Combined Remediation Technologies Pave the Way for the Rapid Redevelopment of a Legacy Brownfield Site

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Background/Objectives. The brownfield site development plan included an apartment complex and commercial buildings near a former industrial facility with groundwater impacted by chlorinated solvents discharged before 1970. Investigations to define the nature, extent, and general structure of the groundwater plume had been ongoing at the site since the 1980s and these identified a source area and a 1.5-acre downgradient plume. Legacy chemical oxidation and vapor extraction programs had marginal impact and before redevelopment could proceed, a faster and more complete remediation approach was needed.

Approach/Activities. The response plan included excavation and iron-enhanced bioremediation in the source area. To address the downgradient plume, passive flux meters (PFMs) were installed to delineate the prominent flux zones and magnitudes of groundwater and contaminant flux. The PFMs indicated that the average groundwater velocity was about 300 feet per year, roughly four times lower than that estimated using hydraulic characterization methods. Using this information, an optimized remediation approach was prepared to achieve a two-year remediation goal with the greatest economic efficiency. We used a multi-component competitive sorption model to determine the location and geometry of five permeable reactive barriers within the plume. These contained a mixture colloidal activated carbon to retard contaminant migration and sulfidated zero valent iron to promote destruction of the adsorbed contaminants.

Results/Lessons Learned. To monitor performance, paired wells were installed downgradient of each barrier. After approximately one-year post-injection, the remediation program met or exceeded the performance expectations predicted by the competitive sorption model. In the source area, CVOC concentrations were reduced by 98 percent, and greater than 95 percent CVOC reductions were achieved in the plume area. Significant concentrations of ethane, an abiotic degradation byproduct, were observed indicating complete degradation of the CVOCs had occurred with minimal daughter product formation. After about eighteen months, the site owner successfully petitioned the regional water quality control board to end plume monitoring and remove the performance monitoring wells so that the property redevelopment could proceed.