

KB-1®

Case Study

Client:

Maul Foster & Alongi, Inc.
Portland, Oregon

Site Location:

Portland, Oregon

Services Provided:

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

“Within 6 months TCE concentrations were below federal MCLs (5 µg/L) at approximately half of the monitoring well locations and 98% of the estimated TCE mass was removed.”

Full Scale KB-1® Bioaugmentation for TCE DNAPL Source Area Treatment

Project Highlights

- DNAPL-associated TCE concentrations decreased below federal MCLs within 6 months
- 98% of estimated TCE mass was removed within 6 months
- Enhanced TCE DNAPL dissolution observed

Problem

A trichloroethene (TCE) release at the site in the early 1980s led to concentrations of TCE and cis-1,2-dichloroethene (cDCE) as high as 592 and 90 milligrams per liter (mg/L), respectively, where TCE dense non-aqueous phase liquid (DNAPL) was suspected to be present. The contaminated zone ranged from 50 to 110 feet below ground surface (bgs) and was located adjacent to a river.

Solution

Bench scale treatability and field pilot studies demonstrated that in-situ chemical reduction (ISCR) – enhanced bioremediation, including KB-1® bioaugmentation, was the most efficient treatment approach. The full scale implementation was an expansion of a successful pilot study conducted in 2006¹ and consisted of a 150 foot long biobarrier amended with an electron donor and KB-1®. Approximately 200 injection points were used to inject 270,000 kilograms of electron donor and 2,000 liters (L) of KB-1®. Injection depths ranged from 40 to 112 feet bgs with four-foot injection intervals used to enhance vertical coverage. KB-1® was applied to each injection interval 7 to 14 days after electron donor conditioning of the aquifer produced suitably reducing conditions.

Results

Within 6 months TCE concentrations were below federal MCLs (5 µg/L) at approximately half of the monitoring well locations and 98% of the estimated TCE mass was removed. TCE dechlorination products (cDCE and VC) were generated initially, followed by a rapid decline with observed increases in ethene. Chloride concentrations increased to a greater extent than expected based on the aqueous phase TCE concentrations, suggesting that TCE DNAPL dissolution had occurred. TCE half-life data indicated that TCE removal was a first order reaction with observed half-lives as low as 10 days.

Reference:

¹Peale, James, Erik Bakkom, Fayaz Lakhwala, James Mueller, Josephine Molin. 2008. TCE plume remediation via ISCR-enhanced bioremediation utilizing EHC® and KB-1® Remediation. Autumn, 2008, pages 19-31

Peale, J.G.D., Bakkom, E., Mueller, J., Molin, J., Przepiora, A. 2010. Pathway Identification During Successful ISCR-Enhanced Bioremediation of a TCE DNAPL Source Areas. Proceedings of the Seventh International Conference on Remediation of Chlorinated and Recalcitrant Compounds–2010. Battelle Press, Columbus, OH (In Press)



KB-1® application at the site using injection dispenser across vertical intervals to deliver small volumes effectively