

# WATER DESALINATION REPORT

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## Company News

### DUPONT'S NEW MEMBRANE DREAM TEAM

For the second time in ten days, DuPont announced that it would acquire a UF membrane technology company. Last Thursday, DuPont said that it had signed an agreement to acquire the Memcor business, including its pressurized and submerged hollow-fiber UF membranes and membrane bioreactor (MBR) technologies from Evoqua Water Technologies. The move comes a little more than a week after the company announced it would purchase the inge UF product from BASF GmbH.

The deal, which is valued at \$110 million, is expected to close by the year's end, and includes Memcor's workforce, a manufacturing site in Windsor, Australia, and associated operations and intellectual property. The agreement contains a provision for a post-closing price adjustment that suggests a 12.5X EBITDA multiple.

According to DuPont CEO Mark Doyle, the announcement reinforces the company's commitment to invest in specialty solutions aligned with high growth, attractive end markets, adding, "Our strategic intent for the Water Solutions business is to have a robust portfolio of technologies so that our talented global organization can leverage a broad range of solutions to solve our customers' most pressing challenges."

The Memcor and inge deals add new manufacturing capabilities in Australia and Europe, respectively, broadening DuPont's low-pressure membrane portfolio to bring additional strengths that address different markets and regions. They also increase DuPont's installed base by nearly 2,000 installations around the world.

UK-based membrane consultant Graeme Pearce summed DuPont's current situation up, noting, "The news of the Memcor acquisition is even more significant than last week's inge announcement because Memcor provides DuPont with a full suite of membrane products. In addition to NF and RO, it now has both pressurized and submerged low-pressure membrane options, PVDF and PES material choices, MBR capabilities and excellent sales channels. The only thing missing is a TIPS product."

## Company News

### MEMCOR'S LONG AND WINDING ROAD

Memcor's original microfiltration (MF) technology was rooted in the work performed by the University of New South Wales' (UNSW) Membrane Research Group to develop a polyamide hollow-fiber membrane in the late 1970s. The membrane was patented by Unisearch, the university's holding arm, licensed to US-based Baxter Travenol Laboratories in 1981, and sold to Memtec Ltd. in 1983.

Memtec was a new company comprised of a team of Baxter Travenol's senior managers and scientists, who continued to develop with the technology, and came up with the innovative polypropylene hollow-fiber membrane microfilter system used in Memtec's continuous microfiltration (CMF) system. By 1984, the company was floated on the Australian Stock Exchange, and began selling systems in the Australian, North American and European markets.

In 1997, at the peak of its roll-up, USFilter acquired Memtec for \$330 million in what one observer said was "the water industry's first unsolicited bid". The acquisition was not wholeheartedly embraced by the employees, and the product's name was changed to Memcor. (*Editor's note:* By way of its 1996 acquisition of Wheelabrator, USFilter already owned Memtek, a tubular MF company, which was subsequently referred to internally as "Memtek with a 'K'"). Memcor was subsequently sold to Vivendi/Veolia as part of its USFilter acquisition in 2000. USFilter/Memcor was sold to Siemens in 2005, and to Evoqua in 2014.

Long-term Memcor employees have endured a series of highs and lows over the past 20 years. Your correspondent was present at the 1997 WEFTEC conference, a few weeks after the announcement that USFilter would take over the company, when three USFilter executives visited the Memtec booth to introduce themselves. However, the lone regional manager staffing the booth at the time was not star-struck by his visitors, and unapologetically registered his concerns about being swallowed up by a company with hundreds of other products.

But the lowest point in the group’s morale probably occurred during the latter part of the Siemens-era between 2012-2014, when Siemens began divesting its water technologies













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1892 – DuPont founded as a gunpowder manufacturer  
 1897 – Dow founded to extract bromine from underground brine  
 1964 – DuPont textile group begins R&D on nylon-6 fiber RO membrane  
 1967 – First commercially successful hollow fiber RO module by DuPont  
 1969 – DuPont commercializes the B-9 brackish RO element  
 1971 – DuPont licenses Richter-Hoehn aromatic polyamide RO membrane  
 1975 – First commercial SWRO plant uses DuPont B-10 membrane  
 1977 – FilmTec founded by three North Star Research Institute ex-employees  
 1977 – DuPont’s RO business moved to new Polymer Products group  
 1979 – FilmTec’s Cadotte files 344 patent for TFC RO membrane  
 1981 – Baxter Travenol licenses UNSW’s PA hollow-fiber MF membrane  
 1982 – DuPont acquires spiral CA membrane from Ames Crosta Babcock  
 1983 – Baxter Travenol sells MF membrane to Memtec, an Australian start-up  
 1984 – Memtec develops polypropylene MF membrane system, holds IPO  
 1985 – Dow Chemical acquires FilmTec for \$75 million  
 1986 – FilmTec’s NF membrane adopted for offshore sulfate removal projects  
 1992 – DuPont sells A-15 spiral technology to TriSep (now Microdyn-Nadir)  
 1992 – DuPont introduces the double-bundled B-10 Twin permeator  
 1993 – Court says Cadotte’s 344 patent US gov’t property; users pay royalties  
 1993 – Dow’s ROSA RO projection software released to the public  
 1997 – Memtec acquired by USFilter, Memtec becomes Memcor  
 1998 – DuPont puts Permasep RO group up for sale  
 1999 – DuPont ceases accepting orders for new RO projects  
 2000 – USFilter/Memcor sold to Vivendi/Veolia  
 2000 – inge GmbH founded with PES Multibore UF membrane  
 2001 – DuPont ceases supply of replacement Permasep RO permeators  
 2004 – DuPont “permanently” closes Permasep business  
 2005 – USFilter/Memcor sold to Siemens  
 2006 – Dow develops 16-inch diameter RO membrane  
 2006 – Dow acquires China’s Omex’s UF, MBR membranes and EDI process  
 2009 – Memcor develops the Mempulse aeration system for MBR  
 2011 – BASF acquires inge watertechnologies AG from founders  
 2014 – USFilter/Memcor sold to AEA/Evoqua Water Technologies  
 2015 – Dow and DuPont agree to “merger of equals” as DowDuPont  
 2017 – DowDuPont announces it will spin off membrane business  
 2017 – Dow’s WAVE RO projection software released, replaces ROSA.  
 2018 – Dow Water & Process Solutions rebranded “DuPont Water Solutions”  
 2019 – DuPont to acquire BASF’s inge UF membrane group  
 2019 – DuPont to acquire Evoqua’s Memcor membrane product group

and alternately announced that Memcor was for sale, then wasn’t, before selling it along with other USFilter legacy products to Evoqua.

It has since weathered those storms, as well as numerous warranty issues, before settling down to re-establish itself as a leading MF/UF membrane system supplier. Early indications are that the company’s current employees are pleased at the prospect of finding themselves as part of a company dedicated to membrane technology.

### Company News

#### MACHINE LEARNING COMES TO SWRO

Synauta, a Canadian startup, says that it can save desalination plant owners up to 20 percent in operating costs by better matching plant design to daily operating conditions. The company is now working with a number of leading plant operators to undertake trials on both large and small plants. Synauta CEO Mike Dixon told *WDR* that the tests “are yielding initial results of up to 10 percent average energy savings, and more than 20 percent in chemical savings for SWRO plants.”

Because of fluctuating seawater temperature and salinity, a plant’s optimum operating points can change on a daily, even hourly, basis. The ability to maintain optimum performance is further complicated by membrane fouling, and the need to produce consistent permeate quality. Synauta’s solution accounts for multiple input and output parameters, ensuring each desalination plant’s design criteria are met.

“While at LG NanoH2O, I observed many plants that were not performing up to expectations. I was looking for solutions to this challenge when I came across machine learning, which saves a lot of time on lengthy projections and calculations. Talking to operators, and recalling my own experiences as an operator, it became obvious that this technology could provide real economic benefit to our industry,” said Dixon. “We’ve estimated that the global desalination industry could save over 3 million tonnes of CO2 annually by improving operating efficiencies.”

Synauta provides its customers with a historical data audit, process equipment analysis and instrumentation analysis to predict the savings for a specific plant. This is followed by an agreed period of assessment with operators controlling the software inputs. The solution is then securely integrated with the plant’s SCADA system, with an energy and chemical savings case study developed from the trials. The payment model is Software-as-a-Service, with a monthly fee based on the amount of savings realized.

### Artificial Intelligence vs Machine Learning

*Artificial Intelligence (AI)* is the branch of computer science that broadly deals with the creation of intelligent machines that attempt to recreate the human thought process and are capable of performing tasks the typically require human intelligence.

*Machine Learning* is a subset of AI and refers to training computers to improve their learning over time, autonomously, by feeding them data and information in the form of observations and real-world interactions. Machine Learning makes computer processes more efficient, cost effective and reliable, and helps people control systems more efficiently and make data driven decisions.

“Operators typically must focus on alarms and maintaining pumps, valves and sensors, so matching plant design to plant operations can be challenging. Our patent pending technology is designed to help operators produce the right quantity and quality of water, without the headache of lengthy calculations,” notes Dixon.

### IN BRIEF

In announcing a strategic plan entitled “Shaping Suez 2030”, Bertrand Camus, **Suez’s** newly installed CEO, said last week that Suez would cut €1 billion (\$1.1 billion) of costs by 2023, and sell up to €4 billion (\$4.4 billion) of assets to deliver a 2% increase in return on capital. Although he would not say which businesses might be sold, it has been speculated that Agbar, the Barcelona-based Spanish water operator, was one possibility, while Suez’s remaining equity interests in desalination and wastewater projects are also likely candidates to be put on the block.

The American Water Works Association (AWWA) has released its Manual of Water Supply Practices–M9, entitled *Inland Desalination and Concentrate Management*. The manual includes chapters on Brackish Water Desalination, Discharge Options for Concentrate Disposal, Enhanced Recovery and ZLD, Cost of Desalination and Concentrate

### Research

#### UConn Center Holds Inaugural Workshop

On 27 September, the University of Connecticut (UConn) hosted over 80 representatives from 60 companies at the introductory event for the newly opened Fraunhofer USA’s Center for Energy Innovation. Attendees traveled from across North America, Singapore, Japan, Germany and Denmark to attend the *Industrial Workshop on Separations Technology*, and to hear sessions that included presentations by technology providers and end users.

Sessions were chaired and panels were moderated by Professor Jeff McCutchoen, the Center’s executive director,

Heartland Technologies’ Earl Jones, True North’s Steve Kloos and Peter Fiske, the executive director of the National Alliance for Water Innovation, who was recently selected to manage the DOE’s Desal Hub.

Some of the participating membrane and membrane systems companies were 3M, Alsys, Cerahelix, CrossTek, Gradiant, i2m, Inopor, KMS, Marmon Water, Nanostone, Safbon and Veolia Water.

The panel discussions will be available online in a few weeks, and a link will be included in a future edition of *WDR*, when it is available. The speakers are pictured below.





Management. The 231-page manual is available for \$185.00 at <https://tinyurl.com/y6l4hf8z>.

Brazil's **Ceará Water and Sewage Company (CAGECE)** has posted a public notice, or edital, on its website with accompanying contract documents, including drafts of an invitation to tender and contract to design, build, operate and maintain a 1 m<sup>3</sup>/s (22.8 MGD) SWRO plant in the Metropolitan Region of Fortaleza, in northeastern Brazil. The project will involve private finance. Interested parties should visit <https://tinyurl.com/y2syzsow>.

**Acciona** and **Siemens** have renewed a one-year-old agreement in which the two companies will be EPC partners for the water industry. Siemens said that its collaboration with Acciona would combine the expertise of both companies to provide our customers with digital solutions for drinking water, desalination and wastewater treatment plants.

The World Health Organization (WHO) has released a 124-page report on *Microplastics in drinking-water*. The report contains a summary of the evidence, key findings, recommendations and research needs concerning the potential human health risks associated with exposure to microplastics in the environment through drinking-water. The smallest particle size detected was 1µm. The use of membranes was among those technologies addressed in the study, and—unsurprisingly—was found to be highly effective in microplastic particle removal. The report is available at not charge, and can be downloaded at <https://tinyurl.com/y3utz9hr>.

## Transition

### C. WILLIAM SALTONSTALL, JR. (1925–2019)

Dr Bill Saltonstall, the former research director of Envirogenics, and one of the industry's early membrane desalting engineer-scientists, died on 27 September in Aliso Viejo, California. He was 94.

He was born in El Centro, California, and he initially worked with DuPont on cellulose acetate derivatives used in the photographic industry. Bill joined Aerojet General in 1964, where he began working on polymers used in the company's space and missile program.

Recognizing that water was a growing and marketable commodity, the company invested over \$2.5 million in the

embryonic RO technology. In 1965, Aerojet successfully built an experimental, 1,000 GPD brackish water RO unit for the US Office of Saline Water (OSW), which was already thought to represent the most economically promising of all desalting methods. They soon received a follow-on order for another brackish RO and two units, which were to be tested on salt water.



Bill recognized that the development of better acetate membranes was the most critical factor of building an RO system, and organized a strong team of polymer and water specialists to investigate RO membrane technology. Additionally, the team developed commercial ultrafiltration and hemodialysis membranes as part of Aerojet's Envirogenics Systems group, and also supported its newly acquired distillation business.

He resigned from Envirogenics in October 1978 to open his own RO membrane consulting business in West Covina, California.

Bill was inducted into the American Membrane Technology Association's Hall of Fame earlier this year in recognition of his contribution to RO's developments as the research director of Envirogenics, whose team invented the cellulose acetate/cellulose triacetate 'blend' membrane that was the dominant pre-thin film composite membrane.

His wife, Virginia, and two sons survive him.

## PEOPLE

After 40 years in the membrane field, and nearly one year after stepping down as SPI's president, **Gerry Filteau** is transitioning into retirement. Gerry's career began with Fluid Systems, where he was an application engineer, dealing with technical issues on RO and NF membrane projects. Gerry moved to Separation Processes, Inc (SPI), in 1998 to work with Dick Sudak, and served as the company's president from 2003-2018. Gerry lives in Southern California, and may be contacted at [gerry.filteau@gmail.com](mailto:gerry.filteau@gmail.com).