

WATER DESALINATION REPORT

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Trinidad

ISLAND'S DESAL CAPACITY CREEPS UPWARDS

Soon after winning the June 2010 election, Trinidad's new government re-evaluated the Water and Sewerage Authority's (WASA) desalination and reuse initiative. The government has since pronounced that the program was dead and the only seawater projects to move forward would be the Seven Seas BOT project at Point Fortin (see following story) and the expansion of Desalcott's Point Lisas Desalination Plant.

Desalcott – a joint venture between Hafeez Karamath Engineering Services (60%) and GE Water (40%) – now reports that it has increased capacity of the eight-year old 28.8 MIGD (34.6 MGD) SWRO to 32 MIGD (38.4 MGD) and that it could be producing 34 MIGD (40.8 MGD) by the end of this month. It expects to reach a production of 40 MIGD (48 MGD) by the end of this year, while moving forward with plans to undertake a larger expansion to 60 MIGD (72 MGD).

Desalcott general manager John Thompson told *WDR*, “The first expansion was the result of a complete ‘debottlenecking’ process throughout the plant. We installed new, higher capacity membranes, made changes to our pumps and piping, and improved our pretreatment system.

“We also rented mobile BWRO trailers from GE to increase our second pass production capacity. Two of the 40-foot long trailers have already been installed and we have just taken delivery of two more trailers which are in the process of being installed.”

Other changes, including the addition of a new transformer, are underway, and have been undertaken by Desalcott's in-house staff.

Thompson said that the arrangements to secure financing for the 60 MIGD expansion are moving forward positively. Although an EPC contractor has not been selected, he said, “We are talking to several parties.”

Caribbean

FAST-TRACK SWRO HITS SPEED BUMP

When Seven Seas signed a BOO contract with Trinidad and Tobago's Water and Sewerage Authority (WASA) to supply desalinated seawater in southwestern Trinidad, its plans were to commission a portion of the plant within four months

and achieve full production capacity within eight months. After the company had begun site work to prepare for the installation of the 5.5 MGD (4.6 MIGD) SWRO plant, it became apparent that supplemental site work and additional permits were required to conduct the work.

Last week, Seven Seas CEO Doug Brown told *WDR* that those permits have now been issued and the company expects to commence construction imminently. “It appeared it might be necessary to find an alternate site, but we were able to obtain the necessary permit and the plant is now moving forward on a fast-track basis. We expect to be making water in the third quarter of this year,” he said.

Meanwhile, Brown said that siting evaluation is nearing completion on Seven Seas' project to provide 5 MGD (4.2 MIGD) of SWRO capacity to the Virgin Islands Water & Power Authority (WAPA) under a 15-year BOO arrangement. “We have identified a plant site in St Thomas and are now in the process of selecting a site in St Croix,” he said.

California

DESAL ADVOCATE NAMES EXECUTIVE DIRECTOR

CalDesal – the state's only advocacy group dedicated to advancing the use of desalination – has named Ron Davis as its first Executive Director. Davis has a long history of water policy experience in California, and has worked as state legislative director for the Association of California Water Agencies.

The non-profit organization works with legislators and regulatory agencies to provide a unified voice on desal issues, as well as advocating individual desalination projects in the state. It was founded in June 2010 and is managed by its members.

The organization currently has 30 public agency and 33 affiliate members. Davis told *WDR* that one of his first goals is to further increase membership, adding both public agencies and companies interested in participating in desal projects in the state.

Davis said that CalDesal is offering *WDR* readers who mention this article a ten percent discount on a new membership if they join the organization within the next month. Contact him at RonD@CalDesal.org.

Technology

BUG POWER DESALTS WATER, MAKES ENERGY

A microbial fuel cell (MFC) is a biological reactor that uses bacteria to convert soluble organic matter into electricity. Although the idea was first developed in 1911, it was only relatively recently that researchers found they could use domestic wastewater as the source of organic matter and bacteria necessary to drive the process.

In the past three years, researchers began looking at ways to modify a MFC so that it could simultaneously desalinate water. *WDR* has previously reported on the research done by Bruce Logan at Penn State (volume 45, number 29) and Zhen He at UWM (volume 46, number 26), and this week, we will take a look at the work done by Zhiyong (Jason) Ren at the University of Colorado, Denver.

Using a concept similar to Drs Logan and He, Dr Ren found that he could simultaneously desalinate water and produce hydrogen gas by adding a third chamber between the cathode and anode chambers of a conventional MFC and a small power supply. Saline water in the center chamber is desalted when ions migrate through ion-selective membranes separating the chambers, with organic oxidation occurring in the anode chamber and H₂ production in the cathode chamber.

“The proof-of-concept study of microbial desalination cells showed a 90 percent desalination rate, but it was restrained by significant pH variations that led to methane contamination and huge power output fluctuations as the process proceeds. We developed an integrated system called

the microbial electrolysis and desalination cell [MEDC] that uses an added voltage to concurrently desalinate water, produce H₂ and treat wastewater,” Ren told *WDR*.

The advantage of the MEDC system is that the desalination process is enhanced and collectable hydrogen gas is generated without the voltage fluctuation and methane contamination from low pH operation.

“With our bench-scale test in a batch operation using an external voltage of 0.8 volts, we are able to produce 1.95 m³ of 98-99 percent pure hydrogen gas per m³ of reactor per day for a net energy gain of 80 percent. We also achieved a 99 percent salt reduction with a one-day detention time and an 80 percent COD removal from primary-settled wastewater recently,” he said.

There is still much work to be done and challenges to be faced, but Ren said that the results are promising and that depending on the level of treatment required, the system could eventually serve as a pretreatment system to provide energy and reduce membrane fouling of a downstream RO process, or be used directly for agricultural irrigation or groundwater recharge.

The Office of Naval Research funded the research and the results of the study were published in the January 2011 issue of *Environmental Science & Technology*. Ren’s group is currently talking with commercial partners to continue the research on a larger scale. With proper funding and the right partners, he hopes to develop modular commercial MEDC systems within the next four years.

WDR’s C_{DR} rating for this technology is 5.2.

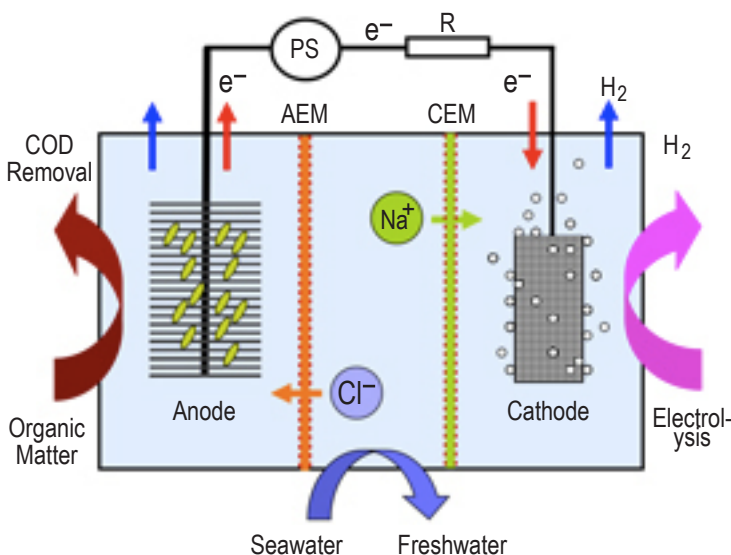
Company News

TESTS BEGIN ON SOLID-STATE MEMBRANE

Florida-based Dais Analytics has begun pilot tests on its Nano-Clear desalination system in Beijing at China’s Academy of Science. Tests of the high-recovery process, which received honorable mention recognition at GWI’s 2008 Technology Idol event, are intended to demonstrate the process’ functionality and scalability on a variety of high-TDS wastewater streams.

According to Dais CTO Scott Ehrenberg, the membrane system requires pretreatment to remove suspended solids, and works in conjunction with vapor compression to produce high quality water without scaling or fouling.

“The membrane is solid, with no porosity. Water transport



Microbial Electrolysis and Desalination Cell Schematic

occurs by solid-state permeation within a 15-nanometer diameter substructure filled with a high charge density electrolyte. The membrane can remove water from solutions that have high TDS content, up to and including precipitation limits. This is possible because the charge density within the membrane far exceeds the ion solution density of the high TDS stream, and can be looked at as form of controlled forward osmosis,” he said.

Testing of the two, 1,250 GPD (4.7 m³/d) units will continue through 2012.

Company News

HIGH EFFICIENCY RO PROCESS LICENSE EXTENDED

It was difficult to miss last week’s press release from GE announcing an expanded license agreement with inventor and patent holder Debashish (Deb) Mukhopadhyay. According to the press release, “GE will hold specific rights to market and manufacture solutions that utilize the HERO [High Efficiency Reverse Osmosis] technology in key industry segments and applications,” including the microelectronics, mobile water treatment and zero liquid discharge markets, the hydrocarbon and chemical processing industries and food and beverage industries.

Because Mukhopadhyay has a license agreement with several other companies that cover the HERO technology, *WDR* contacted both GE and Mukhopadhyay in an attempt to better define the geographies, markets and exclusivity of the agreement. Although both declined an invitation to go into the details of the license, Mukhopadhyay said that the expanded GE license did not signal any dissension among the other licensees and that nothing had been taken away from any of his other partners.

The first HERO license was issued to Nomura Micro Science in 1997, followed by an agreement with Aquatech a few months later. Both contracts are still in place and Mukhopadhyay said that he has several other licensees who bid opportunistically, preferring not to advertise the relationships for strategic reasons.

“I also have good working relationships with companies in China, Europe and Mexico,” he said, adding that an agreement with Kennicott had been severed several years ago due to “irreconcilable differences”. Another agreement with Australia’s Osmoflo is understood to be in a state of flux.

The HERO process pre-conditions RO feedwater using ion exchange to remove hardness, and acidification and degasification to reduce alkalinity, before increasing the pH above 8.5 – usually from 10.0 to 10.5 – to ionize species such as silica and boron. This process enables the RO to operate at recoveries above 90 percent with greater than 99 percent silica rejection. A variation, known as the XRO process, is a mirror image of the HERO process and involves preconditioning the feedwater to allow for RO operation down to pH 2.0 for treatment of semiconductor fabrication wastewater.

More than 150 HERO systems have been installed.

Regarding Veolia’s lawsuit alleging that his 1999 HERO patent infringes on Veolia’s 1993 high-pH RO patent, Mukhopadhyay would only say that it continues to wind its way through the court system.

IN BRIEF

Middle East Desalination Research Center (MEDRC) director Roland Mollinger clarified the organization’s role recently. He told the Huffington Post, “While private corporations specializing in desalination technologies have tens of millions allocated for research and development, MEDRC is not aiming to compete, but instead focuses on regional cooperation, capacity building and applied research to benefit the people of the MENA region.” Beyond their scientific research and capacity building work, he emphasized that MEDRC is seeking to establish itself as an academic center for excellence and a possible degree granting institution, and also to serve as a forum to advance multilateral track diplomacy between Israel and Arab states.

inge watertechnologies has introduced a new line of dizzer Multibore UF membrane modules for small-scale and point-of-use treatment systems. The modules have 0.5 to 6m² (5.4 to 65 ft²) of membrane area and can be inserted in standard, 2.5- or 4-inch diameter pressure vessels.

After the meeting room filled to capacity at San Diego’s National University, prospective attendees had to be turned away from a desal symposium recently organized by the locally-based **Maritime Alliance**. The Alliance is a non-profit organization dedicated to the global promotion of San Diego’s maritime-related businesses. Veteran desalter Randy Truby told *WDR* that the SoCal and Mexican desal communities were well represented, noting, “It was an

interesting and diverse meeting. The Maritime Alliance said they plan to follow up with more public outreach and government agency contact, and hope to formulate strategies to educate the public to the capabilities of desal and maritime technologies.”

Doosan Heavy Industries will manufacture three of the eight MSF units for Saudi Arabia’s Ras Azzour desalination project at its plant in Quang Ngai province, Vietnam. Each evaporator will weigh 4,000 tons and measure 10.6m (35 ft) high, 29.2m (96 ft) wide and 100.4m (330 ft) long. The SR6.6 billion (\$1.76 billion) plant will have a total production capacity of 1,037,000 m³/d (274 MGD), approximately 70 percent of which will be produced using MSF. The balance will be produced using SWRO. Doosan has said it will complete the project by January 2014.

The central California city of **Visalia** will upgrade its existing wastewater treatment plant to incorporate the MBR process employing GE’s ZeeWeed membranes. The upgrade will address current discharge orders that limit discharge requirements to 20 MGD, which is 2 MGD below the rated flow, and a new ammonia discharge limit of 0.025 mg/L. The plant also plans to discontinue discharge to Mill Creek and will divert the discharge to an existing percolation basin southwest of the plant.

Tenders are due this Wednesday, 9 February, for the Federal Electricity and Water Authority’s (FEWA) 68,130 m³/d (18 MGD) **Ghalilah SWRO plant** in Ras Al Khaimah, UAE. At least eight bidders have submitted EOIs for the EPC project. A 13,650 m³/d (3.6 MGD) SWRO constructed by Fisia Italmimpianti has been operating in Ghalilah since February 2005.

Deakin University, in conjunction with the University of Western Australia, will undertake a three-year, \$1.1 million study to address the possible impacts of concentrate discharges from seawater desalination plants on key marine species. Dr Jules Mondon will be the project leader, and the project will be carried out near a Western Australia desal facility. The funding should be finalized within the next three weeks and the project is anticipated to start in April.

Chennai’s state government is preparing a Detailed Project Report for **India’s** third, large-scale seawater desalination plant. The plant is expected to have a production capacity of 200,000 m³/d (52.8 MGD) and be located at Tiruvallur.

Befesa commissioned a 100,000 m³/d (26.4 MGD) SWRO at Minjur in July 2010, and IDE is currently constructing a 100,000 m³/d plant at Nemmeli which is scheduled for completion in 2012.

Spectra Watermakers has introduced a new, 20 GPM (1.26 L/s) Pearson Pump that combines high-pressure pumping and energy recovery in a single unit. Spectra says the evolution and enhancement of its reciprocating pump can reduce energy requirements of the high-pressure circuit of a SWRO system to 2.1 kWh/m³ (7.95 kWh/kgal).

Last week, **Israel’s** cabinet approved an emergency water plan that will increase water production of the country’s seawater desalination plants. The plan, which was proposed by the National Infrastructures Minister and the Prime Minister, calls for the existing plants to run around the clock rather than operating opportunistically to take advantage of lower off-peak electricity rates. A proposal to move forward with an additional SWRO plant at Ashdod and a second plant at Soreq will be submitted for Cabinet approval in the coming weeks.

The **European Desalination Society** (EDS) will hold a three-day course on *Membrane Technology, Process and System Design* on 7–9 March in Genoa, Italy. The course will be taught by Mark Wilf and more information is available at www.desline.com/Wilf_March2011.pdf.

The **H2O World 2011** Annual International Conference on Water & Wastewater Management will be held on 11 March in New Delhi, India. The conference theme will be “integrated water resource development and management for national growth.” For more information, visit www.epcworld.in/H2Oworld/.

JOBS

Process Engineer- Desal N.A. Water Systems LLC, of Veolia Water Solutions & Technologies (VWS), is currently seeking a Process Engineer – Desalination to work in our Moon Township, PA office. The successful candidate will possess a Bachelor’s degree or equivalent in an engineering field, preferably in the field of water/wastewater engineering and ten years or more of desalination experience. For more information and to apply, visit our website: <http://www.veolia.com/en/careers> and search on Job Number 06114.