

Technology Evaluation - Bench-Scale Treatability Testing for a 1,1,1-TCA/TCE Site

CASE STUDY

Treatability
Studies

CLIENT:

COWI A/S, Denmark

SITE LOCATION:

Confidential Site

Project Highlights

- The study results were used by the client to select the most appropriate remedy for field implementation
- Study demonstrated that KB-1® Plus bioaugmentation promoted 1,1,1-TCA dechlorination to CA and TCE dechlorination to ethene
- Study demonstrated that alkaline-activated persulfate promoted the complete destruction of TCE and partial destruction of 1,1,1-TCA

Problem Definition

Enhanced in situ bioremediation (EISB) and in situ chemical oxidation (ISCO) were considered as the preferred remedial technologies for field implementation. Bench-scale tests of the two technologies were performed to provide critical information to support the selection of the most efficient and effective technology. The primary Site contaminants were 1,1,1-trichloroethane (1,1,1-TCA) and trichloroethene (TCE). Due to the contaminant mixture there was uncertainty as to how these technologies would perform. Specifically, 1,1,1-TCA is known to inhibit the reductive dechlorination of TCE if the requisite dechlorinating microbes are absent.

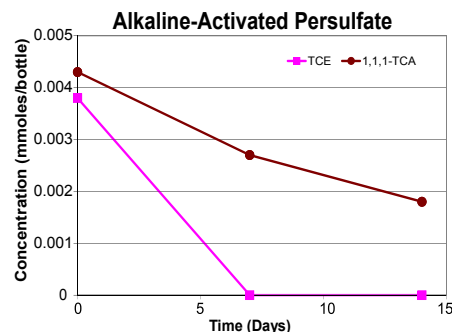
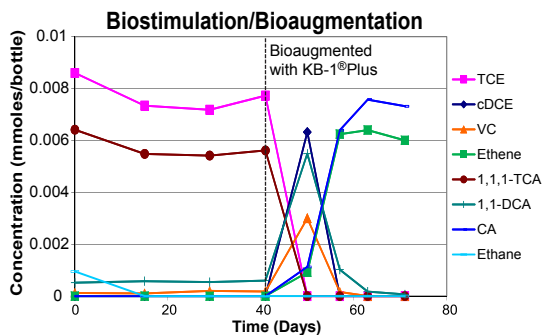
Solution

Bench-scale testing was performed by SiREM to evaluate (1) EISB; and (2) ISCO with alkaline-activated persulfate. Biotreatability microcosms were constructed to evaluate the rate and extent of 1,1,1-TCA and TCE reductive dechlorination under biostimulation (emulsified vegetable oil [EVO]) and bioaugmentation (KB-1® Plus) conditions. ISCO reactors were constructed to evaluate the potential for alkaline-activated persulfate to oxidize both 1,1,1-TCA and TCE.

Notable Results

Biotreatability testing results indicated that EVO alone did not promote complete dechlorination of either 1,1,1-TCA or TCE. In contrast, EVO combined with KB-1® Plus bioaugmentation promoted dechlorination of 1,1,1-TCA (5 milligrams per liter [mg/L]) to chloroethane (CA) and complete dechlorination of TCE (5 mg/L) to ethene within 20 days. Alkaline (sodium hydroxide)-activated persulfate promoted complete destruction of TCE (5 mg/L) after 7 days and 60% destruction of 1,1,1-TCA (5 mg/L) after 14 days. Based on the performance of KB-1® Plus bioaugmentation in the bench-scale study, EISB was selected for field implementation.

RIGHT: Sequential dechlorination of TCE through cDCE and VC to ethene and 1,1,1-TCA through 1,1-DCA to CA (left). Destruction of TCE and partial destruction of 1,1,1-TCA by sodium hydroxide-activated persulfate (right).



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