ISEMS™: Field Demonstration of In Situ PFAS Mass Flux Control

- **Strategic Fit:** Provide PERF members with field evidence for a new in situ technology to manage PFAS in groundwater. In Situ Engineered Mineral Sorption (ISEMS, patents pending) forms iron or aluminum oxide minerals in an aquifer, enabling passive PFAS retention after mineral emplacement.
- **Program Goal:** Assess reagent delivery, mineral formation, and PFAS mass-flux reduction under field conditions. Build on completed and ongoing laboratory tests funded by Arcadis and SERDP to evaluate implementability, performance, and costs.
- **Value Proposition:** ISEMS is a potentially lower-cost alternative to injected colloidal activated carbon (CAC) for in situ PFAS treatment. Further, ISEMS may also enable future recovery of sequestered PFAS for subsequent destruction, with the potential to reduce long-term liability.
- **Program Description:** Build on completed and ongoing column and tank tests to field demonstrate ISEMS at a suitable member site. Use an injection/extraction pair to distribute reagents and monitoring wells to assess performance over 6–12 months. Verify mineral formation, monitor hydraulics and measure PFAS, metals, pH and redox potential (Eh). The work plan will define baseline/comparator monitoring, PFAS mass-flux measures, hydraulic and geochemical limits, and criteria for proceeding to recovery. Following successful sequestration and a favorable interim go/no-go decision, evaluate PFAS recovery and re-establishment of mineral sorption capacity.
- **Deliverables and Schedule:** Work Plan, an Interim Performance Report with a go/no-go decision on PFAS recovery, and a Final Report covering field data, reagent distribution, PFAS mass flux, scale-up costs, lessons learned and recommendations. Planned duration: 12–18 months.
- **Total Estimated Budget:** $150,000: planning/design $15K, field implementation $80K, sampling/laboratory $25K, analysis/reporting $15K, contingency $15K. Assumes host-provided access and use of existing wells. Additional wells may be needed, subject to site-specific scope and budget confirmation.

PERF Proposal Sign-Up Sheet

PERF Project Proposal Title

ISEMS: Field Demonstration of In Situ PFAS Mass Flux Control

Proposal Point of Contact (include name, company and preferred contact details)

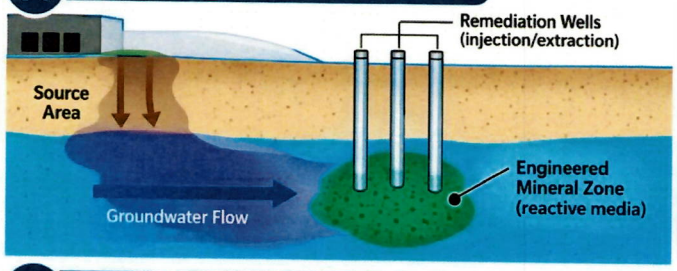
Name	Company	Preferred Contact Details
Craig Divine	Arcadis	craig.divine@arcadis.com

Please return to Irene Montero (Irene.Montero@bp.com

ISEMS: In situ Engineered Mineral Sorption System for PFAS

A repeatable in situ treatment and regeneration cycle

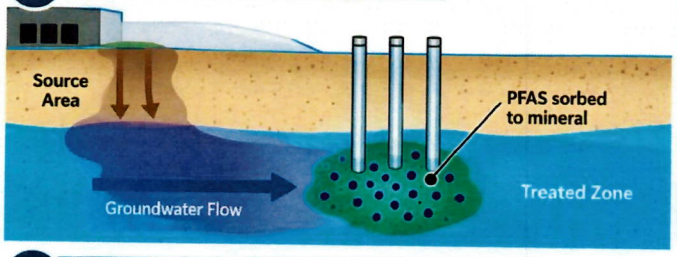
A Establish Engineered Mineral Zone



A. Establish Engineered Mineral Zone

- Use remediation wells to emplace an engineered mineral zone within the PFAS plume.
- The mineral provides high-capacity sorption sites for PFAS.

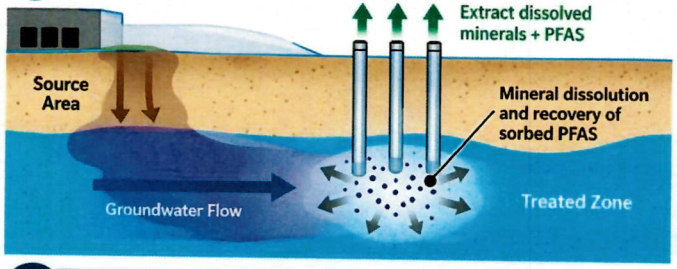
B Treat: Enhanced PFAS Sorption



B. Treat: Enhanced PFAS Sorption

- As groundwater flows through the engineered mineral zone, PFAS is sorbed to the mineral surfaces.
- A downgradient treated zone develops with reduced PFAS concentrations.

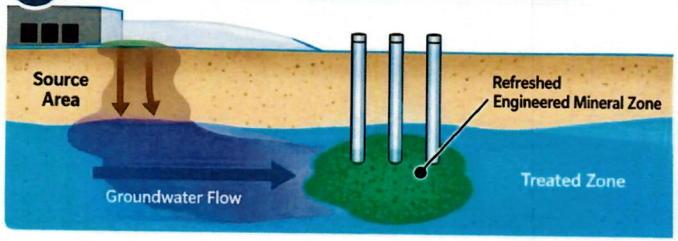
C Regenerate: Mineral Dissolution and PFAS Recovery



C. Regenerate: Mineral Dissolution and PFAS Recovery

- Circulate a benign extracting solution to dissolve the mineral and release sorbed PFAS.
- Recover the dissolved minerals and PFAS through the wells for aboveground treatment and mineral/reagent management.
- The treated zone remains in place during regeneration.

D Refresh: Re-establish Engineered Mineral Zone

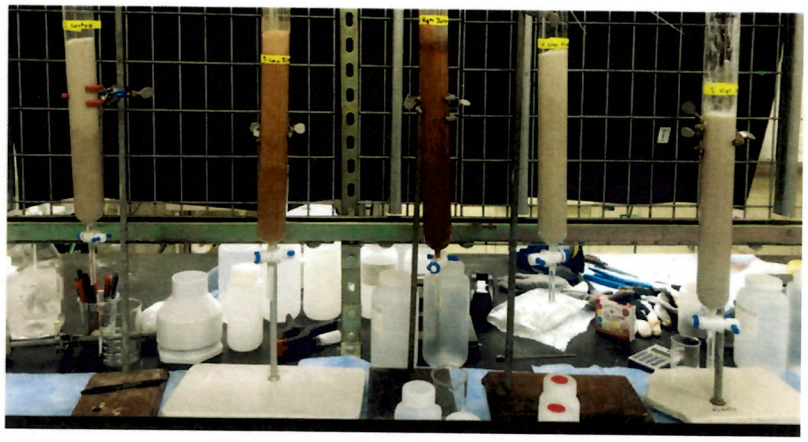


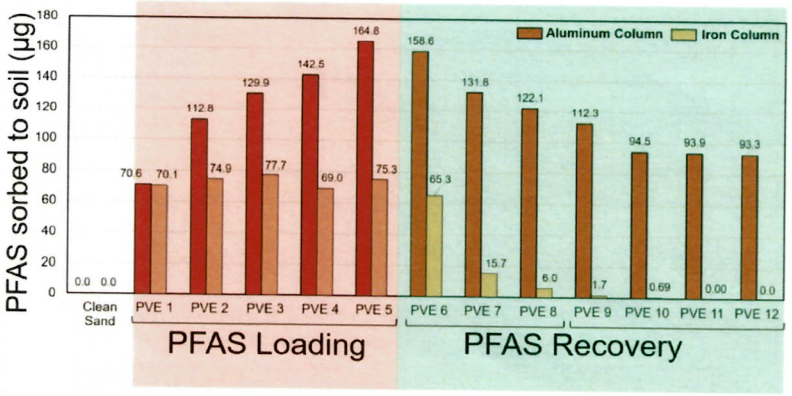
D. Refresh: Re-establish Engineered Mineral Zone

- Re-apply mineral (or adjusted formulation) through the wells to restore the engineered mineral zone.
- The system is ready for another treatment cycle.

A sustainable, repeatable in situ solution for long-term PFAS management

Treats PFAS in place | Recovers PFAS for aboveground management | Refreshable for multiple cycles | Minimizes waste and surface footprint





Column tests show PFAS sorption and recovery with iron and aluminum oxides.