

CM-151 Ultrafiltration Membrane System Helps Semiconductor Fab Enable Reuse to Reduce HF Wastewater Volume

NORTH AMERICAN SEMICONDUCTOR FABRICATOR



The innovative system has proven to be highly reliable, requiring minimal cleaning and oversight.

CHALLENGE



Meet discharge requirements and address increased demand for water:

- A semiconductor fab needed to **upgrade its existing hydrofluoric acid (HF) wastewater treatment process** to address compliance concerns caused by particulate breakthrough.
- The plant was looking for a solution that would enable it to **reuse the wastewater**, rather than simply meet discharge requirements.
- Wastewater reuse offered additional benefits, including helping the plant meet increased water demand and further **reducing its environmental impact**.

SOLUTION

CM-151 enabled the site to reduce operating expenses by \$800K and reduce freshwater consumption

Upgrade treatment process with a reuse system containing CM-151 technology:

- By altering the treatment approach, CM-151 not only enabled the wastewater reuse, it also **eliminated the need to treat and discharge 100 gallons per minute (gpm) of wastewater**.
- The result: more than **\$800,000 in annual savings** through a reduction in wastewater treatment costs, discharge fees, and the acquisition and treatment of freshwater.
- **CM-151 is a robust solution** that can operate at high flux and treat the HF-containing waste stream reliably within a limited footprint.
- It also ensures **more stable reverse osmosis (RO) operation and consistent water quality**.



North American Semiconductor Fab Background

Semiconductor fabs and foundries are facing increased scrutiny for their environmental impact, particularly as demand for chip design innovation intensifies. This can put a strain on existing freshwater supplies and potentially jeopardize operations as the industry undergoes rapid expansion to keep up with growing demand for its products.

A leading foundry in North America was experiencing particulate breakthrough in its existing wastewater treatment plant at one of its fabs. The plant relied on clarifiers and lamella settlers, which delivered inconsistent effluent quality. To address this challenge, the fab piloted and subsequently implemented a new approach – to treat HF-containing wastewater from an existing wastewater treatment process via a reuse system that consisted of CM-151 technology and a reverse osmosis (RO) plant.

The streamlined design of the new process (below) included the addition of caustic (NaOH) to neutralize the wastewater stream, followed by suspended solids removal and silt density index (SDI) reduction through the CM-151 membrane system. The CM-151 system's compact design enabled it to conform to the fab's

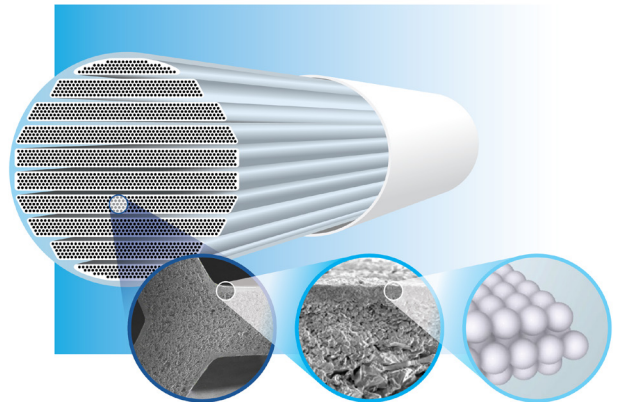
space constraints. Further removal of dissolved solids was accomplished through a downstream RO process, which produced water that was of a high enough quality to be reintroduced into the front end of the ultrapure water (UPW) plant. This process design change moved the fluoride removal step to the RO process, eliminating the need for additional costly chemicals (e.g., CaCO₃).

The innovative system has proven to be highly reliable, requiring minimal cleaning and oversight. It operates at a 95% recovery rate and has shown no sign of degradation from sustained exposure to the neutralized waste stream. Key operational parameters are captured top right.

Implementation of the water reuse solution has helped the facility realize total savings in excess of \$800,000 per year. This includes \$450,000 in operational savings compared to the previous treatment process, \$180,000 in freshwater acquisition and treatment costs, and another \$180,000 in cost avoidance through a reduction in discharge fees.

OPERATIONAL DATA

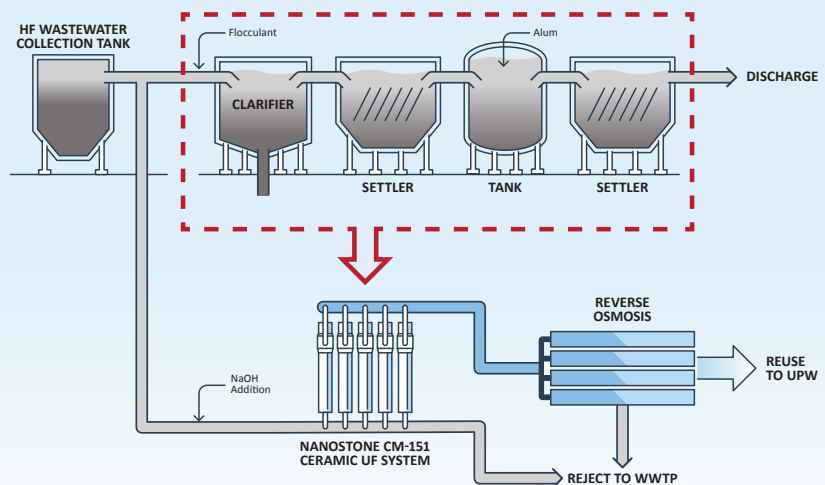
| Constituent | Untreated Wastewater | After CM-151 |
|---------------|----------------------|--------------|
| pH | 3.7 | 8.4 |
| Turbidity | 13 | <0.1 |
| SDI | 80-85 | <2 |
| Fluoride as F | 216 | 139 |
| Recovery Rate | N/A | 95% |



Each module's feed channels are designed to maximize membrane surface area without compromising flowrate, while the unique surface coating provides consistent, reliable removal of solids down to 30 nm in size.

**FOR MORE INFORMATION
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Nanostone Water's CM-151 system is currently delivering high quality water for facility reuse without additional cost and complexity of pre-treatment.