Permanent Treatment of PFAS-Impacted Soil and Sediment Using High Temperature Thermal Remediation

A Proven, Field Demonstrated, Patent Pending Solution

Per- and polyfluoroalkyl substances (PFAS) present a persistent challenge for site owners and regulators due to their chemical stability and resistance to many conventional treatment technologies. Many commonly applied approaches do not destroy PFAS but instead transfer these compounds between media and create ongoing management and long-term liability concerns.

TerraTherm's patent-pending high temperature thermal remediation technology permanently destroys PFAS in soil and sediment by breaking carbon-fluorine bonds through controlled thermal conduction heating (TCH), with integrated vapor treatment and fluorine sequestration to safely manage treatment byproducts onsite.

PFAS Destruction Mechanisms at Elevated Temperature

TerraTherm applies TCH either in situ or in specially engineered piles and containers to uniformly raise soil and sediment temperatures to approximately 350–400°C, a range demonstrated to be highly effective for PFAS treatment, when maintained for a longer duration.

Multiple treatment mechanisms occur simultaneously at these temperatures:

- Direct volatilization of shorter-chain PFAS
- Partial degradation and defluorination of longer-chain PFAS
- Volatilization of a portion of the degraded PFAS, products of incomplete degradation (PIDS) and volatile fluorinated compounds (VFCs)
- Mineralization of remaining non-volatile PFAS and degradation products within the soil or sediment matrix

Vapors and steam generated during heating are actively extracted and treated in a thermal catalytic oxidation system using a catalyst incorporating calcium hydroxide [$Ca(OH)_2$], which promotes complete mineralization of any PFAS in the extracted vapor stream and sequestration of the fluorine produced.

Extracted vapors are subsequently cooled and condensed to remove water.

Field-Proven Performance: ESTCP Demonstration

TerraTherm's technology has moved well beyond the laboratory. In summer 2025, TerraTherm conducted a full ESTCP-funded field demonstration (ER23 8372) on high organic sediment collected from a PFAS-impacted pond associated with historical firefighting training activities at Peterson Space Force Base, Colorado Springs, Colorado.

Key Results:

- >99.9% PFAS destruction and removal, with post-treatment sediment samples non-detect at ng-level detection limits for all target PFAS
- No detectable PFAS, VFCs, or greenhouse gases in the discharged vapor stream above method and blank detection levels
- Very low hydrogen fluoride emissions (<0.15 ppm)
- ~98% of total PFAS mass destroyed onsite
- Only ~2% of starting PFAS mass transferred to condensed liquids requiring secondary treatment or disposal

Proven PFAS Destruction at Full Scale

TerraTherm has unparalleled experience designing and executing electrically-powered TCH systems specifically for soil and sediment treatment at PFAS relevant temperatures. To date, more than 25 projects have been successfully completed.

Key Differentiators:

- Permanent, destructive treatment rather than transfer or containment
- Proven performance for current and future regulated PFAS
- Full scale experience at temperatures required for PFAS destruction
- Integrated vapor treatment and fluorine sequestration strategy
- Defensible emissions performance supported by field data
- Scalable solutions for both in situ and ex situ applications

Contact Us

Contact TerraTherm to learn how high temperature thermal remediation can permanently treat PFAS impacted in soil and sediment, and support defensible, long-term remediation outcomes.

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