



# Innovate to Collaborate

## Advanced Water Treatment Technology Using a Minimal Liquid Discharge Approach Helps Transform the Uzbekistan Fertilizer Production Market

Due to rising demand, growing populations and environmental pressures, industrial wastewater treatment and reuse has become an attractive alternative to freshwater sourcing worldwide. In Uzbekistan – an arid, landlocked country that receives 85 percent of its total water supply from neighboring upstream countries<sup>1</sup> – sustainable water management is critical to help reduce competition for local resources and help ensure economic growth more broadly.

In the Navoiy region – one of Uzbekistan's largest industrial centers – the Navoiyazot Joint Stock Company (JSC) is currently engaged in a series of major development projects to boost the production of mineral

fertilizers, chemical reagents and other small tonnage chemical products, while also meeting the country's environmental standards. Navoiyazot JSC is part of the Uzkimyosanoat Joint Stock Company, which produces more than 30 percent of the total volume of all chemical products in Uzbekistan.

One of these projects is the construction of nitric acid production facility, with an expected capacity of 1,500 metric tons per day to be used in fertilizer.

To conserve freshwater and adhere to strict effluent discharge regulations, the facility required a water processing system to treat industrial water to a purity level sufficient for reuse in the plant's boilers and cooling towers, and to serve

other operational functions. Complicating this challenge, the facility's initial water source – surface water from an industrial channel blended with other minor streams – contained total dissolved solids (TDS) content as high as 1,500 mg/L.

An investment in Water Solutions' energy-saving technology to replace obsolete systems – which date back to the 1960's when operations first commenced – allows Navoiyazot JSC to support economic development in the Navoiy region and increase export potential, while also remaining conscious of their environmental footprint.

Switzerland-based Casale SA – primary contractor for the project – hired Italy-based Unidro to create a reverse osmosis

(RO) system for the new nitric acid plant. A global player in the water and utilities-related process technology space, Unidro has over four decades of experience combining product manufacturing with water treatment processing expertise.

Unidro then turned to Water Solutions, a part of DuPont Safety & Construction, for their considerable experience in sustainable separation and purification technology, including RO, ultrafiltration, nanofiltration and ion exchange (IX).

Water Solutions' Minimal Liquid Discharge (MLD) approach – which helps enable recovery of up to 95 percent liquid discharge at a fraction of the cost of Zero Liquid Discharge – proved to be an ideal, cost-saving strategy for the project.

"MLD is a key concept that helps enable environmental and cost advantages for companies such as Navoiyazot JSC," explained Antonio Arzu, Senior Account Manager at Water Solutions. "We used this game-changing strategy and worked alongside Unidro to design and tailor a system using a combination of RO membranes and IX resins to meet facility requirements at different stages."

Initial treatment of the process water includes a first and second pass using FILMTEC™ BW30XFR400/34 and FILMTEC™ BW30HR440 elements (Fig. 1). These RO elements are designed to handle challenging waters and wastewaters, while providing consistently high performance, long element life, increased productivity and higher water quality, coupled with excellent fouling resistance.

According to Francesco Ghisalberti, Sales Director at Unidro, processed water after the second pass exceeds targets for solids content – helping to achieve a maximum of 10mg/L permeate TDS.

Next, in the more complex MLD phase of the system, water passes through a series

<sup>1</sup> Sustainable Management of Water Resources in rural areas in Uzbekistan report

**Fig. 1: Navoiyazot JSC Initial Water Treatment System**

First Pass	Second Pass
FILMTEC™ BW30XFR400/34	FILMTEC™ BW30HR440
4 Trains/807 total RO elements	2 Trains/182 total RO elements
Capacity: 136 m <sup>3</sup> /h each	Capacity: 122 m <sup>3</sup> /h each
88% recovery	90% recovery
	Maximum 10 mg/L permeate TDS

of pre-treatments, including lime-soda ash warm softening, multimedia filters, cartridge filters with a 5.0 µm rating, and finally 5800Lt of AMBERLITE™ IRC83 Ion Exchange Carboxylic Resins. These resins provide scaling protection for the downstream RO membranes and improves overall system performance.

The final step in the MLD phase employs a combination of next-generation FILMTEC™ FORTILIFE™ technologies – CR-100, XC70, and XC80 elements. The FILMTEC FORTILIFE CR100 element is one of the industry's most advanced fouling-resistant technologies, designed to provide relief from biological fouling, as well as ultra-low differential pressure for improved hydraulic balance. Similarly, FILMTEC FORTILIFE XC70 and XC80 elements achieve reject TDS levels of more than 70,000-80,000 ppm within standard RO operating limits, which helps maximize the water recovery rate and lowers brine volume.

"FILMTEC™ FORTILIFE™ is instrumental in helping drive plant efficiency,"

said Ghisalberti. "Due to the cost-saving performance of these membranes, we were able to reduce the size of the evaporator in the MLD section, which helps lower energy consumption for the operator."

By using MLD techniques and customizing technology for specific treatment stages, the Water Solutions-Unidro partnership has delivered an initial waste stream with a minimum 20 percent solids content. When the new plant goes on-stream in 2019, its performance is expected to help Navoiyazot JSC meet their purity and environmental requirements, as they transform fertilizer production in a country with ambitious growth plans.

"We are passionate about helping operators use MLD to overcome their process water challenges and improve water recovery," said Arzu. "The process relies on a core set of proven technologies, but we're adopting them in a disruptive way to do what's good for both business and the environment."

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