

# WATER DESALINATION REPORT

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## Oil & Gas

### TEXAS PRODUCED WATER RECYCLING GETS BOOST

Last week, the Produced Water Society held its 24<sup>th</sup> Annual Seminar in Houston. In addition to hearing updates on traditional produced water treatment technologies, the 180 attendees learned how unconventional oil and gas production techniques have led to water management challenges that require new, advanced treatment processes.

A presentation by Brent Halldorson focused on west Texas' Permian Basin and highlighted how changing regulations and growing water scarcity are altering the way the industry looks at produced water. "The old way of thinking about produced water focused on disposal. Our new way of thinking about it involves combining disposal, blending and recycling," said the COO of Fountain Quail, a Fort Worth-based water management company.

He said that the Railroad Commission (RRC) of Texas—the state agency regulating the oil and gas industry—enacted House Bill 2767, which helped remove barriers to the beneficial reuse of produced water and encouraged recycling. The law took effect in September and addressed the legal ambiguity about produced water's ownership. According to Halldorson, "The bill transfers the ownership and liability of produced water from the producer [or, driller] to the recycler and then on to the water purchaser/user."

The new rules also include:

- 'Permit-by-rule' – allows operators to recycle water without a permit;
- Multi-lease use – allows water from multiple leases to be co-mingled and recycled for reuse;
- Multi-operator use – allows water from different operators to be recycled and used by an energy company that didn't originally generate it;
- Distilled water – a special distinction was granted for water produced by thermal distillation, which allows it to be handled as freshwater while it remains in the oilfield.

"Brackish water is no longer a 'free resource' in Texas. Municipalities in west Texas now look at it as a part of their future water supply, and there is growing concern

that excessive use of brackish groundwater in oil and gas production could negatively impact the limited fresh water aquifers. The new RRC rules provide a regulatory framework in which recycling produced water is now a viable alternative to disposal, preserving valuable brackish and freshwater resources," Halldorson concluded.

## Oil & Gas

### PRODUCED WATER TECHNOLOGY UPDATES

Nowhere does the apples-and-oranges idiom apply more appropriately than when speaking about the quality of produced water. Truly, no two produced waters are alike. To take things a step further, it is also true that no single produced water's quality or quantity remains the same.

Water quantities and qualities change as oil and gas fields, and even individual wells, mature.

New water treatment and volume reduction technologies that are being developed for use in upstream oil and gas applications must be flexible enough to meet these unique conditions and be robust enough to operate in harsh and remote conditions.

This issue of *WDR* summarizes some of the advanced technologies that were presented or updated during last week's Produced Water Seminar:

*RO about to treat 500,000 bbl/d:* In late 2012, RWL's Nirosoft was awarded a contract to build a 500,000 bbl/d, 3-stage BWRO system to treat produced water in Colombia's Rubiales field.

Last week's seminar attendees saw recent photos of the \$40 million system's installation progress, which should be commissioned before the end of March. The 3-stage RO

#### Produced Water Society Update

Colin Tyrie, the Society's secretary, announced that Global Water Intelligence will take over responsibility for managing future conferences and providing the membership secretariat for the Society, as he moves towards retirement. The Society will remain as a Texas-based non-profit organization, and more information will be provided in the coming months.



*Rubiales project site and RO system (inset) being installed*



system will recover 90 percent of the pretreated produced water for irrigation applications, and Nirosoft has a \$60 million contract to operate the system for ten years.

*Evaporators recycle produced water:* Fountain Quail has over ten years of experience treating produced water in Texas and was the recipient of the RRC’s first recycling permit for shale flowback/produced water. According to COO Brent Halldorson, the new RRC rules for distilled water were based on Fountain Quail’s track record in successfully treating produced water with its NOMAD MVC evaporators.

The company, who is a joint venture partner with Select Energy Services, currently has two NOMADs, each with a production capacity of 4,000 bbl/d, operating in the Permian Basin. The units produce four streams: distilled water to reuse for new fracs, clean ‘heavy’ brine for reuse in drilling operations, oil, which is sold, and solids for disposal.

*TWRA advocates for recycling:* Despite Texas’ immense mineral wealth, it faces tremendous water challenges. The Texas Water Recycling Association (<http://txwra.org>) is a new group of recyclers that believe in incentives, rather than mandates to help find winning recycling scenarios, such as “the use of one industry’s waste to help fill another industry’s need.”

John Tintera, the former executive director of the RRC, and an expert on water use issues in unconventional oil and gas, is the organization’s president.

*ZLD project employs HDH technology:* Last Thursday, Prakash Govindan completed a successful demonstration of Gradiant’s first commercial humidification-dehumidification (HDH) unit in Texas’ Permian Basin and flew to Houston

to deliver a presentation on the use of desalination technologies in oil and gas applications.

Later, he told *WDR* that the test consisted of operating a Gradiant HDH unit—which employs the company’s proprietary carrier gas extraction (CGE) technology—for over six weeks while producing 500 bbl/d of distilled water from a produced water feed stream with a TDS of 120,000-140,000 mg/L. The company will begin ramping-up the facility’s production to 4,000 bbl/d by furnishing seven more modules.



*Gradiant’s HDH project site*

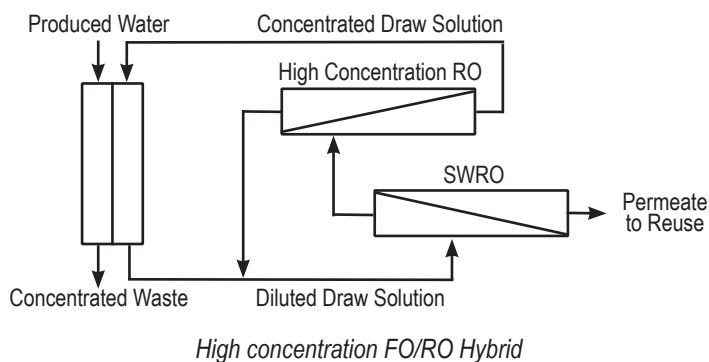
Govindan noted that the ZLD facility will also produce 10-pound brine for well completions, while the fresh water will be used in new frac operations. “Nothing goes down a disposal well,” he said.

*MBC goes commercial:* When data on Oasys’ Membrane Brine Concentrator (MBC) was presented at last year’s PWS Seminar, it reflected the company’s first field pilot installation, which had successfully treated 100 bbl/d of produced water in the Permian Basin using the company’s proprietary forward osmosis process.

During the past year, Oasys has established a new, exclusive partnership with National Oilwell Varco (NOV) and has logged more than 2,000 hours of successful operation in the Marcellus Shale and Permian Basin, where it concentrated produced water from a TDS of 80,000 mg/L to over 200,000 mg/L, a treated water with a TDS of less than 500 mg/L and a heavy, reusable brine.

According to Oasys’ Lisa Marchewka, the company will begin operating a commercial 4,000 bbl/d system—she said it will be the largest FO system in operation in the world—this May. The system will include a fully integrated ClearFlo pretreatment system and will deliver product water with a TDS of less than 500 mg/L while recovering 10-pound brine for resale.

**High-concentration membrane hybrid:** Hydration Technology Innovations (HTI) has expanded the polymeric RO window by extending the acceptable TDS level in a closed loop membrane system up to 140,000 mg/L (as NaCl) in an FO/RO hybrid to maximize water recovery. According to HTI's Upen Bharwada, the system is now in the pilot development stage and combines the company's know-how in both FO and RO.



Using brine from a HiCor high-concentration RO system as the draw solution, an FO system is able to effectively concentrate produced water. In an FO configuration, the membranes have a low fouling tendency, while allowing fresh water—driven by the high salinity gradient—to pass. The diluted draw solution exiting from the FO can be regenerated in a brine-staged RO arrangement, while producing a high-quality water for reuse.

**MD moves into oilfield:** Although mentioned as possibly having oilfield applications, membrane distillation (MD) was not one of the technologies featured at last year's PWS seminar. However, memsys clearwater has since worked with GE Water to develop a mechanical vapor compression (MVC) multiple effect MD unit for oilfield applications.

During a memsys/GE shale gas pilot test, the MD unit provided over 200 hours of continuous service while concentrating 200 bbl/d of feedwater with a concentration of 14-16 percent TDS up to 24 percent TDS, saving up to 40 percent of the energy required in a conventional evaporator system.

**Freeze process moves into pilot phase:** CryoDesalination's inventor was awarded the St Andrew's Prize for the Environment for his freeze desalination process in May 2013. Although the process is ultimately intended for large potable water plants, Norbert Buchsbaum told *WDR* that the present development efforts target desalination of produced water and ZLD applications.

He said that the company has conducted pilot tests of produced water in various shale plays and the company has developed a trailer-mounted concept with a production capacity of up to 3,400 bbl/d for produced water applications. Energy requirements are said to be competitive with other processes, and Buchsbaum said, "We have resolved the ice-brine separation problems that plagued earlier freezing processes. Furthermore, by keeping the ice at all times as a slurry that can be pumped, the handling of solids is avoided."

**System adjusts to changing feedwater:** Since it was introduced at last year's seminar, Water Standard's H2Ocean Spectrum process has been pilot-tested, validated and developed for use in offshore and onshore applications. The system, which is used in conjunction with RO treatment, allows produced water to be integrated into enhanced oil recovery (EOR) projects without salinity or hardness impacts, even as feedwater composition changes.

The company is now proposing the proprietary system on commercial onshore and offshore EOR projects.

## Research

### REQUEST FOR DPR PRE-PROPOSALS ISSUED

Under its Tailored Collaboration Research Program, the WaterReuse Research Foundation (WRRF) has issued two requests for pre-proposals for direct potable reuse (DPR) projects. The projects are:

- *Evaluation of Source Water Control Options and the Impact of Selected Strategies on DPR* – A desktop study evaluating upstream wastewater treatment impacts on DPR source water quality and processes, and evaluating the impact on hydraulic control mechanisms that stress the process. WRRF funding: \$150,000. Estimated project duration: 12 months.
- *Development of Operation and Maintenance Plan and Training and Certification Framework for DPR Systems* – The project calls for developing standard O&M plans for various DPR processes and a training and certification framework for system operators. WRRF funding: \$250,000. Estimated project duration: 12-16 months.

The projects require matching funds of at least 25 percent of the total project costs in in-kind services and/or cash, and utility participation is encouraged. The 15-page pre-proposals are due on 18 February, and full proposals from the selected participants are due on 8 April.

For more information, visit <http://tinyurl.com/kcg4p3s>.



## IN BRIEF

Kuwait's **Az-Zour North 1 IWPP** project reached formal financial closure on 10 January, ending a tender process that began in 2010. The \$1.43 billion project will employ Sidem MED desal technology with a production capacity of 486,400 m<sup>3</sup>/d (128.4 MGD) and valued at €320 million (\$433 million), in addition to a 1,500 MW power station. A developer team led by GdF Suez-led will own and operate the plant under a 40-year power and water purchase agreement with the Ministry of Electricity and Water.

The **European Desalination Society** (EDS) will hold an intensive 3-day *Membrane Technology, Process and System Design* course in Rome on 3-5 March. Dr Mark Wilf will be the course lecturer. For information, visit <http://tinyurl.com/lvha6o>.

The **Middle East Desalination Research Center** (MEDRC) will hold two DHP seminar training series at its headquarters in Muscat, Oman. The seminars will be held on 9-13 February and 16-20 February. For more information, visit <http://tinyurl.com/lobx686>.

**MEDRC** is inviting interested graduate students from the Middle East and North Africa (MENA) region to submit scholarship applications for consideration. Applicants must obtain acceptance from a relevant university offering RO or thermal desalination-based coursework. The submission deadline is 15 June 2014, and the number of scholarships is limited, with selection made on a competitive basis. For information, contact [scholarships@medrc.org](mailto:scholarships@medrc.org).

Quebec-based **H2O Innovation** said that it has been awarded two membrane system contracts for wastewater reclamation projects. The projects include a 4.2 MGD (15,900 m<sup>3</sup>/d) RO system to treat effluent from a municipal MBR system in Hamby, Texas. The permeate will be used to supplement other sources to fill Lake Fort Phantom Hill, the primary source of water for Abilene, Texas. The second project involves the supply of a 1 MGD (3,785 m<sup>3</sup>/d) portable MF/UF system for the West Basin Municipal Water District in Carson, California.

Areva SA, the French-based nuclear power and mining company, has reportedly offered to sell its \$276.3 million **Erongo SWRO plant** in Namibia to the government. Areva

commissioned the 54,000 m<sup>3</sup>/d (14.3 MGD) plant in April 2010, but mothballed the facility in late 2012 after the price of uranium dropped and production of the Trekkopje mines that the plant was built to serve was reduced. Areva is expected to retain a 10 to 20 percent stake in the facility.

Readers are reminded that they have just two more weeks left to nominate a person, project or company for a **Global Water Award**. To begin the nominating process, or to obtain further information on the Awards, which will be presented at the Global Water Summit in Paris on 7 April, visit [www.globalwaterawards.com](http://www.globalwaterawards.com).

## PEOPLE

**Chris Peta**, formerly an executive business developer and account manager for Siemens Water Technologies, has been appointed to a similar position for Schneider Electric. He is based in Pittsburgh, Pennsylvania, and may be contacted at [christopher.peta@schneider-electric.com](mailto:christopher.peta@schneider-electric.com).

Dow Water & Process Solutions has announced several new appointments.

- **Cedella Beazley** has been appointed to Business Unit Director – Filtration, overseeing the filtration business unit and North America commercial teams. She is based in Edina, Minnesota, and may be contacted at [cebeazley@dow.com](mailto:cebeazley@dow.com).
- **Rajat Mehta** has been appointed to Business Unit Director – Ion Exchange Resins, leading the ion exchange business unit and the Europe, Middle East and Africa commercial teams. He is based in Philadelphia, and may be contacted at [rmehta@dow.com](mailto:rmehta@dow.com).
- **Lance Johnson** has been appointed to Business Unit Director – Reverse Osmosis, overseeing the RO business unit and the Asia Pacific commercial teams. He is based in Edina, Minnesota, and may be contacted at [LJJohnson@dow.com](mailto:LJJohnson@dow.com).

**Alejandro Jiménez**, the former international commercial director for Acciona Agua, has been appointed the business development director for TAQA, the Abu Dhabi National Energy Company. He will be based in Abu Dhabi and may be contacted at [alejandro.jimenez@taqaglobal.com](mailto:alejandro.jimenez@taqaglobal.com).