvements to the LMWTP.

Without a clear-cut solution to meet water quality and regulatory requirements within the context of water loss minimization, original research was required. The county and its engineers decided to conduct a pilot study with three primary treatment goals: reduce intermittent turbidity spikes, decrease taste and odor compounds and reduce disinfection byproduct formation. Each criterion had to be achieved with less than 5% water loss.

Alternatives Investigated

As the engineer of record for Manatee County, McKim & Creed, Clearwater, Fla., along with Reiss Eng., Tampa, Fla., conducted a pilot study at the LMWTP to test a wide range of technologies and improvements to address county needs and goals. These technologies could be used as stand-alone solutions or combined to create a hybrid solution that focused on treatment of the RO concentrate stream. The concepts originally targeted for testing included:

- Ultrafiltration (UF);
- Low-pressure RO (LPRO); and
- LPRO concentrate treatment to minimize

water loss via:

- Ion exchange;
- Ion exchange followed by ozonation;
- Coagulation UF;
- Coagulation UF followed by ozonation; and
- Ozonation with biologically activated filtration (BAF).

These technologies were pilot tested relative to the treatment goals and applied to the treatment of the RO concentrate stream to reduce treatment losses. The goal was to blend the treated RO concentrate back into the finished water stream while improving the overall finished water quality—a new approach to reducing water loss. This study was the first of its type conducted for full-scale implementation of a concentrate stream that would be treated and blended into the finished water.

For seven months, the team of McKim & Creed, Reiss Eng. and Manatee County tested the various technologies. The study began during the dry season, when the county typically experiences poorer water quality, and continued through the wet season. This allowed for several different technologies to be tested, with varying levels of treatment/chemical addition, to determine what impacts these would have with respect to treating the RO concentrate stream.

"The study was designed to pilot advanced technologies in unconventional configurations," said Johna Jahn, EI, a staff engineer with McKim & Creed.

Pilot Study Results & Subsequent Steps

Data from the pilot study showed that while each piloted technology was able to meet at least one of the treatment goals, none of the technologies was able to meet all of the goals. The configurations were not able to reduce total organic carbon (TOC) while operating within the acceptable water-loss conditions.

UF provided highly successful turbidity reduction. LPRO resulted in successful constituent removal and operation, but it had unacceptable water loss. LPRO with concentrate treatment using ozone improved taste and reduced odor, but it did

ARTICLE SUMMARY

Challenge: Manatee County, Fla., experienced taste and odor issues, as well as trouble meeting regulatory requirements.

Solution: The county decided to conduct a pilot study aimed at the reduction of intermittent turbidity spikes, taste and odor compounds and disinfection byproduct formation. The county utilized a wide range of technologies in its testing.

Conclusion: The team decided to retrofit the existing multimedia filters with ultrafiltration, a technology that provided numerous benefits during testing—most importantly, highly successful turbidity reduction.

not reduce TOC significantly. Ozonation with BAF was a viable solution for the taste and odor concerns, but it did not diminish turbidity or TOC significantly.

The team then conducted a weighted analysis of the primary water quality goals, with turbidity weighted heaviest at 60% (as it is a regulatory-related target), 20% for taste and odor and 20% TOC. Cost also became a higher priority.

“We worked closely with Manatee County during the pilot study and also during subsequent

evaluations of alternatives for implementation,” Jahn said. “Due to the downturn in the economy that occurred during the course of this project, the significance of cost as a factor in the recommendation for full-scale implementation greatly increased.”

The weighted analysis, combined with the findings of the pilot study, resulted in the team’s recommendation to retrofit the existing multimedia filters with UF. This technology offers many potential benefits to the county, including:



Retrofitting existing multimedia filters with ultrafiltration proved to be a beneficial decision for Manatee County.

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Recognition & Future Plans

In 2010, the Florida Institute of Consulting Engineers presented McKim & Creed with an Engineering Excellence Grand Award for the Lake Manatee Pilot Study Report. The final basis of design report for the UF retrofit was provided to Manatee County in September 2010. Detailed design is anticipated to begin by 2012. When constructed, the UF system retrofit will be the first system of its kind in Florida and the largest such project ever implemented in North America. www

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