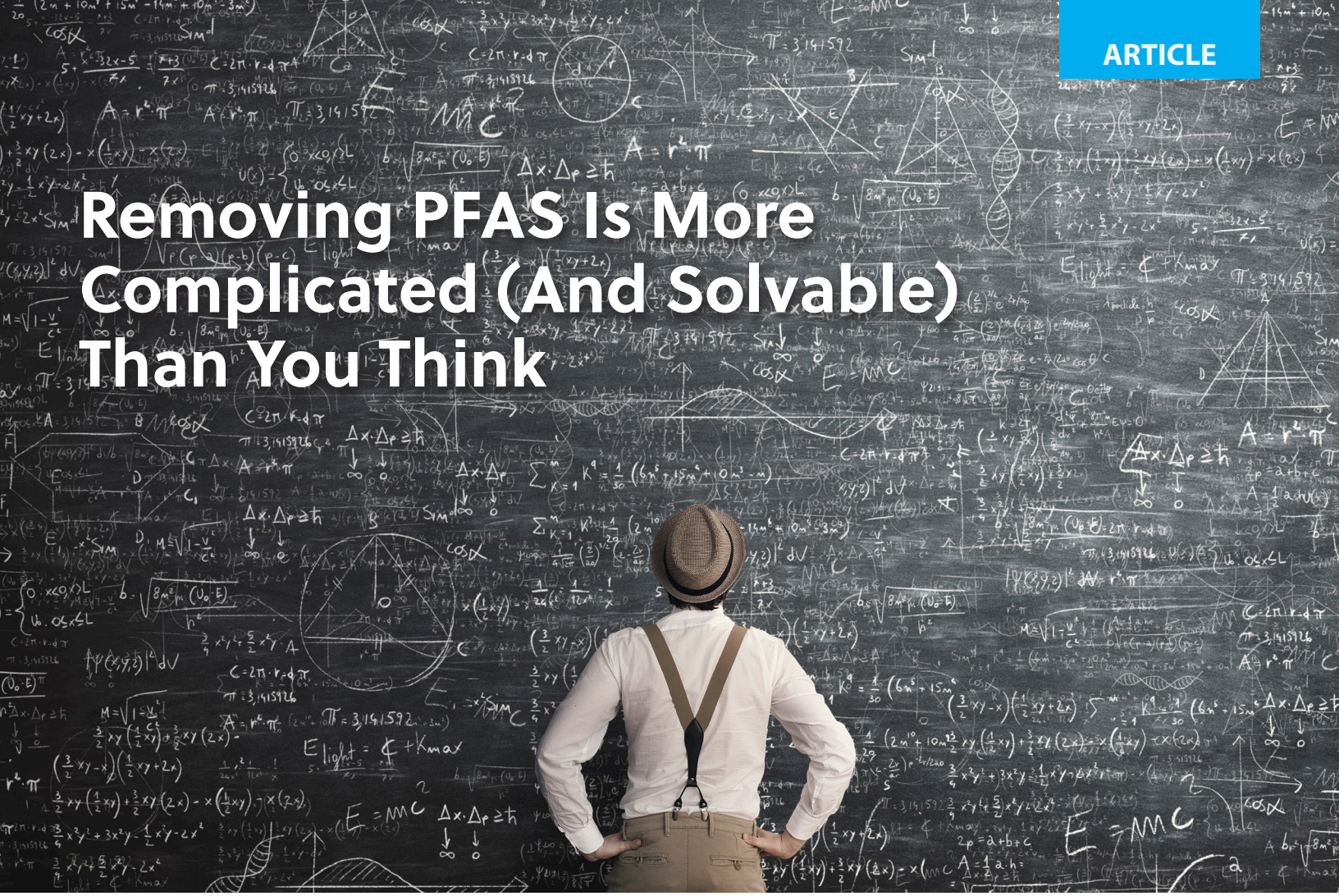
ARTICLE

Removing PFAS Is More Complicated (And Solvable) Than You Think



As the imperative to address per- and polyfluoroalkyl substances (PFAS) contamination in water sources increases, public drinking water providers and industry are scrambling to adopt and implement treatment solutions. In this mad dash, operators, superintendents, managers, and other decision-makers are making assumptions about the best way to remove PFAS, resulting in potentially higher capital costs and more expensive life cycle costs than necessary.

There are a variety of technologies that can be used to treat PFAS across the water industry, and their effectiveness varies depending on a wide range of circumstances. As such, it is critical that water treatment professionals partner with highly experienced solutions providers to engineer a solution that best fits that application and optimizes the total long-term costs of treatment. ChartWater's AdEdge Water Technologies has more than 20 years of experience removing contaminants like PFAS from water. This article will explain the matrix of factors that can affect PFAS removal and why it is important to work with an experienced partner like ChartWater.

How To Choose A PFAS Removal Technology

There are four primary technologies that can address PFAS contamination: granular activated carbon (GAC), ion exchange (IX), FLUORO-SORB media, and high recovery flow-reversal reverse osmosis (FR-RO) (see Figure 1). Each has its own distinct advantages and potential limitations, and which solution will work for a given application depends on the following factors:

Multiple Contaminants in Water Quality. The background composition of the water to be treated has perhaps the greatest influence on the type of technology that can be considered. For example, when high levels of iron and manganese are present in water, they may need to be treated before PFAS can be removed. This is normally done through oxidation with chlorine, which can be harmful to downstream IX media or membranes. FLUORO-SORB media is better suited to this scenario. Likewise, where VOCs are present, GAC can be applied as an effective choice to tackle the water quality. Similarly, where there is high salinity and the desire to protect against future emerging contaminants of concerns, high-recovery FR-RO systems can be a good choice.

Type of PFAS Compound. The specific PFAS to be treated and respective treatment goals vary from state to state. The effectiveness of each media solution for the target PFAS parameters needs to be compared and considered.

System Size and Available Footprint. The media solutions require specific full-scale system sizes to effectively remove PFAS. GAC systems require a larger footprint for a given flow rate, whereas IX and FLUORO-SORB systems are smaller.

Waste Disposal Costs/Logistics. Once the media is exhausted, it must be disposed of. However, local and state regulations, as well as simple logistics, may make disposal a challenge. In addition, RO systems produce reject water that is concentrated with contaminants. Site managers need to consider what waste-disposal options are available to them and the cost of those options. Thankfully, experienced PFAS solutions providers such as ChartWater's AdEdge offer turnkey disposal solutions for spent PFAS-contaminated media and high-recovery FR-RO system to limit reject water volumes.

Life Cycle Costs. Waste disposal is just one aspect of the total operating cost of a given system. Both the initial capital expense (CAPEX) and lifetime operating expenses (OPEX) such as replacing media, labor costs to run and maintain the system, energy demands of the system, and more need to be considered.

FLUORO-SORB MEDIA	ION EXCHANGE
✓ High capacity for PFAS ✓ Short EBCT of 2-3 min resulting in compact footprint ✓ Excellent performance even in presence of TOC, TDS, and free chlorine	✓ High capacity for PFAS ✓ Short EBCT of 2-3 min resulting in compact footprint ✓ Minimal start-up wastewater volumes and no backwashing
GRANULAR ACTIVATED CARBON	**FLOW REVERSAL RO**
✓ Proven PFAS removal and widely accepted ✓ Addresses other water quality parameters as needed (TOC, T&O, VOCs) ✓ Non-leaching	✓ >99% PFAS rejection ✓ "Flow reversal" technology results in higher water recovery rate possible ✓ Multiple contaminant removal solution

Each of the four main technologies that can be used to effectively remove per- and polyfluoroalkyl substances (PFAS) from water –– granular activated carbon (GAC), ion exchange (IX), flow-reversal reverse osmosis (FR-RO), and FLUORO-SORB media –– has different advantages. The key to knowing which one to use is to partner with a vendor that has extensive knowledge and experience working with all four technologies and can engineer a solution based on the specific needs and requirements of the customer.

How To Select A PFAS Removal Partner

One of the most important factors in choosing a PFAS solution provider is whether the solution can be tailored to the site-specific conditions. There are many vendors simply providing equipment that can be used for PFAS treatment, but cost-effectively treating PFAS requires a more thorough understanding of how to combine process design and equipment design, since each potential solution has advantages and limitations and there is no "one size fits all" approach. Suppliers should be able to analyze the water source and evaluate what solutions will and will not offer effective treatment. In addition, suppliers should have a strong understanding of the CAPEX and OPEX of the technologies offered and be able to engineer a solution that can best serve the end user.

It's also important to consider what services are available long term. This may include turnkey media disposal support, as mentioned earlier, or operator training. In an emergency treatment situation, facility managers can consider treatment as a service (TaaS) offered by ChartWater's AdEdge. With TaaS, ChartWater's AdEdge will quickly deliver a PFAS treatment solution on a monthly fee basis, reducing the time it takes for capital purchases. TaaS can be leveraged as an intermediate solution until a permanent installation is built, or as an interim option to meet regulatory treatment limits while a permanent system is designed and constructed.

Regardless of the scenario, when it comes to removing PFAS, the critical first step is to look before one leaps. In other words, don't assume you know what technology is best. Instead, partner with experienced PFAS removal experts to develop a custom solution designed for the specific needs and goals of the application. ■