

Colloidal Activated Carbon Barrier Reduces PFAS Migration from Impacted Groundwater into the Oakland Inner Harbor



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Site Overview

Site Background

- Installation Restoration (IR) Site 14 (Site) is located on former Naval Air Station (NAS) Alameda.
- NAS Alameda served as an active Navy Base from 1940 to 1997.
- Site was developed by dredge and fill operations.



Department of Veterans Affairs
Property Boundary



IR Site 14 Boundary



Alameda Point Boundary



Site Overview

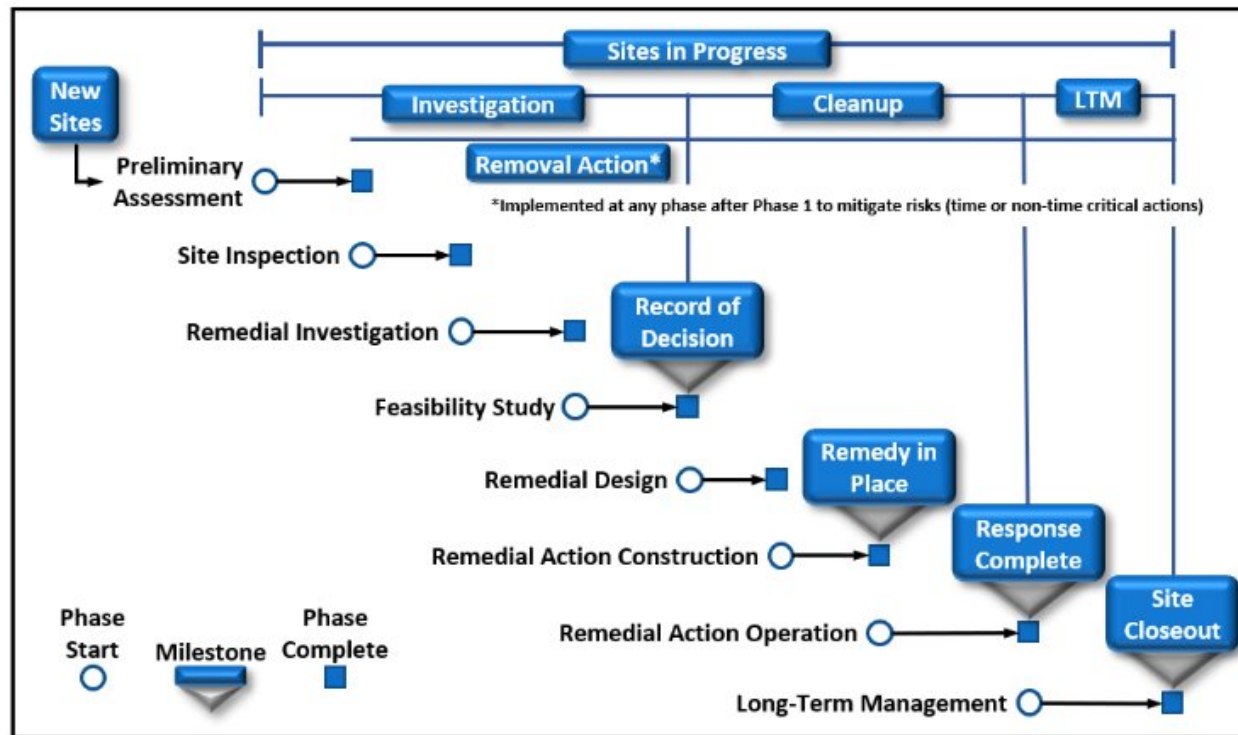
Per- and Polyfluoroalkyl Substances (PFAS) Concentrations

PFAS Source: Firefighting foam used historically during firefighter training.

- Initial Data Set
 - Highest Levels
- PFBS: 16,000 ng/L
- PFOA: 1,100,000 ng/L
- PFOS: 230,000 ng/L



CERCLA Process



Source: <https://exwc.navfac.navy.mil/Products-and-Services/Environmental-Security/NAVFAC-Environmental-Restoration-and-BRAC/Program-Support/CERCLA-Phases-and-Milestones/>



January 26 – January 28, 2026

Stakeholders



SF RWQCB



DTSC



APTIM



Bayside



EPA



Alameda County



CA Fish & Wildlife



US Navy



Citizens Group



Colloidal Activated Carbon (CAC)

Overview

PlumeStop Attributes

- Carbon particle sizes 1–2 μm
- Suspends as a colloid in polymer solution
- Distributes easily under low pressure
- Creates an in-situ purifying filter within the saturated zone
- Reduces concentrations of target compounds in groundwater



How is Remediation Achieved?

PFAS Monitored Retention (PMR)



- Builds on MNA principles, but shifts focus from degradation to retention

Mechanisms

- Sorption to the aquifer material
- Matrix Diffusion
- Chemical Retention
- Dispersion Effects


Groundwater Monitoring & Remediation Practical Application

PFAS Monitored Retention: A Framework for Managing PFAS-Contaminated Groundwater Sites

by David T. Adamson , Charles J. Newell , Poonam Kulkarni and Hans Stroo

Abstract

Groundwater sites contaminated by per- and polyfluoroalkyl substances (PFAS) present unique widespread occurrence and persistence and stringent remediation objectives. While traditional monitoring and natural attenuation have been effective remedial options for many degradable contaminants, their direct application to PFAS is limited due to their inherent stability. However, the development of PFAS monitored retention (PMR) broadens the scope of how retention processes—such as sorption, matrix diffusion, and precursor retention—help to manage PFAS in the environment. This paper summarizes PMR, discussing its evolution from traditional MNA, monitoring technologies, and potential site-specific and broader applications. PMR offers a scientifically robust, cost-effective in situ destruction technologies.



Introduction

The PFAS Remediation Challenge

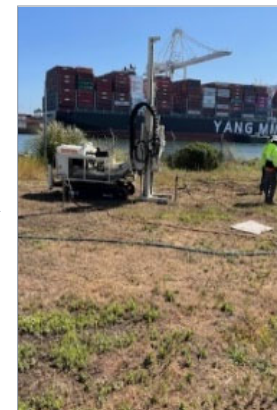
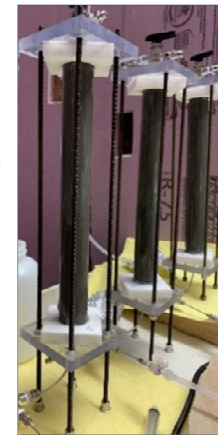
The remediation of groundwater sites impacted by per- and polyfluoroalkyl substances (PFAS) is increasingly recognized as a challenging global environmental issue. These

Currently, there are limited options to destroy PFAS in groundwater plumes using existing technologies such as groundwater pump and treat and in situ sorbents. Con-

Conceptual Design

Create a Barrier to Reduce the Migration of PFAS in the Groundwater

- Injectable
- Permeable formation
- In-situ
- 720-feet long
- 288 direct push injection points



DVT: Upfront Work Dictates Performance

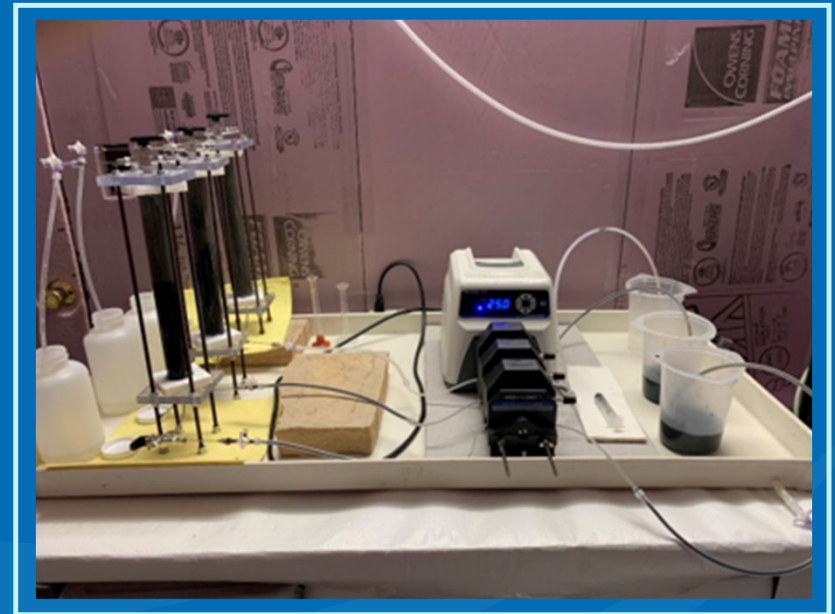


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Column Study

Results

- **C1 = 0.0% CAC**
 - Little adsorption from the native aquifer soils observed
 - **C2 = 0.5% CAC**
 - Reduced from 438,000 ng/L to 1,300 ng/L by Day 47
 - **C3 = 2.0% CAC**
 - Reduced from 438,000 ng/L to <200 ng/L on Day 47 (slightly faster adsorption)
-
- Site groundwater that was collected to run the test had PFAS concentrations over 400,000 ng/L
 - CAC can reduce groundwater PFAS concentration as expected
 - Different concentrations of CAC can be matched to different PFAS concentrations along the barrier



Passive Flux Meter (PFM) Study

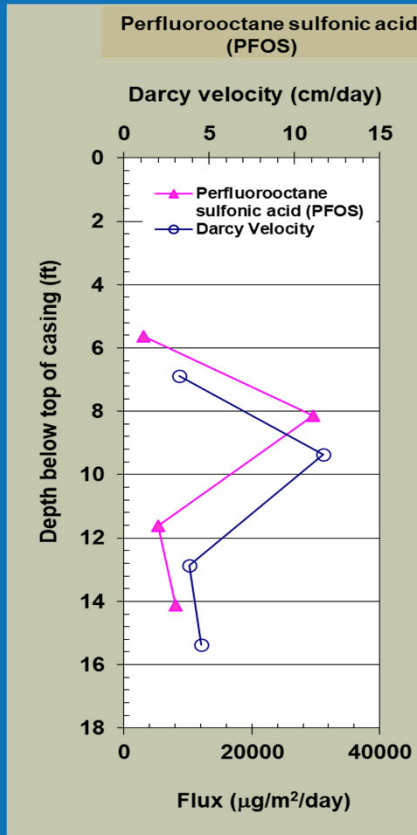
PFM Phases

- **Phase 1:** Determine future well screen placement
- **Phase 2:** Collect pre-injection data
- **Phase 3:** Collect post-injection data (est. Q4-2024)

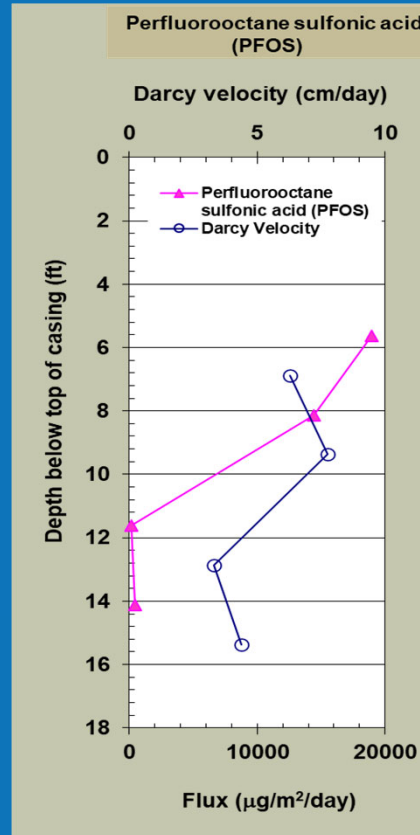


Passive Flux Meter (PFM) Study

M14-37S/D



M14-41S/D



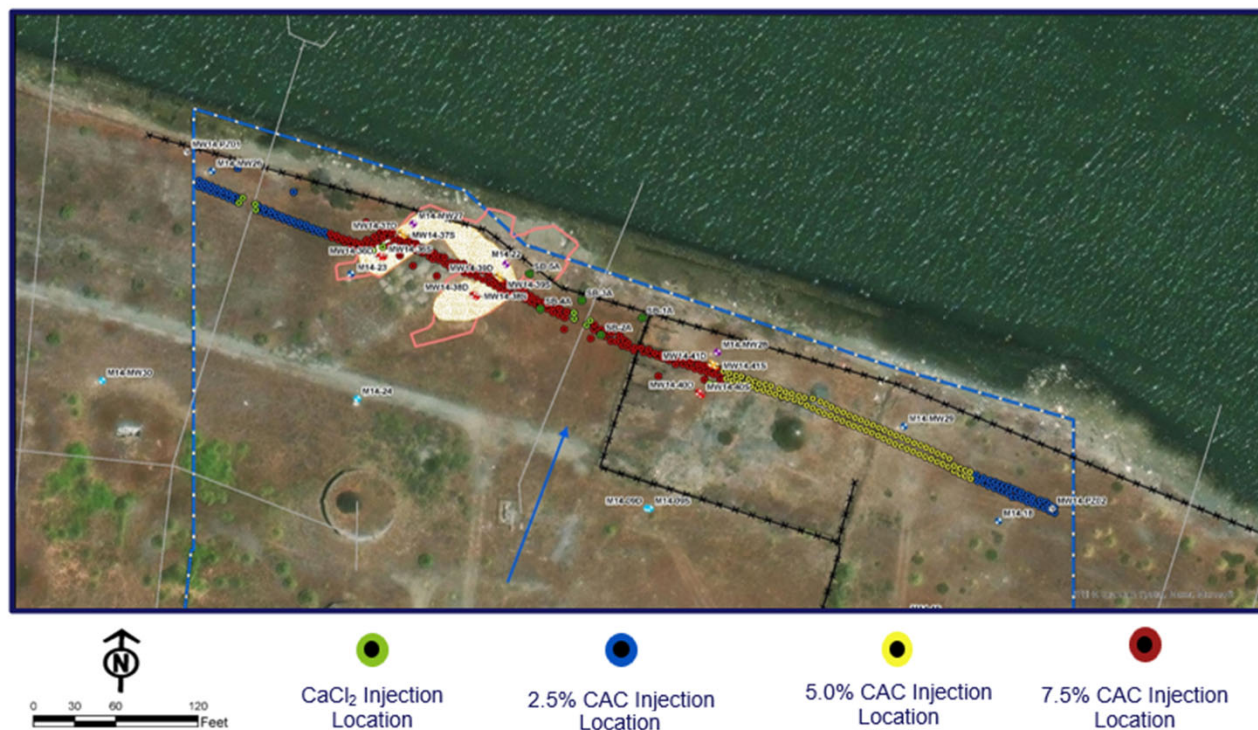
Final Design of CAC Permeable Barrier

Barrier Wall Overview

- 720-ft
- Two lines of injection borings parallel to the shoreline

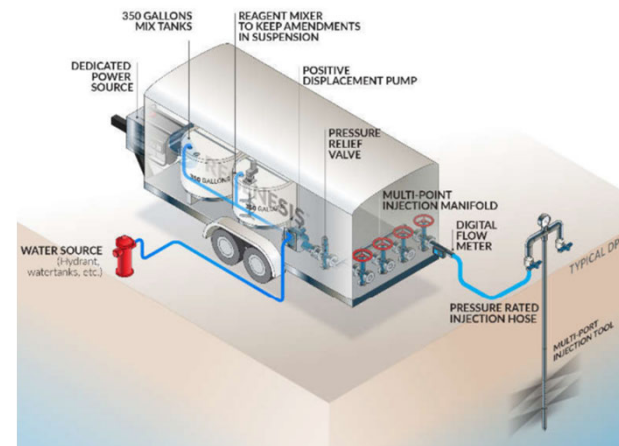
Injection Overview

- Target Zone: 1-16 ft bgs
- Varying doses of CAC injected into each boring, depending on PFAS levels (2.5%, 5.0%, and 7.5%)



Injection Equipment

- Two injection trailers and two direct push rigs to optimize time in the field
- Two 300-gallon mixing tanks per injection trailer
- Variable Speed Pump
- Injection hoses
- Flow meters
- Electronic pressure gauges



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Site Challenges



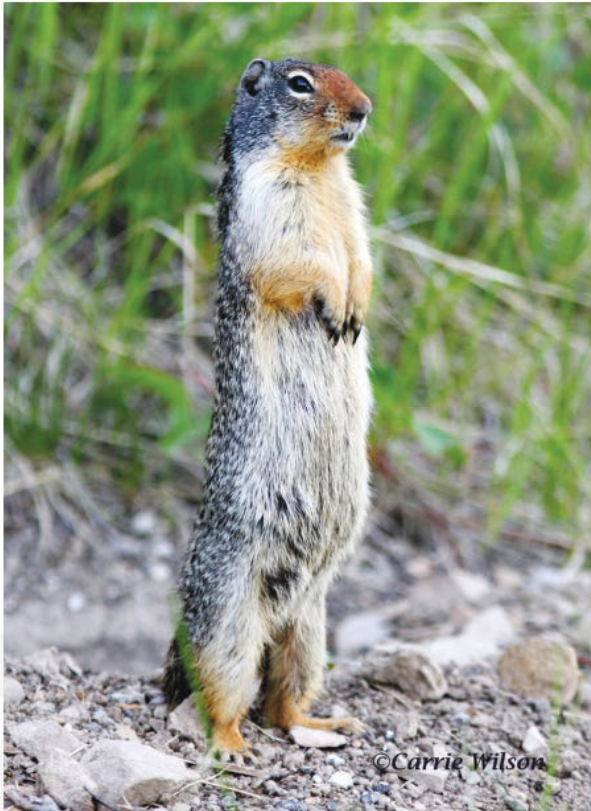
Birds



Gophers/Squirrels



Potholes



Performance Monitoring

Quarterly Sampling

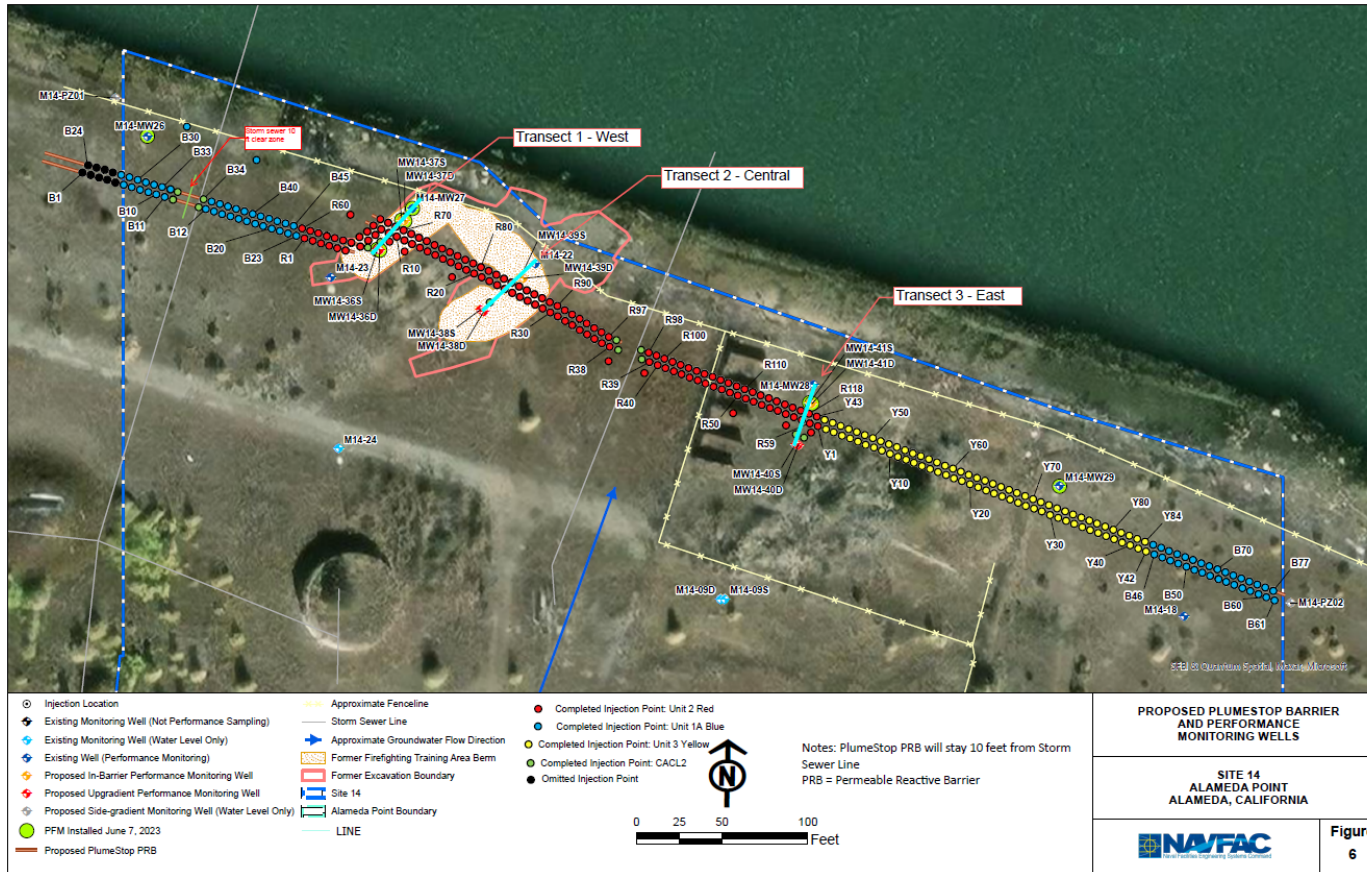
- Sampling 18 wells
- All transect wells
- Cross gradient wells

CAC Observed in Samples

- Primarily in-barrier wells
- CAC was not observed in downgradient wells
- Samples were centrifuged in analytical laboratory

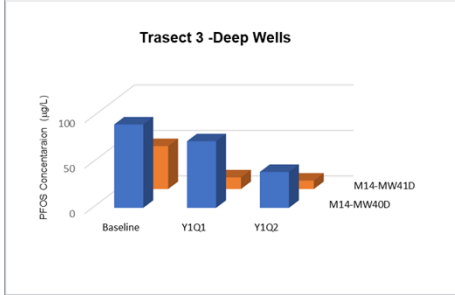
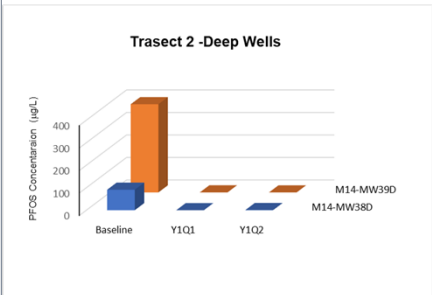
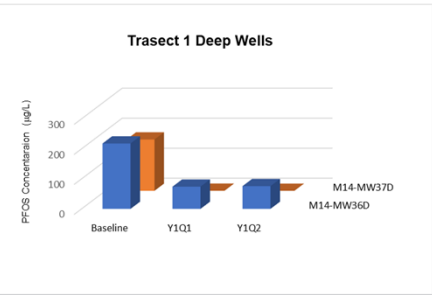
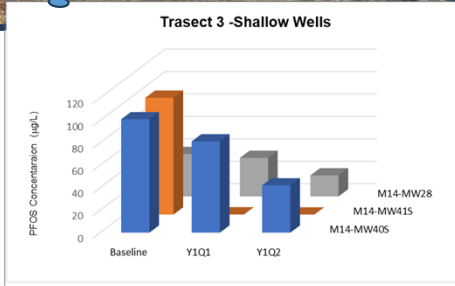
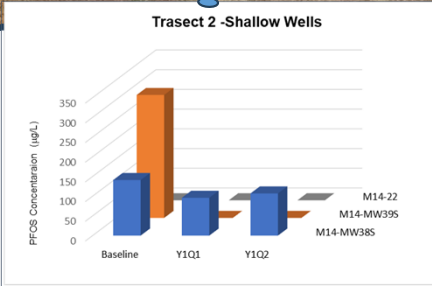
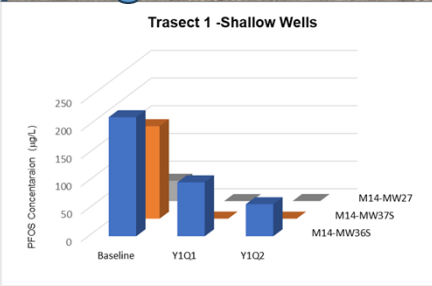


Transect Sampling Locations 1-3



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PFOS Reductions

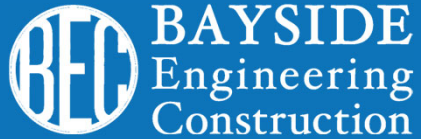


Summary

- <1yr from concept to implementation
- >99% reductions in key PFAS COCs
- Interim Action that fits within CERCLA
- Meets Congressional directives of the DOD to prioritize PFAS remediation that eliminates PFAS risk by considering in situ treatment (2024), and a new proposed bipartisan provisions in the draft FY26 NDAA for accelerated remediation.
- 2025 Remediation Project of the Year (Env. Analyst)



Project Team



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- Abram Eloskof
 - Sridhar Palakur
 - Gary Cronk



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- Robert Mayer
 - Nels Johnson
 - Paul Hatzinger. PhD
 - Michael Lightner



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- Craig Sandefur
 - Dan Nunez
 - Isaac Greg

Questions?



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