

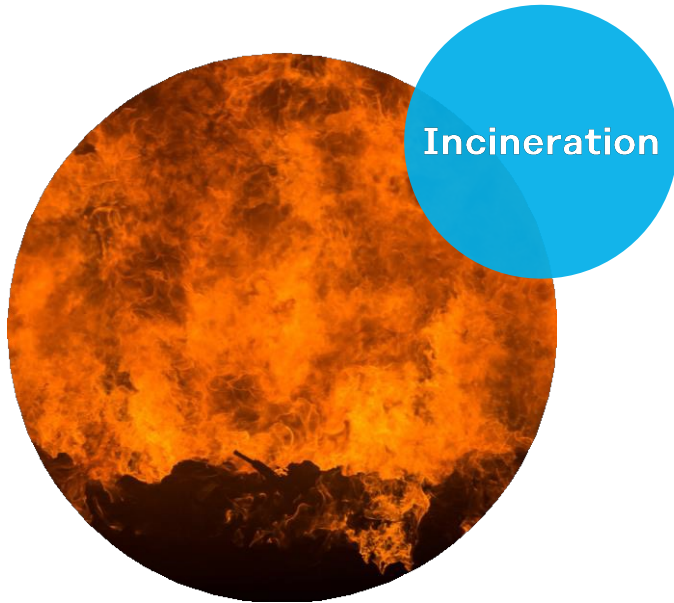


Thermal destruction of PFAS during full-scale reactivation of PFAS-laden granular activated carbon

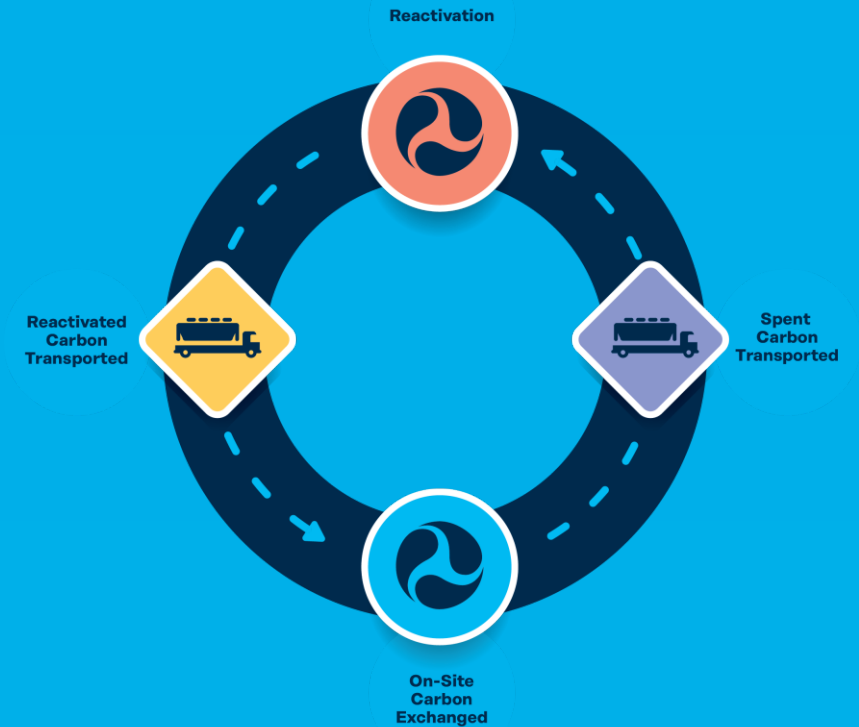
Angela Rodriguez, PhD
Applications Engineer
Drinking Water Solutions

Reactivation is a unique disposal & reuse option for GAC ONLY

⊘ Common methods used by many technologies (IX resin, Clay-based or novel sorbents) :



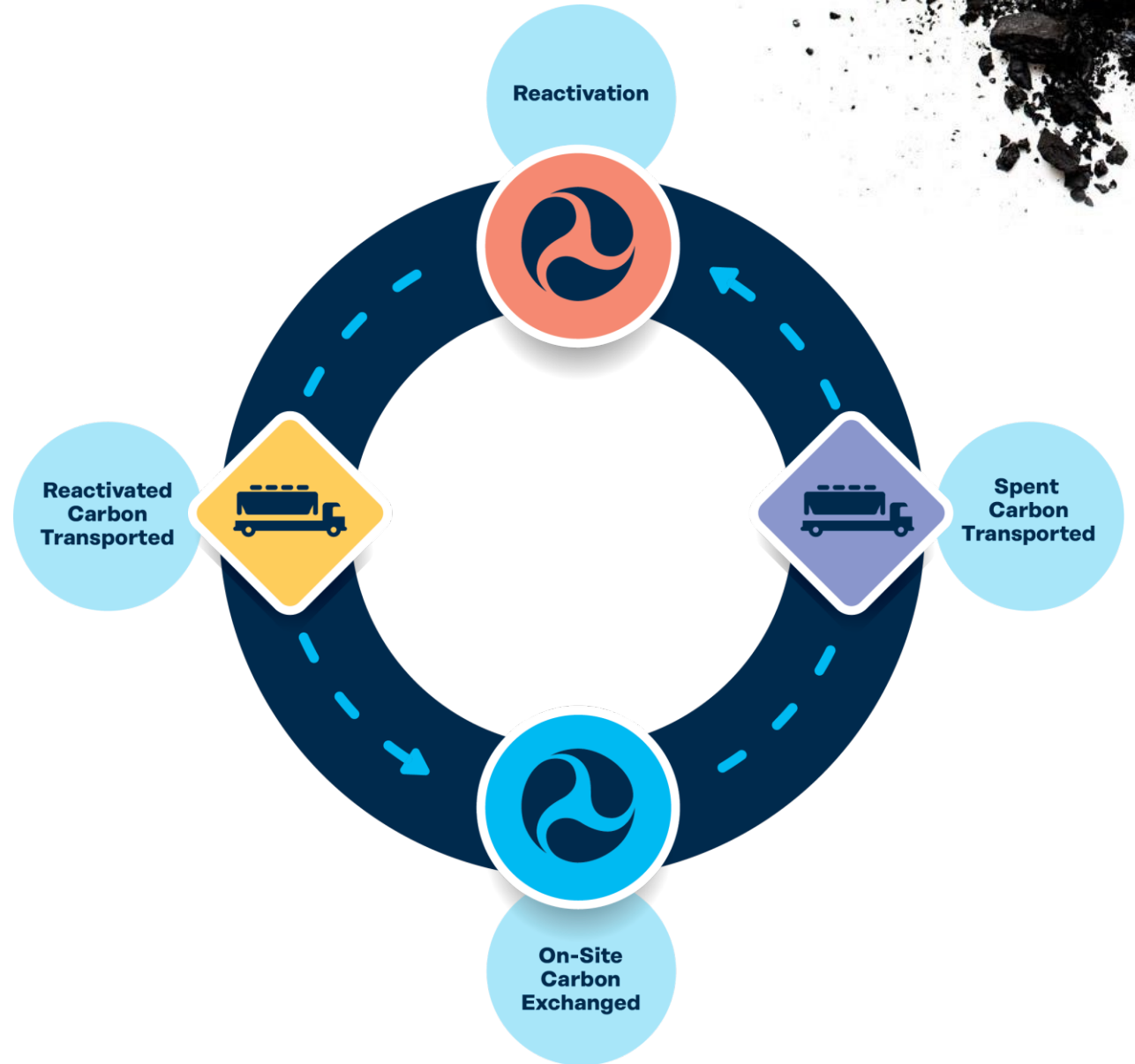
✓ Unique to Activated Carbon:



Reactivation

How Our Products Help Customers and Society

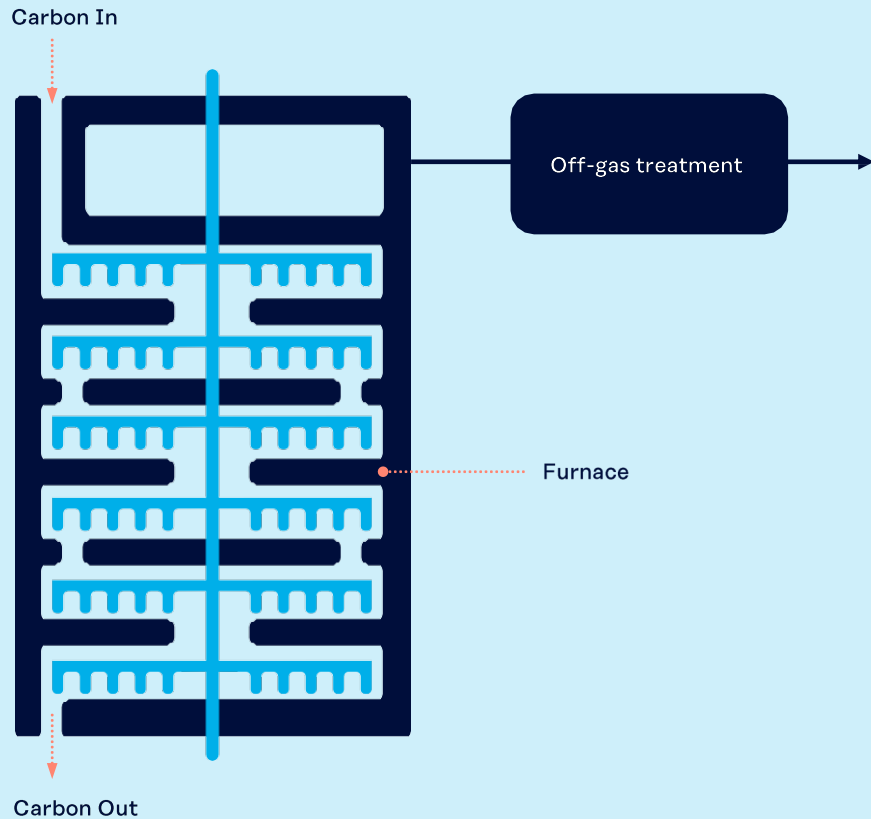
- Certified destruction of the adsorbed materials (which may be classified as hazardous (CERCLA or RCRA))
- No landfill liabilities and more sustainable solution
- 80% Reduction in CO₂ vs. the production of virgin carbon
- Lower cost than incineration and more sustainable



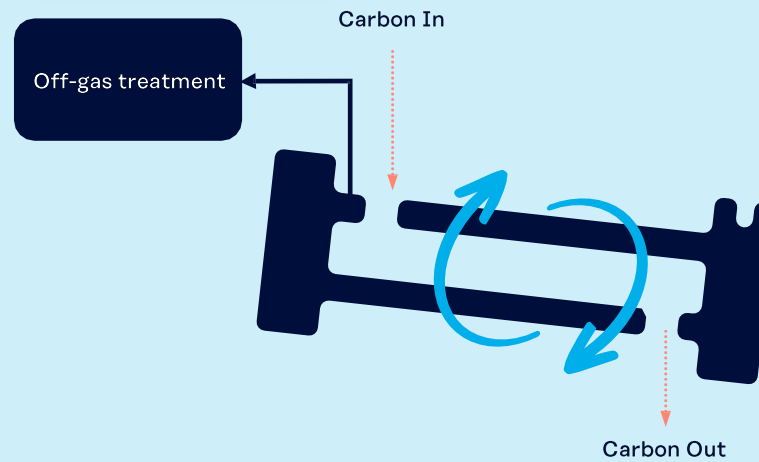
Reactivation Systems

There are two primary types of reactivation systems:

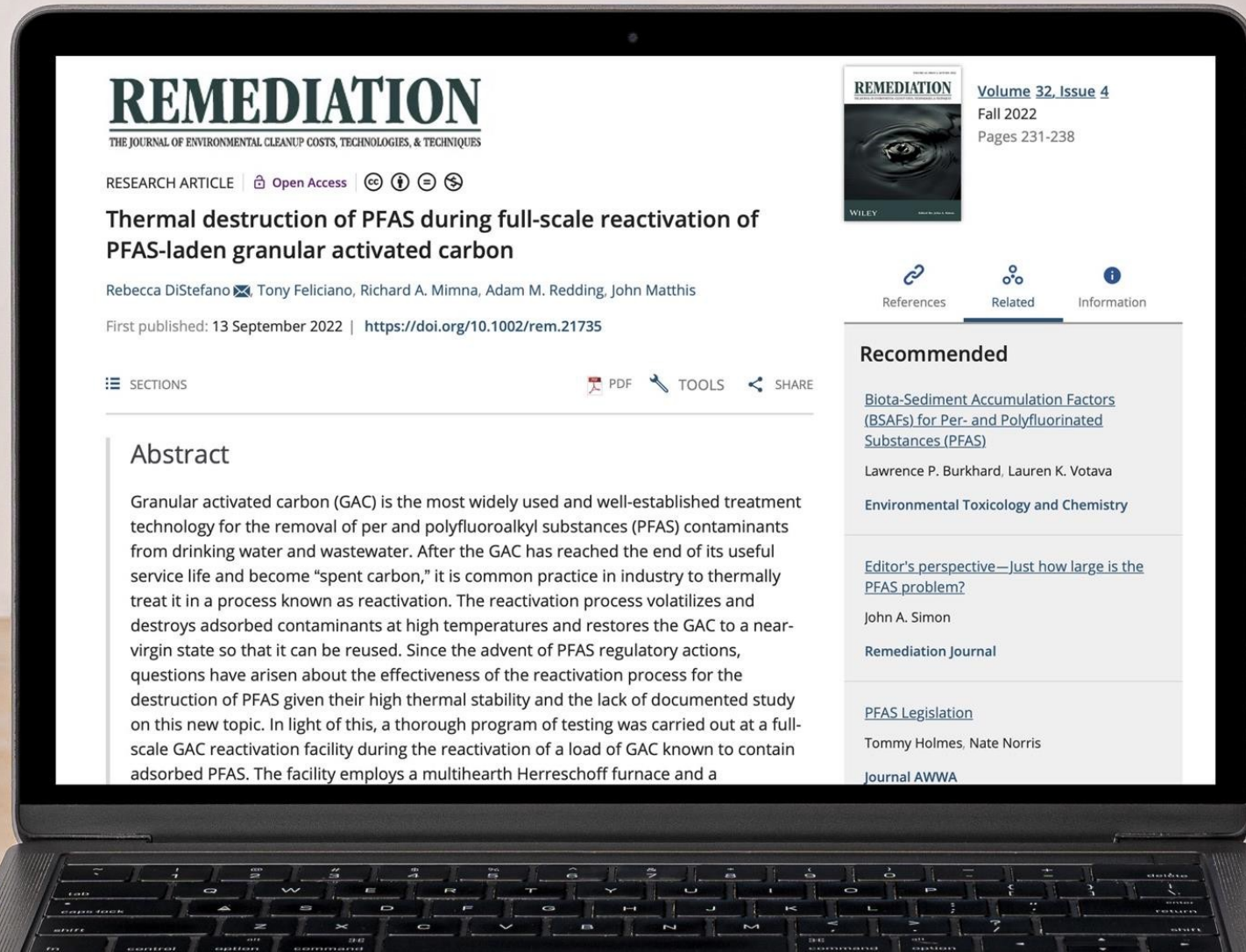
1 Multiple Hearth Furnace



2 Rotary Kiln



Recent Peer Reviewed Journal Article Demonstrating Calgon Carbon's Reactivation Effectiveness



REMEDICATION
THE JOURNAL OF ENVIRONMENTAL CLEANUP COSTS, TECHNOLOGIES, & TECHNIQUES

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Thermal destruction of PFAS during full-scale reactivation of PFAS-laden granular activated carbon

Rebecca DiStefano, Tony Feliciano, Richard A. Mimna, Adam M. Redding, John Matthis

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Abstract

Granular activated carbon (GAC) is the most widely used and well-established treatment technology for the removal of per and polyfluoroalkyl substances (PFAS) contaminants from drinking water and wastewater. After the GAC has reached the end of its useful service life and become "spent carbon," it is common practice in industry to thermally treat it in a process known as reactivation. The reactivation process volatilizes and destroys adsorbed contaminants at high temperatures and restores the GAC to a near-virgin state so that it can be reused. Since the advent of PFAS regulatory actions, questions have arisen about the effectiveness of the reactivation process for the destruction of PFAS given their high thermal stability and the lack of documented study on this new topic. In light of this, a thorough program of testing was carried out at a full-scale GAC reactivation facility during the reactivation of a load of GAC known to contain adsorbed PFAS. The facility employs a multihearth Herreschoff furnace and a

Volume 32, Issue 4
Fall 2022
Pages 231-238

References Related Information

Recommended

[Biota-Sediment Accumulation Factors \(BSAFs\) for Per- and Polyfluorinated Substances \(PFAS\)](#)
Lawrence P. Burkhard, Lauren K. Votava
Environmental Toxicology and Chemistry

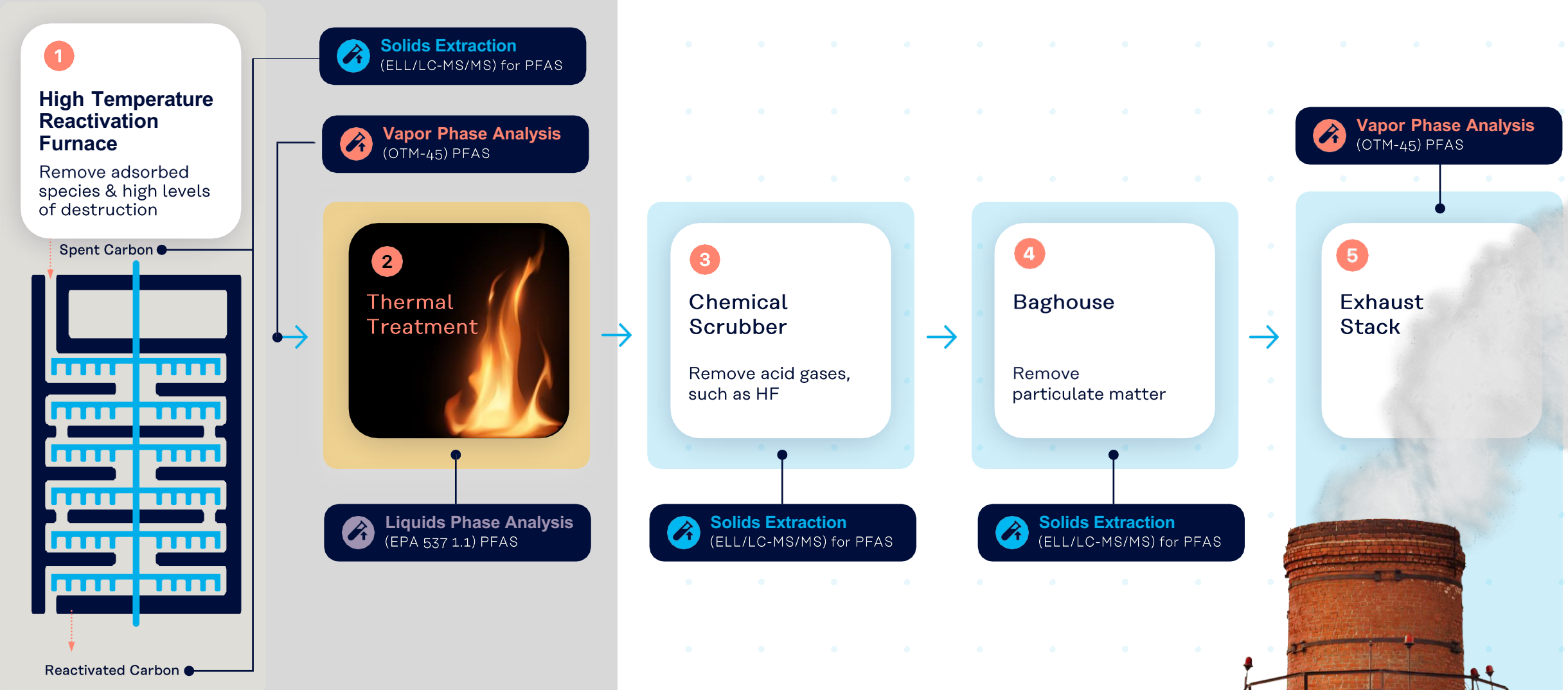
[Editor's perspective—Just how large is the PFAS problem?](#)
John A. Simon
Remediation Journal

[PFAS Legislation](#)
Tommy Holmes, Nate Norris
Journal AWWA

Published
Open
Access
13-Sept-
2022



Calgon's Reactivation is a Unique Process with Multiple Destructive Technologies



Best Commercially Available Analytical for PFAS was used



Calgon's Furnace & Abatement System Destroys PFAS

Hearth PFAS Destructive Reduction Efficiency (DRE): >99.9%

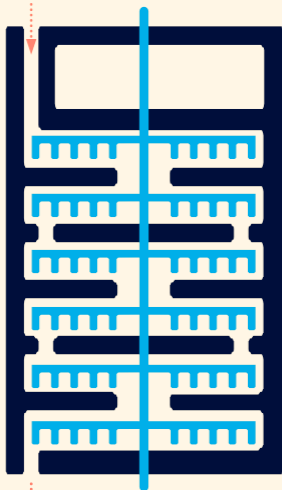
Complete System PFAS DRE: >99.99%

1

High Temperature Reactivation Furnace

Remove adsorbed species & high levels of destruction

Spent Carbon



Reactivated Carbon

Thermal Treatment

Further reduce species present from furnace offgas

3

Chemical Scrubber

Remove acid gases, such as HF

4

Baghouse

Remove particulate matter

5

Exhaust Stack

Robust, Additional Abatement Systems



Reactivation effectively removes PFAS below detection limits

	NG/G	Spent Carbon Composite Sample for Each Emissions Test			Reactivated Carbon Composite Sample for Each Emissions Test		
		TEST 1	TEST 2	TEST 3	TEST 1	TEST 2	TEST 3
PERFLUOROBUTANOIC ACID	PFBA	6300	6700	4700	<1.9	<1.9	<1.9
PERFLUOROPENTANOIC ACID	PFPEA	2600	2500	1500	<0.58	<0.58	<0.58
PERFLUOROHXANOIC ACID	PFHXA	3700	2900	1600	<0.58	<0.58	<0.58
PERFLUOROHEPTANOIC ACID	PFHPA	1600	1300	620	<0.58	<0.58	<0.58
PERFLUOROOCTANOIC ACID	PFOA	18000	14000	5800	<0.58	<0.58	<0.58
PERFLUORONONANOIC ACID	PFNA	88	72	53	<0.58	<0.58	<0.58
PERFLUORODECANOIC ACID	PFDA	71	51	21	<0.58	<0.58	<0.58
PERFLUOROUNDECANOIC ACID	PFUNDA	45	24	24	<0.58	<0.58	<0.58
PERFLUORODODECANOIC ACID	PFDODA	<9.7	<9.1	<9.6	<0.58	<0.58	<0.58
PERFLUOROTRIDECANOIC ACID	PFTRIDA	59	30	28	<0.58	<0.58	<0.58
PERFLUOROTETRADECANOIC ACID	PFTETDA	<9.7	<9.1	<9.6	<0.58	<0.58	<0.58
PERFLUOROBUTANESULFONIC ACID	PFBS	11000	8200	6300	<1.9	<1.9	<1.9
PERFLUOROPENTANESULFONIC ACID	PFPEs	6700	4700	1200	<0.58	<0.58	<0.58
PERFLUOROHXANESULFONIC ACID	PFHXS	33000	22000	5900	<0.58	<0.58	<0.58
PERFLUOROHEPTANESULFONIC ACID	PFHPS	5100	3100	810	<0.58	<0.58	<0.58
PERFLUOROOCTANESULFONIC ACID	PFOS	16000	12000	6700	<0.58	<0.58	<0.58
PERFLUORONONANESULFONIC ACID	PFNS	40	27	9.9	<0.58	<0.58	<0.58
PERFLUORODECANESULFONIC ACID	PFDS	180	110	37	<0.58	<0.58	<0.58
PERFLUORODODECANESULFONIC ACID	PFDOS	<32	<30	<32	<1.9	<1.9	<1.9
PERFLUOROOCTANESULFONAMIDE	PFOSA	340	340	380	<0.58	<0.58	<0.58
NMEFOSAA	NMEFOSA	720	550	560	<1.9	<1.9	<1.9
NETFOSAA	NETFOSAA	610	520	440	<1.9	<1.9	<1.9
HFPODA	GENX	6500	40000	55000	<1.9	<1.9	<1.9
4:2 FLUOROTELOMER SULFONIC ACID	4:2 FTS	<32	<30	<32	<1.9	<1.9	<1.9
6:2 FLUOROTELOMER SULFONIC ACID	6:2 FTS	290	110	800	<1.9	<1.9	<1.9
8:2 FLUOROTELOMER SULFONIC ACID	8:2 FTS	<48	<46	<48	<2.9	<2.9	<2.9
10:2 FTS	10:2 FTS	<32	<30	<32	<1.9	<1.9	<1.9
PERFLUOROHXADECANOIC ACID		<9.7	<9.1	<9.6	<0.58	<0.58	<0.58
PERFLUOROOCTADECANOIC ACID		<9.7	<9.1	<9.6	2.2 / <0.57	<0.58	<0.58
SUM 29 PFAS COMPOUNDS:		112943	119234	92483	2.2	0	0

High Loadings of PFAS on spent carbon!

PFAS below detection on reactivated carbon extraction

Conclusions & Key Findings



Calgon's Reactivation is a unique process that thermally removes PFAS and achieves high destruction in the reactivation furnace and our robust abatement systems



Reactivation is not the same as Regeneration (steam only)



Reactivation is less expensive than Incineration



Calgon Carbon's proprietary reactivation process and conditions achieved > 99.99% PFAS destruction for total PFAS



Reactivation is a safe, proven, simple, cost-effective and fully commercial offering



Reactivation is a sustainable process that has 80% reduction in CO₂