

## City of Clifton, TN

### Application

Purification of surface water with PFAS and other contaminants to drinking water standards with regulatory compliance and Zero Liquid Discharge (ZLD).

### Project Status

Detailed Design Complete → Construction Contractor Awarded → Procurement in Progress

### Background

The Tennessee River water possess the usual challenges of metals (Fe, Mn) and background organics such as TOC, DOC, NOM and THM & HAA precursors. The source water faces the additional challenge of PFAS contamination that changes in concentration and composition with seasonal and weather events to exceed regulatory standards.



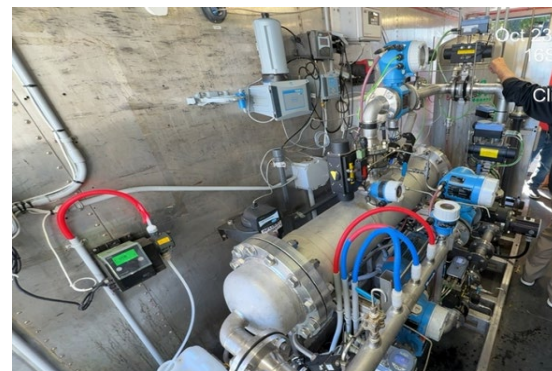
The **Cuf** process effectively removes multiple contaminants, including PFAS, in a single operation. The system comes preconfigured for PFAS recovery facilitating future upgrade. By implementing a pump to precisely injecting, mixing, and holding Colloidal Activated Carbon, **Cuf** provides a reliable, low-cost, and flexible solution for PFAS treatment, in addition to standard water purification. The **Cuf** process requires no pre-treatment, achieves 100% water efficiency and Zero Liquid Discharge (ZLD), and is NSF/ANSI/CAN 61-372 certified.





## On Site Verification Performance

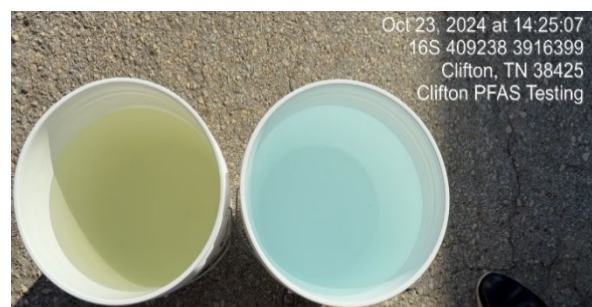
Sustained PFAS removal using CAC on the more challenging surface water with elevated levels of background TOC/DOC/NOM was piloted on site.



## Cuf Activated Carbon Performance

The pilot was conducted using the equipment identified above taking water directly from the Tennessee river (no pretreatment) and background TOC of nominally 1.8 ppm to produce filtrate water quality as shown below

| 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 |



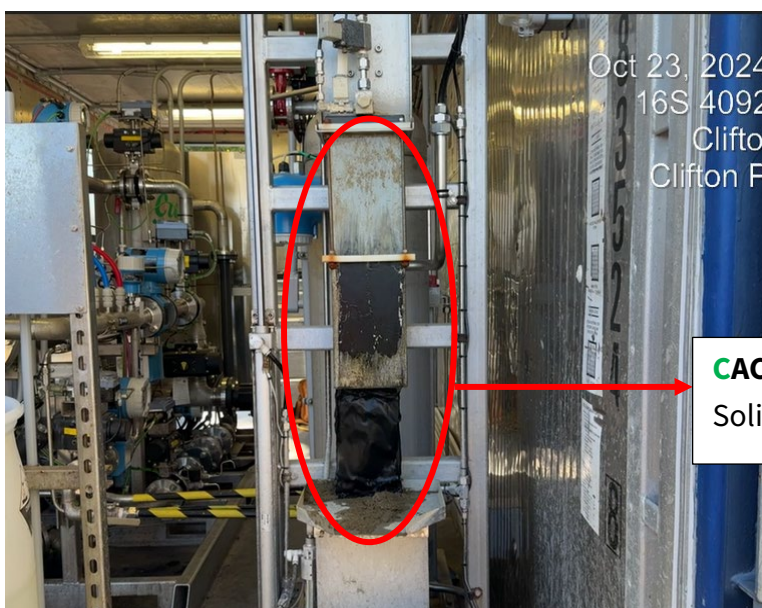
The Cuf pilot process demonstrated;

- Sustained 100% water efficiency
- Zero Liquid Discharge
- TOC removal 1.87 ppm → 1.33 ppm
- The **Elimination** of pretreatment, backwash and CIP
- Purification of river water to drinking water standards, including PFAS, in a single platform and in a 4-minute process time.
- Continuously produced water at 7 day intervals between rinses.





The picture below shows De-Watered 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).



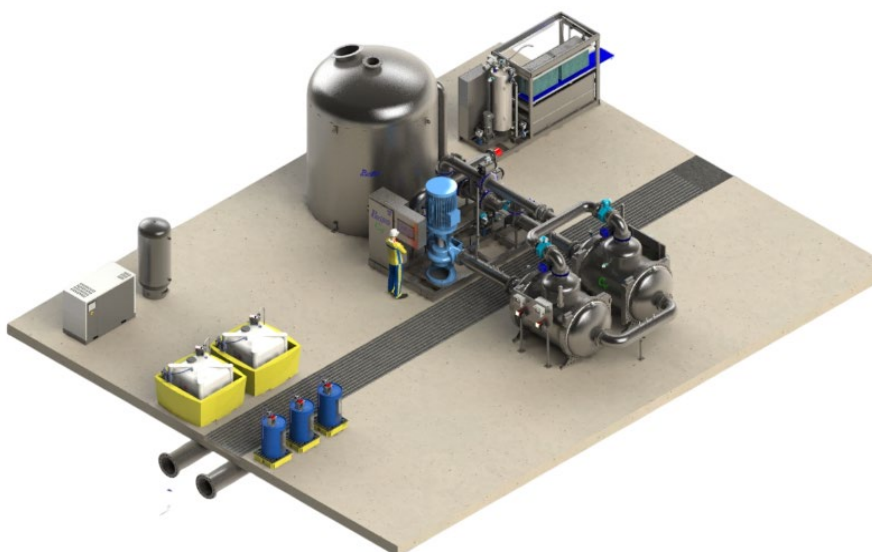
CAC Being Recovered in  
Solid Form Using SRU

## Performance Note

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. This challenge is not present in the easier purified ground water. The Cuf operation is consistent, sustained, durable and proven in municipal drinking water since 2014.

## Cuf CAC Solution for PFAS

This solution, currently in full scale design, consists of the following.





## Environmental & Economic Advantage

| Estimated OPEX                          | \$/1000 gal  | \$/m3        |
|---|--------------|--------------|
| Energy Cost (0.64 kWh/kgal)             | 0.046        | 0.012        |
| Coagulant 15 ppm                        | 0.023        | 0.006        |
| CAC 2 ppm                               | 0.023        | 0.006        |
| TMP Rinse Cost 0.5 Per Week             | 0.003        | 0.0007       |
| Miscellaneous / Contingency/Maintenance | 0.005        | 0.0013       |
| <b>O&amp;M Cost Estimate</b>            | <b>0.100</b> | <b>0.026</b> |

| Cost and Consumption @ 2.0 MGD          | Cost         | Gal / MGD | L / MLD |
|---|--------------|-----------|---------|
| Energy Cost (Industrial Average \$/kWh) | \$0.071      |           |         |
| Coagulant ACH (50%)                     | \$1.04 / gal | 22.2      | 84.18   |
| CAC (35%)                               | \$5.00 / gal | 4.7       | 17.74   |
| Sodium Hypochlorite (12.5%)             | \$1.46 / gal | 0.1       | 0.45    |
| Sodium Hydroxide (50%)                  | \$2.30 / gal | 0.0       | 0.16    |
| Citric Acid (50%)                       | \$4.47 / gal | 0.03      | 0.10    |

Producing Better Water At Lower Cost



## Reference Documents

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

