Abstract A-70, in: Bruce M. Sass (Conference Chair), *Remediation of Chlorinated and Recalcitrant Compounds—2006.* Proceedings of the Fifth International Conference on Remediation of Chlorinated and Recalcitrant Compounds (Monterey, CA; May 2006). ISBN 1-57477-157-4, published by Battelle Press, Columbus, OH, www.battelle.org/bookstore.

Inhibition of Reductive Dechlorination by Sulfate Reduction in Microcosms

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High sulfate (>1,000 mg/L) concentrations are potentially problematic for field implementation of *in situ* bioremediation of chlorinated ethenes because its reduction competes for electron donor with reductive dechlorination. As a result of this competition, reductive dechlorination of chlorinated ethenes may be inhibited. The Source Area Bioremediation (SABRE) project is an international collaboration of twelve companies, two government agencies and three research institutions. The project is chartered to determine if enhanced anaerobic bioremediation can result in effective and quantifiable treatment of the chlorinated solvent DNAPL source areas as demonstrated in a field-scale pilot project. At sites such as the SABRE field site where sulfate is high, the electron donor demand associated with sulfate must be understood to ensure that adequate electron donor is present to support reduction of chlorinated ethenes and sulfate. As part of a significant laboratory effort conducted by the SABRE group in support of the planned field project, we evaluated the impact of high sulfate concentrations (*circa* 1,000 mg/L) on electron donor consumption and reductive dechlorination of trichloroethene (TCE).

The effects of sulfate on reductive dechlorination of TCE were investigated as part of a larger 168 bottle randomized microcosm study carried out by four industrial laboratories (Dupont, GE, SiREM, and Terra Systems) collaborating in the SABRE project. The study was designed to examine the effects of electron donor selection (lactate, acetate, methanol, soybean oil, hexanol, butyl acetate), TCE concentration (100 and 400 mg/L), supplemental nutrient amendment (ammonia, phosphate, yeast extract) and bioaugmentation (KB-1^{TM}) on the reductive dechlorination of TCE. Preliminary results after 120 days of incubation suggest: 1) all electron donors supported sulfate reduction, 2) the presence of sulfate did not inhibit TCE reduction, 3) sulfate reduction occurred concurrently with reductive dechlorination of *cis*-1,2-dichlorothene and 4) vinyl chloride reduction generally did not occur at sulfate concentrations >50 mg/L.

To further explore these observations and to determine the effects that sulfate might have on reductive dechlorination of TCE in source areas, select microcosms (representing each of the 6 donors tested in the study) in which TCE had been completely dechlorinated to ethene were respiked with TCE and sulfate to a target concentrations of 800 and 1,000 mg/L respectively. During the incubation reductive dechlorination and depletion of sulfate were tracked in microcosms. Additionally, samples for PLFA and PCR analysis were collected to allow analysis of any changes in the microbial community during the incubation. Results from these studies will be applied to the accompanying column studies and numerical modeling effort as well as the ultimate design of the SABRE field pilot.