

WATER DESALINATION REPORT

AWWA/AMTA MEMBRANE TECHNOLOGY CONFERENCE ISSUE

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Chile

COPPER MINE WILL INSTALL MODULAR SWRO

Canada-based Teck Resources, the majority owner of the Quebrada Blanca Phase 2 (QB2) copper mine in the Tarapacá Region of northern Chile, has awarded a contract for a 102,360 m³/d (27 MGD) SWRO system to IDE Technologies. The mine, which is one of the world's largest undeveloped copper resources, will be the first large-scale use of desalinated seawater in place of freshwater for mining in the Tarapacá Region.

IDE told *WDR* that the desalination facility, which will be located near the port, will consist of dissolved air flotation (DAF) with gravity multimedia filters installed in the same cells. The five-train SWRO system will desalt the seawater to less than 1,500 mg/L TDS for use in the copper concentrator. The system will be shipped in pre-fabricated modules to simplify installation, startup and cost.

Bechtel will be responsible for the EPC management.

The project will also include a 165km (100 mi) pipeline, which will extend to an elevation of 4,300m (14,100 ft). First copper production is planned for 2021. (Visit Booth 616)

Company News

INVESTORS BACK 3D-PRINTED SPACERS

Aqua Membranes debuted its 3D-printed membrane spacer technology at last year's MTC, and returns to this year's event less than two weeks after it was announced that Pentair had closed a minority investment in the company during a reported \$3 million 'Series A' investment round. Proceeds from the round will be invested in equipment required to build out a rapid, high-volume production line at its Albuquerque, New Mexico, manufacturing facility.

Craig Beckman, Aqua Membrane's CEO, told *WDR* that the company is currently producing prototype elements for trials on a limited basis, and plans to seek NSF approval in the next few months. The company should have its first commercially available elements before the end of the year. (Visit Booth 903)

Post-treatment

STUDY EVALUATES SWRO SUPPLY INTEGRATION

Of the many individual engineering projects that make up a seawater desalination plant, the post-treatment system is one of the least glamorous. But the post-treatment system's success often plays a disproportionately significant role in the overall operating cost and public acceptance of a new project. Not only does the post-treatment system's performance determine the final water quality in terms of public health and aesthetics, it also ensures compatibility with the existing blended water supply and the conveyance and distribution systems.

A new Water Research Foundation (WRF) report, entitled *Carlsbad Desalinated Seawater Integration Study*, examines the blending of Carlsbad Desalination Plant's (CDP) water supply into the San Diego area conveyance and distribution network from the outset of the plant's initial operation in December 2015. Brent Alspach was the principal investigator of the Arcadis-led team that was awarded the research project, which also included the University of Texas, Poseidon Water, the San Diego County Water Authority and eight of its member agencies.

The 114-page report goes well beyond simply compiling finished water quality data. It evaluates the percent of desalted seawater comprising the blend water delivered to the Authority's member agencies, and how the quality varies widely based on a complex combination of managed and passive influences, including factors related to system management, member agency intake location, climate, regulations, conservation, customer habits and demographics.

#RunningDryMovement Update

Mina Guli, MTC's 2018 keynote speaker, is a water advocate and ultra runner. Last year, she set a goal of running 100 marathons in 100 days to raise awareness of the world's water crisis. However, last month, after completing her 62nd consecutive 26.2-mile marathon, Mina was sidelined with a broken femur. The worldwide #RunningDry community picked up the mantle to log the miles and spread the message on her behalf. Among the 100 Water Heroes Mina named was AMTA's Lynne Gulizia, of Toray.



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The report even considers how the contracting arrangement impacts the blended water quality. Because the project was delivered under a take-or-pay contract structure, the Authority is obligated to pay for a fixed quantity of desalinated water regardless of the availability of less expensive, and higher salinity imported water. In order to avoid paying for unused water, the Authority prioritizes the use of desalted water to satisfy demand, and when demand is low, some agencies may receive 100 percent desalinated seawater.

The variability of the CDP water in treated water blends is a defining characteristic of its integration into the San Diego regional conveyance. Although the same complex array of factors that contributes to this variability will not apply in every case where SWRO water is blended into existing regional supplies, this report provides an excellent guide for use in the planning phase of new seawater desal projects.

The report is available at <https://tinyurl.com/y4tdgthl>.

Editor's note: A WRF/WaterReuse Association partnership will host a 1.5-hour webcast to discuss the *Carlsbad Seawater Integration Study* presented by Arcadis' Brent Alspach on Thursday, 14 March. The webcast will also include a second report on *Pretreatment for SWRO: Existing Plant Performance and Selection Guidance*, presented by Stantec's Joe Jacangelo. For webcast details, visit <https://tinyurl.com/y3cjd8se>.

California

SWRO DISCHARGE MEETS PERMIT LEVELS

Following a story in the 4 February issue of *WDR*, which reviewed a paper addressing the salinity of the Carlsbad Desalination Plant's (CDP) concentrate discharge, Poseidon senior vice president Peter MacLaggan contacted *WDR* to confirm that the plant's discharge complies with its current discharge permit.

MacLaggan said, "The Ocean Plan salinity limit is not applicable to the CDP at this time, and the CDP is in full compliance with the salinity limit in its existing discharge permit. The San Diego Water Board expects to revise the CDP discharge permit to incorporate the Ocean Plan salinity requirements later this year. The CDP intake and discharge facilities will be modified to comply with the revised permit."

Company News

2018 A BANNER YEAR FOR MF/UF SUPPLIER

At the 2015 MTC in Orlando, Florida, China's Scinor Water introduced Scinor Water America (SWA), its new international distribution arm, and CEO Tom Poschmann told *WDR*, "We're young, educated and nimble, and we have some of the strongest and most permeable membrane products on the market." As his team sets up the stand in New Orleans, he looked back on the last four years, and

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remarked on how quickly the time has gone, and the progress the company has made.

“In 2018, we expanded on the success of the previous year, booking 24 new orders and completing 15 MF/UF retrofit startups, which accounted for 100 percent of our revenues. We now have an installed base of over 40 plants, spread across drinking water and wastewater applications. SWA has emerged as a leader in the California wastewater market, and we now have seven operating systems including OCWD’s GWRs and West Basin’s EC Little Recycling Plant, where we completed a 2,500-module retrofit of submerged membranes to increase capacity by 40 percent.

“We’ve also been selected to supply the UF membranes for the new Monterey One Water AWTF, which expects a mid-year startup,” he said.

SWA now accounts for 20 percent of Scinor’s global membrane sales, and it has expanded its reach into Canada and Australia, with Australia accounting for five new orders. Besides increasing its activities in direct replacement and new-build applications, SWA’s 2019 plans include more difficult, non-traditional retrofits, which offer end-users an option to improve performance. These include more cassette-type submerged membrane retrofits, and a proprietary ‘inside-out to outside-in’ module that accomplishes the challenging retrofit simply, without major equipment and programming modifications.

The company now has NSF/ANSI 419 listings, encompassing 18 UF models that have expanded its US stocking capabilities in a new facility in Chesapeake, Virginia. It also plans to begin manufacturing in North America in 12 to 18 months.

Poschmann said that he expects more of the same in the coming year, noting, “We saw multiple repeat orders from customers who experienced the performance improvements of our TIPS PVDF membranes over other polymers, including NIPS PVDF products. That performance was complemented by our continuous focus on technical guidance, aftermarket support and customer satisfaction.” (Visit Booth 204)

NSF/ANSI 419 Certification

Two weeks ago, *WDR* outlined the importance of NSF/ANSI 60 and 61 certifications, which are intended to limit the amount of impurities that water system additives and components may introduce in drinking water systems. Another NSF standard—NSF/ANSI 419—establishes the requirements for the *performance* of public drinking water equipment. The standard was implemented after the US EPA’s Environmental Technology Verification program ended in 2014. The standard includes requirements found in the EPA’s Long Term 2 Enhanced Surface Water Treatment Rule (the LT2ESWTR, or simply the ‘LT2 rule’), which allows manufacturers to prove *Cryptosporidium* reduction. It also includes additional requirements for safety, including the optional evaluation of MF/UF modules for virus reduction.

Technology

TWO-STAGE FILTRATION BETTER THAN ONE

Though this story’s headline seems intuitive, Hitachi Metals issued a press release earlier this month in which it announced that the use of UF pretreatment, followed by its new ceramics adsorption filter (CAF) reduced biofouling of SWRO membranes. In a laboratory demonstration, the company said that the two-stage UF-CAF pretreatment extended SWRO pressure by 2.3 times compared to UF treatment alone.

Unfortunately, almost no additional data was submitted on either the CAF process or the experimental conditions to gauge the value of the lab test. Other than mentioning that the base ceramic material is cordierite, a ‘magnesium alumina silicate’, there is no description of the coating, the flux used on the UF or the CAF, the CAF pore size, or the cleaning regimen required.

It is therefore, not possible to determine if the CAF process requires UF or other pretreatment, if it can be used as a standalone process, if additional coagulants or filter aids are required, how it is cleaned, and most importantly, what are its capital and operating costs.

No information was provided on when the CAF process will be commercially available.

WDR’s current CDR for this pretreatment combination is 4.0.

Potable Water Reuse Map

The Global Water Connections Map is an interactive map that profiles and identifies the locations of potable reuse projects around the world. The map was funded by the former Australian Water Recycling Centre of Excellence, and is now managed as *Water 360* by the Water Services Association of Australia and the Water Research Foundation. To view the map, visit <https://watereuse.org/educate/water-reuse-101/global-connections/>.

Technology

NEW MEMBRANE DEVELOPMENT STATUS

In light of the focus on membranes at this week’s Membrane Technology Conference, WDR has summarized some of new membranes under development on the following page. The list includes a description of the membranes, as well as the current Technology Readiness Level (TRL) using a 1-9 scale developed by NASA in the 1990s. In those cases where the developer did not provide the TRL, it was estimated based on the information available.

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Current Membrane Development Projects

Supplier, Developer	TRL	Membrane Type	Form Factor	Membrane Material	Description	Max Temp, °C	Cl ₂ Tolerant
Anfiro (US)	6	UF	FS, SW, HF	Self-assembling, multi-block copolymer	Very sharp, & customizable MWCO between 6,000-15,000 Da	65°	Y
Anfiro (US)	6	NF	FS, SW, HF	Self-assembling, multi-block copolymer	Sharp, customizable, pore sized and chemistry	65°	Y
Aquaporin A/S (Denmark)	9	FO	HF	Aquaporin-impregnated polyamide	Aquaporin TFC	50°	N
Aquaporin A/S (Denmark)	8	FO	FS	Aquaporin-impregnated polyamide	Aquaporin TFC	50°	N
Aquaporin A/S (Denmark)	7	BWRO, SWRO	FS, SW	Aquaporin-impregnated polyamide	Aquaporin TFC	50°	N
CSIRO, Monash University (Australia)	3	NF, RO	n/a	Metal-organic framework	Ion selective hydrating-dehydrating membrane	n/a	n/a
CSIRO (Australia)	5	MD	FS	CVD graphene-coated PTFE membrane	Anti-fouling graphene membrane, branded GraphAir.	60°	Y
Cerahelix (US)	8	NF	M	Ceramic with DNA-imprinted pores, and sharp MWCO	MWCO 400 to 1,200 Da.	90°	Y
Econopure (US)	9	NF	SW	TFC membrane with open channel (wider spacers)	Low-fouling NF membrane for use with DE pre-coat	45°	N
HydroP (Israel)	6	NF, RO	FS, SW	Peptoid additive	Additive used to enhance TFC membrane performance	45°	N
Ionic Industries (Australia)	4	NF	FS	Reduced graphene oxide	Shear-aligned membranes with tunable selectivity	n/a	n/a
Lockheed Martin (US)	5	NF	FS	Graphene composite	Perforated graphene laminated onto surface of polymeric substrate	>50°	Y
Massachusetts Institute of Technology (US)	3	NF, RO	FS	CVD on graphene	Roll-to-roll graphene sheets with pulsed oxygen plasma etched pores	>50°	Y
Nagare Membrane (US)	8	NF	HF	Aligned carbon nanotube (CNT)	CNT in polyethersulfone matrix	150°	Y
NanoSun (Singapore)	9	UF	FS	PVDF	3D printed PVDF nanofiber sheets with 100,000 Da MWCO	45°	Y
PolyCera (US)	8	NF	FS, SW	Organic metal	Super hydrophilic with ceramic-like performance at 500 Da MWCO	80°	Y
Shinsu University (Japan)	5	NF, RO	n/a	CNT in polyamide nanocomposite matrix	Multi-walled CNT	>80°	Y
University of California, Riverside (US)	3	MD	FS	CNT/PVA film on PTFE support	Hydrophobic resistive-heating composite	95°	n/a
University of Cincinnati (US)	3	MD	FS	MFI-type zeolite nanosheet on alumina substrate	Laminate of ultrathin zeolite nanosheet tiled membrane	95°	n/a
University of Connecticut (US)	3	NF, RO, FO	FS	Polyamide TFC	3D-printed TFC with controllable thickness and roughness	45°	N
University of Illinois (US)	3	NF, RO	FS	Molybdenum disulfide	High permeability perforated MoS ₂ nanopore sheet	n/a	n/a
Via Separations (US)	5	NF, RO	FS, SW	Graphene oxide scaffold	Hydrophilic graphene coating provides tunable chemistry and size exclusion	100°	Y
Harvard University Wyss Institute (US)	3	MF, UF	n/a	PVDF, PTFE	Liquid gated membranes	n/a	n/a
Zhejiang University (China)	3	RO	FS	Polyamide	Turing-type surface nanostructures	45°	N
ZwitterCo	4	NF	FS, SW	Self-assembling zwitterionic copolymer	Organic, fouling-resistant copolymer	60°	Y

Form Factor: FS=Flat sheet, SW=Spiral-wound, HF=Hollow fiber

Technical Rediness Level (TRL): 9=commercial, 8=ready for use, 7=prototype demo, 6=functional modeling, 5=lab simulations, 4=bench testing, 3=proof-of-concept testing

Prize Competition

US DOE ANNOUNCES WAVES TO WATER PRIZE

Yesterday, the US Department of Energy (DOE) announced its *Waves to Water* prize competition to spur innovation in wave energy-powered desalination systems. The challenge is expected to accelerate the development of the next generation of transformational technology and desalination innovation as part of the previously announced Water Security Grand Challenge, a DOE-led framework.

The \$2.5 million prize will provide innovators a pathway from initial concept, to technical design, to prototype, to field-tested systems that use only waves as a power source. The prize seeks to accomplish three goals:

- Evaluate the economic basis for small-scale modular wave power desal
- Demonstrate desal and marine renewable energy integration
- Validate technologies in a field test setting that meet quantifiable benchmarks

The DOE is formally soliciting from the public through a Request for Information (RFI), which is open until 15 March. To download the RFI, visit <https://tinyurl.com/yxnzvegr>.

IN BRIEF

LG Chem, the supplier of NanoH₂O RO membranes, is introducing its new, high-performance R G2 brackish water membrane at this week's MTC. The 8-inch diameter, 400 ft² element uses the company's Thin Film Nanocomposite (TFN) technology and boasts a 99.78% salt rejection and a 11,500 GPD (43.5 m³/d) permeate flow. (Visit Booth 203)

Lanxess' Liquid Purification Technologies business unit—which operates in the US as LANXESS Sybron Chemicals—is introducing its new B400 and B440 HP brackish water RO membranes at this week's MTC. The membranes, with 400 and 440 ft² of membrane area, respectively, provide an average salt rejection of 99.7 percent. The company is also displaying the Gigamem UF module, following its recent marketing agreement with Polymem. (Visit Booth 609)

The new **Caribbean Desalination Association** (CaribDA) board has been seated. Shawn Meyer-Steele, of H₂O Professionals, and Karlene Singh, of Consolidated Water Company, have taken up their positions as president and vice president, respectively, of CaribDA for two-year terms. Meyer-Steele replaces outgoing president John Thompson, of Desalcott, and Singh takes over for Manuel Pereira, of Aquarelectra Production.

Planning Ahead: The American Filtration Society (AFS) has announced that it will hold its **World Filtration Congress** on 20-24 April 2020 in San Diego, California. The conference will include a membrane track, which is expected to include 20 technical presentations. For more details, or information on abstract submittal, Visit <http://www.wfc13.com>.

The Kuwait Institute for Scientific Research (KISR) will host the **13th WSTA Gulf Water Conference** on 12-14 March. For more information, visit <https://gulfwaterconference.org>.

Membrane Operator Certification (MOC): The Southeast Desalting Association (SEDA) and South Central Membrane Association (SCDMA) will hold the following March operator training courses:

- *12-14 March* – MOC-II, Advanced RO System Training Williamsburg, Virginia, <https://tinyurl.com/y6fnc2at>
- *19-21 March* – MOC-I, Intro to Membrane Systems Port St Lucie, Florida, <https://tinyurl.com/y6mmqks5>
- *26-28 March* – MOC-1 Intro to Membrane Systems Elmhurst, Texas, <https://tinyurl.com/y4uqs4ar>

California-based **PolyCera** has signed a two-year distribution agreement with Germany's **Inaqua**, a Ravago Chemicals Company, to represent PolyCera's portfolio of membrane products in 25 countries throughout Europe, the Middle East and North Africa. Inaqua, part of the Ravago Chemicals group, is a water treatment products and service company, and the products covered by the agreement include PolyCera's oleophobic, hydrophilic high temperature Titan products and the FDA-approved Hydro range of Spiral Monolith products. (Visit Booth 909)

Energy Recovery Inc (ERII) has announced that it has been awarded contracts totaling \$4.9 million for its PX-Q300 Pressure Exchanger technology for desalination projects in the UAE. The units are expected to ship in the first quarter of 2019. (Visit Booth 309)

PEOPLE

Chuck Martz, formerly with Dow Chemical, has started Blue Arch Development, LLC, to provide marketing and business development services to the industrial water treatment industry. He has over 20 years of water industry experience, including business leadership, marketing strategy, implementation and new technology launch. He is based in the greater Philadelphia, Pennsylvania, area and may be contacted at chuck@bluearchdev.com.