

WATER DESALINATION REPORT

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Texas

LONE STAR STATE CONFERENCE REVIEW

Brackish water desalination was the over-arching theme at Texas Desalination Association's (TDA) annual conference in Austin last week. After all, San Antonio's SAWS BWRO plant had recently been commissioned and El Paso's Kay Bailey Hutchison BWRO plant recently celebrated two significant achievements: the tenth anniversary of successful operation and the commissioning of Enviro Water Minerals Company's new concentrate recovery facility.

Despite a strong emphasis on brackish groundwater—of which Texas is said to have 2.7 billion AF (3,300 km³)—seawater desalination was not forgotten. Besides reviewing seawater desal lessons-learned around the world, Brownsville PUB's Judy Adams predicted an SWRO plant in the utility's future. TDA president, Paul Choules of Water Cycle, also laid out his proposed model for how to build an SWRO plant in Corpus Christi at a total water cost of less than \$3.00/kgal (\$0.80/m³). *Hint:* The plan leverages electricity rates of \$0.034/kWh.

In a keynote speech, State Representative Lyle Larson, one of the legislature's strongest desal advocates and the chair of the Natural Resources Committee, acknowledged his disappointment that Governor Abbott "wasn't in the Christmas spirit", and vetoed five of his water-related bills, including one for brackish water development and another for aquifer storage and recovery (ASR).

Despite Texas' recent coastal flooding resulting from Hurricane Harvey, Representative Larson pointed out that Corpus Christi reservoirs' levels increased by only one-inch (25.4mm), and said that based on expected weather patterns, it is likely that the area could return to drought conditions within two years. Noting that it's always better to undertake such infrastructure projects before another water crisis occurs, he suggested that "now is the time to plan and build new brackish and seawater desalination capacity."

State Senator Juan "Chuy" Hinojosa, Chairman Todd Hunter and representatives Kyle Kacal and Paul Workman all echoed Larson's comments, stressing that they weren't interested in

more studies, which they interpret as another stalling tactic; they want to see a seawater project, sooner rather than later.

Also at the conference, the TDA awarded its newly instituted Ed Archuleta Desalter Scholarships to Savanna Smith, Alon Kirschner and Golam Hyder.

Desal Planning

WHEN AND HOW BIG?

Various reported as a \$3.5 to \$6 billion project, the 450,000 m³/d (118 MGD) Victorian Desalination Plant (VDP) in Wonthaggi, Australia, is one of the world's largest seawater desalination plants. It may also be the world's most expensive and controversial desal facility. The controversy began in 2007, when the decision to build the plant was made, and continued through its 2012 commissioning.

Criticism reached a fever pitch when a 2011 government report revealed that the plant's total water cost would be A\$5.09/m³ (\$5.17/m³; \$19.57/kgal) if its full production was ordered. Even if no water is ordered, the plant operator is paid an annual standby fee of A\$654 million (\$664.4 million).

As it turned out, the plant sat idle for the next few years, and no water was required until last year, when an order was placed for one-third of its annual production capacity. Then, this past March, the Minister for Water announced a standing minimum order of 15 million m³/yr (12,160 AFY), or 10 percent of its annual production capacity, for the next three years.

Desalter Networking Event

The organizing committee of the 18 October Desalter Get Together in San Diego is in the final stages of securing a venue. They have told *WDR* that they have been unable to respond to all the inquiries directly, but expect to do so in the coming week. The event, which was the idea of several long-time desalters, is open to all interested past and present desalters and members of the membrane community. More details will be emailed to all those who contact the committee at DesalterGetTogether@gmail.com.

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450,000 m³/d Victorian Desalination Plant – Wonthaggi, Australia

Melbourne’s storage levels now stand at 69 percent, and drought-proofing measures—which include full production of the VDP—would only be triggered if levels dropped below 60 percent. However, Chris Williams, Melbourne Water’s integrated planning manager, told a water forum last week that to help guard against Melbourne’s next drought, it made more sense to use desalinated water, while banking dam water “to underpin water security and our ability to be resilient against long-term droughts.”

Under a high population growth, low rainfall scenario, Melbourne could face chronic water shortages within 10 to 12 years, which would not only require operating the VDP at full capacity, but would also trigger increasing the plant capacity by another 50 million m³/year (40,534 AFY).

An online paper by MIT researchers, to be published in the October issue of the ASCE’s *Journal of Water Resources Planning and Management*, uses the VDP as a case study in modeling the challenges facing urban planning. Titled “Water Supply Infrastructure Planning: Decision-Making Framework to Classify Multiple Uncertainties and Evaluate Flexible Design”, the paper uses a new planning tool to analyze multiple uncertainty, risk and capital planning scenarios involving both existing reservoirs and new supply infrastructure.

The researchers applied the model to the Melbourne framework to evaluate opportunities for a reduction in capital investment using a flexible approach. They ran 100,000 simulations to evaluate six different infrastructure investment scenarios ranging from doing nothing to using

various combinations of pipeline upgrades and small and large SWRO plant arrangements over a 30-year timeframe.

Although the four alternatives that included desal have high capital costs, in more than 30 percent of simulations, they incur cheaper overall costs, including damages for water shortages, than a no-build or pipeline alternative.

The VDP can produce 150 million m³/yr (121,601 AFY). But in the MIT team’s simulations, building a desalination plant half that size usually worked well, and was the best-performing option in 20 percent of the simulations, and in the top three of 90 percent of the simulations. In all 100,000 simulations, it was never the worst or second worst performing option.

Sarah Fletcher, an MIT doctoral candidate and the study’s lead author, told *WDR*, that the Melbourne analysis shows that the best answer is not only predicated on assumptions about the city’s future, but also judgments about the value of water during times of scarcity and society’s appetite for risk. She said that future work could extend the study by incorporating additional uncertainties such as modeling different water end uses, risk mitigation of public-private partnerships, population growth and various water conservation strategies.

The paper is available at <https://tinyurl.com/yaxvvaef>.

Editor’s note: The VDP plant has a nameplate rating of 150 million m³/yr, which equates to an average daily production of 411,000 m³/d (108.6 MGD). To ensure this production, the plant must have an availability of about 92.5 percent, and was therefore constructed to be able to deliver 444,000 m³/d (117.3 MGD). The MIT researchers used a \$2.9 billion capital cost (\$7,056/m³/d) in their evaluation.

To understand how an SWRO project could cost this much, it’s necessary to understand the circumstances surrounding the VDP’s schedule and timing. To accomplish such an enormous design, permitting and construction feat in such a relatively short timeframe, the plant had to address siting and design challenges in the most expeditious (and often, most expensive) way possible. This meant spending more than might otherwise have been required to avoid having to deal with contentious issues and permitting and engineering challenges. All of this occurred during a global SWRO construction boom when the VDP had to compete with other projects for equipment and supplies, not to mention with local labor and construction resources during Australia’s surging mining industry.

Oman

OILFIELD BRINE CONCENTRATOR TENDER OUT

Petroleum Development Oman (PDO) has issued tender documents for its Qarn Alam Steam Project for a thermal brine concentration system to treat 25,000 m³/d (6.6 MGD) of hypersaline produced water having a TDS of 150,000 mg/L. The water is currently disposed of in surface and deepwater wells.

PDO said that it is seeking a technology provider that is able to treat the produced water to boiler feedwater quality, in order to save aquifer water for future use. The project is said to be in line with the PDO water management strategy of ‘reduce, reuse and relocate’. It will also minimize deepwell disposal while ensuring a regular and reliable supply of steam to support production of heavy oil with an API gravity of 16.

The project is to be developed under a 20-year design-build-own-operate-transfer arrangement with the successful contractor responsible for EPC of the water treatment facility, water storage tanks and transfer pumps, site preparation and all utilities, and the treatment and handling of all waste in accordance with PDO specifications.

Tender documents are available at the PDO public tender website at <https://srm.pdo.co.om/irj/portal>. Final statements of qualification are due by 7 November.

Company News

INNOVATIVE EDR DEMO UNDERWAY

Evoqua has begun a two-month demonstration run of its Nexed electrochemical desal process at El Paso Water’s Kay Bailey Hutchison Desalination Plant. The 25 gpm (1.6 L/s) system will use the same feedwater that has been pretreated for use in the existing, full-scale BWRO system. Brad Rickenbach, Evoqua’s business development manager for the technology, presented a project update at Texas Desalination Association’s annual conference in Austin last week.

Nexed is an electrochemical technology that he described as an advanced, next generation configuration of electrodialysis reversal (EDR). Initially known as E-Desal, the technology was first proposed by Evoqua (then, Siemens) in 2008, as a response to an open challenge by Singapore PUB to reduce the energy requirements for seawater desalination.

After winning the competition, Evoqua entered into a three-year cooperative effort with PUB, which included a \$4 million grant from Singapore’s Environment and Water



Nexed Pilot at Kay Bailey Hutchison Desalination Plant – El Paso, Texas

Industry Development Council, to further develop and test the technology. Evoqua still conducts related Nexed R&D and manufactures its modules in Singapore.

The technology has since evolved and Rickenbach told *WDR* that its ‘sweet spot’ revolves around applications with a TDS of less than 7,000 mg/L that require salt removal rates of 70-95 percent at recoveries of 75-95 percent, adding, “It’s particularly effective with brackish water applications that have high silica concentrations and which may be too difficult for RO.”

The El Paso demonstration will be operated by the University of Texas at El Paso (UTEP) and will consist of two, two-pass modules in series to provide a total of four passes. The demo system will treat feedwater that has a TDS of up to approximately 3,000 mg/L. During the first phase of operations, the chlorine tolerant system will operate at an 88 percent recovery to produce water with a TDS of less than 650 mg/L. The demonstration’s second phase is intended to optimize energy savings, and is expected to operate at a recovery of 82.5 percent.

Evoqua has applied for NSF approval and is currently making the process available for industrial applications.

Company News

REMINDER PROCESS SEEKS DEMO SITES

Since introducing its unique post-treatment process in 2014, Swiss-based Omya International has successfully demonstrated its OARP (Omya Advanced Remineralization Process) technology on full-scale SWRO installations in Spain, the Netherlands and Israel, and is currently demonstrating its OARP technology at one of the world’s largest desalination plants in Saudi Arabia.

Unlike conventional lime systems or calcite contactors, OARP uses micronized calcium carbonate and a patented,

submerged UF membrane filtration step to provide easy operation and reliable performance. The system produces no waste stream and has demonstrated the ability to reduce the plant footprint while avoiding the clogging and turbidity issues common in other post-treatment processes.

The process also has the flexibility to add magnesium to the remineralized water if it is required to achieve the finished water quality goal.

Omya told *WDR* that it is seeking European and North American BWRO, SWRO or reuse RO sites to further demonstrate its containerized remin system, which has a 17.6 gpm (66.7L/min) production capacity.

IN BRIEF

The Northwest Membrane Operator Association (NWMOA) will conduct a **Membrane Operators Certification** course on Low Pressure Membrane Systems in Kennewick, Washington, on 3-5 October. For information, visit <https://tinyurl.com/y9cte2gt>.

The Southwest Membrane Operator Association (SWMOA) will host San Diego-area tours of the Carlsbad SWRO plant and the Toray, Hydranautics and Protec Arisawa membrane manufacturing facilities on 10 October. The following day, a workshop entitled *Start-up Challenges of a Membrane Manufacturer & Equipment Facility* will be held in Carlsbad. See the workshop/tour flyers at <https://tinyurl.com/y9sourh8>. Note: The tours are intended for utilities and end users.

Sourcewater, the Houston, Texas-based online marketplace for water and water services in the upstream oil and gas industry, has announced that it has received strategic funding from **Marubeni**. Sourcewater currently lists over 100,000 water sources, uses and disposals in six US states and one Canadian province.

U.S. Water, the Minnesota-based water treatment equipment and services provider, has announced the acquisition of **Tonka Water** from Meriwether Capital. Tonka, another Minnesota company, products include the U-Flex UF membrane systems and Pore-Flex RO systems.

WEFTEC 2017 – Chicago

The Water Environment Federation (WEF) will hold its annual WEFTEC Conference and Exhibition at McCormick Place in Chicago, Illinois, on 30 September – 4 October. Organizers expect more than 1,000 exhibitors and 20,000 attendees. For more information, visit <https://www.weftec.org>.

The South Central Membrane Association (SCMA) is offering an **RO Operations & Maintenance** workshop in El Paso, Texas, on 31 October, and 2 November in San Angelo, Texas. For information, visit <https://tinyurl.com/y7k6cwq8>.

A paper by MIT researchers entitled “Unpacking compaction: Effect of hydraulic pressure on alginate fouling” has been published in the 8 September online edition of Elsevier’s *Journal of Membrane Science*. In the paper, Emily Tow and Dr John Lienhard, describe how they isolated hydraulic pressure from draw solution osmotic pressure by pressurizing an entire FO module to show that operating pressure alone did not affect flux decline rate, flux recovery after cleaning or foulant removal mechanisms. They conclude that alginate gel compaction by high feed pressure does not occur, low operating pressure is not advantageous for fouling resistance and other explanations should be sought for FO’s high fouling resistance relative to RO. For more information, visit <https://tinyurl.com/y88d63kl>.

PEOPLE

Joe Lauria has been named Black & Veatch’s vice president and director of planning and growth for the company’s water business, with primary focus on the California, Florida and Texas markets. Formerly with MWH and Arcadis, he is based in Irvine, California, and may be contacted at LauriaJ@bv.com.

Tony Fuhrman, formerly a key account executive and process separations product marketing manager for Hydranautics, has been appointed area market director by the LG Water Solutions division of LG Chem. He will lead the company’s business strategy for the Americas. He is based in Pittsburgh, Pennsylvania, and may be contacted at afuhrman@lgchem.com.

