ONVECTOR

ROBUST TECHNOLOGIES
FOR WATER AND WASTEWATER TREATMENT

HARNESSING THE **POWER OF LIGHTNING**

How Onvector eliminated PFAS contamination at Joint Base Cape Cod using its Plasma Vortex technology

41°38'39.8"N 70°31'49.4"W

OVERVIEW

Onvector delivers robust Plasma Vortex destruction technology for hazardous pollutants in contaminated critical drinking water and wastewater applications. Onvector creates technologies that dramatically lower costs and environmental impacts. Onvector's Plasma (ionized gas) originates from electrical energy as an input and causes rapid degradation and destruction of PFAS (per-and poly-fluoroalkyl substances) molecules in liquids and foams including aqueous film-foaming foams (AFFF). The high- efficiency Plasma Vortex technology incorporates innovations in advanced materials, power electronics and fluid dynamics to deliver cost savings for today's toughest water and waste treatment challenges.

CHALLENGE

PFAS, which have high toxicity at very low concentration levels and do not degrade significantly by any natural processes, are present in groundwater at the former Joint Base Cape Cod Fire Training Area primarily due to historical use of AFFF. The PFAS compounds have migrated into the aquifer underneath JBCC, which serves as a source of drinking water for neighboring communities.

SOLUTION

The two-part solution was implemented to demonstrate the efficacy of Plasma Vortex destruction technology.

First, a pilot groundwater treatment system, supplied by Emerging Compounds Treatment Technologies, Inc. (ECT2), was used to remove and concentrate PFAS from groundwater at the former Fire Training Area using a regenerable ion exchange treatment approach. ECT2's on-site resin regeneration process removed PFAS from the resin and, through distillation of the regenerant solution, created a highly concentrated waste (still bottoms) suitable for on-site Plasma Vortex destruction.

Second, the Air Force base implemented Onvector's Plasma Vortex for final destruction of the concentrate, mineralizing PFAS in the spent ion exchange regenerant (concentrated still bottoms after solvent recovery) to harmless products (e.g., fluoride ions, carbon dioxide, water), therefore, providing destruction of the PFAS concentrated waste on-site and eliminating the potential for PFAS waste tocontaminate the drinking water.

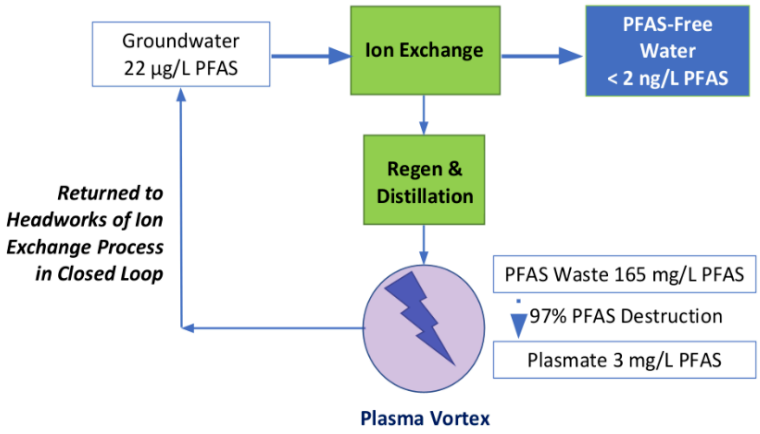
RESULTS

Approximately 350,000 gallons of groundwater, having an average influent PFAS concentration of 22 ug/L, were treated to MassDEP drinking water standards for long-chain PFAS6 (PFOS, PFOA, PFHxS, PFNA, PFHpA, PFDA) to 20 ng/L combined, and new EPA maximum contaminant levels for drinking water were met as well.

The treatment system was effective in purifying groundwater but generated a small volume of highly-concentrated PFAS waste. These residuals were treated with Plasma Vortex, and PFAS concentration was reduced from 165 mg/L to 3 mg/L. The degree of PFAS destruction attained was sufficient to allow the plasma-treated concentrate to be recycled back to the front of the ion exchange process, hence coupling PFAS removal from groundwater and final PFAS destruction in residual waste within a fully closed loop with no liquid discharge or air emissions.

RESULTS (cont.)

The pilot test demonstrated 97% PFAS destruction via Onvector's Plasma Vortex technology for this concentrated PFAS waste from the ion exchange regeneration process. Typical energy utilization rates were 10,000 kWh/kg of PFAS mineralized for reduction of PFAS levels to µg/L levels. Typical PFAS mineralization rates for the pilot system included 3 to 5 g PFAS/hr of treatment time and, with polishing, successfully achieved PFAS concentration levels of single ng/L or "non-detect" without high energy use or operating costs meeting both state and federal drinking water limits. Destruction capacity can be increased economically by adding Plasma Vortex reactors.



MEASUREMENT	
Average total PFAS concentration in groundwater influent	22 µg/L
Total PFAS concentration in resin-treated water	1.8 ng/L
Total PFAS concentration in regenerant waste (plasma influent)	~165 mg/L
Liquid waste discharge	None
Air emissions	None

SOLE-SOURCE ELIGIBLE AS PHASE III SBIR

This pilot program was a Phase II contract under AFWERX, the tech accelerator of the USAF, with funds from U.S. Small Business Innovation Research (SBIR). As a result, Onvector's Plasma Vortex PFAS Destruction technology and the combined solution with ECT2 regenerative ion exchange system are eligible for a Phase III contract.

Phases I and II (already completed by Onvector) satisfy the government's competition requirements and enable Onvector to receive a sole-source position for Phase III. Some of the benefits to the government include:

- Maximum flexibility; DD2579 not required
- No J&A required under FAR 6.302-5
- No Pre/Post Award Synopsis required

A SBIR Phase III contract is funded by purchasing units and organizations (rather than SBIR) and can take the form of a regular procurement effort for products, production, services, R/R&D, or any combination. Phase III can be funded by procurement, operations and maintenance, construction, research, or any other type of funds from any military branch or federal agency. There are no limits on the number, duration, type of dollar value of a Phase III contract, nor any limit on the time between Phase II and Phase III.

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