Evaluating the Effect of Salinity on In Situ Biological Reduction of a 1,2-DCA Plume

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Background/Objectives. High salinity is known to inhibit the growth of microbes responsible for reductive dechlorination of halogenated VOCs. However, the concentration and compositional aspects of salinity that inhibit reductive dechlorination is not well documented in the scientific literature.

ERM is performing a pilot study to evaluate the effectiveness of in situ biological reduction (ISBR) of 1,2-dichloroethane (1,2-DCA) under moderate salinity (brackish) groundwater conditions. The site is located in a coastal area with historical seawater intrusion occurrence.

The pilot study treatment zone consists of sand/gravel soil present between approximately 55 to 65 feet below ground surface (hereafter “deeper groundwater”). Subsurface volatile organic compound (VOC) impacts occurred due to a release at a former chemical manufacturing facility. Deeper groundwater is impacted with approximately 1,000 micrograms per liter (µg/L) 1,2-DCA and trace (i.e., less than 5 µg/L) ethylene dibromide, trichloroethene, and chloroform. Salinity related geochemistry indicate 10,000 milligrams per liter (mg/L) TDS, 5,300 mg/L chloride, and 550 mg/L sulfate.

ISBR was selected for pilot testing in deeper groundwater because it successfully remediated 1,2-DCA in shallow groundwater at this site. However, the shallow groundwater contained approximately one-fourth the salinity as the deeper groundwater, hence the need for the pilot study.

Approach/Activities. The pilot study consisted of installing one injection well and one monitoring well located 10 feet apart. 4,600 gallons of reagent fluid were injected into the injection well. Reagent consisted of emulsified lecithin substrate (ELS) (a carbon substrate), EHC-liquid (containing iron salts) and bioaugmentation inoculants. Inoculants included a low-pH tolerant strain of dehalococcoides (DHC; KB-1+) and a culture containing chloroform degrading microbes (MDB-1). The reagents were selected based on lessons learned from the successful shallow groundwater ISBR remediation findings.

Groundwater monitoring consists of pre-injection, 5 days post injection, and monthly performance monitoring for up to 1 year following injections.

Results/Lessons Learned. Results monitoring and data evaluation are ongoing. TOC was measured at a maximum concentration of 1,300 mg/L in the nearby monitoring well immediately after injecting, indicating adequate reagent loading and distribution. Eleven months after injections, 1,2-DCA declined by over 99 percent and chloroethane (a 1,2-DCA breakdown product) increased. Sulfate was reduced to non-detect, indicating ISBR-favorable sulfate-reducing conditions were achieved and remediation of 1,2-DCA would ensue. These results suggest reductive dechlorination of 1,2-DCA is occurring despite moderate salinity groundwater conditions. Microbial data suggest *Dehalobacter spp, Dehalogenimonas spp.,* and *Dehalobium chlorocoercia* microbial species are responsible for 1,2-DCA reduction rather than DHC. This

presentation will summarize the pilot study results to characterize the effect of salinity on 1,2-DCA reductive dechlorination.