SiREM
Leading Science · Lasting Solutions

KB-1®

Case Study

Client:
Geosyntec Consultants, Inc./ NASA

Site Location:
Launch Complex 34, Cape Canaveral, Florida

Services Provided:
- Gene-Trac® *Dehalococcoides* Testing
- Biotreatability Testing
- KB-1® Bioaugmentation

"NASA undertook a field testing program of KB-1® bioaugmentation to target TCE DNAPL in groundwater using LC34 as the demonstration site. "

Treatment of DNAPL Through Enhanced Bioremediation

Project Highlights

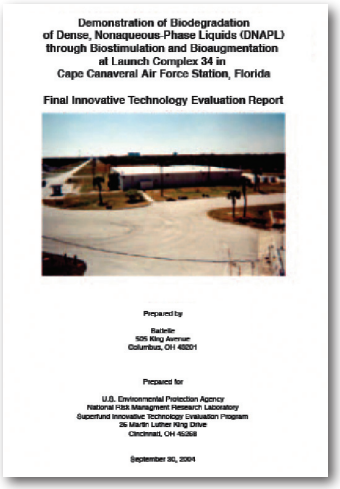
- Dechlorinating activity of KB-1® confirmed at aqueous TCE concentrations as high as 260 mg/L
- 98% TCE DNAPL mass removal indicating enhanced TCE dissolution
- EPA SITE Program Verification

Problem

As a result of trichloroethene (TCE) releases to groundwater during the 1960s, TCE is now found in the sandy aquifer beneath the Site in the form of a dense, non-aqueous phase liquid (DNAPL). Testing for the vinyl chloride reductase *(vcrA)* gene (Gene-Trac®-VC) and bench scale treatability testing indicated that indigenous *Dehalococcoides (Dhc)* found at the Site were not uniformly capable of complete dechlorination of TCE to ethene (Hood et al., 2008).

Solution

NASA undertook a field testing program of KB-1® bioaugmentation to target TCE DNAPL in groundwater using LC34 as the demonstration site. The US EPA Superfund Innovative Technology Evaluation (SITE) program (EPA, 2004) collected parallel independent data to validate performance. Groundwater at the site was amended with dilute ethanol as an electron donor and recirculated through the demonstration plot to promote in situ microbial growth. The recirculated groundwater was bioaugmented with 60 liters of KB-1® culture with the goal of introducing large numbers of *Dhc* capable of complete dechlorination of TCE.


Demonstration of Biodegradation
of Dense, Nonaqueous-Phase Liquids (DNAPL)
through Biostimulation and Bioaugmentation
at Launch Complex 34 in
Cape Canaveral Air Force Station, Florida

Final Innovative Technology Evaluation Report

The EPA Superfund innovative technology evaluation (SITE) program evaluated this study and parallel results were provided in the above report

Results

Enhanced bioremediation, including KB-1® bioaugmentation, rapidly increased the rate of TCE biodegradation with ethene concentrations in stoichiometric excess of the initial TCE concentrations, indicating enhanced removal of TCE-DNAPL (>98% mass removal) and confirming that dechlorinating activity was not inhibited by high concentrations of TCE. Two years after this study, follow up testing confirmed that dechlorinating activity continued in the absence of ongoing treatment and resulted in further decreases in TCE concentrations, demonstrating that bioremediation is an effective approach for both enhanced DNAPL removal and/or containment of TCE-impacted groundwater in DNAPL source zones. As a result, bioaugmentation technologies are currently being deployed at several sites at Kennedy Space Center and related facilities.

References:

EPA 2004.Demonstration of Biodegradation of DNAPL through Biostimulation and Bioaugmentation at Launch Complex 34 in Cape Canaveral Air Force Station, Florida Innovative Technology Evaluation Report. http://www.epa.gov/nrmrl/pubs/540r07007/540r07007.pdf

Hood E.D., D.W. Major, J.W. Quinn, W.-S. Yoon, A. Gavaskar, and E.A. Edwards. 2008. Demonstration of Enhanced Bioremediation in a TCE Source Area at Launch Complex 34, Cape Canaveral Air Force Station. Groundwater Monitoring and Remediation. 28 No. 2:1-10.