Municipal Treatment Strategies for PFOA/PFOS Compliance

Understanding EPA Regulations and Proven Technologies (GAC/IX/RO)

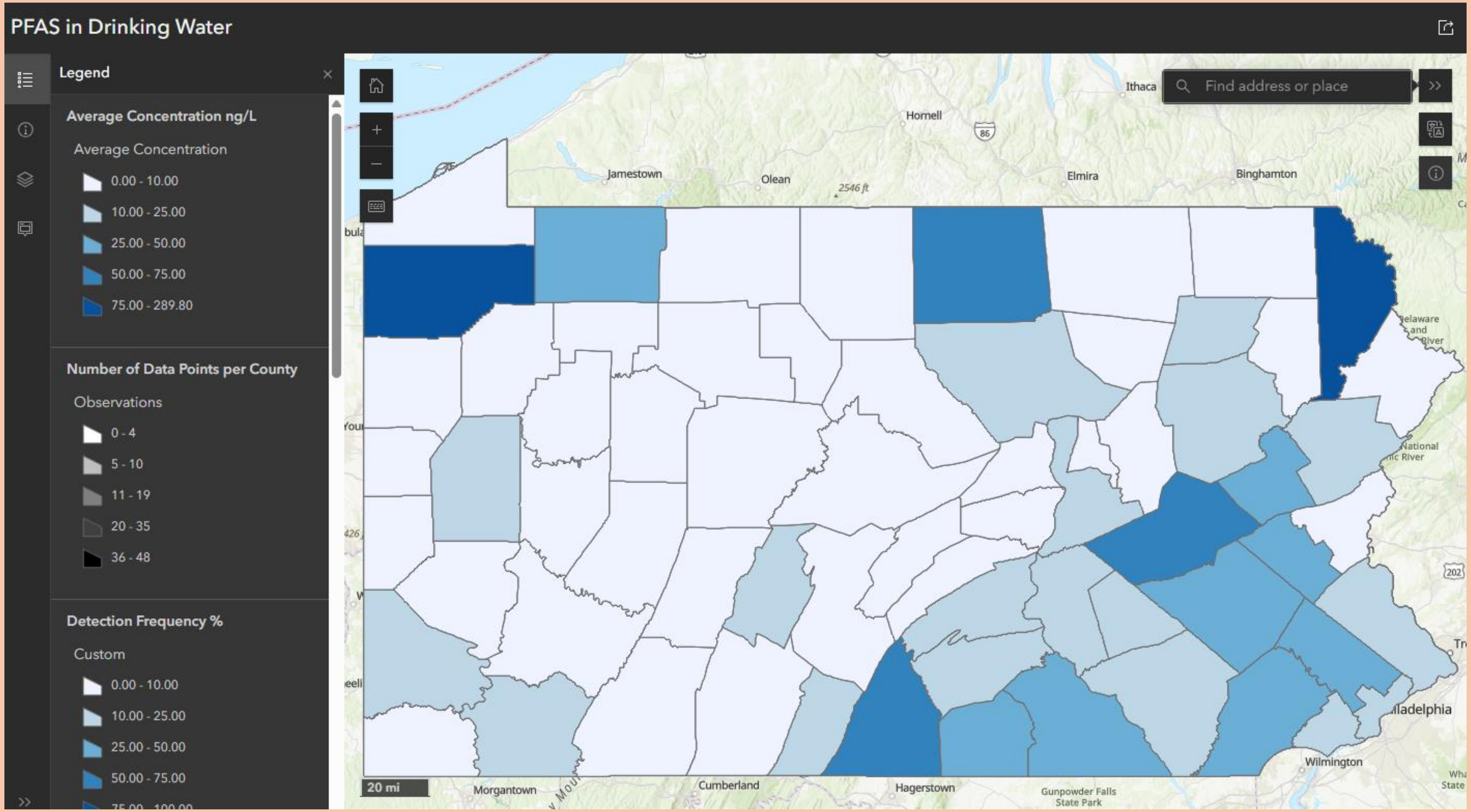
The New Regulatory Landscape

- Final Rule (April 2024): EPA sets Maximum Contaminant Levels (MCLs) for PFOA and PFOS at 4.0 parts per trillion (ppt).
- Mixtures: Hazard Index of 1.0 for PFHxS, PFNA, HFPO-DA (GenX), and PFBS.
- Timeline:
- 2027: Initial monitoring must be completed.
- 2029: Full compliance required (must have treatment installed).

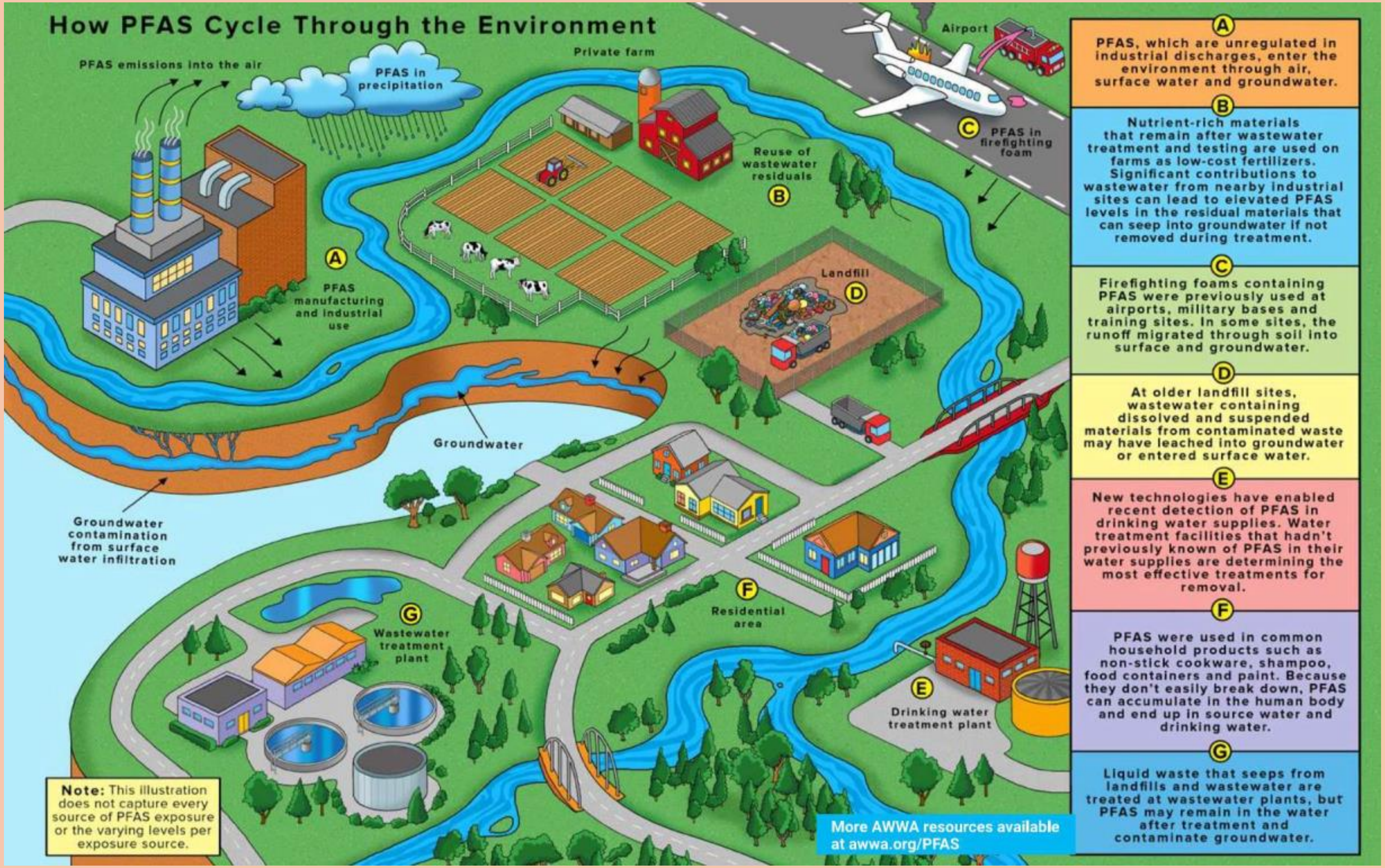
Main Takeaways

- Treatment Technologies: The most effective, tested methods for removing PFOA/PFOS at the municipal level are Granular Activated Carbon (GAC), Ion Exchange (IX) resins, and High-Pressure Membranes (Reverse Osmosis/Nanofiltration).
- Regulatory Changes: The EPA has set enforceable Maximum Contaminant Levels (MCLs) of 4 parts per trillion (ppt) for PFOA and PFOS, which public water systems must comply with by 2029.
- Challenges: Conventional wastewater treatment does not destroy PFAS, and it can accumulate in sludge.
- Cost: Implementing these technologies requires significant investment for design, construction, and operation of treatment systems

Average concentration (mg/l) in Pennsylvania

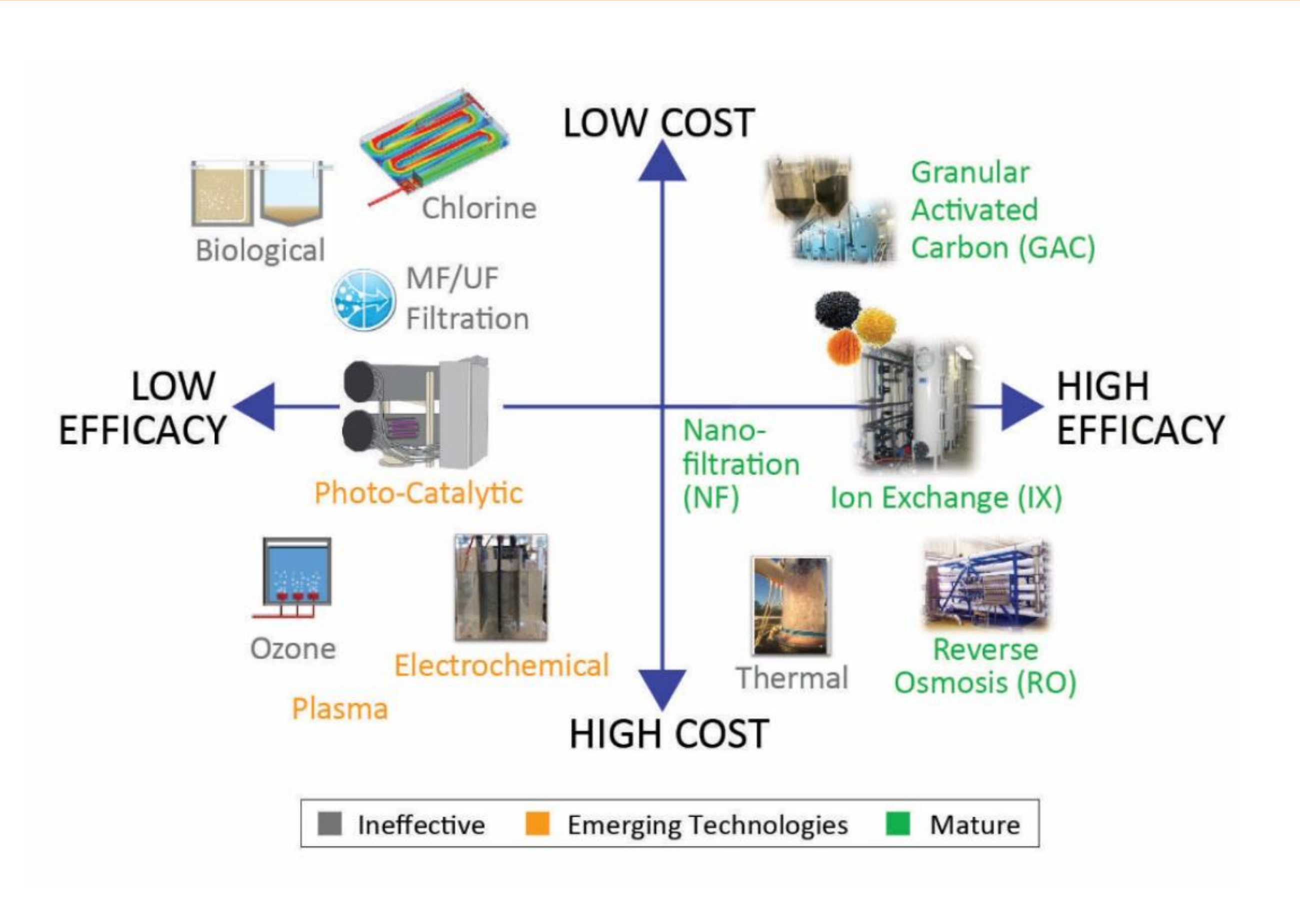


How PFAS Cycle Through the Environment



PFAS are used in many kinds of products

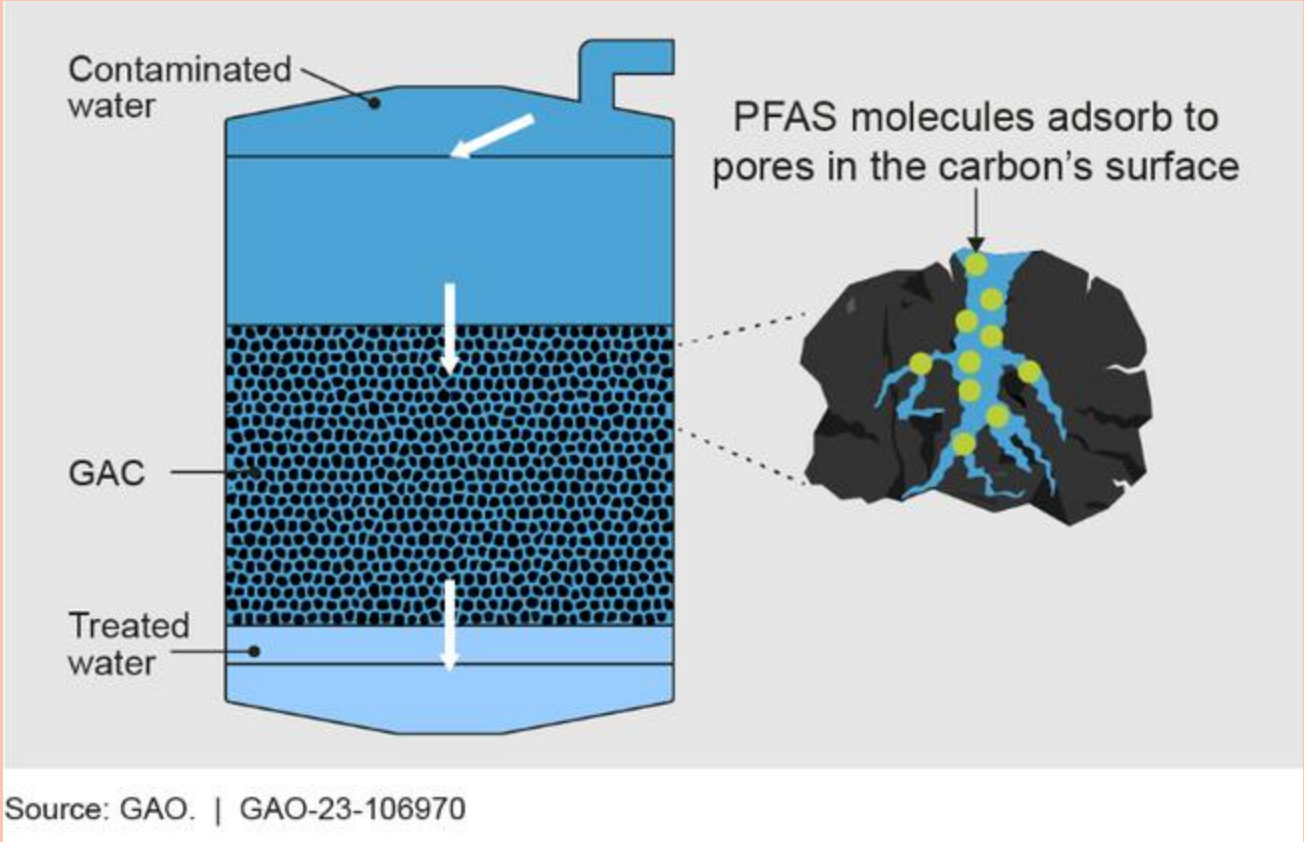
Treatment Technologies Available



Key Treatment Technologies (Best Available Technology)

- Granular Activated Carbon (GAC): Adsorbs PFAS onto porous carbon. Effective for long-chain (PFOA/PFOS).
- Ion Exchange (IX) Resin: Specialized, positively charged resins that attract negatively charged PFAS.
- Reverse Osmosis (RO): High-pressure membrane technology. Highly effective at removing a wide range of PFAS.

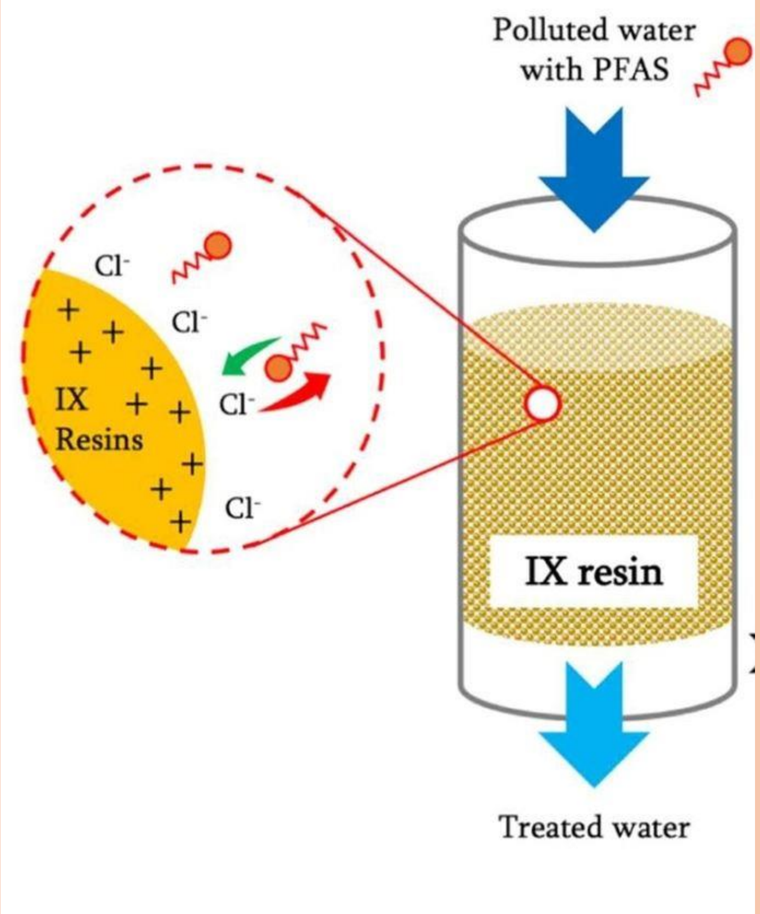
What is a Granular Activated Carbon System



GAC systems work by taking advantage of the high surface area of activated carbon particles, which effectively adsorb contaminants, including PFAS compounds. As water containing PFAS flows through the bed of activated carbon, it attracts and binds the contaminants.

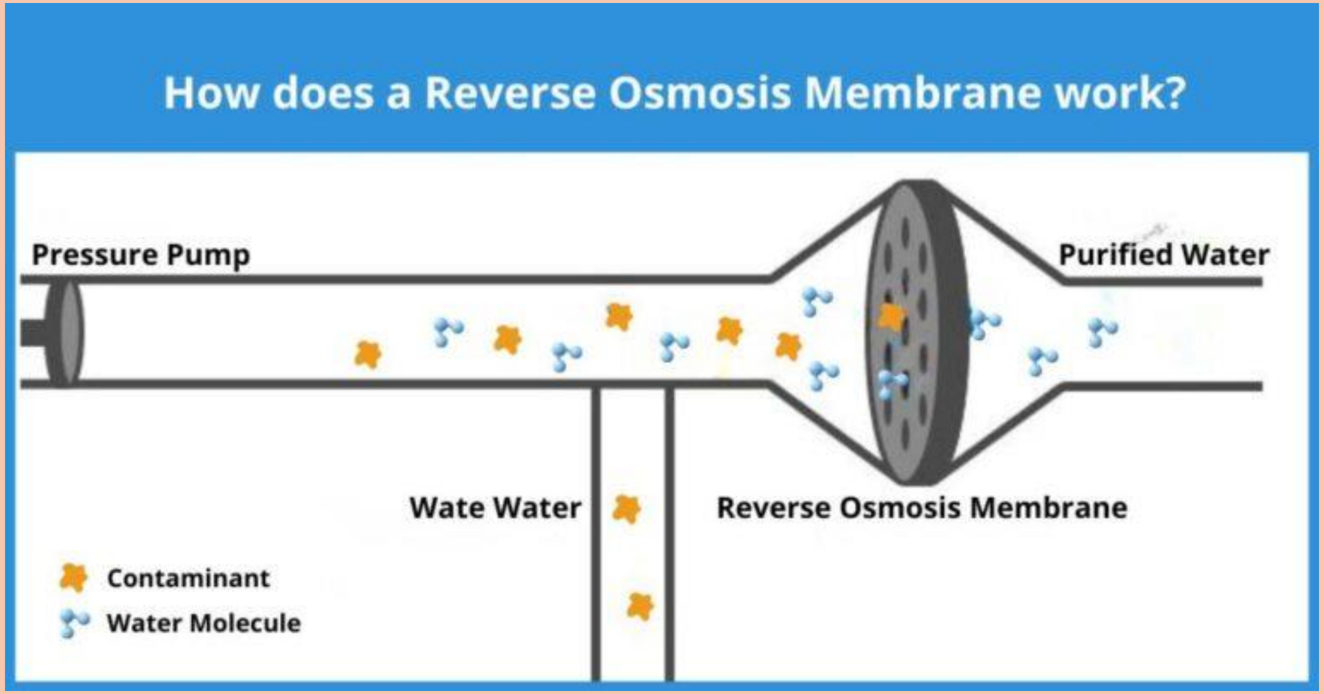
This process is particularly effective for long-chain PFAS compounds, which more readily adhere to the carbon surface. Over time, as more contaminants accumulate, the GAC media becomes saturated, requiring replacement or offsite regeneration to maintain performance.

What is a Ion Exchange (IX) Resin System



The “ion exchange” method begins with soaking special plastic beads called “resin” in salt water, so that chloride ions attach themselves to the positively charged nitrogen ions in the resin. Then, when you add your PFAS-contaminated water, the PFAS ions displace these chloride ions. The result is that your PFAS is attached to the resin instead of floating in the surrounding water. The technology attracts and traps all these molecules so the system can let clean water flow through.

What is a Reverse Osmosis System



Reverse osmosis (RO) systems improve water quality by using a filtration process that forces water through a semipermeable membrane under high pressure. This membrane allows water molecules to pass through while blocking larger particles, contaminants, and dissolved substances, such as salts, bacteria, and chemicals. The high pressure helps push the water through the membrane, effectively removing impurities and leaving behind cleaner, purified water. The process results in safer water for consumption, as harmful substances are effectively separated and flushed away. Reverse osmosis is considered the most effective filtration method, capable of filtering out contaminants such as lead, VOCs, microplastics, fluoride, chlorine, and harmful chemicals like PFAS.

Technology Comparison: GAC vs. Ion Exchange

- GAC: Lower upfront CAPEX, but higher frequency of media replacement. Good for high-concentration, long-chain PFAS.
- IX: Higher capacity for shorter-chain PFAS, smaller footprint, but higher initial media costs.
- Performance: Both can achieve >90-99% removal.

Cost Considerations (CAPEX/OPEX)

- O&M Costs: Ranging from $0.06 to $0.28 per gallon for GAC/IX depending on site complexity.
- Small System Solutions: Specialized, cost-effective options exist for smaller, rural communities.
- Waste Disposal: Spent media requires high-temperature incineration or landfilling, posing liability risks.

Hearthstone Well Site

- Sample Concentrations
  - PFOA 12.39 mg/l
  - PFOS 10.97 mg/l

- Flowrate 400 gpm

- System Selected - It is proposed to install a PFOA/PFOS removal system in a new building at the existing Hearthstone site. A two (2) vessel adsorption system will be installed. The system will consist of a skid mounted treatment unit, manufactured and supplied by CalgonCarbon®.

- Construction Cost: $2.4 million (which 2.0 million dollars is a grant)

F-8 Well Site

- Sample Concentrations
  - PFOA 5.60 mg/l
  - PFOS 7.07 mg/l
- Flowrate 200 gpm
- System Selected - It is proposed to install a PFOA/PFOS removal system in a new building at the existing Hearthstone site. A two (2) vessel adsorption system will be installed. The system will consist of a skid mounted treatment unit, manufactured and supplied by CalgonCarbon®.
- Construction Cost: $2.0 million (which 2.0 million dollars is a grant)

Buckingham Water Company Site

- Sample Concentrations
  - PFOA 12.60 mg/l
  - PFOS 11.61 mg/l

- Flowrate 00 gpm

- System Selected - It is proposed to install an Ion Exchange removal system in a new building at the existing Water Company site.

- Construction Cost: Still in design but an estimated construction is 2.5 million dollars