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PFAS – An Innovative Treatment

AQUEOUS ELECTROSTATIC CONCENTRATOR IS DESIGNED TO REMOVE "FOREVER CHEMICALS" FROM STREAMS INCLUDING WASTEWATER, GROUNDWATER AND SURFACE WATER

By Ted J. Rulseh

PFAS, sometimes called forever chemicals because of their persistence, have gained attention as pollutants of significant concern.

Drinking water and wastewater agencies have been searching for cost-effective treatments for PFAS. Solutions that have been explores include reverse osmosis, adsorption with granular activated carbon, and ion exchange.

Now BioLargo, a company that specializes in innovative technologies for solving challenging environmental problems, has introduced an Aqueous Electrostatic Concentrator (AEC) for PFAS removal.

The company says the device can remove more than 99% of PFAS from wastewater, groundwater or surface water in a single pass with short contact time. It selectively targets and removes PFAS compounds with minimal disruption to the base water chemistry.

The modular, compact unit takes advantage of the polar behavior of PFAS molecules to optimize removal while minimizing waste.

The system collects and retains the PFAS compounds; after an extended operating life, modules are exchanged through a service that handles disposal of PFAS-laden waste. Dennis Calvert, CEO of BioLargo, Tonya Chandler, director of strategic marketing, talked about the technology in an interview with *Treatment Plant Operator*.

tpo: What qualifications does your company have for addressing PFAS in water and wastewater systems?

Calvert: Our technical group that has a track record of 30 or 40 years attacking problems around the world. Members of our engineering team in previous positions led one of the world's largest dioxin remediation projects, organized the pumping out of New Orleans post-Katrina, and provided technical support to the U.S. Postal Service for addressing anthrax threats at the post office. We also spent years developing an advanced oxidation process for the water industry. So it was a natural extension to say we know what to do with PFAS.

tpo: How did your team go about developing the technology?

Calvert: About two years ago our engineers came up with an idea for isolating and concentrating PFAS. At the core, it's the selectivity that makes the process unique. We're able to highly concentrate and extract PFAS compounds from a stream of water, and also from soil, such as at military bases. We got a U.S. EPA grant that allowed us to dedicate budget to the project. After that we decided to finance the balance with our own funds.

tpo: Where does this technology stand in terms of commercial availability?

Calvert: We're now doing commercial trials with some of the largest customers in the industry, including the federal government. We're also doing work with the Orange County Water District in California, commonly thought of as one of the world's leading innovators. We have a number of clients working through our early-stage testing program, and we're preparing to introduce our first units into the field.

tpo: In simple terms, how does the AEC process work?

Calvert: The technology uses an electrochemical field. Water passes through the field, and with that configuration we're able to migrate the charged PFAS molecules to their opposite charge. As we migrate them in a flow of water, we take them across a membrane. As they touch the membrane they attach, in sort of the way flypaper would capture a fly. While concept is very simple, the implementation is extraordinarily complex because there are many variables: power, flow rate, materials, washing, extracting, replacing.

tpo: Is the AEC technology useful for other applications as well?

Chandler: It can be used for chlorine removal and some metals removal, but the innovation was designed for PFAS; we found along the way that it can be used for other purposes.

tpo: How do you separate PFAS from the many charged particles in a water stream?

Tonya: That is the proprietary aspect of the process. However, as we put the water through an electrical charge, we do end up with an anion stream and a cation stream. Because the PFAS has been removed from the anion stream, we can blend that back to whatever chemistry the customer needs. For example, if they need to remove chlorides, we can blend the water back in at a rate that will get them below their chloride limit.

> "By selective extraction, we can concentrate PFAS across a very small footprint of membrane that is easily replaced in a cartridge system." **DENNIS CALVERT**

tpo: Does the process require customizing or calibration for the specific source water?

Calvert: There is always the variable of the water itself. We developed a testing program so that before we got too deep into the cycle we run some preliminary screens.

tpo: How would you summarize the advantages of the AEC technology?

Calvert: Fundamentally, we see it as a lower-cost alternative, especially on the maintenance side. Replacement and disposal are big cost centers for the current menu of solutions. Second, our process is available for use across a broad range of waters.

> “Fundamentally, we see [AEC] as a lower-cost alternative, especially on the maintenance side.” **DENNIS CALVERT**

Chandler: It can be used on wastewater, and there are not a lot of solutions available that can remove PFAS from wastewater cost-effectively. For example, activated carbon has been the go-to option, but putting activated carbon on a secondary wastewater stream uses up the carbon very rapidly.

tpo: What is the specific advantage on the waste disposal side?

Calvert: By selective extraction, we can concentrate PFAS across a very small footprint of membrane that is easily replaced in a cartridge system. We handle the waste product for the client, and it is a very small amount as compared to what could be truckloads of spent activated carbon. The regulatory environment is narrowing in on PFAS and will continue to for some time. The disposal of truckloads of carbon laden with PFAS is highly problematic.

tpo: Are any technologies available for destruction of PFAS?

Calvert: We are working on some breakdown technologies that are not yet ready for prime time. We understand from our experience with dioxin in the 1970s what it takes to break those strong carbon bonds. That’s an area of keen interest for us. But because the regulatory noose is tightening, what’s most critical is to get the PFAS out of the water first rather than wait around for a destructive technology.

tpo: How does your testing program operate?

Chandler: First, for a small fee the customer can send a sample of about five gallons that we will test to determine what the best treatment path is. If that for some reason our process is not effective, we’ll move on to other technologies or combinations of technologies to find the best solution for them. At the end the customer receives a report.

tpo: What happens of the customer wants to explore further?

Chandler: The next step is on-site testing, during which we credit back the cost of the first test. We set up parameters with them, such as how long we will be there and who will operate the pilot system. We then perform test and give them another report. If they choose to go to a full-scale system, we’ll credit the cost of the on-site pilot test.

tpo: What specifically can you offer if the AEC process itself does not prove to be an optimum solution?

Chandler: We may look at adding in, for example, a nanofiltration process or some sort of carbon treatment. We are willing to pair our technology with others if that is what it takes.

Calvert: In some situations a client may want only 50% or 70% PFAS reduction. That does two things. It reduces power consumption, and it increases flow rate. So that calibration can be optimized to meet the customer’s specific requirement.

tpo: How do you handle the maintenance side of the customer relationship?

Chandler: Once they received a full-scale process, we offer a maintenance contract that includes a service exchange on the membrane modules. We monitor the system, and when we see that a module is close to end of life, we exchange it and dispose of the PFAS-laden material. tpo

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