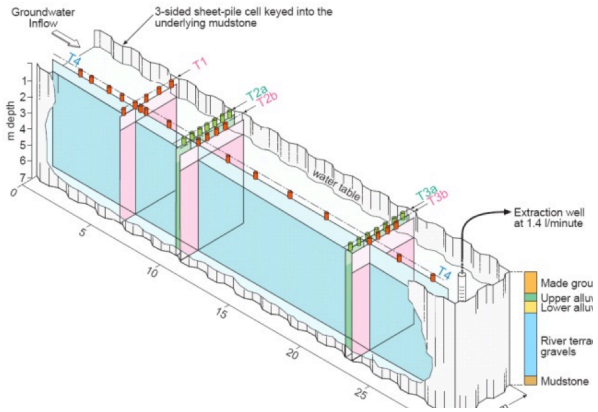
Geosyntec consultants

Development and Demonstration of Enhanced In Situ Bioremediation of a DNAPL Source Area

United Kingdom



Geosyntec led the design of this sheet-piled test cell for evaluating in situ remediation of DNAPL at a former manufacturing plant

Client: Confidential

Services Provided:

- ✓ Field pilot study design
- ✓ Laboratory studies
- ✓ Pilot study management and data evaluation
- ✓ Training and best practice guidance

Project Objective

The application of enhanced in situ bioremediation for the treatment of chlorinated solvent source areas, referred to as dense non-aqueous phase liquid (DNAPL), offers major potential as a technically and economically effective remediation option. Project SABRe (**S**ource **A**rea **B**io**Re**mediation) was designed to develop and demonstrate that enhanced anaerobic bioremediation can result in cost effective and quantifiable treatment of chlorinated solvent DNAPL source areas. Geosyntec was a key member of this collaborative project that was undertaken and financed by a multidisciplinary team from the United Kingdom, United States, and Canada, forming a unique industry-regulatory-academic partnership.

Geosyntec's Scope of Services

The SABRe project comprised laboratory and field pilot-scale development of enhanced anaerobic bioremediation applied to DNAPL source areas to accelerate reductive dechlorination by specific types of bacteria. Field pilot studies were undertaken in two closely coordinated trials: one contained cell that enabled intensive control and monitoring of the treatment process, and one uncontained area that represented a practical model of how such a process could be cost-effectively implemented at further sites. Planning and design of the field trials was been supported by performance and analysis of extensive and detailed laboratory studies. Geosyntec conceived and designed a highly instrumented in situ test cell (over 400 sample points were established within the 4x30-meter test cell) for demonstrating the use of bioremediation to deplete DNAPL source areas. The purpose of the test cell was to facilitate monitoring of groundwater quality downgradient of a TCE DNAPL source area to estimate DNAPL mass depletion over a two year experimental period. Geosyntec also conducted bench scale microcosm batch and column studies to support the project design, and took a lead role in managing the ongoing experimental design for the field trials.

Notable Accomplishments

The development of any in situ remediation technology requires a high level of confidence in the field performance and understanding of the process to facilitate reliable implementation and widespread acceptance. For DNAPL remediation, this need is greater due to the complexity of source areas, the difficulty in demonstrating performance of existing competing technologies, and their ineffectiveness. The SABRe test cell was intensively monitored by traditional and novel chemical, biological and geophysical techniques, which yielded one of the most comprehensive data sets ever collected for this purpose. These data have been used to develop, calibrate, and verify a comprehensive process model that simulates DNAPL dissolution, multi-species chemical transport, partitioning, various redox processes, electron donor fermentation and degradation of chlorinated ethenes by reductive dechlorination. Data and model results have demonstrated extensive degradation and substantial mass reduction within the cell. Bioremediation is a leading alternative for full scale remediation at this site.

The SABRe project has been instrumental in advancing the state of the science and practice of DNAPL source area bioremediation. The findings have been disseminated in a series of technical bulletins and associated training events. Geosyntec's substantial support and leadership of this project is an example of our commitment to the development of the most effective remediation technologies and approaches for use at contaminated sites.