Drinking Water Solutions

CalgonCarbon
A Kuraray Company

FILTRASORB® Granular Activated Carbon (GAC)

Drinking Water Solutions

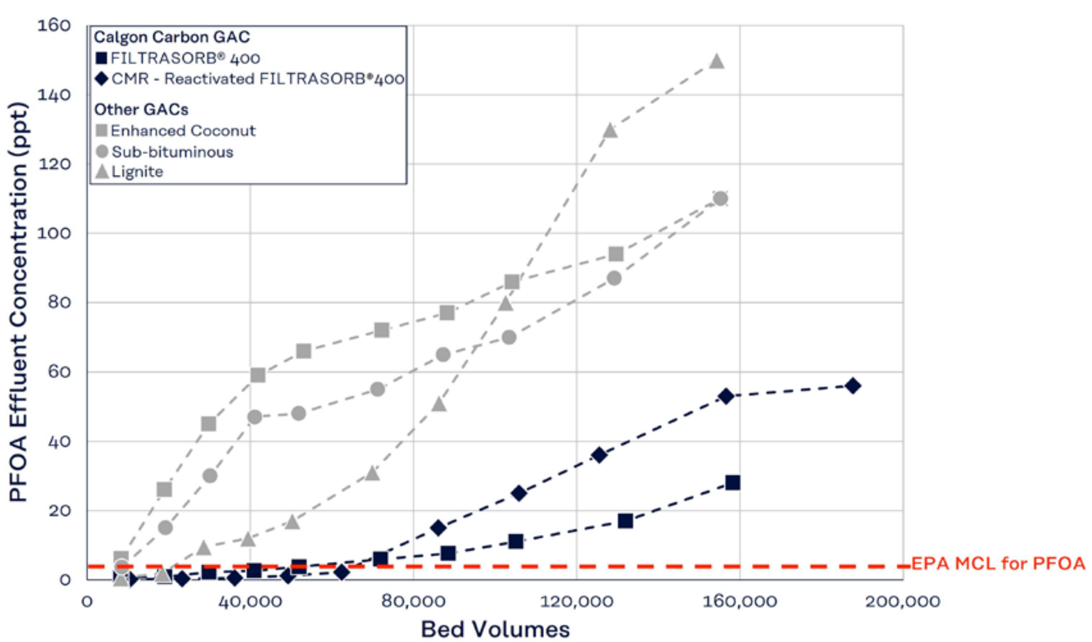
The Solution

Calgon Carbon is the undisputed leader in activated carbon in the world. Alongside Calgon Carbon's diverse range of FILTRASORB® granular activated carbon (GAC) products, our team of experts brings extensive knowledge and experience in GAC applications.

The FILTRASORB line, designed for removing organic compounds from water and wastewater, holds National Sanitation Foundation (NSF 61) certification and is AWWA B604 compliant for use in drinking water treatment. It can be effectively used in both pressure vessel and gravity filter designs.

FILTRASORB is a high-performing, cost-effective GAC product designed for the removal of organic compounds from drinking water. Developed, mined, and manufactured from select grades of bituminous coal in the United States, FILTRASORB is a high-activity product that offers superior removal capability of organics such as per- and polyfluoroalkyl substances (PFAS) and other groundwater contaminants. FILTRASORB's exceptional durability also allows for it to be recycled through a thermal process called reactivation.

PFOA Breakthrough Curves



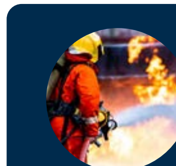
Influent Concentration of PFOA is 177 ppt

FILTRASORB

FILTRASORB 400 GAC and Reactivated FILTRASORB 400 GAC significantly outperform all types of Direct Activated GACs for PFAS removal by a factor of up to 7x.

Activated Carbon Adsorption: Simultaneous Removal of Multiple Organic Contaminants in Water

GAC is an EPA-recognized best available technology (BAT) for removing an array of drinking water contaminants including PFAS, total organic compounds (TOC), disinfection byproducts (DBPs), VOCs, and 1,2,3-Trichloropropane (TCP). When GAC is installed to adsorb a specific compound, it can also protect the drinking water supply from other compounds and act as a barrier against chemical spills in the source water. Additionally, GAC is a contaminant removal technology that minimizes the need for additional resources.



Per- and Polyfluoroalkyl Substances (PFAS)

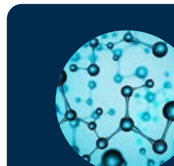
- PFOA
- PFOS
- PFHxS
- PFNA
- HFPO-DA (GenX)
- PFBS

Disinfection Byproducts (DBPs)

- Trihalomethanes (TTHMs)
- Haloacetic Acids (HAA5s)

Pesticides

- Dieldrin
- Glyphosate
- Atrazine
- Carbaryl

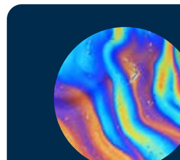


Carcinogenic VOCs

- TCE
- PCE
- 1,2,3-TCP

Endocrine Disrupting Chemicals (EDCs) and Pharmaceuticals and Personal Care Products (PPCPs)

- Pharmaceuticals
- Growth hormones
- Caffeine



Defense Barrier

- Chemical Spills

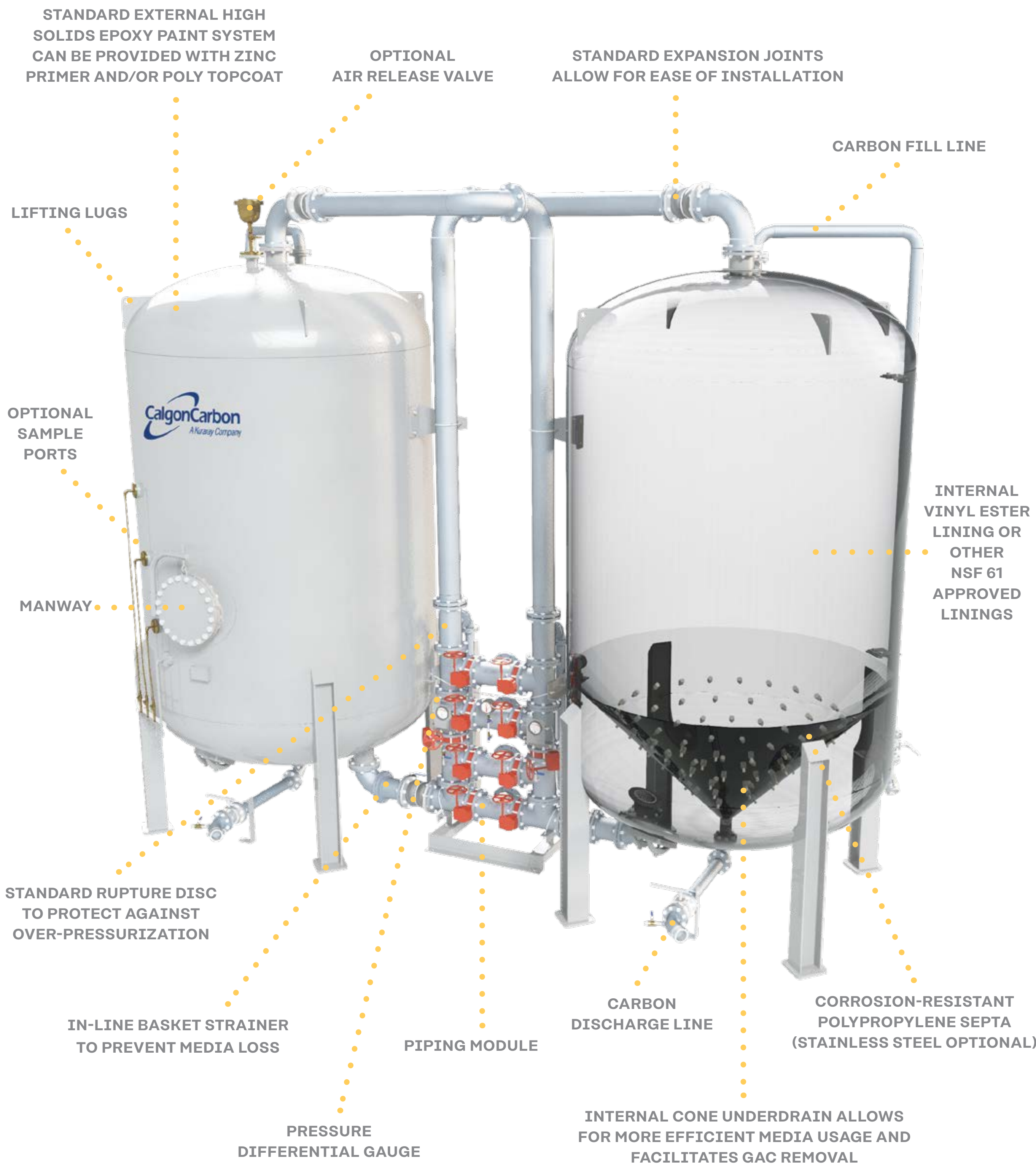
Algal Toxins

- Microcystin
- Cylindrospermopsin
- Anatoxin A

Plastics Manufacturing

- Phthalates
- Bisphenol A (BPA)

Water Treatment Equipment



Calgon Carbon's liquid-phase equipment systems provide utilities with compact, flexible, and cost-effective means to apply both GAC and ion exchange (IX) technologies to treat even the most difficult water treatment challenges. Calgon Carbon has over 35 years of experience in equipment fabrication and installation.

AquaKnight™ adsorption systems are available in two distinct offerings, the AquaKnight Gold Certified (GC) and the AquaKnight Custom Certified (CC).

The AquaKnight GC series are the gold standard of adsorption systems. They are designed with the highest level of drinking water purification and safety in mind. Each system is formulated and certified to meet the NSF 61 drinking water standard. The entire AquaKnight GC system is fully NSF 61 certified, providing a more cost-effective and expedited delivery than customizing and certifying each component. Each system incorporates two pressure vessels along with a compact pipe rack engineered to minimize space and cost while allowing for maximum operational flexibility.

The AquaKnight CC series is similar to the GC series, while also allowing for customizable options to suit specific design needs. The CC system can be customized and certified through an additional rigorous process.

AquaKnight Models

Equipment	Design Pressure (psig)	Pounds of GAC per Vessel	Flow for 10 min EBCT (gpm)*	Cubic Feet of Resin per Vessel	Flow for 2.5 min EBCT (gpm)*
AquaKnight GC 6	125	6,000	150	106	320
AquaKnight GC 8	125	10,000	250	212	640
AquaKnight GC 10	125	20,000	500	353	1,060
AquaKnight GC 12	125	20,000	500	424	1,270
AquaKnight GC 12–40	125	40,000	1,000	na	na
AquaKnight GC 14	125	60,000	1,500	na	na

*Empty bed contact time (EBCT) requirements and gallons per minute (gpm) vary by application. Contact a Calgon Carbon representative for equipment design information.

NOTE: AquaKnight GC 6 and GC 8 models have internal ring underdrain. All other models have internal cone underdrain.

Reactivation

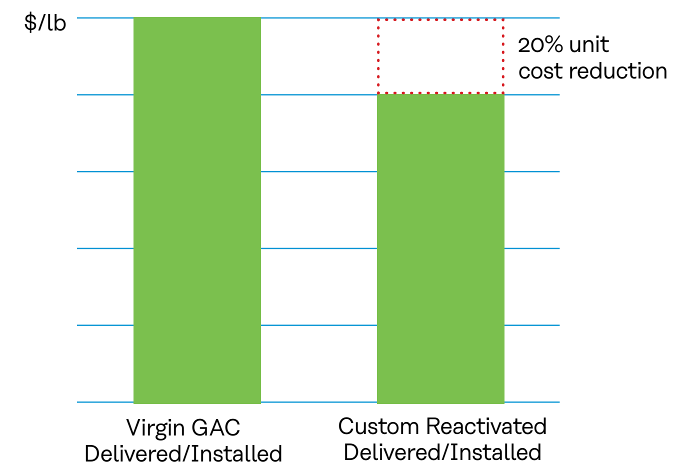
What is Custom Municipal Reactivation (CMR)?

CMR allows municipalities to recycle and reuse their own carbon. CMR reduces GAC-related operating costs by approximately 20% as compared to virgin GAC, with little to no sacrifice in performance. Calgon Carbon has three potable reactivation facilities in the United States, all of which are NSF 61 certified for the processing of potable spent carbon.

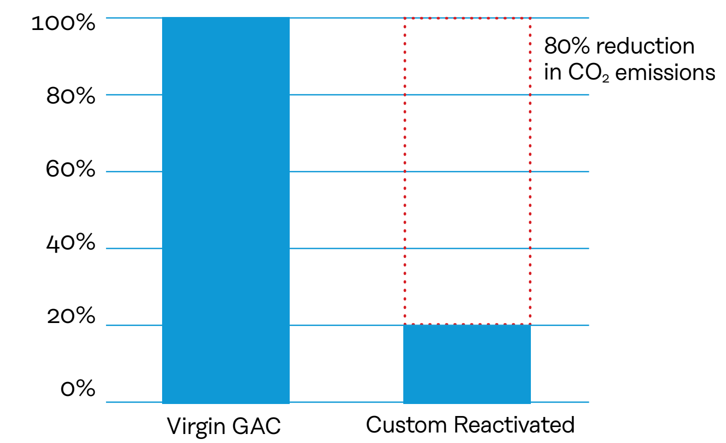
Carbon reactivation is a high-temperature treatment process in which adsorbed chemical constituents are removed from spent activated carbon and thermally destroyed. The reactivated carbon is then reusable and can be returned to service. A quality custom reactivated product starts with a quality virgin GAC product. GAC from bituminous coal manufactured via a reagglomeration process, like Calgon Carbon's FILTRASORB GAC, provides the best starting material for a reliable CMR product. Other activated carbons made from less durable starting materials will break down in the reactivation process.

Calgon Carbon is fully positioned to handle spent carbon from a wide variety of applications. These applications range from potable GAC used for PFAS, DBP, TOC, and other contaminant removal to industrial GAC used for petrochemical groundwater clean-up.

Comparison of Typical Costs for Virgin and Custom Reactivated GAC



Comparison of Relative CO_2 Emissions Related to the Use of Virgin and Custom Reactivated GAC



Reactivation is a Sustainable Process

CMR utilizes high temperatures to destroy contaminants similar to incineration or other destructive technologies, but Calgon Carbon's proprietary reactivation process also maintains the integrity of the activated carbon so it can be reused and recycled. CMR is environmentally friendly and significantly lowers CO_2 emissions compared to virgin GAC manufacturing. In fact, reactivated carbon provides an 80% reduction in greenhouse gas emissions as compared to the production of virgin carbon. It reduces the use of non-renewable resources, minimizes waste, and eliminates landfilling or incineration of spent carbon.

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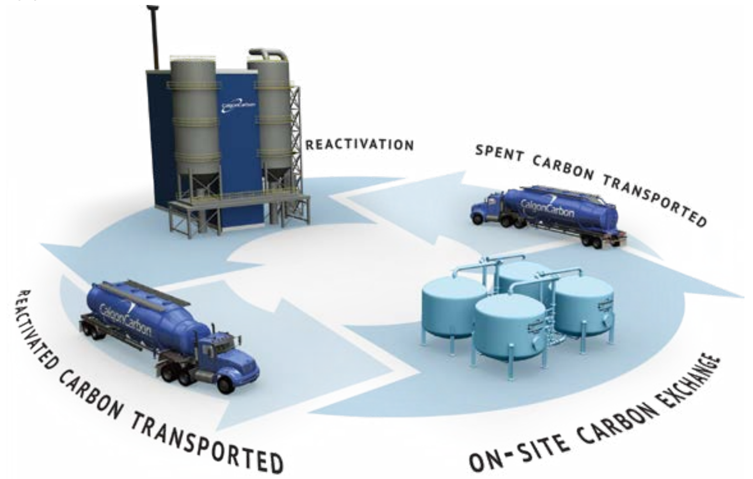


Reactivation for PFAS

Calgon Carbon conducted and published a peer-reviewed study at their RCRA reactivation facility in 2022[1]. The study demonstrated that Calgon Carbon's proprietary reactivation process is capable of destroying PFAS to 99.99% removal efficiency. Additionally, the study showed that PFAS were removed from the spent GAC to below detectable levels.

1 DiStefano R., Feliciano T., Mimna R.A., Redding A.M., & Matthis J. (2022). Thermal destruction of PFAS during full-scale reactivation of PFAS-laden granular activated carbon. *Remediation Journal*.

Media Exchange

Field Services

Calgon Carbon has Regional Field Service teams located across the United States, which have been providing on-site GAC-related services for more than 60 years. Calgon Carbon's field service representatives are OSHA certified and fully trained to provide safe and expert oversight for equipment installations, repair and maintenance, and turnkey activated carbon exchanges.

The Field Services team has all the equipment and experienced personnel you need to make your on-site carbon and media exchange quick, clean and safe. Once spent carbon or media is removed from your site, it is handled and disposed of using methods that are environmentally friendly and in full regulatory compliance. Through the use of our reactivation facilities, we "close the loop" on your carbon disposal while minimizing the costs and delays you can experience by using multiple suppliers.

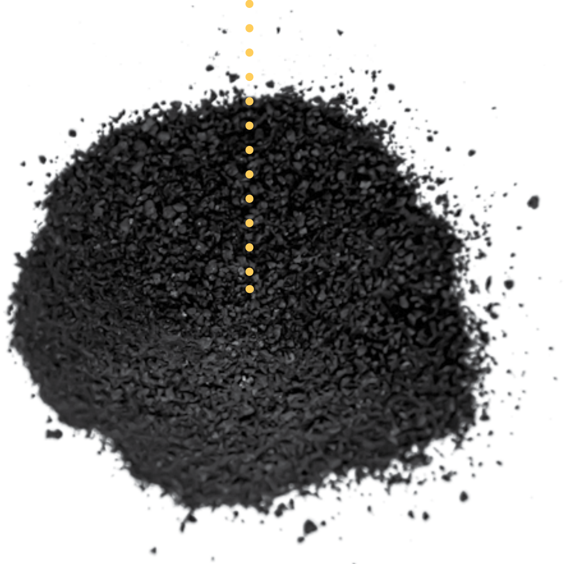
Other Offerings

Ion Exchange Treatment Technology

Calgon Carbon offers ion exchange resin for the removal of compounds such as perchlorate, nitrate, PFAS, arsenic, and hexavalent chromium from water and wastewater streams. We also offer both fixed bed and continuous regenerable systems for a variety of applications, which provide more efficient resin utilization, chemical consumption, and lower effluent waste volumes. The continuous regenerable systems also have the capability for the simultaneous removal of multiple contaminants as new regulations are passed.

Piloting

The Calgon Carbon team also offers equipment and experienced technical personnel to conduct pilot scale trials at customer sites utilizing the actual water that is to be treated. From these trials, Calgon Carbon can assist in the evaluation of the treatment effectiveness and development of full-scale system design. Alternatively, Calgon Carbon provides products and pilot scale equipment to allow the customer to conduct these trials. Regardless of the approach, design and setup is critical to running a viable pilot and Calgon Carbon is ready to assist. Customers can count on Calgon Carbon's vast experience to ensure that piloting is done right.



Research & Development

World-Class Innovation

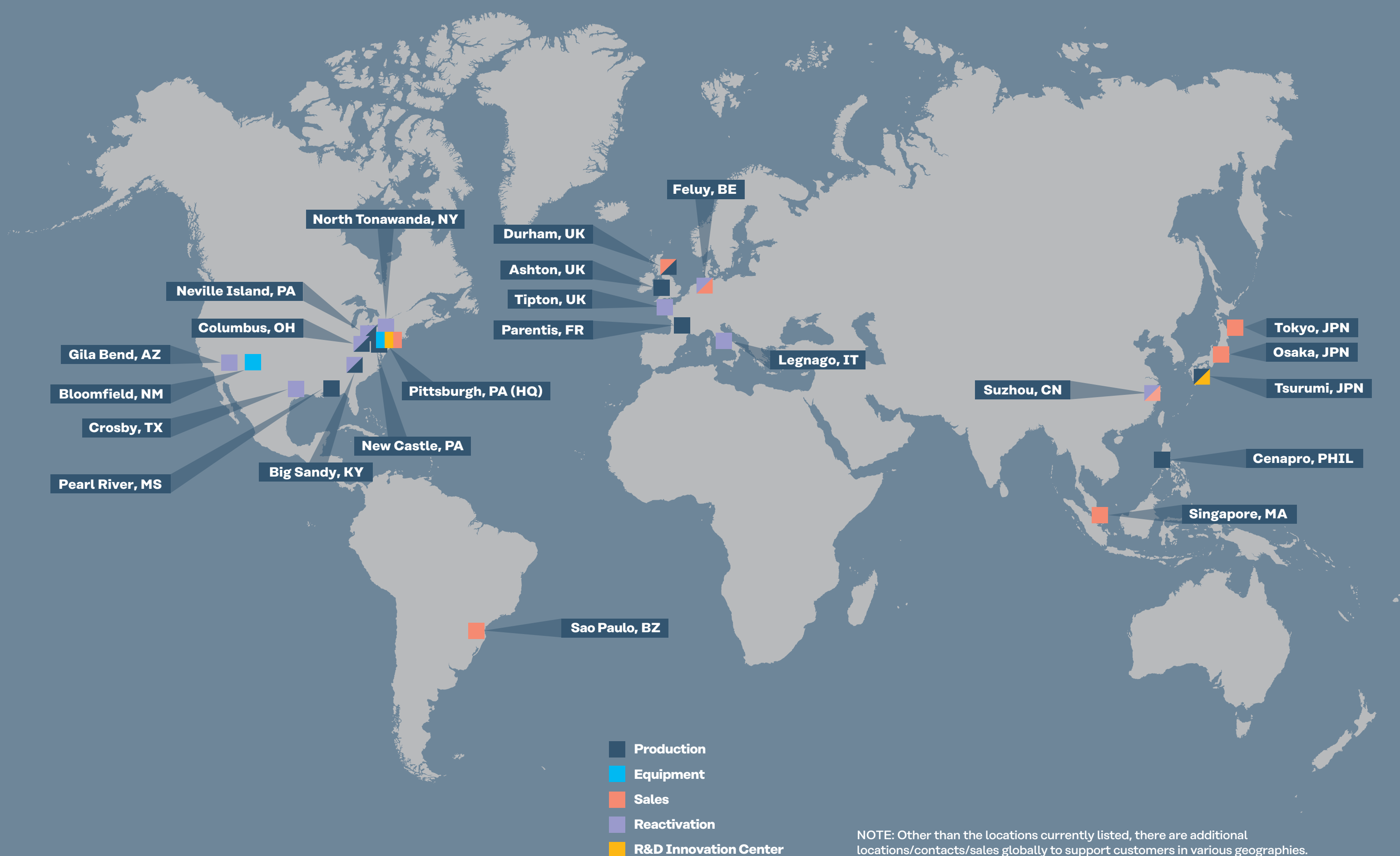
Calgon Carbon maintains a world-class Innovation Center where we are committed to helping our customers solve their toughest purification problems. Calgon Carbon's experienced and reliable experts are considered the gold standard in the water treatment industry. Through advanced testing, pilot studies, and peer-reviewed research, it's easy to see why "experts choose experts." Our technical organization includes both R&D and Process Development teams that engage in technical customer support, exploratory work, and the scale up of new technologies. Calgon Carbon performs various bench-scale tests including isotherms, accelerated column tests, computer modeling, and customized experiments to simulate and predict GAC performance in customers' specific applications. We can examine and compare the effectiveness of many types of GAC for the removal of a wide variety of contaminants. To determine if custom reactivation is suitable for a given application or customer, lab scale reactivations can be carried out at our Innovation Center labs. We set the industry standard with hundreds of pending and granted patents and a team of scientists/engineers dedicated to developing new processes, standards, and methods related to GAC and reactivation, while carrying out proven testing methods as well.

Our innovative leadership dates back generations. Nearly 85 years ago, we responded to the need to create a crucial war material, domestically sourced activated carbon for use in respirator gas masks. Since then, we have continued our innovative leadership, including pioneering the use of GAC in drinking water treatment nearly 70 years ago. It does not stop there—Calgon Carbon continues to innovate and develop new products through its world-class R&D.

Testing Options

ISOTHERM	PILOT	FULL SCALE PLANT
Static Test	Dynamic Test	Continued Service
Contaminant Removal Determination	Contact Time	Process Optimization
Produces Rough Estimate of Carbon Utilization	Linear Velocity	Carbon Optimization
	Carbon Volume	Carbon Exchange

Your Global Partner



NOTE: Other than the locations currently listed, there are additional locations/contacts/sales globally to support customers in various geographies.

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