

WATER DESALINATION REPORT

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Hong Kong

SWRO BID SUBMISSION DATE EXTENDED

Hong Kong's Water Supply Department (WSD) has extended the bid date for the Tseung Kwan O SWRO plant to 14 December. The plant will have a first stage production capacity of 135,000 m³/d (35.7 MGD), with provisions for future expansion up to 270,000 m³/d, and a portion of the plant's power is to be provided by solar energy using PV panels.

Four groups have been pre-qualified to bid the project. They are: Veolia/Vinci, Suez/Drageages, IDE/China Harbor Engineering, and Acciona/China State Engineering. The bid evaluation will consider a technical versus price weighting ratio of 40:60.

Black and Veatch is WSD's project consultant. The project will be delivered under a 10-year design-build contract with a 5-year extendable term currently being recommended. It is expected to be operational in 2022. More information is available on the project website at <https://www.tkodesal.hk>.

Company News

SWRO BRINE CONCENTRATOR EMPLOYS OARO

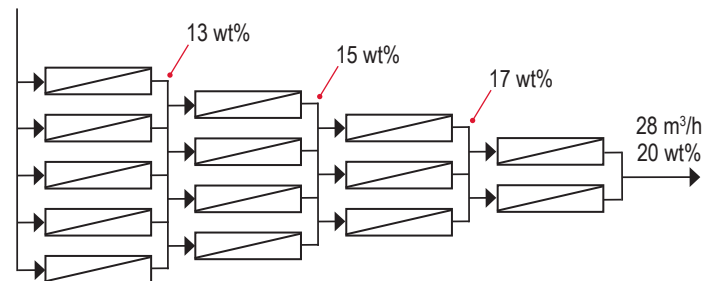
At the 2017 Global Water Summit in Madrid, Turkey's Hyrec took home Technology Idol's Distinction Award for its Hyrec Brine Concentrator, an osmotically-assisted reverse osmosis (OARO) technology. Last week, *WDR* checked in with Basel Abu Sharkh, the company's CEO and Tech Idol presenter.

"We've made a lot of progress in commercializing our OARO technology since then. In addition to our near commercial size seawater concentration system, which has been in operation for six months, we are working with some sodium sulfate and lithium chloride streams, and concentrating textile and high-salinity chemical industry waste streams containing sodium chloride salt concentrations of more than seven percent," said Dr Abu Sharkh.

Hyrec's patented Brine Concentrator is a variation of the RO process in which a dilute saline solution is introduced on the membrane's product side to reduce the osmotic pressure

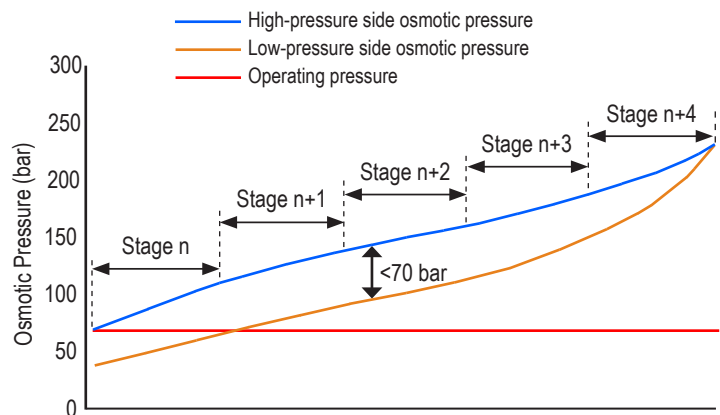
differential, and lower the required feed pressure. Brine is cascaded through multiple stages, concentrating the solution to near saturation levels, while producing a low-TDS product water stream.

100 m³/h @ 9 wt% Concentrated Seawater



Typical flow diagram for Hyrec Brine Concentrator

The diagram below shows that even though the concentrate's osmotic pressure may exceed 200 bar (2,900 psi), the differential pressure in any stage of the system will not exceed 70 bar (1,015 psi), and is well within the limits of most of today's SWRO membranes.



Despite feedwater osmotic pressure, system pressure <70 bar

"Our multistage OARO system is successfully concentrating 220 m³/d [58,125 GPD] of reject from a SWRO system operating in the Aegean Sea. It produces 20 m³/d [5,284 GPD] of brine with a 250,000 ppm TDS, while recovering about 200 m³/d [52,840 GPD] of low-TDS permeate. Our



Hyrec Seawater Brine Concentrator

system has been in operation for more than six months, and its energy consumption is approximately 5.8 kWh/m³ [22.95 kWh/kgal],” said Abu Sharkh.

The company currently has operations in Bahrain, Saudi Arabia and Turkey, and is planning to relocate its headquarters to Boston in January 2019.

Innovation

MULTIPLE INDEPENDENT DISCOVERIES

In the previous article, *WDR* reviews a new, innovative membrane brine concentration process. How innovative? Well that depends. At least two other companies are in various stages of developing a multi-stage RO process that is designed to concentrate brine well beyond the conventional RO limits, and all claim to have some level of proprietary intellectual property.

Last week, while talking to Robert Bergstrom about the proprietary deep-sea RO technology he is developing, your correspondent reminded him that there are currently two other companies also pursuing their own deep-sea RO concepts. He was, of course, well aware of the other efforts underway, adding, “I’ve been amazed at the number of people who are working in the field of submerged RO. I remind myself of the phenomenon of simultaneous invention, where the same thing is invented by two or more people at the same time without knowing of each other.”

He cited other examples of multiple independent discoveries, noting, “Ben Franklin’s lightning rod was invented twice in six years, calculus more than twice in the same century. And, the transistor, talking movies and jet engine were invented multiple places independently in the same year.”

Desalters may recall that two separate teams—a Weir team led by Professor Robert Silver in the UK and an Aqua-Chem team led by Gordon Leitner in the US—both independently invented the multistage flash (MSF) distiller in the late 1950s. It also seems that variations of the forced circulation evaporator are invented (reinvented?) several times each year.

Physicist Harriet Zuckerman, a 1977 Nobel laureate, summed up the phenomenon best when she said, “You do not make a discovery until a background knowledge is built up to a place where it’s almost impossible not to see the new thing, and it often happens that the new step is done contemporaneously in two different places in the world, independently.”

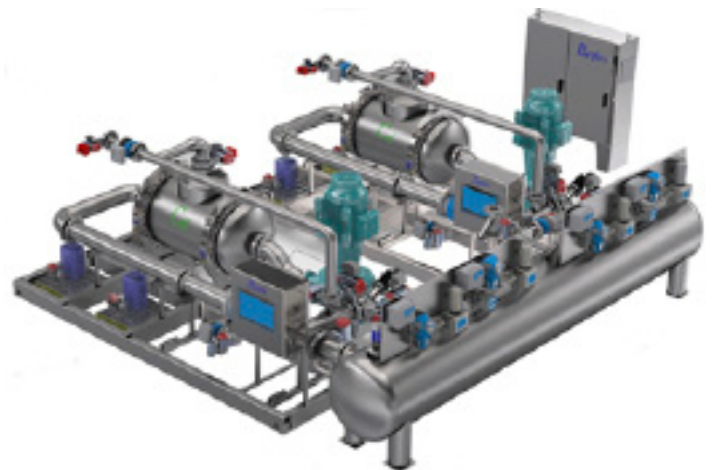
A list of other multiple independent discoveries, is available at https://en.wikipedia.org/wiki/List_of_multiple_discoveries.

Canada

CERAMIC UF TREATS MUNICIPAL WATER SUPPLY

Ontario-based Purifics Water has been awarded a \$1.32 million contract to supply two ceramic UF systems with a combined production capacity of 1,000 m³/d (0.26 MGD) for the Village of Granisle, British Columbia’s Lake Babine Water Treatment Plant. The plant is designed to remove color to less than 5 TCU, dissolved organic carbon to less than 1 mg/L, and to exceed 3-log removal credits for *Cryptosporidium*.

Progressive Ventures Construction will construct the plant, which will include a new water treatment building, the two ceramic membrane systems, primary and secondary disinfection, a new clear well, new pumping system and tie-in to the existing distribution systems.



Purifics Ceramic UF Systems

Purifics president Brian Butters said that the company's CUF® ceramic membrane system was selected to eliminate the need for additional pretreatment and because it allows for the use of free chlorine for both primary and residual disinfection, eliminating the need for UV disinfection. The installation will be the first CUF system to treat potable water in Canada.

This is the company's seventh such CUF system, and follows successful installations at Hilldale Water District in Mississippi, Artesian Water in Delaware and several small water systems in Texas.

Transition

WILLIAM E. KATZ (1924-2018)

Bill Katz, a former executive vice president at Ionics, Inc., died on 10 November in Massachusetts. He was 94 years old.

Born in Honesdale, Pennsylvania, Bill was a World War II Army veteran who attended the Massachusetts Institute of Technology, where he graduated first in his class, with BS and MS degrees in chemical engineering. Upon graduating in 1949, he joined the newly formed Ionics as its twentieth employee, and



began working in its lab. He is the last surviving member of the group that developed and patented the ion exchange membrane for use in electro dialysis systems in 1952, a group that included Walter Juda, Ed Gilliland and George Doriot.

Bill commissioned the first commercial electro dialysis installation in Coalinga, California, in 1957. He also served as Ionics' corporate treasurer, vice president of sales, executive vice president, and a member of the company's board of directors before retiring in May 2003.

In the highly competitive world of membrane-based desalination, he was widely recognized as a global pioneer. Along the way, he received numerous industry awards, including the American Desalting Association's Water Quality Person of 1992, followed by its lifetime achievement award. He was also awarded the American Membrane Association's 2015 Hall of Fame Award.

Former Ionics CEO Art Goldstein worked with Bill for more than 40 years, and recalled that in both his business and personal dealings, he was highly ethical, widely respected and very fair, adding, "Bill was admired by customers and competitors alike. He was a wise counselor and an advisor to all of us on a wide variety of challenges and opportunities, and was widely adored by our employees and management team.

"Throughout his life, Bill was a lover of music. As an accomplished jazz pianist, Bill often performed late in the evening at hotels when he and other members of the Ionics team were on the road. Seeing this side of Bill often 'broke the ice' and endeared him to many of our customers.

"It was an enormous pleasure to have had him in my life."

Bill's wife Martha died in 2016, and he is survived by their four children and grandchildren.

IN BRIEF

The American Membrane Technology Association (AMTA) and the Southwest Membrane Operators Association (SWMOA) will hold a technology transfer workshop on *Membrane Use in Oil, Gas and Mining* on 11-13 December in Keystone, Colorado. For more information, visit <https://tinyurl.com/y9d73syu>.

Vancouver's Seaspan Shipyards, has selected Canada-based **BluMetric Environmental**—a publicly traded professional services firm—to provide shipboard SWRO units for the Royal Canadian Navy Joint Supply Ships. The C\$4.16 million (\$3.15 million) contract includes harbor and sea acceptance trials. Seaspan is one of the largest shipbuilding and ship repair companies in Canada.

The Multi-State Salinity Coalition (MSSC) will accept applications for its **2019 Future Industry Leaders Scholarship Program** until Friday, 21 December. For information on how to apply for the \$2,500 Student/Professor Scholarship, visit <https://tinyurl.com/ycpmxgqm>.

Plan Ahead – Elsevier will hold its 4th International Conference on *Desalination Using Membrane Technology (MEMDES 2019)* in Perth, Australia, on 1-4 December 2019. Abstracts should be submitted by 31 May 2019. For details, visit <https://tinyurl.com/y76b8xde>.

Seventy seven percent of **Baltimore, Maryland**, voters have voted to ban the privatization of the city's water and sewage systems. It is the first large US city to take such a

step. The city reportedly has one of the country's oldest water systems, and decades of deferred maintenance have resulted in a quadrupling of water rates since 2000. Suez had recently proposed a public-private partnership in which it would operate the city's facilities, which the city would continue to own.

Microdyn Nadir has completed a membrane retrofit of an existing 1,500 m³/d (0.4 MGD) municipal MBR installation in the Konacik district of Bodrum, Turkey. Originally commissioned in 2013, the plant owner selected Microdyn's Bio-Cel 400 membrane modules for the two-tank retrofit. The plant effluent—which has a BOD <5 mg/l, TSS <5 mg/L, and ammonia <1 mg/L—is used for irrigation.



One of two tanks retrofit with Micron Nadir MBR Bio-Cel membranes

Danfoss has launched a new series of axial piston pump (APP) designed for the zero liquid discharge and brine concentration applications. The new APP W HC pumps, which can handle flow ranges of 11-24 m³/hr (11-196 gpm), are made of duplex stainless steel and deliver total efficiency rates of 90% at pressures up to 120 bar (1,740 psi).



Tampa-based **AquaVenture Holdings** said it had terminated its plans to acquire a 757 m³/d (200,000 GPD) SWRO plant in Long Island, the Bahamas, for \$3 million. The deal had been announced in February of this year, and was to deliver water to the Water and Sewage Authority under a long-term agreement. No reason for the cancellation was provided. In other news, AquaVenture also announced that it would acquire **AUC Group**, a Texas-based supplier of field-erected

and modular wastewater treatment plants for \$128 million, and nearly 122,000 AquaVenture ordinary shares of stock.

Last week, while launching seven of the country's strategic projects, one of which was Saudi Arabia's first nuclear research reactor, Saudi Crown Prince Mohammad bin Salman also inaugurated the **Al Khafji** 60,000 m³/d (16 MGD) Solar PV-powered SWRO desalination project, and laid the foundation stones for a 5,200 m³/d (1.4 MGD) solar energy powered absorption desalination technology plant in Yanbu.

Swansea Water District has awarded Maryland-based **Watek Engineering Corporation** a \$73,856 contract to conduct a complete review of its desalination process and plant. The Swansea facility is New England's first municipal desal plant, and combines an MF/RO system to desalt 1.2 MGD (4,452 m³/d) of tidal river water with an MF system to filter 1 MGD (3,785 m³/d) of groundwater.

The Orange County Water District (OCWD) has awarded **Butier Engineering** a management services contract not to exceed \$8.5 million for the final expansion of the Groundwater Replenishment System's (GWRS) 130 MGD (492,100 m³/d) indirect potable reuse plant.

PEOPLE

Stanton Smith, formerly a vice president with Nanostone Water, has left the firm to establish Membrane Guru LLC, a specialty consulting firm focused on ultrafiltration design, troubleshooting and commercialization. He is based in Boston, Massachusetts, and may be contacted at stanton@membraneguru.com.

Douglas Brown will step down from his role as CEO of AquaVenture Holdings and Seven Seas Water at the end of 2018, although he will continue to serve as Chairman, with a full-time focus on M&A efforts. Meanwhile, **Anthony Ibarguen**, CEO of AquaVenture's Quench subsidiary, will be promoted to CEO and president of AquaVenture Holdings. In other moves, **Olaf Krohg** has been promoted to CEO of Seven Seas Water, and **Frederick Hung** will be promoted to president of the company.