

Split-Feed for Energy Savings

By Ian C. Watson

Jupiter, Fla., unveils split-feed NF plant

On Dec. 15, 2010, in a ceremony at its new water treatment plant, the town of Jupiter, Fla., unveiled a new and unique split-feed nanofiltration (NF) plant. Planning for this project started in 2004 and included extended pilot testing of the split-feed approach in both 4- and 8-in. formats. The plant replaces the town's original lime softening plant and will operate in conjunction with an existing brackish water reverse osmosis (RO) plant. The blended output from these two plants will provide the water system's users with a stable, balanced and reliable high-quality water supply.

Looking Back

David Brown, Jupiter's director of utilities and an American Membrane Technology Assn. (AMTA) director and former AMTA president, acted as the master of ceremonies for the dedication. He described the activities of the past four years to an audience of more than 100, acknowledging the contributions made by the town's elected officials and the project team, including Amanda Barnes, P.E., who as assistant utilities director had been Jupiter's program manager. Brown acknowledged the forward-thinking approach of the town's mayor and council to ensure a high-quality, reliable water supply for residents and reminisced about the first membrane plant that was built in the town: the 6-million-gal-per-day (mgd) Phase I brackish water RO plant, opened in 1990.

This was followed by Phase II in 1995 (also totaling 6 mgd) and Phase

III in 2005. Phase III involved the addition of energy-recovery turbines to Phase I, together with membrane replacement after 15 years and feed pump rebuild to reduce the discharge head. This phase also included the addition of a 1.7-mgd train, bringing the total capacity of the RO plant to 13.7 mgd.

Brown introduced Jupiter Mayor Karen Golonka, who reiterated his comments about the visionary council and the strong commitment of the town to provide its residents with the best-quality and most reliable water supply that can be achieved. Mayor Golonka also commended Brown and his staff for the outstanding job that they had done over the years in supporting this commitment. Howard Osterman, the utility's financial consultant, then commended Jupiter for its visionary approach to the water system and for taking the financial steps necessary to fulfill its commitment to its constituency.

Conventional vs. Split-Feed NF

In 2004, the idea of the split-feed approach was floated after a visit to the Netherlands by a utility department staff member. The employee brought back the concept of split feed, with which the Dutch had been working and had installed in some facilities. The driver for considering this concept was the potentially significant energy savings it offered.

A conventional Florida NF design traditionally has been a two-stage, seven-element vessel approach, operating at 85% to 90% recovery. In this design,



The membrane hall. Array is 63:18 with second stage at the top.

in which the feedwater passes through 14 membrane elements in series, the hydraulic pressure loss in the system dominates the membrane pressure equation, resulting in a feed pressure of about 90 to 100 psi.

In the split-feed approach, which utilizes specially designed pressure vessels with a center port, the feedwater passes through six elements in series, significantly reducing the hydraulic pressure drop.

Energy Savings

For Jupiter, piloting in both 4- and 8-in. configuration at 85% recovery and an average flux of 15 gal per sq ft per day demonstrated that a feed pressure of 50 to 55 psi could be expected in full scale, and that the unusual vessel characteristics would not lead to excessively rapid fouling or scaling issues.

At the time of the split-feed NF plant dedication, all five trains in the 14.5-mgd installation (17-mgd ultimate capacity) were operating at feed pressures of 53 to 55 psi, confirming the pilot study results and resulting in anticipated energy savings of 35% to 40% over the conventional Florida NF design. **MT**

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NF feed pump room, with cartridge filter discharge to the right.



Director of Utilities David Brown led the plant's December 2010 dedication ceremony.