Use of longitudinal STREAMTUBE-based monitoring approaches to determine contaminant fate within the SABRE intra-source/plume test cell

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Chlorinated solvents such as trichloroethene (TCE) have proven to be extremely common groundwater contaminants. Such solvents have been released to the subsurface as a dense nonaqueous-phase liquid (DNAPL) that migrates below the water table to form a heterogeneous distribution of DNAPL, the 'DNAPL source zone' which slowly dissolves to form continuous aqueous-phase plumes down gradient. Due to the persistency of chlorinated solvent DNAPL source zones, expected to last decades or longer, there has been significant interest in the natural attenuation of the dissolved-phase plumes generated. Biodegradation of dissolved phase TCE may be appreciable under appropriate site conditions, e.g. anaerobic highly reducing conditions that promote dechlorination of TCE to cDCE (cis-dichloroethene), VC (vinyl chloride, *aka*. chloroethene) and ultimately ethene. As biodegradation at most sites is thought to be limited by the availability of electron donor and, or presence of suitable bacteria, e.g., *Dehalococcoides* (Maymó-Gatell et al., 1997), most bioremediations involve amendment injections of electron donor and potentially bioaugmentation involving injection of consortiums of dechlorinating bacteria.

Due to the fundamental control of the DNAPL source zone on the generation of dissolved-phase plumes, there is significant interest in achieving remedial control of the source. The degree to which TCE dechlorination reactions may naturally occur, or be induced via in-situ bioremediation within high concentration DNAPL source zones, however, remains uncertain.

Project *'SABRE'* (*S*ource *A*rea *B*io*RE*mediation) aims to evaluate DNAPL source zone biroremediation through the detailed monitoring of a historical TCE release at a UK industrial site. The *Streamtube* project, undertaken by Birmingham University, is collaborating with this project. The aim of the *Streamtube* initiative is to evaluate the use of longitudinal streamtube-based monitoring approaches to determine contaminant fate and transport behaviour under natural and remediation scenarios within the SABRE intra-source/plume test cell (Figure 1). In particular, it will assess temporal and spatial DNAPL dissolution within the source and delineate plume transport parameters under semi-natural (forced gradient) and remediation conditions.

Currently, the baseline monitoring phase (of 4 months) has been completed (eg. Figure 2), electron donor and bio-culture has been added and the operational period is underway.

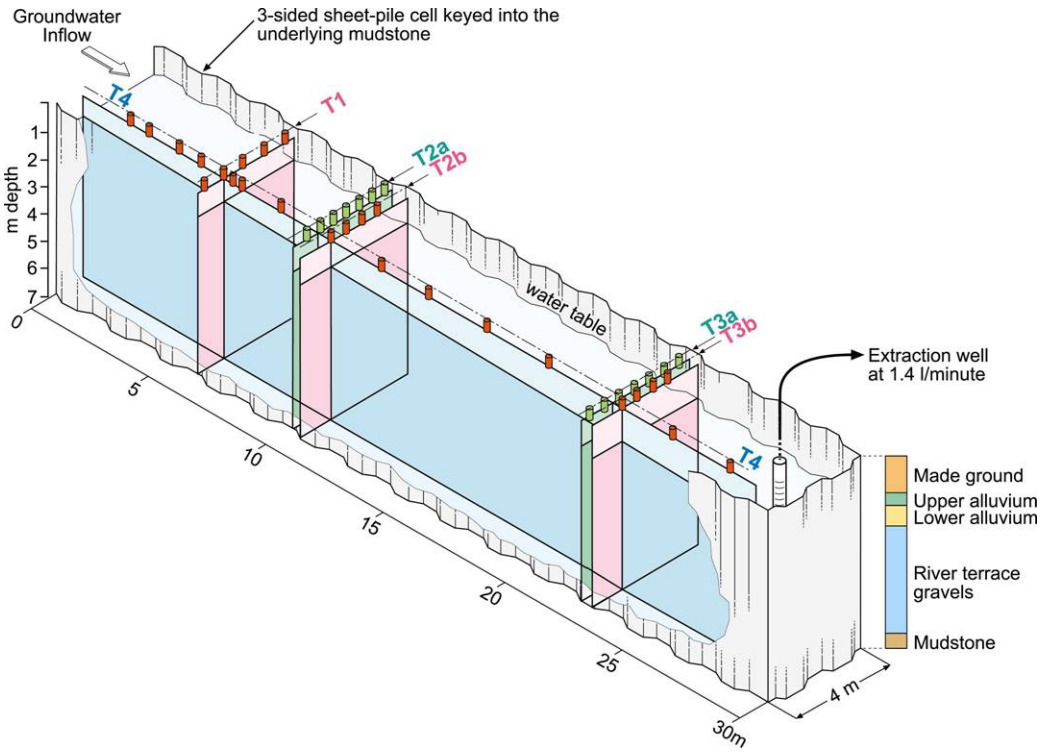

Figure 1. Schematic of the SABRE-cell design

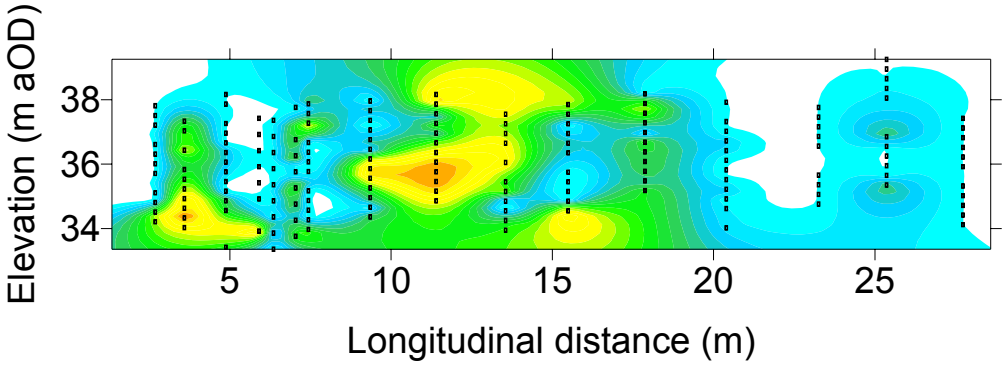

Figure 2. Example longitudinal transect for trichloroethene, the parent contaminant.