More is better: Membranal Approach to Effective PFAS Removal at the Highest Recovery Rates of 97%

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The City of Rome, in Northwest Georgia, is challenged with the presence of perfluoroalkyl and polyfluoroalkyl substances (PFAS) in their surface water source, which cannot be treated by the existing conventional treatment processes at the Bruce Hamler Water Plant (flocculation, sedimentation, gravity mixed media filtration, and chlorine disinfection). The capacity of the water treatment plant is 18 MGD, although currently, it operates at an average demand of 7 MGD.

The goal of the pilot study was to demonstrate several PFAS treatment technologies, including GAC, ion exchange, and conventional RO. Our objective was to demonstrate the performance of ultra-high recovery Flow-Reversal Reverse Osmosis (FR-RO) process to remove PFAS at the highest possible recovery.

FR-RO is a proven technology with over 40 installations worldwide, including 3 full-scale systems and multiple pilot systems in the United States, including recognition by the Bureau of Reclamation (P2P Grant Award). The technology employs the simplicity of operation and conventional RO equipment with two unique and continuous process functions: Flow-Reversal and Block Rotation.

Reverse Osmosis (RO) is proven to remove PFAS effectively, but the high recovery FR-RO approach enables significant system performance improvements, resulting in optimized operating and infrastructure costs and savings such as higher recovery rates, lower concentrate volumes, savings on OPEX, and smaller footprint.

The feed water source of the FR-RO pilot system was UF pre-treated water from the Etowah and Oostanaulah rivers, where multiple PFAS species were detected. A three-stage FR-RO system had a 3:2:1 array with 4-inch energy saving BW membranes. The FR-RO pilot system operated onsite between February 10, 2021, and April 30, 2021, treating blended water from the two rivers and water solely from the Etowah River.

This paper will describe how the FR-RO technology works and present data highlighting the stable operation determined by documenting flows, flux, differential pressure, and more. While the conventional RO achieved a 90% - 93% recovery rate, the FR-RO operation resulted in superior removal of all PFAS species at a recovery rate of 97%.