

## Thermal Treatment of PFAS

Applying our FlexHeater® thermal conduction heating technology, we can generate temperatures to volatilize per- and polyfluoroalkyl substances (PFAS) in situ from the vadose zone or ex situ from a TRS-designed treatment cell. PFAS impacts are prevalent in the vadose zone, as the deposition of these compounds resulted largely from the use of aqueous film forming foams.

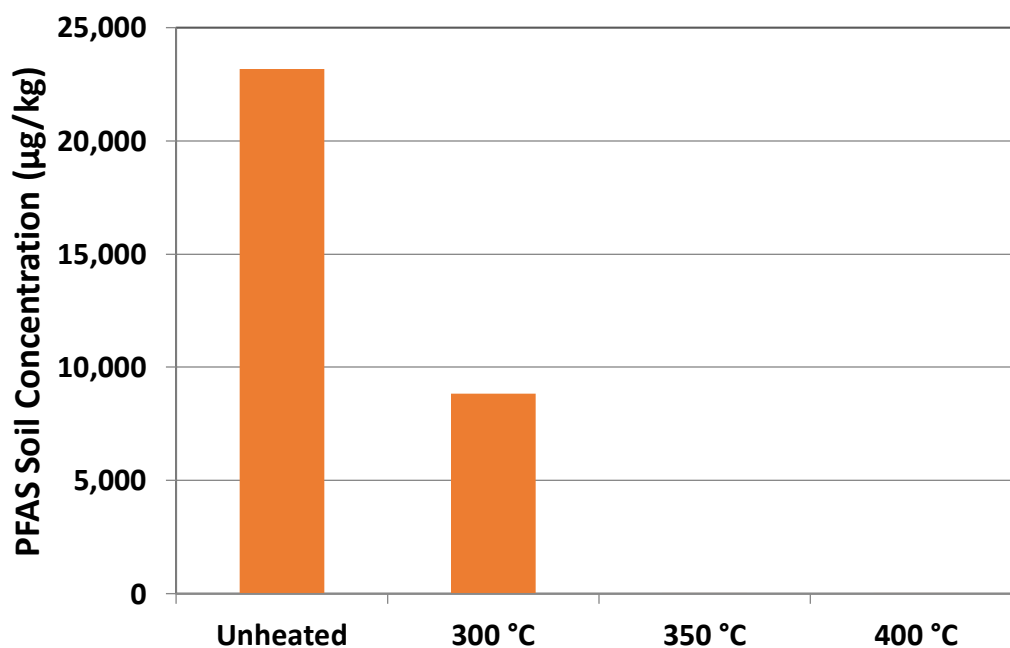
TRS has demonstrated the removal of more than 99.99% of PFAS from soils, regardless of the total organic carbon levels.

Compound	Abbreviation	Untreated (ug/kg)	400 C (ug/kg)	% removed at 400 C
Perfluorobutanoic acid	PFBA	91	0.049 J	>99.999%
Perfluoropentanoic acid	PFPeA	100	<0.077	>99.999%
Perfluorobutanesulfonic acid	PFBS	41	<0.025	>99.999%
Perfluorohexanoic acid	PFHxA	200	<0.042	>99.999%
Perfluoroheptanoic acid	PFHpA	27	<0.029	>99.998%
Perfluorohexanesulfonic acid	PFHxS	1600	<0.031	>99.999%
Perfluorooctanoic acid	PFOA	64	<0.086	>99.865%
Perfluorononanoic acid	PFNA	16	<0.036	>99.997%
Perfluorooctanesulfonic acid	PFOS	21000	<0.2	>99.999%
Perfluorodecanesulfonic acid	PFDS	48	<0.039	>99.999%

In June 2020, the U.S. Patent & Trademark Office has issued a patent to TRS for the in situ and ex situ thermal treatment of PFAS. Studies have shown that temperatures more than 400° Celsius are required to breakdown perfluorinated substances, which could create unwanted byproducts. The patented TRS process generally operates in the temperature range of 350 to 400°C, which is below the temperatures where breakdown products would be

anticipated. Therefore, TRS's patented PFAS process is much safer than other thermal processes, such as rotary kilns or oven-like chambers, that operate at higher temperatures. The ITRC PFAS document describes that thermal desorption effectively removes PFAS at 350 to 400°C and cited the TRS-authored *Remediation* article.

After evaporating the PFAS, TRS collects the gas phase compounds and thermally oxidizes them or scrubs them for subsequent treatment.



Concentrations of PFAS after Two Weeks of Heating at Various Temperatures