From 71% to 85%: Recommissioning an Idle Recovery RO System with Flow Reversal to Treat Extremely High Silica Concentrations in a Bottling Plant

PROJECT BACKGROUND

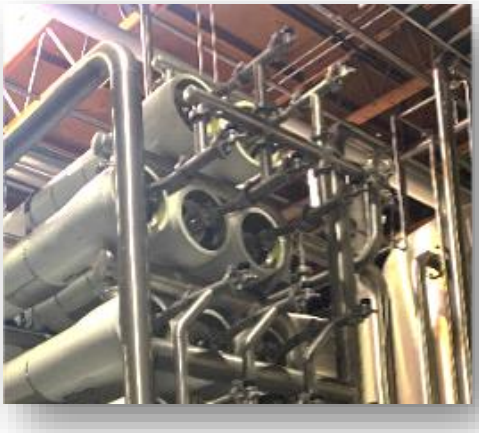
A Bottling Plant located in the Western United States struggled with raw water quality containing greater than 60 ppm silica. The plant had two 250 gpm conventional Reverse Osmosis (RO) systems operating at a 71% recovery rate, and a 150 gpm Recovery RO system fed by the concentrate from the Primary RO system that contained more than 250 ppm silica. The high silica concentration caused severe scaling of the membranes. The RO system was designed to have a recovery rate of 30%; however, the high operational cost for cleaning and constant flushing required to operate the RO far outweighed the minimal extra water production. The situation forced the operators to decommission the system with little hope to find a solution to the challenge posed by silica.

The need to maximize water production and savings, and to achieve corporate sustainability objectives led to the decision to seek a technological solution that will achieve an ambitious recovery rate goal of more than 85% for the site.

TREATMENT SOLUTION

The technology that drew the attention of the company's R&D Department and plant engineers was ROTEC's high-recovery Flow Reversal RO - a continuous process that employs conventional, non-proprietary RO equipment with two unique principles: Flow Reversal and Block Rotation. Flow Reversal is designed to inhibit mineral scaling and biofouling, two of the limiting factors in high-recovery RO, by periodically reversing the crossflow of feed water inside the pressure vessel, ensuring the scale does not have time to form on membranes surfaces before changing the conditions and introducing under-saturated feed water.

The proposed solution was to retrofit the existing, decommissioned 150 gpm Recovery RO system to enable its operation as a Flow Reversal RO system and achieve the maximum available recovery rate.



The conventional recovery Reverse Osmosis system at the bottling plant before the retrofit.

Retrofit of the Reverse Osmosis system with the Flow Reversal technology.

QUICK FACTS

SITE NAME:
Bottling Plant - International Beverage Company

LOCATION: West Coast, U.S.A.

CHALLENGE: Achieving the highest recovery rate despite high concentrations of silica.

FLOW RATE:
Two 250 gpm RO systems & 150 gpm Recovery RO System

SOLUTION:
Retrofitted Flow Reversal Reverse Osmosis System

RESULTS: The retrofitted Recovery RO system is currently operating stably at a 55% recovery rate, which increased the overall recovery of the plant from 71% to 87%.

For more information on these solutions, visit adedgetech.com.

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THE TEAM

AdEdge collaborated with ROTEC and the plant engineer during the design, installation, startup, and optimization period. Due to the COVID19 pandemic, most of the work had to be executed remotely.

INSTALLATION, OPTIMIZATION, & PERFORMANCE

This retrofit project started in March 2020 and included the installation of two additional pressure vessels, a booster pump, valves, analytical equipment, ROTEC's flush system, and replacement of the old membranes.

Completion of the onsite testing, which confirmed smooth mechanical operation of the retrofitted system, kicked off the optimization stage during which the recovery rate of the retrofitted system was increased gradually.

The retrofitted Recovery RO system is currently operating stably at a 55% recovery rate, which increased the overall recoveryof the plant from 71% to 88%.

RESULTS & SIGNIFICANCE

This project is the first retrofitted Flow Reversal RO system in the US, and treating extremely challenging water quality which enables the recommissioning of an idle RO system at the highest recovery possible with minimal mechanical modifications and smooth integration with existing equipment.

The Flow Reversal mechanism enables the system to operate "against all odds" at 550% saturation index for the silica compared to the expected 200%, as projected by the antiscalant vendor.

A view of the complete retrofitted RO system designed to optimize the recovery rate.

The Team onsite after the successful startup and installation of the Flow Reversal System.