Brown AND Caldwell

PFAS

Capability Brief: PFAS

Brown and Caldwell Treatability Testing Laboratory

Overview

Poly- and perfluoroalkyl substances (PFAS) are a large class of emerging contaminants consisting of synthetic chemicals such as perfluorooctanoic acid (PFOA), perfluorooctane sulfonate (PFOS), perfluorononanoic acid (PFNA), and GenX. The USEPA has issued a PFAS Action Plan that currently includes a health advisory level of 70 ng/L for total PFOS and PFOA in drinking water. Several states have established more restrictive criteria for PFAS compounds with some state regulations also addressing surface water, wastewater, stormwater and biosolids.

Practical solutions + innovation

BC supports client technology selection through rigorous bench- and pilot-testing with site-specific water.

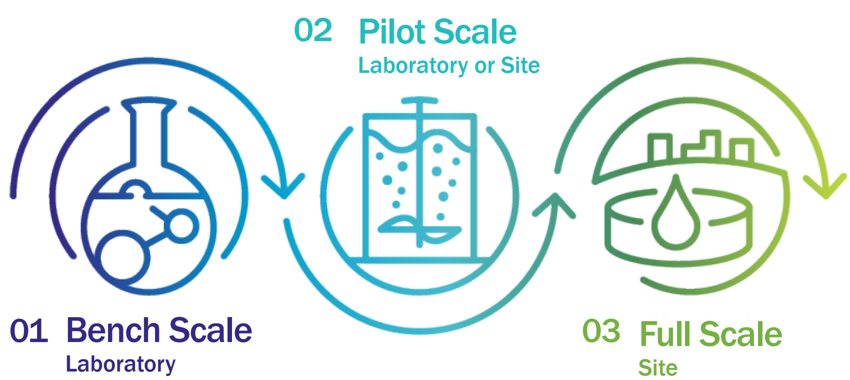
BC has a sophisticated Treatability Laboratory enabling expedited data development to support solution implementation to keep pace with regulatory requirements and public pressure. BC's Treatability Laboratory provides rapid analyses for conventional treatment approaches for PFAS, including granular activated carbon (GAC), ion exchange (IX) and reverse osmosis (RO). We are also making strategic investments in research and development of destructive treatment technologies to support our clients' needs for addressing long-term management of PFAS.

Identifying and proving solutions for PFAS

BC offers services for the testing and development of treatment solutions for PFAS and other emerging contaminants. We develop design criteria for engineering traditional treatment solutions and are working with innovative technology partners to bring to market new proven solutions and technologies that optimize the operation of these conventional treatment approaches.

Technology selection for conventional processes

BC helps clients with the full spectrum of services from initial concept and bench-testing technologies through pilot-testing and full-scale design. Conventional treatment technologies like granular activated carbon (GAC) and ion exchange (IX) and reverse osmosis (RO) are used to remove PFAS from groundwater and drinking water. BC has standard testing protocols that are applied with site-specific water to evaluate the feasibility of these technologies, develop engineering design criteria, and estimate operational costs so that solutions can be implemented with confidence.



01 // Replicate unique site conditions inside the lab for reliable answers

- Isotherm testing
- Rapid small-scale column tests (RSSCTs)
- Technology evaluations

02 // Industry leading pilot-scale testing experience inside our lab or on-site

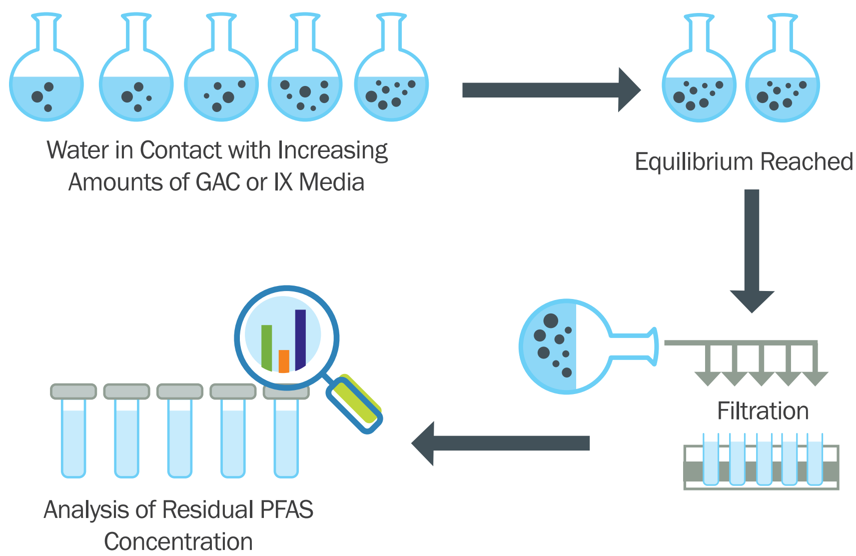
- Small-system evaluation
- Combined processes

03 // Well-versed in full-scale demonstrations for startup, troubleshooting or process optimization

- Proof of performance on a fraction of flow using full-sized process equipment

Isotherm testing

Isotherm tests are used to quickly identify the most promising adsorptive media for a given contaminant. When using isotherm testing for PFAS, the adsorptive media is GAC or IX. This media is added to various water-to-media ratios to accurately assess treatment feasibility. Using site-specific water source/samples, our laboratory accurately analyzes the media application using isotherm models to estimate the maximum sorptive capacity, facilitating the best media selection for the site.



Isotherm testing benefits:

- Evaluate treatment feasibility
- Screen and select media for each unique site
- Evaluate maximum capacity of media
- Quick turnaround (most tests take 2 weeks)

Rapid small-scale column tests (RSSCTs)

Laboratory RSSCTs provide fast and inexpensive evaluation of contaminant removal by sorptive media that can be used to inform full-scale system designs. When considering GAC or IX-based PFAS treatment solutions, RSSCTs provide critical information on the frequency of media change-outs, typically the most important factor in the lifecycle cost of implementation. This media changeout frequency is determined by kinetics of media exhaustion from a contaminant in a water sample.

RSSCTs are used to evaluate specific contaminant breakthrough, different adsorption media types, empty-bed contact times (EBCT), and carbon/resin use rates to inform full-scale design criteria and expected performance.

RSSCTs benefits:

- Compare different media/resins
- Validate/calibrate vendor models
- Simulate full-scale breakthrough using both proportional diffusivity and constant diffusivity models, depending upon water characteristics
- Estimate breakthrough/usage, media change out, and life-cycle operational costs
- Optimize design and operations

Pilot-scale and Full-scale Testing

BC's laboratory team collaborates with project design teams to gather data that reflects on-site treatment conditions and leverages bench-, pilot-, and full-scale testing to improve facility design, inform process implementation, and optimize treatment process operations.

Laboratory results equip clients with confirmation of the most effective design for their project. Conducting these tests early in the planning and design process supports overall project efficiency by solidifying project direction early, reducing capital and operations costs, and supporting adaptability of operations for sustainable process compliance.

Client Challenges and Results

PFAS in Potable Wells
Municipal Client

After identifying PFAS in potable wells and GAC-treated water, a client began supplementing capacity at a hefty price, while urgently seeking a cost-effective and public health-protective solution for the short- and long-term. BC is conducting full-scale testing of an optimized GAC to determine the potential benefits of a full-plant carbon change. BC is also assisting with on-site piloting an IX resin to evaluate GAC alternatives. Site footprint, operational changes, and required retrofits are being assessed.

***RESULTS MATTER //** We are helping the client to evaluate and compare life-cycle capital, operational, and maintenance costs for full-scale operation of these treatment solutions.

PFAS in Leachate and Groundwater
Industrial Client

BC has and continues to assist clients in performing technology evaluations for leachate treatment using treatability testing and a weighted rating system for quick decision-making. Our on-site piloting of treatment for high concentration PFAS leachate included a multi-month comparative performance evaluation of membrane and adsorption technologies to evaluate removal, residuals, and operational considerations and treatment to below all USEPA and states' health advisory limits.

***RESULTS MATTER //** Evaluations demonstrate actionable progress in PFAS reduction plans and regulatory negotiations.

Innovation (BC Research and Development)

Nondestructive treatment technologies such as GAC and IX resins focus on PFAS removal by separation, which produces residuals that must be managed. This creates potential for long-term risk management costs for PFAS associated liabilities. Conversely, destructive technologies for PFAS are focused on breaking down these chemicals into less harmful end products.

The destruction of PFAS in residuals is an area of ongoing research and development. While there are several innovative, destructive technologies under consideration, BC is actively testing technologies which have already been shown to effectively degrade PFAS compounds under laboratory conditions. BC is working with a team of global experts and equipment manufacturers to scale up destructive technologies. These emerging technologies would remove potential future liability or disposal costs and may offer a more cost-effective solution without the need for media replacement in the treatment process.

BC's Technology Innovation and Leadership Team and our Treatability Testing Laboratory are working to validate and advance innovative PFAS solutions in partnership with technology providers and academic partners. Promising solutions are rigorously tested at bench- and pilot-scale to confirm feasibility and refine engineering design criteria. BC research confirms the feasibility, implementability, cost, and regulatory requirements for construction and operations of innovative treatment for our clients.

Laboratory Contacts

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