

WATER DESALINATION REPORT

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Texas

DEVELOPER SELECTED FOR STATE'S 1ST DESAL PPP

Last week, in a move that caught most observers by surprise, the city of Alice selected Florida-based Seven Seas as its preferred bidder for a 3 MGD (11,355 m³/d), four-train brackish groundwater RO system that is to be delivered under a 15-year build-own-operate-transfer (BOOT) contract.

The South Texas city has been buying its raw water from the Corpus Christi Water Department since 1962. In a feasibility study conducted by NorrisLeal five years ago, it was determined that the City could save up to \$0.75/kgal (\$0.20/m³) by drilling its own brackish groundwater wells and building a BWRO system.

On this basis, and assuming that the project was to be delivered through a conventional procurement, the City was approved for a \$5.5 million financial assistance package from the Texas Water Development Board (TWDB), consisting of \$3 million in low-interest financing, \$1 million in zero-percent financing and \$1.48 million in principal forgiveness as a disadvantaged community. The funding was to have been used to drill a test well, which could later be converted to a production well, and for permitting and plant design.

Although the City has apparently used some of the funding for the test well, sometime in late 2019, it decided that the project would be delivered as a public-private partnership (PPP) in which the successful developer would be responsible for the permitting and plant design in addition to owning and operating the facility. Then, on 2 January, they issued an RFP for a BOOT project, with a bid closing date of 28 January.

At last week's council meeting, the city's staff recommended, and the council approved, the selection of Seven Seas Water as the party with whom negotiations should be held. Seven Seas' price for the project was \$2.20/kgal (\$0.58/m³), including a \$0.22/kgal (\$0.06/m³) electricity cost, based on a maximum specific energy consumption of 3.14 kWh/kgal (0.90 kWh/m³). The offer compares to the Epcor-NorrisLeal Engineering project team's price that ranged from \$2.99-\$3.44/kgal (\$0.79-\$0.89/m³), including power.

Richard Whiting, Seven Seas' vice president of business development, told *WDR* that the project could be making water in 12 to 18 months, depending on Texas Commission on Environmental Quality approvals.

Company News

FLORIDA OEM ADDS TEXAS PRESENCE

Although Florida's Kemco Systems acquired Bob Johnson & Associates (BJA) in October 2019, the acquisition was not formally announced until this month. At the time, Kemco CEO Tom Vanden Heuvel said the company was still assimilating Water Resources, Inc, an Alabama-based DAF specialist that it had recently bought. "Then along came Covid-19, which slowed our integration efforts. But, as things have begun to settle down, we are moving forward with our plans," he told *WDR*.

Bob Johnson & Associates (BJA) was founded in Houston in 1969 and has a long history of providing membrane filtration and water softeners to the Texas market. In addition to its capital equipment business, it also developed a membrane chemicals and service DI offering. However, when its founder retired in 2002, the business was sold to another family, and the capital equipment side of the business lost much of its past momentum.

"We've had a growing interest in the Texas market, and BJA provides us with a good platform to expand in the state and beyond. We are moving engineering and manufacturing to our 60,000 ft² (5,575 m²) manufacturing plant in Clearwater, Florida. We will keep the chemical blending and service DI operations in Houston."

Since the transition of the management team, Vanden Heuvel said that he and Larry Jessup, the director of operational excellence, are dividing their time between Houston and Clearwater, setting a new course and culture with the Houston team.

"The re-naming of Bob Johnson & Associates to Kemco Systems represents a step-change in how customers will experience our team in Texas. Similarly, we are excited

to bring the ScaleFree brand of membrane cleaners and antiscalants to our existing Kemco customers as well as continue private labeling for other OEMs that are interested in selling chemicals with their systems,” Vanden Heuvel explained.

Lessons Learned

WHAT’S YOUR FAVORITE PLANT?

WDR recently asked some long-time desalters to name their favorite desal plant or most memorable project, and briefly explain what made it so unforgettable. This week, three more memorable projects are profiled, beginning with two plants that are remembered for all the wrong reasons, and a third that spectacularly recovered from a disaster:

Dr Jim Birkett – Consultant, retired **Aquanova MSF units, Aruba**

Being an old guy, my best memories are from my youth. Since starting in desal in the 1960s, it’s only natural that those memories are of the thermal persuasion. Perversely, my favorite plant is one that by most accounts was a big disappointment, and on which my only direct role was to conduct a “postmortem”. I am referring to Aquanova BV’s brief experience in Aruba in the late-1970s.

For Aruba, then a part of the Netherlands Antilles, the Netherlands-based Aquanova seemed almost too good to be true. Problems with currency exchange rates and customs duties and fees were to be minimal, and although the technology was relatively unproven, the modular multistage flash (MSF) process looked attractive and technically fascinating.

Between 1978 and 1984, Aquanova furnished three 4,000 m³/d (1 MGD) and one 6,000 m³/d (1.6 MGD) MSF units to WEB Aruba, the island’s water company. Each of the units consisted of multiple 500 m³/d (132,100 GPD) sub-units with 30 stages in a vertical stack array. The tubes and shells were of aluminum, and individual flash chambers were compact, to promote ‘gentle’ rather than explosive flashing, with centrifugal separation of brine droplets rather than conventional demister pads.

Alas, they never performed up to specification! Air ingress and corrosion were especially troublesome. It proved difficult to maintain and control vacuum in the stack configuration that allowed for easy interchange of stages. Production plummeted and Aruba was forced to import a portion of its water.

As the Aquanova units failed, Aruba returned to Aqua Chem to supply traditional and reliable once-through MSF units,



Aruba’s MSF Evaporators, circa 1982

purchasing seven units between 1983 and 1998, some of which were only recently decommissioned and replaced with SWRO systems.

My personal involvement with the Aquanova units was minimal but unique. In the early 1980s Aquanova’s parent company, Holec BV, contracted me to review the Aquanova technology and competitive opportunities and to make recommendations on what they should do with it. I presented my findings to them in a meeting in Rotterdam. As I spoke, the Holec attendees kept smiling and winking at each other as I gave one dismal comment after another. I was humiliated. But at the end of the meeting, they admitted that they had come to the same conclusions themselves, although their upper management had demanded a second opinion. I only served as the ‘medical examiner’ brought in to view the corpse, perform a post mortem, and declare that the design was indeed dead.

I often think of the Aquanova design as an example of a sincere and imaginative engineering effort that tried to change too many variables simultaneously. The units were so “pretty”. Unfortunately, that wasn’t enough.

Epilogue: In 2008, the first of the Aqua-Chem MSF was replaced with a more economical SWRO system, and in 2015, the last MSF units were demolished and replaced with SWRO.

Art Goldstein – Ionics CEO, retired

Tampa Bay Seawater RO Project

After Ionics' completion of the Santa Barbara project, our next significant desalination opportunity was Tampa Bay Water (TBW). In the late 1990s, we put considerable effort into preparing a BOO bid for the US' first large-scale SWRO project, which we believed would enable us to maintain our business momentum. The bid stands out in my memory because we lost that opportunity in dramatic fashion, and for all the wrong reasons.

While the loss was a major disappointment, it also turned out to be a major learning experience. The TBW bidding process provided a very important lesson regarding a potential client's understanding of the risks and complexities of a BOO contract. We learned that the TBW board members and managers knew very little about the questions that they should ask, and the evidence that they should require, to successfully demonstrate that bidders could reliably design, bid and deliver under a BOO contract.

In addition to Ionics, the bidding process attracted DuPont [i.e., the "old" DuPont] and Stone and Webster (S&W), best-known for its power industry expertise. DuPont was an excellent, pioneering manufacturer of hollow-fiber RO membranes, but had built virtually no desalination facilities. S&W was a highly successful engineering firm but had never designed, built or operated a major desalination plant.

After the bids were opened, it was announced that Ionics was the low bidder. Jerry Maxwell, TBW's General Manager, told us he was ready to award us the contract. However, when he brought this recommendation to the TBW board, they rejected it because they believed a re-bid would obtain an even lower price. Incredibly, the TBW board demanded an-unheard-of three successive "best and final" offers (BAFOs)!

The board clearly had no interest or understanding of the quality of the bids, or the challenges and technical risks that had to be overcome, to complete the project successfully. As inexperienced buyers with no exposure to the risks involved in desalination projects, they were interested in only one thing: the lowest price.

Both Ionics and DuPont dropped their bid prices slightly after the first two BAFOs, and we continued to remain the low bidder. On the third BAFO, DuPont dropped out. Only S&W, Ionics and a new bidder remained. We did not change our bid for the last BAFO. But amazingly, S&W dropped its price to an amount 20 percent under our previous low bid!

The TBW board believed they had done a superb job of squeezing the price and they declared S&W the winning



Tampa Bay Water Desal Plant – The first large-scale SWRO in the US

bidder. Maxwell was apoplectic. He immediately called me saying he knew we had the best design and the best bid, and asked if we would be willing to match S&W's price. Knowing that S&W's pricing was substantially below our costs, the answer was obvious. A contract was awarded to S&W Water in July 1999.

After five years of hard work, it hurt us deeply to walk away, but it hurt S&W and TBW even more. Shortly afterward, S&W declared bankruptcy. TBW's mismanagement and very substantial overruns delayed project completion by five additional years. We were very lucky!

Epilogue: TBW purchased from the project from the private development, design and construction consortium in May 2002 with construction only 30% finished. Although the construction was 'completed' in May 2003, the plant failed to pass the performance test, and the construction contractor filed for bankruptcy in October 2003. Acciona Agua was then hired to redesign, renovate and operate the plant. It passed its final acceptance testing in December 2007, and has been operating as necessary, ever since.

George Gsell – MECO CEO

US Army's Lightweight Water Purifier

MECO's history of supplying desal units to the US and international peacekeeping forces stretches back to 1939 when we patented the trailer-mounted vapor compression units used to supply desalted seawater to troops during World War II. In 2002, the US Army awarded MECO a project to design, performance test and deliver a new Lightweight Water Purifier (LWP) unit.



The Lightweight Water Purifier (LWP)

A Florida company was initially awarded the contract following a competitive bid process, but when their prototypes failed to pass the performance tests, the contract was novated to MECO. We redesigned the system and built three prototypes, which successfully passed subsequent testing. We were then awarded a ‘low-rate, initial production contract’ of seven units.

The units are the successors to the larger ROWPUs (RO water purification units) and TWPSs (tactical water purification systems). We had to design the LWP as a “go anywhere” RO unit that is able to desalt both brackish and seawater in extreme climates, with high turbidity feedwater containing nuclear, biological and chemical (NBC) contaminants, and withstand an electromagnetic pulse (EMP). The LWP must be compact enough to be transportable by a Humvee or Blackhawk helicopter, and rugged enough to be airdropped by a C-130 transport aircraft, with the added ability to be set up by two soldiers in 45 minutes and operated by one.

Unfortunately, after completing those seven units in August 2005, Hurricane Katrina hit Louisiana, and the tidal surge literally flushed everything out of our New Orleans manufacturing facility, including those initial seven units. Our military ‘handler’ for the project was an Army lieutenant colonel. When I told him that we could not get into the city, and had no access to our facility, he directed a helicopter flyover of the MECO plant to assess the damage. They confirmed that our plant was wiped out.

I was then summoned to Washington to brief the commanding general of US Army Ground Support on our status, and to present our plans for moving forward. After the general, and a room full of soldiers under his command, heard my three-minute, six-slide presentation, he simply said, “Son, tell us what you need and we’ll make it happen.” They then immediately committed to provide any resources we needed to get the project back on schedule.

Although we had flood insurance, we later learned that if we didn’t, the Army was prepared to help rebuild our shop.

We finished the initial seven units and received a follow-on contract for 100 more units. We have since furnished 550 LWPs, each capable of producing 125 GPH (11.5 m³/d) of potable water from brackish water, or 75 GPH (6.8 m³/d) from seawater.

It was an awesome feeling to know the US Army had our back when the deck seemed stacked against us.

Epilogue: MECO temporarily relocated its operations to Houston, Texas. In 2014, it moved back to Louisiana, and into a newly built, state-of-the-art 80,000 ft² (7,430 m²) manufacturing facility in Mandeville, which has since been expanded. In addition to serving the defense industry, the company furnishes RO and thermal distillers for industrial, biopharmaceutical and the oil and gas markets. As this issue of *WDR* goes to press, two tropical storms are bearing down on Louisiana and set to make landfall this week.

Covid-19

VIRTUAL PROJECT DEVELOPMENT

Closing an engineered capital equipment deal has always required patience, tenacity and a bit of creativity. But since the end of February, after most water companies eliminated or greatly restrained business travel, everyone, especially sales and business development personnel, has had to adapt to a new way of doing almost everything.

After hearing that a major water company closed an important industrial zero liquid discharge (ZLD) project during the height of the pandemic, *WDR* asked the lead project developer, who is a friend and former colleague, to provide a brief summary of how his company was able to close a deal in the midst of a global pandemic. Here’s his account:

A lot of project work is always done via phone and email, but this project was unlike any other that I’ve developed in over 20 years. Normally, I travel 25 to 50% of the time, and take every opportunity to meet with customers, but in early March, our group all went home on lockdown.

This project is for an industrial recycle/reuse system for a western US facility that must implement a ZLD system due to new discharge limits. The initial work began with a pre-bid conference call last November. We established credibility and began forming personal relationships during an early January 2019 meeting with the owner and owner’s

engineer. That meeting proved invaluable, and since then, we still haven't had a face-to-face meeting.

We submitted our proposal in mid-January, and had bid clarification calls and emails throughout February, before everybody went on home lockdown, eliminating any opportunity for the kind of meetings we would usually schedule for a project of this magnitude and importance. By the end of March, the customer was finally ready to finalize technical clarifications and begin commercial discussions.

Our first commercial call was held on the last Friday in March, with ten people from three time zones all calling in from home. We broke for lunch after 1-1/2 hours—normally, we would have all eaten together, using the informal time to get to know the client on a more personal level—before reconvening for another 4-hour phone session, finishing at 7:00 PM on a Friday evening.

Though we were happy to finally be working towards an order, our family members, who were also locked down at home, were waiting to have dinner and begin the weekend.

We picked up the negotiations again on Monday, with another 5-1/2 hour conference call. This was not necessarily a long meeting, but it was a pre-Zoom, pre-Teams conference call, and with all the “sorry I was on mute” apologies and distractions from other emails and phone calls, it seemed much longer. None of these distractions would have occurred if everyone had been sitting in the same conference room.

Over the next three weeks, we held a total of 30 hours in 13 separately scheduled conference calls. At the end of most days, we would email revised documents with the day's updates. The meant that at the beginning of each day's call, we'd have to make sure everyone was using the latest version of the documents, something that was much easier said than done. These negotiations would probably have taken two or three full days if meetings had been conducted in person.

The mechanical completion date for the system was fixed due to the effective date of the new regulations, and the extended negotiations did impact our execution schedule. However, we were able to get the contract signed during the last week of April.

This was the first of several negotiations that we closed during Covid. We've already become much more adept with teleconferencing technology and etiquette, and the use of Zoom and Teams has become routine. We are also starting to develop new projects remotely, which is something that would have never been done without personally meeting with clients, including one valued at more than \$25 million.

It's clear that the way we conduct post-pandemic business will change; however, the importance of face-to-face meetings should never be underestimated.

Transition

NATHAN BERKMAN (1931-2020)

Nathan Berkman, the General Manager of Israel Desalination Engineering (IDE) from 1968 to 1983, and a founding partner of ADAN Technical & Economic Services, died Saturday morning, 22 August. He was 89 years old.

Nathan earned a Bachelor's degree in Economics from Hebrew University in Jerusalem, and an MBA from New York University. He took the helm at IDE after the small government-owned company terminated its R&D efforts on the Zarchin Freeze desalination process, and had just began the commercialization of its low temperature MVC (LT-MVC) distillation units.



Breaking into the limited market that was then open to an Israeli company with a new, unproven desal plant concept and design, was difficult. Until then, the only LT-MVC units that had been sold were to hotels in Spain, and the government was questioning the company's commercial viability and was on the verge of shutting it down.

It had already lost faith in the company as a potential developer of large-scale desalination plants that could solve Israel's impending water supply crisis, which had been the main reason for establishing the company.

As an economist, with no technical education, who was working with a 'pack' of talented engineers, Nathan knew how to lead, motivate and steer them to develop the highly reliable and efficient desalination plants that eventually broke into the market and resulted in the company's well-deserved reputation. His modest, democratic leadership style was open to any new idea that could pass the technical staff's collective critical review. His door was open to everyone in the company.

Most importantly, Nathan was an indefatigable optimist. It was his optimism that convinced the government to give the company more time and funding, and maintain the staff's high spirits, even when projects failed to materialize and

some questioned its future. IDE Technologies exists today thanks to Nathan, his optimism and many smart decisions.

When Nathan left IDE, the company had increased the production capacities and efficiencies of its LT-MVCs, expanded its product range to include large-scale, low temperature MEDs, and MED-TVCs and early-design RO systems. It also broadened its markets to include the Western Hemisphere.

It was his foresight that led to the establishment of ADAN, which became Israel's leading desalination engineering consulting company, serving the Israeli Water Commission (now, the Israel Water Authority) and the governmental Inter-Ministerial Tender Committee as their technical consultant for all the large national BOT and BOOT desalination projects.

Nathan retired from ADAN in 2015. His two sons, seven grandchildren and one great grand-daughter survive him.

IN BRIEF

California's Orange County Water District was awarded \$5 million in grants from the State Water Resources Control Board Division of Financial Assistance for construction of its **Groundwater Replenishment System (GWRS)** Final Expansion project, based upon the increased water supply, superior water quality and multiple benefits the GWRS brings to the region. The MF/RO/UV expansion began in 2019 and will increase its capacity to 130 MGD (492,050 m³/d). Construction will be complete in 2023.

Boston-based **Gradient Corporation** said that it has secured 12 new desal and industrial wastewater treatment projects during the first half of 2020. The projects range from the production of domestic water from surface supplies to the treatment of industrial effluent for reuse and ZLD applications. Delivered under equipment sale and BOO business models, the projects will deliver annual revenues of approximately \$25 million across the Asia Pacific region. The company also said that it has consolidated its membrane innovations into RO Infinity (ROi), an integrated technology suite. The new brand comprises the Counterflow RO (CFRO) process, as well as advanced RO and FO techniques to overcome barriers that limit traditional desalination methods.

The **Middle East Water Research Center (MEDRC)** has issued a call for applications for MSc Fellowship Awards in

Palestine and Jordan. The awards provide targeted funding to exceptional Master's students in critically important areas of water science and security. MEDRC Fellowship funds may cover tuition and fees as well as research costs. The Palestinian awards are administered in collaboration with the Palestinian Water Authority. For details, visit <https://tinyurl.com/yxrkeb53>. The Jordanian awards are administered in collaboration with the Jordanian Ministry of Water and Irrigation. For details, visit <https://tinyurl.com/y4q239x4>.

Tomorrow, August 25, the American Membrane Technology Association (AMTA) kicks off its six-part webinar series that takes an in-depth look at Enhanced Recovery for NF/RO Systems. The first live installment is entitled *Conventional/Thermal Processes: What You Need to Know About Enhanced Recovery and ZLD*, based on AMTA's 2019 New Mexico workshop, held in collaboration with Reclamation's Brackish Groundwater Desal Research Facility. More details can be found at <https://www.amtaorg.com/online-training>.

The **Water Research Foundation (WRF)** has announced the release of RFPs for 12 research projects including projects to develop a "Framework for Quantifying Energy Optimization Reporting", and an assessment of "Vulnerability of Source Waters to Toxic Cyanobacterial Outbreaks". For details on all of the projects, visit <https://www.waterrf.org/open-rfps>.

At least 29 companies have submitted responses to a call for EOIs from parties interested in purchasing Saudi Arabia's **Ras Al Khair IWPP**. The plant, which was commissioned in 2014 and includes a 1.024 million m³/d (271 MGD) SWRO/MSF desalting plant and a 2,650MW combined cycle power plant, is located 60km (38 miles) northwest of Jubail. The Saline Water Conversion Corporation (SWCC), the plant's owner, is expected to issue an RFP by the end of October. A team comprising BNP Paribas (lead, financial), Abuhimed Alsheikh Alhagbani/Clifford Chance (legal), Atkins (technical), EY (accounting), Mercer (HR) and PwC (IT/processes) is advising SWCC on the process.

PEOPLE

With the recent shutdown of Griswold Water Systems, **Richard Chmielewski** reports that he is available to consider other options. With 40-years of desalination experience, the former Protec-Arisawa pressure vessel product manager, who is based in Southern California, may be contacted at dcres@hotmail.com.