

KB-1®

Case Study

Client:

Tetra Tech
Ann Arbor, Michigan

Site Location:

Eastern Indiana

Project Duration:

Full-scale remediation
initiated 2007

Services Provided:

- KB-1® Bioaugmentation
- Gene-Trac®
Dehalococcoides Testing

“Based on the success of the initial biobarrier, source zone remediation and a second mid-plume biobarrier were implemented in 2008.”

Full Scale KB-1® Biobarrier for TCE Plume Containment

Project Highlights

- Implementation of a 1,250 foot wide KB-1® bioaugmented barrier
- Treatment of VOCs under high groundwater velocity conditions
- Conversion of high TCE concentrations to non-toxic ethene

Problem Definition

The site is a former manufacturing facility, where a historic trichloroethene (TCE) release created a plume 1,100 feet wide and 7,000 feet long averaging 3,600 micrograms per liter ($\mu\text{g}/\text{L}$) TCE, with a groundwater velocity of about 2 feet per day. Prior to biostimulation with electron donor, the groundwater conditions ranged from aerobic to mildly reducing and Gene-Trac® testing indicated the absence of dechlorinating *Dehalococcoides* (*Dhc*) bacteria. Electron donor addition in the absence of bioaugmentation resulted in the accumulation of the toxic biodegradation product cis-1,2-dichloroethene (cDCE).



Extent of TCE plume (green) and location of pilot test area and full scale biobarrier indicated in red (from Kovacich et al., 2007)

Solution

The goal was containment of the TCE source zone through establishment of a biobarrier adjacent to the facility beneath which the source zone is located. A bioaugmentation pilot test was performed to determine if KB-1® would improve the extent of dechlorination. The pilot test resulted in non-detectable concentrations of TCE, cDCE and vinyl chloride in less than one year.

Based on encouraging pilot test results, a full-scale biobarrier was implemented adjacent to the source zone. The biobarrier is 1,250 feet wide and utilized 106 direct push points to inject 60,000 lbs of emulsified vegetable oil electron donor. Once anaerobic groundwater conditions were established, 60 permanent injection wells on 15-30 foot centers were each bioaugmented with 5.5 liters (L) of KB-1®.

Notable Results

Two months after bioaugmentation complete dechlorination of tetrachloroethene (PCE), TCE and cDCE to ethene was observed across the biobarrier at the injection locations. Concurrent increases in dechlorinating *Dhc* bacteria were observed, increasing from near non-detect (10^3 *Dhc*/L groundwater) to extremely high concentrations of 10^9 *Dhc*/L after bioaugmentation. Within six months, the dechlorinating zone had migrated 45 feet downgradient where moderate concentrations of 10^6 *Dhc*/L were detected. Ethene was the primary degradation product in groundwater exiting the barrier, indicating a robust dechlorinating zone had been successfully established. Based on the success of the initial biobarrier, source zone remediation and a second mid-plume biobarrier were implemented in 2008.

Reference:

Kovacich et al., 2007. Full-Scale Bioaugmentation to Create a Passive Biobarrier to Remediate a TCE Groundwater Plume Paper I-18, in: A.R. Gavaskar and C.F. Silver (Symposium Chairs), In Situ and On-Site Bioremediation -2007. Proceedings of the Ninth International In Situ and On-Site Bioremediation Symposium (Baltimore, Maryland; May 7–10, 2007).