

WATER DESALINATION REPORT

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Florida

TASTING THE FUTURE

After winning 2007's Taste Test for 'best drinking water in the state,' Florida Keys Aqueduct Authority (FKAA) might be urged to reconsider using their Stock Island SWRO facility only for emergency operation. Colleen Tagle, the Authority's public information officer said the award was granted by the Florida Rural Water Association two weeks ago after competing against 31 entrants from utilities throughout the state, and it will now represent Florida at the national competition in Washington, DC.

FKAA is the sole provider of potable water for residents of the Florida Keys, transporting water from three plants through a 130-mile (208km) transmission pipeline and 649 miles (1,040km) of distribution pipelines. The primary water treatment facility is a conventional lime softening plant, but the Authority also operates two SWRO facilities for emergency operation – the 2.18 MGD (8,252 m³/d) Stock Island Plant and the 1 MGD (3,875 m³/d) Marathon Plant. It was the Stock Island system water that won the taste test.

The SWRO plants were initially supplied in 1981 as interim plants, but after only 18 months of operation, they were placed in standby operation and eventually, long-term storage. Between the mid-1990s and 2001, CH2M Hill made several design changes, and an extensive refurbishment was carried out in part by Harn R/O Systems. The changes included a new building, computer based instrumentation and rehabilitation of supply wells and disposal wells – the facilities are located in the Florida National Marine Sanctuary and surface discharge is not permissible.

One of the most significant changes to have taken place was Harn's replacement of the original Dupont B-10 membranes with Toyobo's Hollosep membranes. FKAA chief plant operator Pat Suniewick told *WDR* that the new membranes are able to reduce the 37,000 mg/L TDS to less than 200 mg/L in a single pass. "Unlike the original hollow-fiber membranes, the Toyobo fibers are wound in a criss-cross pattern that results in more turbulence and less fouling," he said.

According to Suniewick, "The system is still only used for high demand periods during the tourist season, weather emergencies or if a pipeline break occurs. It's kept in hot-standby and can be brought on-line with about two hours notice."

The system operates at 35-40% recovery and each 0.5 MGD (1,892 m³/d) train is equipped with a 650 HP (485 kW) diesel driven, multistage vertical turbine pump to provide 850 to 1000 psi (59 to 69 bar) operating pressure. Each SWRO train has a reverse running energy recovery turbine to recover 200 HP (150 kW), and the total diesel fuel consumption is 1.39g/kgal (1.39L/m³).

Harn R/O is currently making some additional modifications including the replacement of the feed, permeate and concentrate lines with higher grade materials; the feed and concentrate lines will be AL6XN with valves of 254SMO, and the permeate lines will be type 316 stainless steel. "We will also reconfigure the piping to improve the energy efficiency and reduce the number of isolation valves," said company president, Jim Harn.

After 26 years of operation, the Stock Island SWRO is still doing its job and making good water. FKAA executive director Jim Reynolds credits the plant operators under the direction of area manager Roy Coley. "Desalination is an important part of our alternative water supply plan. We call it 'A Taste of Florida's Future,'" he said.

Technology

GETTING THE BUGS OUT

Microbial fouling of RO membranes continues to be one of the primary limiting factors in RO optimization of both seawater and wastewater reuse systems. In fact, for the first time, the October IDA World Congress has allotted a separate session for the subject. A team of researchers is now reporting results that contradict the long held belief that lower average system fluxes and lower imposed fluxes decrease the possibility of microbial membrane fouling.

The research team, led by Professor Harvey Winters from Fairleigh Dickinson University and funded by GrahamTek, has shown that high flux operation resulted

in minimal membrane fouling in separate pilot studies at Singapore PUB's Bedok NEWater Plant, at the Singapore Port Authority SWRO Plant, and at SWRO pilot plants in Abu Dhabi and Sharjah, UAE. All of the membrane elements tested were fitted with GrahamTek flow distributors.

Professor Winters told *WDR* that most commercial 8-inch diameter SWRO membranes operate at a flux of 10 GFD or less to prevent significant fouling. "GrahamTek was able to operate the 16-inch [element diameter] Bedok water reuse plant at an average system flux in the mid-20 GFD range and the seawater systems at 14 to 18 GFD without any indication of membrane fouling," he said.

Based on these successes, a team of researchers was assembled to investigate how membrane fouling was prevented. According to Winters, the team focused on several operational aspects, but the critical flux of the microbes seemed to stand out. It was hypothesized that success was, to a large extent, due to an increase in the critical flux – the highest flux at which microbes will not deposit on the membrane – resulting from higher cross-flow velocities.

The data will be published in a paper to be presented by Winters and co-authors Professor Tony Fane and Bjarne Nicolaisen at the IDA World Congress. The paper will explain how microbial membrane fouling occurs and causes flux reduction and increase in salt passage. Another interesting part of the paper is how they show differences between microbial membrane fouling which manifests itself in the feed-end elements and a non-fouling thermodynamic restriction, which becomes apparent in the brine-end elements.

Winters has developed a microbial membrane fouling factor which incorporates critical flux analyses and the concentration polarization, and which can be used as a guide in selecting SWRO operating parameters. Once the microbial population is determined, a fouling factor can be calculated based on average GFD, imposed flux, cross-flow velocity, and recovery.

This is the first time that microbial membrane fouling potential has been tied with bacterial concentration and RO operating parameters. Winters says his analyses relate to the real world in that when SWRO plants have increased their cross-flow velocities and average system fluxes, significantly less fouling resulted.

Arizona

15-YEAR OLD MEMBRANES STILL PERFORM

Years after being mothballed, the Yuma Desalting Plant completed a 90-day test during which it operated at 10 percent of its 72 MGD (272,500 m³/d) capacity. The test ended two months ago and Jim Cherry, the Bureau of Reclamation's area manager, said the plant operated with few problems. A report on the operating results, preliminary cost estimates and the plant's impact on a 40,000-acre (16,187 ha) marsh in Mexico is expected later this year.

Perhaps the most interesting aspect of the plant's recent trial run was the fact that many of the BWRO membranes were used during the plant's initial nine-month operation in 1992-1993. According to Mike Norris, Reclamation's desalting group manager who is responsible for plant operations, Hydranautics' original 8.5-inch elements were used, some which were in cold storage and some that had been stored in the dry desert air at the plant.

"After the original '92-93 tests, we removed and cleaned the membranes, and then dried them in a process we developed to preserve them under ambient conditions. Before the recent tests, we took random samples to check the membrane integrity and salt passage, before re-installing them in the original pressure vessels," he said, noting that all o-rings were replaced.

Technology

FUSIBLE PIPE A NO-LEAK OPTION

When Collier County recently expanded its South County Regional Water Treatment Plant, a significant portion of the project involved conveying brackish feedwater from 24 wells through more than six miles (9.6km) of underground pipeline to the 12 MGD (45,420 m³/d) RO facility. Historically, such a project would have used HDPE pipe. However, when Greeley and Hansen designed the project, it allowed the use of HDPE or a new, Fusible PVC™ pipe product offered by Underground Solutions, Inc (UGSI).

The pipe contains a proprietary PVC formulation that creates a monolithic, gasket-free piping system when combined with UGSI's proprietary butt fusion process. Company president and CEO Andy Seidel told *WDR*, "We originally thought the pipe would primarily be used in trenchless applications similar to our recently

completed project in South Carolina where our 10 inch [254mm] butt-fused pipe was pulled through a one-mile long directionally drilled borehole under the Beaufort River. Fusible PVC is also proving to be very successful in direct bury applications such as the Collier County project due to significant material and installation cost savings.”

Greeley and Hansen project engineer Tom Wilson told *WDR* the decision to open up the specification to include a Fusible PVC option was due to the fact that it required fewer joints and therefore no external joint restrainers that would be subject to corrosion at a joint leak. “The pipeline would be conveying saltwater and we were concerned about potential leaks. With fusible pipe, we only have joints at the fittings. It’s also an excellent choice for those locations where we had to directionally drill under roadways and wetlands,” he said.

Contractors are not yet as familiar with Fusible PVC and while it’s not as flexible as HDPE, it provides a stronger pipe with less weight and a thinner pipe wall than HDPE. According to Wilson, “It’s one heck of a product. Our clients prefer it over polyethylene because they already have emergency equipment to deal with any problem that may arise with PVC.”

According to Craig Wiley, vice president and division manager of Reynolds Inc, the RO wellfield development project cost \$48 million, approximately \$7.5 million of which represented the piping and its installation. It was the first time Wiley installed Fusible PVC and he told *WDR* that the way the specifications were written, there was little choice in the matter.

“I’m a big fan of HDPE pipe and we have installed almost four million feet in Dalton, Georgia alone. But because of wall thickness requirements, the specs allowed either 30-inch fusible PVC or 36-inch HDPE pipe, and the PVC alternative was clearly less expensive,” he said. Wiley also noted that the installation of the PVC was no different than HDPE pipe, the fusing process was very similar, and he believes that PVC’s biggest advantage is that it could be inserted in any mechanical joint.

As desalination projects increase in size and are located further from water users, feedwater sources and concentrate discharge locations, fusible pipe appears likely to find even more applications.

Research

MEMBRANE FELLOWSHIPS AWARDED

Partnership fellowships for membrane projects have been awarded by NWRI for several membrane projects:

- Eva Steinle-Darling of Stanford will examine RO/NF effectiveness in removing perfluorochemical contaminants in recycled water.
- Kendra Coylar of University of Colorado at Boulder will use membranes to recycle water at bio-refineries.
- Manish Kumar of University of Illinois is developing a biomimetic polymeric membrane to remove dissolved contaminants from drinking water.
- Nancy Lin of UCLA is developing a new class of membranes with low mineral scaling tendencies and bio-adhesion resistance.
- Katherine Benko of Colorado School of Mines is evaluating an integrated membrane system using ceramic membranes to treat produced water.

Funding for these fellowships comes in part from NWRI corporate associates including Boyle Engineering, Cargill, Carollo Engineers, CDM, Kennedy/Jenks, MWH and Malcolm Pirnie.

New Mexico

BRACKISH DESAL R&D CENTER OPENS

A ribbon-cutting ceremony for the Bureau of Reclamation’s new Brackish Groundwater National Desalination Research Facility was held in Alamogordo, New Mexico last week. Reclamation Commissioner Robert Johnson welcomed dignitaries including US Senator Pete Domenici, credited with getting funding for the facility.

The facility represents a partnership between Reclamation and Sandia National Labs to bring together researchers from other Federal government agencies, universities, the private sector, research organizations, and state and local agencies to work collaboratively and in partnership.

The 16,000 square foot (1,490 m²) facility has room to facilitate nine projects and will include six inside bays with water available at a rate of 30 gpm (1.9 L/s) and three outside bays with a potential water supply of 60 gpm (3.8 L/s).

Australia

SWRO EXPANSION PLANS CLARIFIED

Queensland's government recently announced plans to use a A\$30 million (\$25.4 million) cost savings for a upgrade to the 125 ML/d (33 MGD) SWRO plant now under construction. Last week, Alan Davie of the Gold Coast Desalination Alliance – the Veolia/John Holland joint venture constructing the plant – described the preliminary expansion plans to *WDR*.

According to Davie, "Expansion to 47 ML/d will require some flaring of the inlet tunnel inlet area and some modifications of the outlet diffuser. At this point we are not deviating from the very real need to have the 125 ML/d plant operational by November 2008. Additional capacity will occur by retrofitting after the current commitment has been secured. While some aspects of the expansion can be achieved within the current construction scope, some additional physical development work will be required."

The plant will be owned by SureSmart Water, a privately incorporated special purpose company whose two, 50 percent shareholders are the Queensland State Government and the Gold Coast City Council.

IN BRIEF

Hurricane Dean's threat on the Yucatan peninsula has resulted in the postponement of the **Cancun, Mexico** desalination technology workshop that was to have been presented by National Oilwell Varco, Toray Membranes and Energy Recovery, Inc on 23 August.

The municipality of **Saint-Benoit-du-Lac, Québec, Canada** has installed a 27,000 GPD (102 m³/d) emergency nanofiltration system to remove blue algae from the Lake Memphrémagog potable water source. H₂O Innovation supplied the system and Group SM was the consultant. The emergency system will operate until a permanent filtration system is installed.

The **National Water Research Institute** (NWRI) has announced that Dr William Cooper, with the University of California, Irvine and Dr Steve Duranceau with the University of Central Florida have joined the organization's research advisory board.

Singapore's **Hyflux** reported revenues for the first half of 2007 were down 27 percent due to a partial divestment of the 136,380 m³/d (36 MGD) SingSpring SWRO facility. The second quarter profit rose by 113

percent to S\$5.2 million (\$3.3 million) as industrial sales increased by 23 percent. Industrial sales in China contributed 74 percent to the first-half revenue.

W.E.T. GmbH of Kasendorf, Germany has installed a 19,200 m³/d UF system (5 MGD) spa filtration system in Bad Aibling, Bavaria. The system will use Inge AG's Multibore UF modules. Since 2003, W.E.T. GmbH has installed 32 systems filtering 51,240 m³/d (13.5 MGD) of bathing water with 13 systems now under construction.

An Export Achievement Award was presented to **Aquatech International** by the US Department of Commerce last week. The award recognizes US companies that have entered a new overseas market with assistance from the Department's US Commercial Service. With export counseling from the Service in Pittsburgh, Aquatech was able to win a \$75+ million contract for its evaporators in Italy and was able to add twenty-five new employees.

Wetico/Saudi Berkefeld has announced that it has received an order for two desalination barges that will produce a total of 52,000 m³/d (13.7 MGD) of potable water for Saudi Arabia's western province. The SR 200 million (\$53.3 million) project is scheduled for completion in 2008.

PEOPLE

Readers may have noticed a new name on the cover letter accompanying recent issues of *WDR*. **Elisabeth (Beth) Fullana** is our new customer relations manager and will continue to make sure our subscriptions run smoothly and issues are sent out on time. Beth is originally from Kent, in southeast England. She has a degree in International Relations from the University of Wales and has just received an MSc in Latin American Relations from the Oxford University. She has is fluent in Spanish and previously worked for a London company that designed spreadsheet management software. If you have any questions regarding your subscription, contact Beth at ef@globalwaterintel.com

Last week, we incorrectly reported the new e-mail address for **CJ Kurth**, vice president of engineering for NanoH₂O. His correct address is cj@nanoh2o.net