

From Pilot to Full-Scale Implementation:

PFAS and Multi-Contaminant Removal in Clifton, TN

City of Clifton, TN

Application

Purification of surface water with PFAS and other contaminants to meet drinking water standards with a focus on operational reliability, regulatory compliance and Zero Liquid Discharge (ZLD).

Project Significance

The City of Clifton represents a full transition from pilot validation to full-scale implementation of an integrated PFAS and multi-contaminant treatment system.

Following successful on-site pilot performance under variable surface water conditions, the **Cuf**[®] system with Colloidal Activated Carbon (**CAC**) was selected for full-scale deployment. This project demonstrates the ability to move beyond pilot testing and implement a single-platform solution capable of addressing PFAS and broader water quality challenges simultaneously.

Project Status

Pilot Completed → Full Scale System Awarded → Implementation Underway

Background

The City of Clifton sources water from the Tennessee River, presenting a complex treatment challenge due to:

- Variable PFAS concentrations influenced by seasonal and weather conditions
- Elevated background organics (TOC, DOC, NOM)
- Metals (Fe, Mn) and disinfection byproduct precursors (THMs, HAAs)

These conditions required a solution capable of maintaining consistent performance under variable water quality, while addressing multiple contaminants within a single system.





Figure 1: Tennessee River

Technology Selection

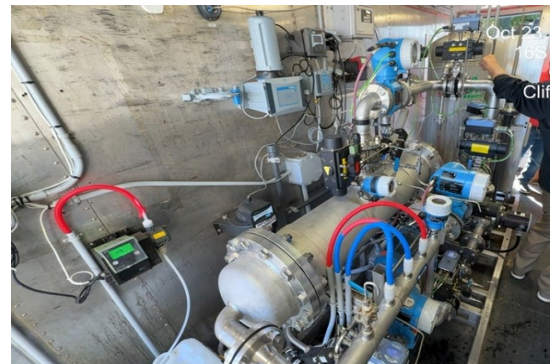
The **Cuf**® system with **CAC** was selected based on its ability to:

- Remove PFAS and co-contaminants in a single integrated process
- Operate without pretreatment, backwash, or media changeout
- Maintain stable performance under fluctuating surface water conditions
- Achieve 100% water recovery with Zero Liquid Discharge (ZLD)
- Provide a pathway for future PFAS destruction and carbon recovery

This approach simplifies system design while reducing operational complexity compared to conventional multi-stage treatment systems.

On Site Verification

A pilot system was deployed on-site, treating Tennessee River water directly without pretreatment.





Key Results

Source – Tennessee River End Use – Drinking Water Flux – 250 GFD		
Contaminant		
TOC (ppm)	1.8	1.3
PFOS (ppt)	6.7	<2.0
PFOA (ppt)	3.3	<2.0
PFHxA (ppt)	2.1	<2.0
PFBS (ppt)	2.6	<2.0
PFBA (ppt)	4.0	<2.0



Operational Performance

The **Cuf**[®] pilot process demonstrated;

- Sustained 100% water recovery (ZLD)
- No pretreatment, backwash, or CIP required
- Continuous operation with stable performance
- Treatment achieved within a ~4-minute process time
- Maintained operation with extended run times between rinses

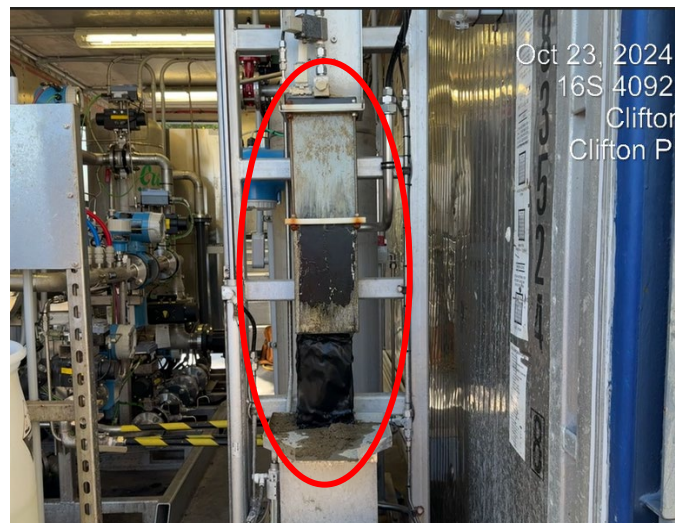
The pilot confirmed that effective PFAS removal could be achieved even in the presence of competing organics typical of surface water sources.

Technology Overview

Cuf[®] combines continuous ultra-filtration with Colloidal Activated Carbon (**CAC**) to remove PFAS, organics, metals, and suspended solids within a single system.

The process operates in steady-state without fixed media beds. Recovered **CAC** solids are managed through the Solids Recovery Unit (**SRU**), with a pathway for PFAS destruction (**POD**), supporting a closed-loop approach.

The picture below shows recovered **CAC** solids being discharged from the process in real time. The picture shows the solids falling off the flat plate SiC membrane after a dynamic shockwave. **CAC** solids can be handled through POD (PFAS On-Site Destruction).





Performance Insight

This is a high-performance achievement as surface water is much more challenging to process due to the high organic background that competes for the activated carbon. The **Cuf**[®] operation is consistent, sustained, durable and proven in municipal drinking water since 2014.

Outcome

Based on pilot performance, the City of Clifton advanced the **Cuf**[®] CAC system to full-scale implementation.

This project confirms the technology as a proven, deployable solution for PFAS compliance, capable of moving beyond pilot validation to real municipal adoption.

Cuf[®] CAC Solution for PFAS

The layout illustrates the integrated configuration of the treatment system, including CAC dosing, membrane filtration, solids recovery, and system controls. The modular design supports streamlined installation, reduced footprint, and simplified operation compared to conventional multi-stage treatment systems.

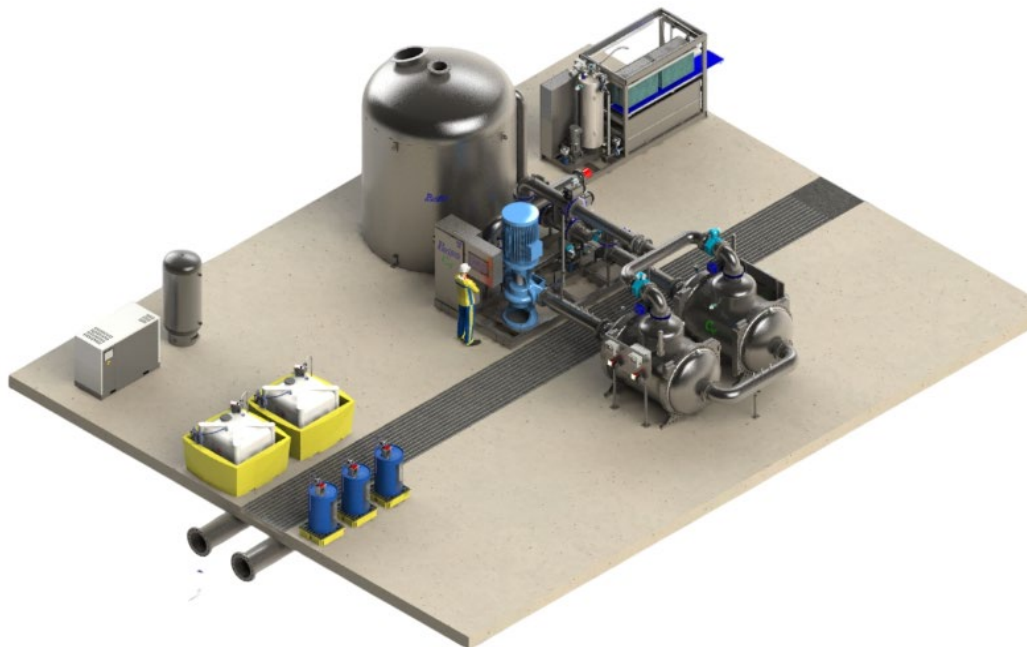


Figure 2: Full-Scale **Cuf[®] CAC System Layout – City of Clifton, TN**





Environmental & Economic Advantage

Estimated OPEX	\$/1000gal	\$/m3
Energy Cost (0.64 kWh/kgal)	0.046	0.012
ACH Coagulant (15 ppm)	0.023	0.006
CAC (2 ppm)	0.094	0.025
TMP Rinse Cost (0.5 per week)	0.003	0.001
Miscellaneous/Contingency/Maintenance	0.005	0.001
O&M Cost Estimate	0.171	0.045

Cost & Consumption @2.0 MGD	Cost	Source
Energy Cost (Industrial Average \$/kWh)	\$0.071	Domestic
Coagulant (50%)	\$1.04 / gal	Domestic
CAC (35%)	\$20.00 / gal	Domestic
Sodium Hypochlorite (12.5%)	\$1.46 / gal	Domestic
Sodium Hydroxide (50%)	\$2.30 / gal	Domestic
Sulfuric Acid (98%)	\$5.95 / gal	Domestic

Producing Better Water At Lower Cost



Reference Documents

- On-Site Pilot Verification Program.
- Pilot Report
- Why **Cuf**® for PFAS Removal.
- **Cuf**® Process.

