

CASE STUDY



Built to last

*RO elements stand the test of time
at a North Dakota electric utility*

By Craig Granlund

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Among the biggest challenges facing coal-fired, electric-generating stations throughout the U.S. is the selection of a reliable, economical and long-lasting water treatment system for providing massive amounts of clean boiler feedwater. After eight years in operation, in 1992, the lignite-based, 900,000-kW Antelope Valley Station near Beulah, N.D.—an integral part of the Basin Electric Power Cooperative—switched to a new reverse osmosis (RO) system to treat its boiler feedwater, which comes from Lake Sakakawea, a reservoir of Missouri River water.

After 16 years in service, the original elements of this RO system are still efficiently and economically cleaning the process water from this surface water source. In fact, the Dow Filmtec BW30-8040 elements nearly match the outstanding performance they exhibited when they were first installed, reducing conductivity from 450 to 12 μ mhos (μ) while running at 75% recovery.

Pretreatment & Maintenance

The Antelope Valley Station system is made up of four trains of a 5 to 2 array of vessels, each containing six Filmtec BW30-8040 elements. The feedwater arrives from Lake Sakakawea via a pipeline 9 miles long, where it goes through a prechlorination step before passing through the clarifiers. From the clarifiers, the water is cold-lime softened, followed by the addition of liquid ferric sulfate and a polymer as coagulation aids. The water is then pumped to a 1-million gal per day clear well and then on to the main plant, where it goes through a sand and anthracite filter and a separate carbon filtration step.

Additional pretreatment steps include 5.0- μ cartridge filters, the addition of sulfuric acid to reduce the pH to 7 and a temperature increase to about 75°F before the water is finally pumped to the RO system. A heat exchanger that uses waste heat from the plant increases the temperature of the feedwater.

The RO elements receive a routine chemical cleaning once per quarter, while O-rings and adaptors are changed out as needed.

The Elements

With a nominal active surface area of 330 sq ft, the Filmtec BW30-8040 element used at this site is a predecessor of today's BW30-365 element, which has a nominal

active surface area of 365 sq ft. This family of industrial RO elements has become a standard choice worldwide for system designers, original equipment manufacturers and system operators when consistently high performance and maximum-element life are important factors for treating difficult feedwaters. These elements have a long track record of proven performance, high rejection and outstanding robustness and durability across a wide range of feed conditions.

The current Filmtec BW30-365 element features the industry's thickest feed spacer to lessen the impact of fouling; may be cleaned over the widest pH range (1 to 13) for the most effective cleaning; and is best suited for systems operating on challenging feed streams, where reliable pretreatment may not be an option or where maximum "cleanability" delivers value.

Plant Performance

Temperature	75°F (24°C)
Stage 1 pressure	225 psi (15.5 bar)
Stage 2 pressure	185 psi (12.8 bar)
Concentrate pressure	160 psi (11 bar)
Feed conductivity	450 μ mhos
Concentrate flow	173 gpm (39 cu m/h)
Concentrate conductivity	1390 μ mhos
Product flow	520 gpm (118 cu m/h)
Product conductivity	12 μ mhos

Sixteen years after installation, the original Filmtec BW30-8040 elements continue to perform beyond expectations. The table below summarizes recent RO plant data from 2007, after 15 years of service:

The durability and cleanability of RO elements—combined with proper pretreatment and excellent maintenance—are critical to the long-term performance and cost-effectiveness of coal-fired electric plant water treatment operations. Operators and maintenance personnel at the Antelope Valley Station have achieved outstanding economic and performance results, boosting the life span of their RO elements well beyond the typical industry average using Filmtec membranes. **MT**

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