Water Desalination Report

The international weekly for desalination and advanced water treatment since 1965

Volume 44, Number 5 4 February 2008

Florida

Neighborhood-friendly WTP

RO elements were being installed in their pressure vessels last week as the City of North Miami Beach neared completion of a 17 MGD (64,345 m^3/d) expansion of its Norwood Water Treatment Plant. When construction wraps up later this month, the plant will have a total capacity of 32 MGD (121,120 m^3/d), consisting of a blend from five separate treatment lines.

The plant was initially constructed in the 1950s as a lime softening facility to treat water from the 200–foot (61m) deep Biscayne Aquifer. While the Biscayne was able to provide some of the water necessary to meet the community's growing water needs, the City had to turn to the deeper, more saline Floridan Aquifer to provide almost 40 percent of the additional capacity.

According to Jeff An, the City's utility planning manager, water quality differences between the two aquifers necessitated two different treatment approaches. "The Biscayne Aquifer produces a hard water that is high in organics. Based on a two-year pilot study, we found that we can treat it very effectively with nanofiltration. On the other hand, the Floridan Aquifer has a TDS of approximately 3,800 mg/L and requires treatment with brackish RO," said Dr An.

Tetra Tech—the City's design engineer for the project—developed a treatment approach that includes a 9 MGD (34,065 m^3/d) NF system and a 6 MGD (22,710 m^3/d) BWRO system. An additional 1.5 MGD (5,678 m^3/d) of Biscayne water and 0.5 MGD (1892 m^3/d) of Floridan water is filtered and blended with the membrane permeate to increase the total capacity of the project to 17 MGD.

Both membrane systems were supplied by Biwater AEWT and employ Hydranautics membranes. The three-train UF system operates at 80 percent recovery while the RO system has two trains operating at 75 percent recovery. Pretreatment consists of sand separation followed by 5-micron cartridge filtration and acid feed. RO feedwater is also pretreated with a scale inhibitor.

Although two electrical grids serve the plant, 100 percent standby generation capacity was installed to ensure its operation if the power supply was interrupted by a hurricane.

Assistant utility director Karl Thompson told *WDR* that the utility added five new supply wells for the Biscayne Aquifer and four new wells for the Floridan Aquifer to feed the membrane plant. In addition, a new, 3,400–foot (1,036m) deep injection well was added to handle all of the RO and NF concentrate. "The total capital expenditure for the treatment facility was $35 million and the total project cost including the land acquisition, well fields and increased water storage capacity was $65 to $70 million," he said.

The membrane facility's control room is strategically located to overlook the pretreatment, pump and membrane halls, and is accessible to the administration building and training facilities via a wide, elevated walkway that makes it one of the most tour-friendly treatment facilities your correspondent has visited.

Because the plant is located in the middle of a residential neighborhood—and adjacent to a school—an extensive public outreach campaign was begun well in advance of the project. One street was closed and numerous houses along the plant's perimeter were purchased and replaced with linear parks. The plant's administration building was designed to include extensive training facilities and meeting rooms for use by community residents.

The general contractor is Poole and Kent and the project is scheduled for final commissioning in April.

Singapore

5th NEWater plant awarded

One of Singapore's Four National Taps will soon be opened a bit further as PUB—the national water agency—announced the selection of SembCorp Industries over five other bidders to design, build, own and operate the fifth and largest NEWater facility at the Changi Water Reclamation Plant (WRP). The new plant will initially treat 68,130 m^3/d (18 MGD) of the WRP's total 800,000 m^3/d (211 MGD) effluent and will be ramped up to 228,000 m^3/d (60 MGD) by 2010.

The first NEWater Plant undertaken as a public-private partnership was the 148,000 m^3/d (39 MGD) Ulu Pandan NEWater Plant constructed by Keppel Seghers and commissioned in March 2007. The other NEWater

Global Water Intelligence

Tom Pankratz, Editor, P.O. Box 75064, Houston, Texas 77234-5064 USA
Telephone: +1-281-857-6571, www.waterdesalreport.com, email: tp@globalwaterintel.com

plants include Bedok, Kranji and Seletar with a combined output of 92,000 m^3/d (24 MGD).

The new Changi plant will employ the same MF/UF and RO technology as the other NEWater facilities. To minimize land requirements and reduce piping costs, the NEWater facility will be built on the roof of the WRP which was designed by CH2M Hill and is currently in the final stages of testing and commissioning. The plant reportedly now receives 600,000 m^3 of influent daily.

When Ulu Pandan was commissioned in March 2007, the cost of NEWater from the combined facilities was reported to have been S$1/ m^3 ($0.71/ m^3; $2.69/kgal). Under the 25-year DBOO agreement for Changi, SembCorp will furnish the S$180 million ($127.3 million) facility at a first-year water price of approximately S$0.30/$m^3$ ($0.21/ m^3; $0.80/kgal).

Simultaneous to the plant's construction, PUB will expand the NEWater pipeline network by 87km (54 mi). Fifteen of 20 tenders, worth over S$400 million ($283 million), have been called for the work since September. The completed pipeline will link the Changi NEWater Plant to Tuas, Jurong Island, Sentosa and the four existing NEWater pipelines.

Singapore's Four National Taps are local catchment water, imported water, NEWater and desalinated seawater.

SembCorp is a Singapore-based utilities and marine group and has been operating a 35,000 m^3/d (9.3 MGD) water reclamation plant on Singapore's Jurong Island since 1999. The company recently acquired and operates the Fujairah I desalination and power plant in the UAE.

Texas
Water Planning 101

During the Multi-State Salinity Coalition's recent National Salinity Summit in Las Vegas, Jorge Arroyo of the Texas Water Development Board (TWDB) presented a vision of the state's water management strategies for the next 50 years. Unlike many locations that respond to crises, Texas has a formal process for developing the state's future water needs.

Planning is based on the 1950's drought-of-record, and a New State Water Plan has been prepared every five years since 1957. Water demand projections have become more accurate with each water plan and while some elements of each plan have become reality, others have only remained ideas. The 2007 Plan estimates that if the state water plan is not implemented, approximately 85 percent of the state's projected population will not have enough water by 2060 in drought conditions.

Desalination's role in Texas' long-term water management strategy has increased in importance since the previous plan was prepared in 2002. Arroyo told *WDR*, "Our water demands will exceed existing supplies by 7,860 MGD (29.7 million m^3/d) by 2060. If all the strategies recommended by the water planners are implemented, water supplies will increase by 8,000 MGD (30.3 m^3/d). Of that amount, four percent could be supplied by desalination. 123.3 MGD (467,000 m^3/d) by seawater desalination and 156 MGD (590,000 m^3/d) by brackish water desalination."

United Arab Emirates
Zero carbon city to use desal/reuse

Later this month, ground will be broken on a project that Abu Dhabi hopes will play a decisive role in its transition from technology consumer to technology producer. Located 30km (19 mi) east of the capital city, Masdar—meaning "the source" in Arabic—will be developed by the Abu Dhabi government to be the "world's first zero –carbon, zero–waste, car–free city."

The 6km^2 (2.3 m^2) city will eventually be home to 50,000 residents, 1,500 businesses and the Masdar Institute, a graduate-level institution focused on energy and sustainability-technology research and established with MIT's assistance. Foster and Partners designed the facility and CH2M Hill will serve as program managers.

As one would expect with such a project, the water supply and wastewater treatment systems will be designed to minimize energy consumption and waste production while maximizing conservation and water reuse. According to CH2M Hill's Lisa Henthorne, a groundwater desalination system is expected to provide an estimated 10,000 m^3/d (2.6 MGD) water supply, and both MBR and natural processes are being evaluated for waste treatment. "Our goal is to reduce per capita water consumption by more than 50 percent of the national average, and we will consider indirect potable reuse," she told *WDR*.

Organizations interested in supplying technology or otherwise participating in the project should contact Henthorne at lisa.henthorne@ch2m.com

Research

DESAL, REUSE R&D FUNDING AVAILABLE

The WateReuse Foundation (WRF), under its 2008 unsolicited research program, has issued a request for pre-proposals for funding consideration. It is anticipated that two to four water reuse or desalination projects will be funded to maximum level of $175,000 each.

WRF executive director Wade Miller told *WDR*, "Our objective is to ensure that the Foundation isn't missing ongoing or promising work in academia or other sectors. Through this effort, we are encouraging those entities that may have creative, innovative concepts to submit them for consideration."

Pre-proposals are due by 3 March and will be ranked by a 24-person research advisory committee. A shortlist will be prepared by 19 March from which full proposals will be requested for submittal by 27 June. Projects will be awarded on 29 September.

IN BRIEF

The island nation of **Mauritius**—located off Africa's east coast—is reportedly considering seawater and brackish water desalination to alleviate shortages caused by decreasing reservoir levels. Louis Ange Perrine, the commissioner in charge of water management, has said up to four plants will be in operation by March, although the director general of the Central Water Authority wants to wait some time before investing in large projects because of the outlay required.

Durrat Al Bahrain, **Bahrain's** planned $6 billion residential, commercial and tourist resort development announced the award of a 25-year DBO contract to Energy Central for a SWRO facility that will have an eventual capacity of 30,000 m^3/d (8 MGD). Energy Central is a Bahrain-based utilities services company.

Power supply problems have reportedly plagued Thailand's second largest SWRO plant since it was installed in mid-2006. The 12,000 m^3/d (3.2 MGD) plant was furnished by REQ Water Service at a cost of 528 million baht ($16.9 million) and provides water to the **Phuket Provincial Water Supply** at a cost of 40 baht/m^3 ($1.28/$m^3$; $4.84/kgal). Improvements have been made to the unstable power supply and the disruptions have been reduced from ten to three per day.

Siemens Water Technologies has signed an agreement with **CH2M Hill Singapore** to identify future market and solution trends within the South East Asian region and India. The agreement covers large end-users and contractors of all industries.

WATEK Engineering will relocate to new offices. Effective 18 February, their new contact details are:

12122-B Heritage Park Circle
Silver Spring, Maryland 20906
Phone: +1-301-933-9690 Fax: +1-301-933-9691
Website: www.watek.com

PEOPLE

Bob Siemak, formerly vice president of municipal development for Parsons Water and Infrastructure has been appointed chief of engineering and planning for the Water Replenishment District of Southern California. He can be contacted at rsiemak@wrd.org

Aqualyng Holding has announced that veteran desalter **Dave Laker**, has joined the firm as a Dubai-based senior technologist. He was formerly with Calder AG and can be contacted at dlaker@lyng.no

JOBS

Oman's **Sultan Qaboos University** will establish a research program in nanotechnology for water desalination. It is soliciting applications for a Chair to head an interdisciplinary team to maintain strong collaboration with universities and research organizations. For information, visit www.squ.edu.om/JobOpportunity/eng.html

Desalting History

RED-LETTER RO MEMBRANE DATES

A timeline chronicling the history of RO membrane development and commercialization is included on the back page of this issue. Space limitations prevent us from including a more complete list, but there are plans to expand it for the 2008 issue of the *IDA Desalination Yearbook*.

Similar timelines have also been prepared and are being updated for other membrane (UF/MF, NF, MBR, ED) and thermal (MED, MSF, VC) technologies. We encourage readers to submit to *WDR* the details of events they feel should be recognized because of their importance to our industry.

— Reverse Osmosis Membrane Milestones —

1748 — French physicist J.A Nollet describes "osmosis" as a liquid phase separation process using a membrane
1948 — UCLA Dr Gerald Hassler studies osomotic processes using cellophane membranes
1950 — Hassler describes "salt repelling osmotic membranes" and "perm-selective films" in unpublished paper
1955 — First reported use of term "reverse-osmosis" in US Dept of Interior's Saline Water Commission annual report
1955 — University of Florida's Charles Reid begins study of "*Osmotic Membranes for Demineralisation of Saline Water"*
1959 — Desalination capability of cellulose acetate film demonstrated by Breton and Reid
1960 — Asymmetric cellulose acetate membrane developed by Sidney Loeb and S. Sourirajan at UCLA
1963 — First practical spiral wound module by General Atomics
1965 — 19 m^3/d 'Raintree' plant in Coalinga, California is first commercial BWRO
1965 — RO's solution-diffusion mass transport phenomenon described by Lonsdale, Merten and Riley
1967 — First commercially successful hollow fiber module by DuPont
1967 — Toray introduces its first spiral wound cellulose acetate membrane
1968 — D.T. Bray of Fluid Systems designs first multi-leaf sprial wound element
1969 — DuPont commercializes 4-inch B-9 brackish element
1971 — Aromatic polyamide membrane patented by Richter-Hoehn and assigned to DuPont
1972 — Interfacial composite membrane developed by John Cadotte
1974 — First SWRO plant commissioned using 4-inch DuPont B-10 elements in Bermuda by Polymetrics
1976 — DuPont commercializes 8-inch B-10 seawater element
1977 — California's Water Factory 21 injects reclaimed effluent using RO into coastal barrier to prevent saltwater intrusion
1977 — FRP vessels introduced by Fluid Systems
1978 — Cadotte receives '344' patent for first fully aromatic thin film composite (FT-30) membrane and assigns to FilmTec
1979 — 12,000 m^3/d Jeddah SWRO commissioned using spiral wound polyamide membrane by Fluid Systems
1986 — Dow Chemical acquires FilmTec
1089 — 56,800 m^3/d Jeddah SWRO commissioned using cellulose triacetate hollow fiber membranes by Toyobo
1989 — CPA (composite polyamide) membrane patented by Hydranautics
1992 — 272,500 m^3/d Yuma, Arizona brackish RO project commissioned
1993 — Court rules that FT-30 Cadotte patent is owned by US government and all users must pay royalty
1994 — First low-fouling membrane introduced by TriSep
1995 — ESPA (energy saving polyamide) membrane introduced by Hydranautics
1998 — Koch Membrane Systems acquires Fluid Systems
2000 — DuPont abandons desalination membrane business
2002 — 18-inch diameter MegaMagnum element introduced by Koch Membrane Systems
2003 — Dual open-ended cellulose triacetate hollow fiber membrane introduced by Toyobo
2003 — SWC (seawater composite) membrane introduced by Hydranautics
2004 — Bureau of Reclamation sponsored study recommends 16-inch large diameter standard
2006 — Lab-scale carbon nanotube membrane developed at Lawrence Livermore National Laboratory
2006 — Thin-film nanocomposite membrane developed at UCLA
2007 — 10,000 m^3/d system at PowerSerya, Singapore first to use 16-inch dia seawater elements by GrahamTek