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Martha’s Vineyard Airport Selects PlumeStop to Treat PFAS

Cost-Effective *In Situ* Approach Treats a PFAS Source Area With No Greenhouse Gases or Hazardous Waste

PlumeStop Barrier Shows Early Success Against PFAS at Martha's Vineyard Airport

Cost-Effective *In Situ* Approach Addresses PFAS Risk with No Greenhouse Gases or Hazardous Waste

A PlumeStop® barrier was recently installed as a pilot test at Martha's Vineyard Airport to demonstrate the *in situ* treatment of a PFAS plume. In less than four months, PlumeStop has eliminated PFAS mass flux immediately downgradient of the barrier and significantly reduced PFAS concentrations further away, as monitoring continues. The cost-effective and sustainable solution to remove PFAS exposure risk provides an alternative to expensive and ineffective pump & treat (P&T) systems.

Background

PFAS Impacts to Groundwater Following FAA-Required AFFF Testing

“In 2018, we started talking to the airport about potential PFAS concerns from the use of firefighting foams. We did some initial evaluation of the site and identified some elevated concentrations of PFAS.”

—Ron Myrick
Vice President, Environmental Group
Tetra Tech Infrastructure Northeast

TETRA TECH

Martha’s Vineyard, a picturesque island off the coast of Massachusetts, is a major summer tourist destination, accessible only by boat or plane, with many celebrities and politicians visiting the island each year.

Martha’s Vineyard Airport, centrally located on the island, is the only airport served by commercial airlines. The airport is also used by a significant number of general aviation aircraft, with a high number flying in during the summer months.

Up until 2019, the FAA required the airport to conduct fire training exercises using aqueous film-forming foams (AFFF) in an area near the runway, which leached into the underlying groundwater, impacting it with PFAS contaminants.

Tetra Tech, a global environmental consulting firm, has worked with Martha’s Vineyard Airport over the years, addressing a dry-cleaning solvent release and other environmental issues at the site. At the request of the airport, Tetra Tech conducted an initial, preemptive PFAS assessment in 2018, confirming the presence of PFAS, commonly known as “forever chemicals” in groundwater.

Remedy Selection

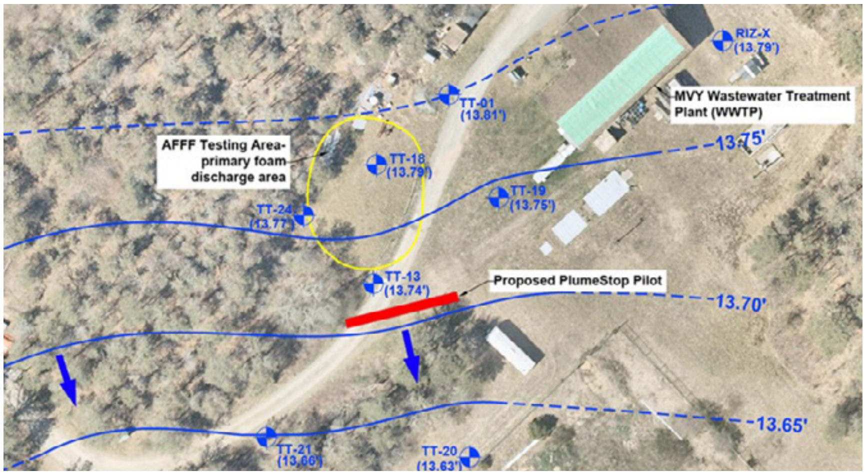
Key Factors in the Selection Included Avoiding Greenhouse Gas Emissions and PFAS Hazardous Waste Disposal

Once Tetra Tech had assessed the PFAS contaminant plume, the next step was to evaluate remedial options and select a remedy for pilot testing. Ultimately, the remediation goal was to stop further PFAS movement away from the site. Tetra Tech opted for an *in situ* remediation approach. A PlumeStop® permeable reactive barrier (PRB) would be installed to filter PFAS out of groundwater, sorbing the contaminants onto the aquifer matrix and preventing further plume migration.

PlumeStop colloidal activated carbon, injected using a permeable reactive barrier (PRB) approach, was selected over pump & treat (P&T) alternatives. Tetra Tech reasoned the PRB would provide the best opportunity to meet the objectives due to its ability to target and inject over discrete zones. The goal of the pilot test was to demonstrate the proof-of-concept in the field while providing valuable information for a potential future full-scale application.

"One of the reasons we selected PlumeStop was because it didn't have ongoing operation of maintenance costs. The fact that PlumeStop is something you inject in the ground, it captures the PFAS, provides the containment that we're desiring, and we don't have a disposal cost associated with it is certainly an advantage."

—Ron Myrick
Vice President, Environmental Group
Tetra Tech Infrastructure Northeast



Map showing proposed location of PlumeStop PRB pilot test

Critically, the PlumeStop *in situ* treatment approach avoids the high costs for installing, operating, and maintaining a P&T system. P&T's high costs to treat PFAS are not just monetary, but also represent a significant cost to the environment. This includes emitting thousands of tons of greenhouse gases (i.e., CO_2) to power these systems over many decades and generating hazardous PFAS waste materials requiring shipping off the island for disposal.

Following extensive site characterization, Tetra Tech concluded the best place for the pilot test was immediately downgradient of the AFFF discharge area (i.e., the PFAS source zone).

Remediation Design

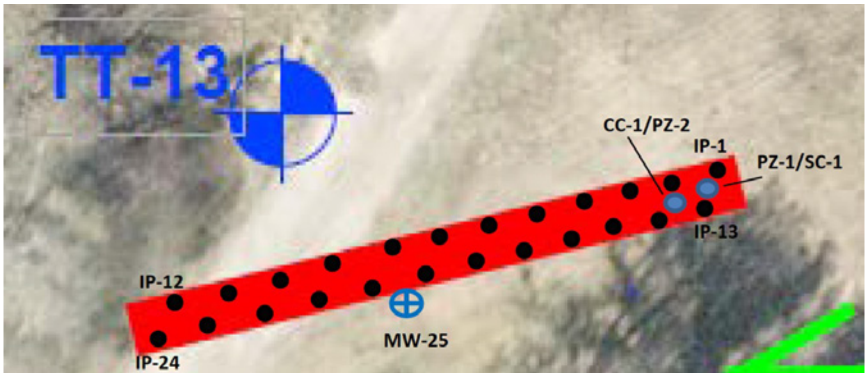
Mapping PFAS Mass Flux with FluxTracer

FluxTracer®
Flux Mapping Tool

FluxTracer®, a contaminant flux measurement technology developed by REGENESIS, was installed in a new monitoring well to directly measure the contaminant flux. Data obtained from FluxTracer is used to identify the PFAS flux zones and direct the successful application of PlumeStop.

The PlumeStop pilot test design included a 60-foot-long barrier containing two rows of staggered injection points, approximately spaced five feet within and between rows.

The performance goal was to stop further PFAS migration out of the AFFF source zone for 15 years. Contaminant flux measurements were obtained using FluxTracer®, informing the PlumeStop dose required in the barrier to achieve this objective.



In-field PRB design showing injection point configuration, design verification testing locations, and adjacent near-term performance monitoring well.

> ***"When you're putting together a design, and particularly, a barrier type design, it is critical for us to understand the flow, or mass flux, of the contamination coming in. We find the use of the FluxTracer is critical to the success of a PlumeStop remedy."***
>
> ***—Maureen Dooley***
> ***Vice President, Industrial Sector***
> ***REGENESIS***

"Typically, if we do have to make (design) adjustments, we'll collect the data in the field and relay it to the technical services team. They'll interpret it and work with us to create a new plan for approval by the client prior to implementing."

– Christian Parke
Project Supervisor
REGENESIS Remediation Services

Design verification testing, or DVT, was completed as part of the pilot test application to ensure design assumptions matched field observations and to adjust the design where necessary.

The specific DVT activities completed for this project included:

1. Assessing amendment distribution
2. Verifying the lithology in the injection zone
3. Measuring the lateral and vertical contaminant flux across the proposed barrier location using REGENESIS' FluxTracer technology

PlumeStop PRB Application Design

Contaminants of concern	PFAS
Treatment Zone Geology	Coarse to fine sand, very little silt, no clay
Barrier length	60 linear feet
Target treatment zone	30 to 40 feet bgs
Injection configuration	24 points, 5-feet spacing, two rows
PlumeStop applied	9,200 pounds/10,044 gallons

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Results and Conclusion

Early Performance Data Show PFAS Mass Flux Eliminated Downgradient of PlumeStop Barrier, as Monitoring Continues

Application Results

REGENESIS Remediation Services (RRS) conducted the PlumeStop application during a cold and rainy week in December 2022. RRS began the injection at the end of the barrier and collecting samples from piezometers and soil cores to confirm the distribution of PlumeStop. RRS adjusted the injection flow rates to maintain low pressures, optimizing PlumeStop's precise placement in the injection zone. Table 1 Visual observations from the piezometers and soil cores collected during the application confirmed that PlumeStop was adequately distributed.

Table 1 **Injection Pressures and Flow Rates**

Injection pressures and flow rates recorded by RRS during application. GPM=gallons per minute, PSI = pounds per square inch.

	Average	Standard Deviation	Median
Flow Rates	5.3 GPM	0.8 GPM	5.3 GPM
Pressure	18 PSI	13 PSI	13 PSI

Performance Monitoring Results

Six PFAS are currently regulated by the Massachusetts Department of Regulations (MassDEP). These compounds are referred to as the MassDEP PFAS6: PFOA, PFOS, PFNA, PFHxS, PFHpA, and PFDA. The first performance monitoring sampling event was conducted 103 days post-injection, showing the following changes in PFAS6 concentrations relative to baseline.

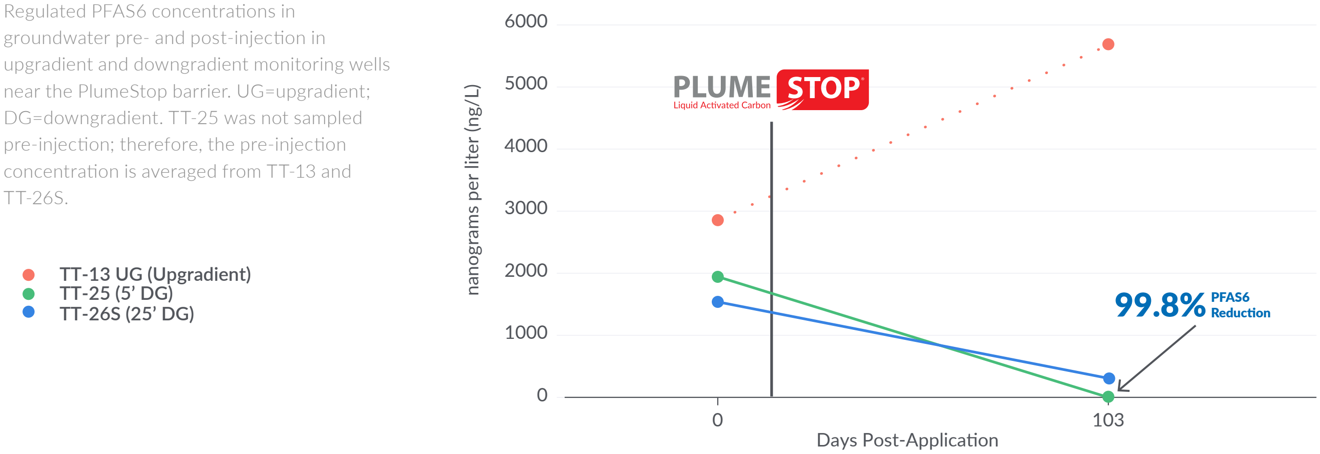
Five Feet Downgradient:	TT-25 (5'DG)[1]	MassDEP PFAS6 concentrations were reduced by 99.8%.
Twenty-five Feet Downgradient:	TT-26S (25' DG)	PFAS6 concentrations were reduced by 78%.
Seventy-five Feet Downgradient:	TT-20	PFAS6 concentrations were reduced by 57%.
Upgradient (Background) Well	TT-13	PFAS6 concentrations increased by 100%, effectively doubling the contaminant mass flux into the barrier. This concentration increase in the upgradient well is likely due to precipitation flushing resulting from heavy rainfall events in the area over the monitoring period.

1. *TT-25 was not sampled pre-injection therefore its pre-injection concentration is averaged from the nearest upgradient and downgradient wells, TT-13 and TT-26S, respectively.*

Figure 3

Regulated PFAS6

Regulated PFAS6 concentrations in groundwater pre- and post-injection in upgradient and downgradient monitoring wells near the PlumeStop barrier. UG=upgradient; DG=downgradient. TT-25 was not sampled pre-injection; therefore, the pre-injection concentration is averaged from TT-13 and TT-26S.



Conclusions

In less than four months, the PlumeStop barrier has shown rapid reductions in groundwater PFAS concentrations, substantially reducing mass flux immediately downgradient, with reductions seen further beyond the barrier. PFAS concentrations are expected to decrease at further distance in the plume as the clean water front advances downgradient from the barrier.

These early results demonstrate the successful application of the PlumeStop pilot test barrier. Performance monitoring will continue, with potential barrier expansion to be considered pending future monitoring results. In the meantime, the current pilot barrier is designed to immobilize PFAS in the plume's core for 15 years or longer, minimizing plume migration away from the site. The remedy mitigates the problem cost-effectively and sustainably, while eliminating harmful greenhouse gas emissions and the need to transport hazardous PFAS waste materials off the island.

About the Consultant

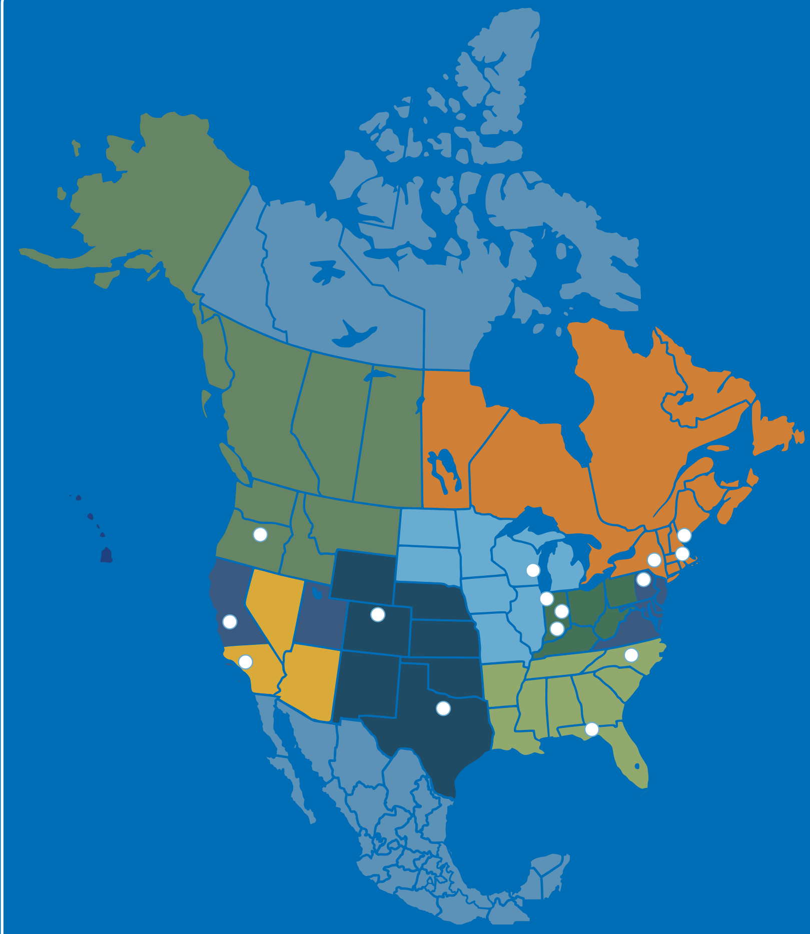
Tetra Tech

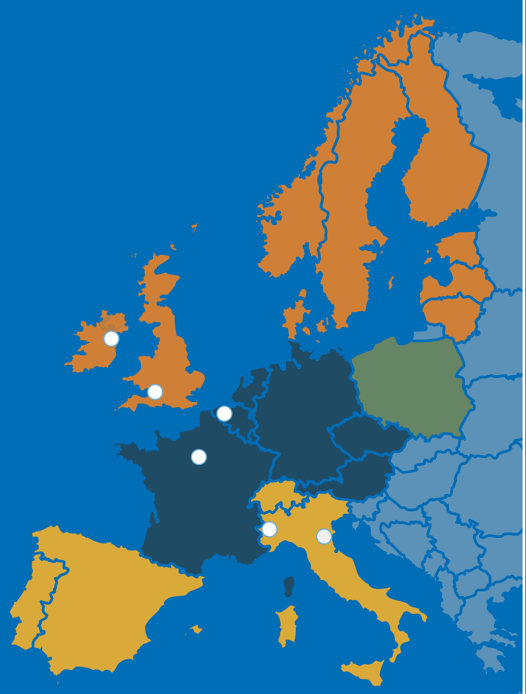
Tetra Tech is a leading, global provider of consulting and engineering services. We are differentiated by Leading with Science® to provide innovative technical solutions to our clients. We support global commercial and government clients focused on water, environment, sustainable infrastructure, renewable energy, and international development. With 27,000 employees worldwide, Tetra Tech provides clear solutions to complex problems.

Ronald Myrick

Ronald E. Myrick, Jr., PE, LSP is Vice President of the Environmental Group for Tetra Tech Infrastructure Northeast (INE), which is comprised of the Permitting/Natural Resources and Remediation, Assessment and Compliance business areas. He has more than 25 years of experience managing site investigation, remediation and environmental compliance projects for public and private clients. His responsibilities include project scope development; estimating, scheduling and contract administration; design and implementation of environmental investigation and remediation projects; and assessment of environmental compliance with state and local regulations. Ron's technical expertise includes managing environmental investigations and remedial projects under the Massachusetts Contingency Plan (MCP), as well as emergency response activities associated with highway accidents and other accidental releases. He has assisted Martha's Vineyard Airport with the assessment and mitigation of Per- and polyfluoroalkyl substances (PFAS) since 2018 to proactively address PFAS impacts on the airport property and surrounding residential areas. Ron received his BS in Civil Engineering from University of Massachusetts Amherst in 1994, his MS in Environmental Engineering from Worcester Polytechnic Institute in 1997, and his MS in Civil Engineering from Northeastern University in 2001.

We're Ready to Help You Find the Right Solution For Your Site





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