



FILMTEC™ Membrane Elements

FILMTEC™ Elements Still Delivering Outstanding Performance After 15 Years In Service

Site Information

Location:

Beulah, North Dakota,
USA

Size:

520 gpm (118 m³/h)

Purpose:

Provide clean boiler feed
water

Time in Operation:

15 years



For 15 years, FILMTEC™ elements have provided clean boiler feed water from the Missouri River for the Antelope Valley Electric Generating Station.

Introduction

The Antelope Valley Station (AVS) is a lignite-based electric generating station with a capacity of 900,000 kW. The station is located seven miles northwest of Beulah, North Dakota, and is operated by Basin Electric Power Cooperative. Established in 1984, AVS is an integral part of Basin Electric's generating and transmission network that provides electricity to member electric distribution systems throughout the Upper Midwest of the U.S.

In 1992, a reverse osmosis (RO) system containing 168 FILMTEC™ BW30-8040 elements was installed to provide clean boiler feed water to the generating station. The feed water source is Lake Sakakawea, which is a reservoir of Missouri River water. The original installation was by Polymetrics, which ultimately became Siemens Water Technology after Siemens purchased US Filter in 2005. After 15 years these original elements are still efficiently producing clean process water from this surface water source. This case history shows how the durability and cleanability of FILMTEC membranes combined with proper pretreatment and excellent plant maintenance make such an achievement possible. The AVS RO system is an example of how FILMTEC elements can offer the best overall economics for RO system operators.

FILMTEC™ Elements

The FILMTEC™ BW30-8040 element originally used at this site (nominal active surface area of 330 ft² (31 m²)) was a predecessor to today's BW30-365 element, which has a nominal active surface area of 365 ft² (34 m²). BW30-365 is the element of choice for system designers, original equipment manufacturers (OEMs), and system operators requiring consistently high performance and maximum element life when treating difficult feed waters. This element offers proven performance, high rejection, and outstanding robustness and durability across a wide range of feed conditions:

- Features the industry's thickest feed spacer (34 mil) to lessen the impact of fouling.
- May be cleaned over the widest pH range (pH 1 - 13) for the most effective cleaning.
- The FILMTEC BW30-365 element is best suited for systems operating on challenging feed streams, where reliable pretreatment is not an option, or where maximum cleanability delivers value.

RO Plant Pretreatment and Maintenance

The AVS system is made up of four trains of a 5-2 array of vessels, each containing six FILMTEC™ BW30-8040 elements. The feed water arrives from the lake via a 9-mile-long pipeline where it goes through a prechlorination step before the clarifiers. From the clarifiers, it is cold-lime-softened, and liquid ferric sulfate and a polymer are added as coagulation aids. The water is then pumped to a 1 mgd clear well and then on to the main plant where it goes through a sand/anthracite filter and then a separate carbon filtration step. Additional pretreatment steps include 5 µm cartridge filters, the addition of sulfuric acid to reduce the pH to 7.0, 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 feed water.

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

Plant Performance

After 15 years of operation, the FILMTEC™ BW30-8040 elements show close to the same excellent performance as when they were installed, reducing conductivity from 450 µmhos to 12 µmhos while running at 75% recovery. The table below summarizes current RO plant data after 15 years of operation.

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 µmhos
Concentrate flow	173 gpm (39 m ³ /h)
Concentrate conductivity	1390 µmhos
Product flow	520 gpm (118 m ³ /h)
Product conductivity	12 µmhos

Conclusions

The durability and cleanability of FILMTEC™ elements combined with proper pretreatment and the excellent maintenance provided by the Antelope Valley Station boosted the life span of the elements significantly beyond the typical industry average. While long life is a hallmark of FILMTEC membranes, the exceptional long membrane life achieved here is to the credit of the operators and maintenance personnel at AVS. This system is an example of how FILMTEC elements can offer the best overall economics for RO system operators.

FILMTEC™ Membranes

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