



World's first underground niobium mine achieves zero liquid discharge with Q-SEP[®] ultrafiltration membranes

QUA[®]
An Aquatech Company

Client: Niobec Mine

Plant Capacity: 120 m³/hr (528 gpm)

Located approximately 200 km north of Quebec City, Canada, the Niobec Mine is the world's first and only underground niobium mining site. This operation presented Niobec, Inc. with dual challenges: efficient management of highly saline mine water, along with maintaining a strong commitment to environmental stewardship.

Working closely with Niobec, QUA's parent company, Aquatech, implemented an advanced, modularized, closed-loop water treatment solution to reduce water withdrawals, minimize waste, and prevent the discharge of salt-laden effluent into local waterways.

Challenges:

The Niobec Mine's wastewater contains high levels of total dissolved solids, often exceeding 25,000 ppm. The underground mining operations result in saline wastewater that contains high sulfate, sodium, chloride, and heavy metals. The mine wastewater required complex pretreatment to comply with chloride and TDS discharge standards.

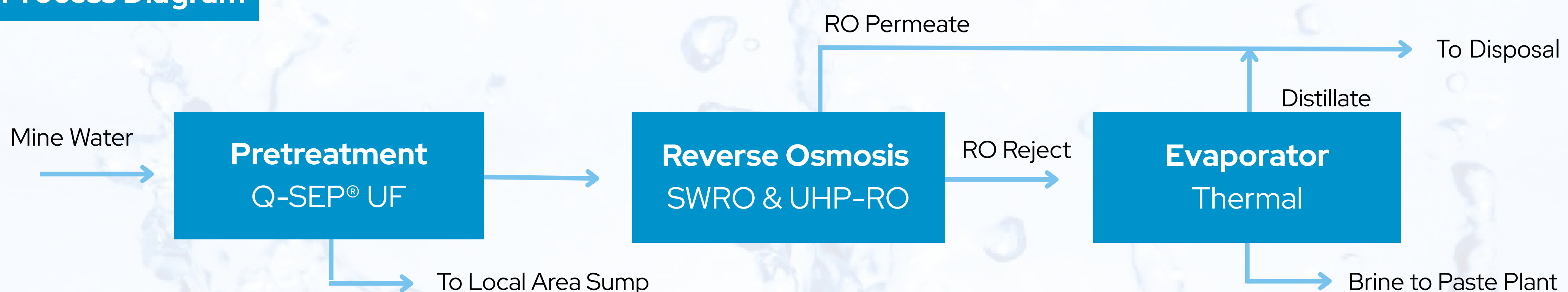
Traditional methods of softening the mine water before reverse osmosis (RO) and thermal treatment would have led to excessive chemical consumption and the generation of large quantities of sludge. QUA's Q-SEP[®] ultrafiltration membrane technology reduced the brine volume to the downstream thermal system, minimizing the risk of operational issues while maintaining an attractive lifecycle cost.

QUA's Solution:

The mine's advanced pretreatment solution integrated media filtration and QUA's Q-SEP[®] PVDF outside-in UF with state-of-the-art reverse osmosis (RO) processes. Q-SEP[®] outside-in UF membranes are made of modified hydrophilic polyvinylidene fluoride (PVDF) material that offers high fiber strength and chemical resistance, resulting in higher membrane productivity.

The Q-SEP[®] UF technology was pivotal in optimizing the performance of the RO stages by efficiently removing turbidity and protecting the RO membranes from fouling. The system generates over 120 m³/hr (528 gpm) of high-quality process water while reusing concentrated brine in paste backfill operations.

Process Diagram



Results

Niobec's facility demonstrated a highly effective approach to managing high-salinity water, cutting sludge production, and reusing industrial brine, offering a robust model for other underground mines worldwide. This water treatment system enabled the mine's expansion to move forward and avoided the discharge of salt-laden mine water into nearby water bodies.

In 2024, the Niobec project was awarded the Engineers' Society of Western Pennsylvania (ESWP) Water and Wastewater Project of the Year. This prestigious recognition highlights the project's engineering excellence and innovation in water treatment.

This project underscores a shared commitment by Niobec, Inc. and QUA to environmental stewardship and operational efficiency, paving the way for broader mining industry adoption of advanced water treatment solutions.

