

Installation of Four Permeable Reactive Zones for Enhanced Bioremediation and Field Changes to Mitigate Geologic Challenges

Trevor Hartwell (Brown & Caldwell, Rancho Cordova, CA)

Grant Geckeler (ISOTEC, San Diego, CA)

Tim Eilber (ISOTEC, Denver, CO)

Background/Objectives. From 1952 until 2009 multiple businesses used both petroleum hydrocarbons and chlorinated volatile organic compounds (VOCs) at a property in northern California, including dry cleaning facilities and a paper box manufacturing and printing facility that used a solvent parts wash tank and underground storage tanks (USTs).

Approach/Activities. In situ bioremediation was the selected approach to remediate PCE and TCE impacts in saturated soils and groundwater beneath the site and to control offsite migration. A concentrated, buffered, microemulsion of a controlled-release, food-grade carbon, nutrients, and iron was mixed onsite with a lecithin-based substrate to create an injectable solution to enhance anaerobic bioremediation. This injectate was injected into 66 temporary, direct push technology points across four separate permeable reactive zones (PRZs). The vertical zone targeted for injection was approximately 30 feet to 45 feet bgs.

Results/Lessons Learned. When performing injection hard pan silt layers at a depth of 23 to 25 ft bgs caused unexpected direct push refusal at many points. During the middle of the project, injections were paused for a hollow stem auger rig to be mobilized to advance boreholes through the hard pan refusal layer complete the injection points at the target depth interval. A total of 60,368 gallons of emulsified lecithin (2% ELS), 11,022 gallons of anaerobic water (prepared with KB-1® primer), and 21.5 liters of KB-1® Dehalococcoides culture was applied in first quarter of 2022. Groundwater monitoring performed six months and nine months after injection show sustained decreases in PCE and TCE concentrations in the injection area. As the contaminant plume migrates through each PRZ, further reductions of PCE and TCE in groundwater are expected, and further groundwater monitoring results at +9 and +12 months will be presented.