Performance-Based Remediation: Cost-to-Objective Achieved Utilizing In Situ Reductive Remediation of Chlorinated Solvents

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Background/Objectives. The owner of an industrial site engaged Groundwater & Environmental Services, Inc. (GES) in regards to the remediation of chlorinated solvents on their property. The property had a historic perchloroethylene (PCE)/trichloroethylene (TCE) plume from one or more undocumented releases. An air sparge (AS) and soil vapor extraction (SVE) system was utilized to remediate the site. However, there was rebound following the shutdown of the remedial system. The impacted area was approximately 1400 ft x 200 ft. The property owner wanted to utilize a remedial technology that would properly remediate the site completely and not exhibit a rebound in concentrations. GES suggested the combination of a limited soil removal and reductive dechlorination to remediate the site and offered to perform the work on fixed cost cost-to-objective performance-based contract.

Approach/Activities. GES first installed additional soil borings at the site to investigate the distribution and concentration of the chlorinated compounds associated with the site. Existing monitoring wells were evaluated for groundwater parameters such as pH, dissolved oxygen (DO), and oxygen reduction potential (ORP) to determine if the conditions in the subsurface were an aerobic or anaerobic. Groundwater samples were also collected to estimate the amount of naturally occurring microbes. Based on the results of the investigation, GES determined source soils remained onsite that were likely leaching to the groundwater. In addition, the subsurface environment was in an anaerobic state and there were sufficient naturally occurring microbes to remediate the impacts. GES then completed successful pilot testing to determine the radius of influence of the injection of a mixture of emulsified vegetable oil (EVO), zero valent Iron (ZVI) and water. The mixture would be utilized to reduce the ORP to a target of approximately -400 millivolts (mV) to assist the naturally occurring microbes to thrive and breakdown the chlorinated compounds. The source soils were removed from the site first. The area was then backfilled and capped with asphalt to match the existing surface. Next, 14 injection wells were installed across the impacted area to be utilized for the injection of the EVO, ZVI and water mixture. Over the course of four different injection events, 94 direct injection points were installed across the site to inject the EVO, ZVI and water mixture. A total of 681 gallon of ZVI and 5,750 gallons of EVO were injected at the site.

Results/Lessons Learned. The initial results revealed a quick reduction of TCE and an increase in dichloroethene (DCE). The TCE concentrations at the site at the start were as high as 44 milligrams per liter (mg/L) and after two injection events the highest concentration was 10 mg/L. Periodic groundwater performance monitoring allowed GES to design future injection events tailored to the observed residual concentrations. Overall, following 18 months of remediation, the remedial goals of the site were met and all soil and groundwater concentrations associated with the site were below State action levels. Additional rounds of groundwater monitoring were conducted to ensure there was no rebound, and the site received closure through the State Agency following the sampling events. The “no further action” was achieved for the budgeted cost-to-objective price.