

In Situ Dechlorination of TCE during Aquifer Heating

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Abstract

Laboratory and field efforts were undertaken to examine trichloroethene (TCE) dechlorination as a function of temperature as an aquifer is heated to temperatures approaching boiling. Experiments were conducted using sediment samples and during electrical resistance heating (ERH) treatment at the East Gate Disposal Yard (Fort Lewis, Washington), which contains nonaqueous phase TCE and hydrocarbon contamination. Laboratory microcosms with these sediments showed TCE dechlorination at 70°C with measured products of acetylene, ethene, and ethane, indicating an abiotic component of the degradation. In contrast, TCE was dechlorinated to *cis*-1,2-dichloroethene in experiments at 10°C, likely by biological reductive dechlorination. The observed products at 70°C suggest dechlorination catalyzed by reduced sediment iron. Indications of in situ dechlorination were observed in periodic ground water samples collected during field-scale ERH from an average ambient temperature of about 19°C to near boiling. Dechlorination indicators included an increase in chloride concentration at the onset of heating and observation of acetylene, ethene, and methane at elevated temperatures. The data collected in this study suggest that dechlorination can occur during ERH. The overall cost-effectiveness of ERH may be enhanced by fortuitous in situ dechlorination and, potentially, could be further enhanced by specifically designing and operating ERH to maximize in situ dechlorination.

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