MANAGING PFAS IN WATER AND WASTEWATER SYSTEMS

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BACKGROUND

Thousands of different per- and polyfluoroalkyl substances (PFAS) have been widely used in consumer and industrial products for years. PFAS break down very slowly in the environment and are difficult to remove from water. According to the EPA, exposure to some PFAS in the environment may be linked to harmful health effects in humans and animals due to long-term bioaccumulation in tissue. PFAS are classified as either long-chain or short-chain compounds, depending on the number of carbon-fluorine bonds they contain. Short-chain PFAS were developed as replacements for long-chain PFAS due to concerns over potential health effects. Data suggests these short-chain compounds may be less likely to bioaccumulate and are less toxic than long-chain PFAS.

In 2023, the EPA proposed new enforceable limits for PFAS in drinking water, including PFOS, PFOA, PFHxS, GenX, PFNA, and PFBS. The EPA continues to evaluate these and other PFAS compounds included in its 5th Unregulated Contaminant Monitoring Rule (UCMR-5). Addressing PFAS in public water systems is expensive and time-consuming, so water and wastewater utilities should consider developing a **PFAS Management Plan** to evaluate potential impacts on their systems and to determine what steps are needed to address them. Some of the components of a PFAS Management Plan are discussed next.

DEVELOPING A SAMPLING PLAN

One of the first steps is to develop a sampling and testing plan to confirm and quantify the types and amounts of PFAS in the water system. Utilities should design the plan to incorporate all sources of raw water and finished water, as well as filter backwash waste and sedimentation basin waste. At a minimum, it should include the 29 PFAS compounds on the EPA UCMR-5 list. PFAS testing costs generally range from $400 to $600 per sample. Specific sampling procedures have been developed for PFAS sampling, and it is important to follow these procedures to protect the integrity of the PFAS test results.

PFAS testing data should be evaluated to determine whether or not PFAS is present in the water system and whether the specific types and quantities of PFAS are likely to exceed the EPA drinking water standards. Utilities should evaluate the need for additional PFAS testing and attempt to identify and eliminate or reduce source(s) of PFAS since this is likely to be less expensive than developing an alternative source of water supply or installing PFAS treatment facilities. Source(s) of PFAS contamination may include landfills, wastewater discharges, industrial sites, etc.

EVALUATING TREATMENT ALTERNATIVES

Advanced filtration is the only water treatment alternative currently available for PFAS removal, but several PFAS destruction technologies are being developed. Advanced filtration technologies generally include pressure filters with adsorption media, nanofiltration membranes (NF) or reverse osmosis (RO) membrane filtration installed to filter finished water at the end of the water treatment process. Another advanced filtration option is to install GAC on top of gravity sand filters or membranes, but this approach is likely to be less efficient at removing PFAS due to the higher level of organics in settled water and the mixing of adsorption media during backwash cycles.

ADSORPTION MEDIA PRESSURE FILTERS

Adsorption media for pressure filters include granular activated carbon (GAC), ion exchange resins, and clay-based adsorbents. Adsorbents such as GAC are frequently used to remove natural and synthetic organic compounds (i.e., disinfection by-products), tastes, and odors. GAC works well on longer-chain PFAS but is less effective for short-chain PFAS. Positively charged ion exchange resins can effectively remove negatively charged contaminants, like PFAS, but are more expensive than GAC. Some clay-based adsorbents have specially modified surfaces to enable them to specifically target PFAS while minimizing the adsorption of other organics. Some adsorptive media, such as GAC, can be thermally regenerated, but others are single-use, and spent media must be incinerated or disposed in a landfill. Adsorbent pressure filters require infrequent backwash, so the waste stream is minimal. Pilot testing of multiple pressure filter media is recommended to evaluate the effectiveness of PFAS removal and estimated O & M costs (e.g., annual media replacement costs). Adsorption media pressure filters are significantly less expensive than membrane filtration systems, but membrane filtration is considered to be the best available technology.

Krebs is currently pilot-testing PFAS removal with multiple pressure filter media technologies at a 21 MGD water treatment facility to evaluate overall effectiveness and cost. Krebs also recently completed a full-scale GAC pressure filter installation at a water treatment facility in Guin, Alabama. The pressure filters have removed PFAS to non-detect levels for over 14 months (and counting) without the need for media replacement.

GAC PRESSURE FILTERS - GUIN, AL

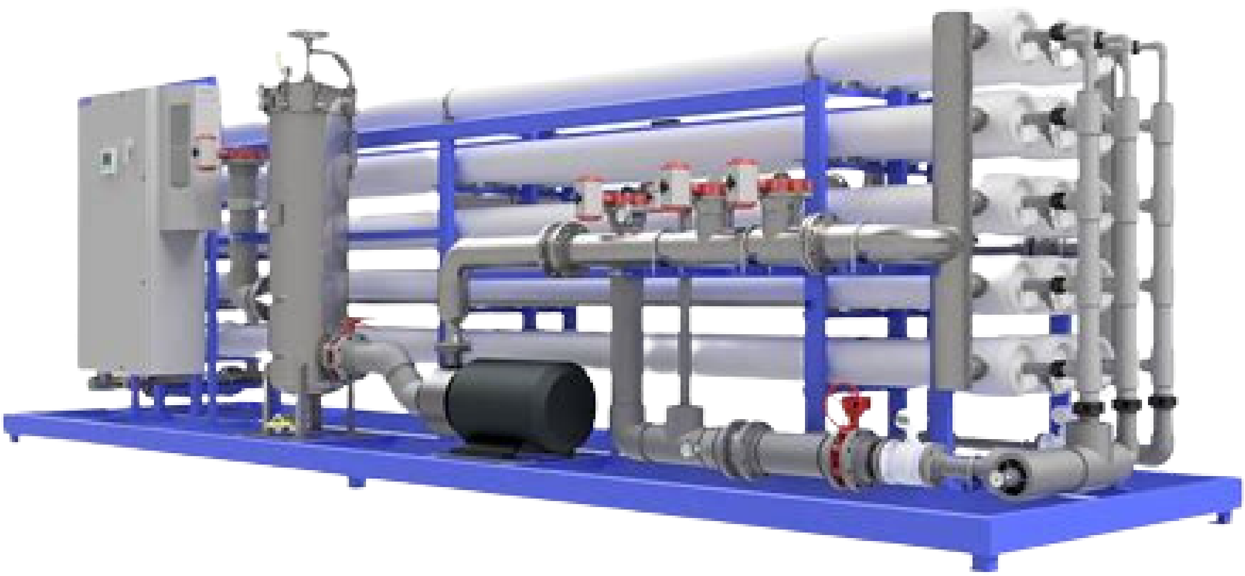
PFAS DESTRUCTION TECHNOLOGIES

Several PFAS destruction technologies are currently in development but are in the early stages. One technology uses reductive defluorination (a chemical/liquid catalyst and UV light) to break apart PFAS. Another technology uses specialized electrodes to pass electrical current through the water, which breaks the PFAS apart. The destructive technologies may prove to be cost-prohibitive unless the PFAS can be concentrated to reduce the volume of water that must be treated. A multifaceted treatment approach will likely be necessary to treat and destroy PFAS to comply with EPA regulations.

KREBS ENGINEERING

NF AND RO MEMBRANE FILTRATION

NF and RO membrane filtration are the most effective methods of removing PFAS and other contaminants, but they are also the most expensive PFAS treatment systems to build and operate. Some NF and RO systems require pre-treatment with membrane microfiltration, and all NF and RO systems consume relatively large amounts of power. RO systems generally remove a higher percentage of PFAS and other organic/inorganic compounds. NF and RO systems also produce a concentrated PFAS waste stream (e.g., reject water), which requires additional treatment with GAC pressure filters or other means before being discharged to a receiving stream. The concentrated waste stream, however, should be better suited for the PFAS destruction technologies currently being developed. A few utilities, such as West Morgan-East Lawrence Water and Sewer Authority (Alabama), the Gadsden Water Works and Sewer Board (Alabama), and the Rome, Georgia water system, have installed or have begun work on RO systems. Krebs has recently started working with other utilities to evaluate and consider RO membrane filtration to comply with anticipated PFAS rules.



WESTECH RO SYSTEM

FUNDING THE REMEDIATION COSTS

PFAS remediation and treatment is time-consuming and expensive, and federal funding assistance has been limited thus far. Water systems should contact their state SRF program to inquire about grants and low-interest loans for PFAS remediation. Increasingly, water and wastewater utilities with PFAS issues are also pursuing litigation to recover these costs by joining the class action lawsuit against PFAS manufacturers or filing an individual claim(s). **Water systems will automatically be included in and bound by the terms of the proposed class action settlement unless they opt out by December 4th (Dupont) and December 11th (3M)**, so utilities should discuss legal options with their local or in-house attorneys as soon as possible. Local or in-house attorneys may not have the needed resources or experience with PFAS, but they can assist with the decision to pursue litigation, develop a shortlist of potential firms, and interview law firms experienced with PFAS litigation.

INVESTIGATING PFAS IN WASTEWATER

The primary PFAS regulatory focus has been on municipal drinking water. Still, the EPA and state regulatory agencies are beginning to focus on PFAS in wastewater. Municipal wastewater systems should consider implementing PFAS testing for industrial wastewater customers and the wastewater influent, effluent, and biosolids at their municipal treatment facilities.

ADDITIONAL RESOURCES

EPA FAQ for PFAS Drinking Water Regulations

UCMR-5 Fact Sheet with List of PFAS

List of EPA-Approvbed Labs for UCMR-5

CONTACT US!

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