

**Environmental Engineering**

**and Earth Sciences**

**EEES Department Seminar**

**"changing our views on old ideas to promote *sustainable remediation*: Fe(III) reduction does not inhibit the complete reductive dechlorination of tce"**



 **PRESENTED BY**

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AEHS Abstract: The effects of Fe(lll) reduction on TCE, cis-DCE and VC dechlorination were studied in both contaminated aquifer material and enrichment cultures. Results demonstrated that Fe(lll) reduction did not inhibit complete dechlorination. The two microbial communities worked synergistically when the total concentration of electron donor was kept low, at stoichiometry or below stoichiometry. When the electron donor concentration was increased by ten times (i.e. a 10X factor of safety often incorporated into bioremediation applications) the rate and extent of complete dechlorination actually decreased.

TCE was reduced concurrently with Fe(lll) in the first 40 days of the incubations. While all incubations generated approximately the same mass of ethane within the experimental timeframe, Fe(lll) speciation (ferrihydrite versus Fe(lll)-NTA) had an impact on daughter product distribution and dechlorination kinetics. 16SrRNA gene clone library sequencing identified *Dehalococcoides* and Geobacteraceae as dominant populations, which included *G. lovleyi* like organisms. Quantitative PCR targeting 16S rRNA genes and Refuctive Dehalogenase genes (*tceA, bvcA, vcrA*) indicated that Dehalococcoides and Geobacteraceae were enriced concurrently in the TCE-degrading, Fe(lll)-reducing sediments. Geobacteraceae and Dehaloccoides were also co-enriched, and the Dehalococcoides abundance in the presence of Fe(lll) was not significantly different from those in the cultures without Fe(lll). Hydrogen reached steady-state concentrations most amenable to complete dechlorination quickly when Fe(lll) was present in the culture, suggesting that Fe(LLL) reduction may actually help dechlorination. Finally, methane production was limited or absent in the low electron donor applications, which eliminates production of a greenhouse gas during remediation.

This approach is part of a broader sustainability in remediation focus, in which the technologies are adapted to utilize fewer resources and generate fewer undesirable by-products. It also facilitates activity from multiple microbial communities at the same time, to increase the rate and extent of complete dechlorination, or degradation of the specific contaminant of concern.

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***Refreshments following Seminar***