

Back Diffusion of VOCs from a Fractured Sandstone Aquifer Treated At Former Industrial Facility

Project Highlights

Large-scale pilot tests confirm management of chlorinated VOC back diffusion from fractured bedrock aquifer

- Tests concluded degradation along biotic and abiotic reductive pathways
- Advanced sorbent technology extends treatment longevity to manage long-term back diffusion

Project Summary

Fractured bedrock aquifers can be extremely heterogeneous which not only results in complex dissolved plume behavior, but can also hinder *in situ* remediation efforts that rely on an injection of amendments to promote microbial activity and abiotic degradation. However, due to the potentially high cost of a pump and treat remedy at a former industrial site in Arkansas, WSP determined that an *in situ* pilot test with advanced substrates was warranted.

At the Arkansas site, a 2016 pilot study was conducted using a multifunctional amendment formulation. REGENESIS[®] 3D-Microemulsion[®], BDI Plus[®], and CRS[®] were injected to remediate affected groundwater within a fractured sandstone bedrock aquifer impacted by chlorinated solvents. The contaminants at the site included trichloroethene (TCE), 1,1,1-trichloroethane (TCA), and degradation products. The plume on site underlies several developed properties and threatens a stream located approximately 1,500 feet from the source area. Results of the first pilot study yielded an 82% reduction within 9 months was measured approximately 80 feet from the application location.

A second pilot study was undertaken in 2017 to emplace a sorbent technology with long-lasting treatment capacity (PlumeStop[®]) on bedrock fracture faces to manage back diffusion from the bedrock primary porosity. This test also included the addition of bioremediation amendments to permanently degrade the sorbed contaminants. The 2017 treatment included PlumeStop and bioremediation amendments. After only one month, an 81% reduction was achieved in samples located 50 feet downgradient.

Preliminary indications of these amendment formulation tests are extremely promising in treating contaminant back diffusion emanating from the fractured bedrock matrix in this aquifer. WSP is confident that favorable performance monitoring results will continue and the full-scale remedy for this complex geologic setting will include REGENESIS products that extend treatment longevity.



Site Details

Site Type: Former Manufacturing/Industrial Facility

Contaminant of Concern: TCE and 1,1,1-TCA and reductive daughter products

Remediation Approach: Pilot Tests of a combined remedy using multiple ERD processes

Soil Type: Fractured Sandstone

Technology Used: 3DME, HRC, CRS, BDI Plus, PlumeStop Liquid Activated Carbon



MICROEMULSION



**HYDROGEN
RELEASE
COMPOUND**



**BIO-DECHLOR
INOCULUM**



**CHEMICAL
REDUCING
SOLUTION**

PLUME STOP
Liquid Activated Carbon



Technology

PlumeStop® is an innovative groundwater remediation technology designed to address the challenges of excessive time and end-point uncertainty in groundwater remediation.

3-D Microemulsion® is an engineered electron donor material that offers a novel three-stage electron donor release profile, pH neutral chemistry, and is delivered on-site as a factory emulsified product.

HRC® is an engineered, hydrogen release compound designed specifically for enhanced, *in situ* anaerobic bioremediation of chlorinated compounds in groundwater or highly saturated soils.

BDI Plus® is designed for use at sites where chlorinated contaminants are present and unable to be completely biodegraded via the existing microbial communities.

CRS® is a liquid iron-based reagent for the enhanced biogeochemical *in situ* chemical reduction (ISCR) of chlorinated contaminants.

About the Client

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