



REUSE OF MUNICIPAL WASTEWATER FOR INDUSTRIAL PLANT SUPPLY

MUNICIPAL WASTEWATER PROVIDES A SOLUTION FOR A MAJOR CHEMICAL PROCESSING PLANT

The Challenge

Water scarcity is requiring large industrial plants to investigate conservation options, including reuse of municipal wastewater effluent, in order to grow sustainably while meeting increased demands for fresh water make-up.

In some locations, utility companies and municipalities have teamed to build reuse facilities that treat effluent from multiple municipal plants and distribute treated water to multiple industrial sites. These centralized reuse facilities have the ability to minimize variations in the quantity and quality of treated wastewater, thus providing a reliable source of water for industrial facilities.

However, access to such facilities isn't always an option, as was the case with a large Gulf Coast chemical plant planning an expansion and having convenient access to a single medium-sized municipal plant.

Solution

Enter Evoqua Water Technologies onto the scene.

After reviewing the factors influencing the plant's decision to reuse municipal wastewater—including periodic droughts in the region, lack of senior water rights to the primary source of fresh water, salinity of site well water, and a desire to broaden options for sustainable fresh water make-up—Evoqua analyzed the municipal wastewater effluent. Given the levels of suspended solids, organics, phosphate, chloride, and silica, Evoqua recommended a preliminary design for the full scale system that used ultrafiltration (UF) for suspended solids removal followed by double pass reverse osmosis (RO) for dissolved solids, silica, and organic removal. This solution also fit well with the industrial plant's space limitations.

With the success of their plant expansion on the line, the customer wanted to prove that the proposed water reuse program would be viable. Evoqua was able to quickly develop a pilot test protocol that met the plant's needs and mobilize an integrated UF and RO pilot system.

Industry

Chemical Processing

The Challenge

A planned expansion for an industrial plant faced with water scarcity and no existing wastewater reuse experience or infrastructure

Keys to Success

Twelve month pilot test with continuous monitoring of water quality provided realistic results for long-term solution design

Solution

Enhanced ultrafiltration (UF) and reverse osmosis (RO) systems with continuous online monitoring



Pilot system installation

Temperature, turbidity, flow, pressure, conductivity, and pH readings were continuously monitored at multiple locations and recorded using Evoqua's Link2Site® remote monitoring system. UF operating conditions were logged and documented in an electronic workbook. RO operating conditions and water quality were logged and entered into Evoqua's RO normalization program for monitoring and evaluation.

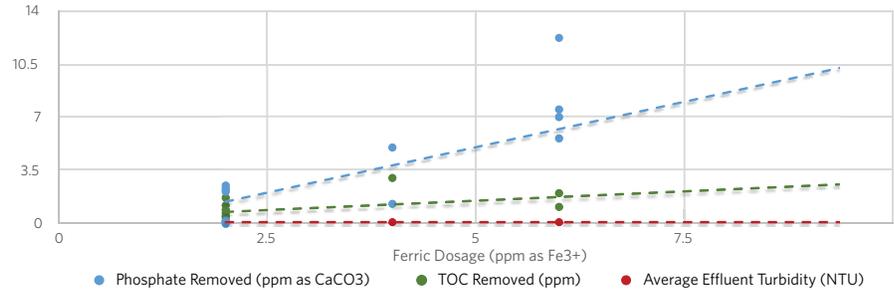


The feed water and UF and RO operating data were evaluated for twelve continuous months, enabling the project team to evaluate the effects of a wide range of conditions based on seasonal variations, short-term weather events, and wastewater treatment plant upsets. The duration of the testing also allowed independent testing of several different operating parameters for the UF and RO units, such as flux, recovery, coagulant dose, and cleaning frequency. This long-term, thorough test design made it possible for the chemical plant to accurately calculate capital and operating costs of a full-scale system based on the pilot.

Results

The pilot testing revealed strong fluctuations in wastewater turbidity, conductivity, phosphate, nitrate, and total chlorine levels, as well as smaller variations in pH, TOC, silica, and ammonia. The UF and RO systems exceeded the testing objectives, allowing for less equipment to be used in the full scale plan, a benefit given the considerable space restrictions at the plant.

Coagulant Dosage (ppm as Fe3+)



After reviewing the full set of data collected over the twelve-month testing period, Evoqua made several additional recommendations for the design of the future full-scale system:

- Addition of enhanced coagulation ahead of UF to increase removal of organics and phosphates
- Online monitoring of TOC and phosphate concentrations to allow for automation of the coagulation system
- Reduction in UF system size, backwash duration, and scheduled cleaning frequency from the preliminary design values
- Maintaining the RO system flux and recovery
- Adding a permeate flush to the RO system
- Inclusion of provisions to add a biocide feed to the RO
- A robust clean in place system to restore membrane performance after feed water upsets

Conclusion

Overall, the pilot testing demonstrated that the municipal wastewater source is a feasible alternative to the current water source. The primary performance targets with respect to system recovery and permeate quality are achievable in a long term operation even with variable feed water quality.



210 Sixth Avenue, Suite 3300, Pittsburgh, PA 15222

+1 (800) 466-7873 (toll-free)

www.evoqua.com

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