The Use of Innovative Characterization Technologies and Novel Amendment Injection Approaches at a Superfund Site

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Background/Objectives. The Commerce Street Plume Superfund Site in Williston, Vermont is contaminated with TCE and its reductive daughter products beneath a mixed-use area. The ROD-selected remedy for this site features in situ chemical oxidation for TCE concentrations greater than 50,000 mg/L, in situ bioremediation (ISB) where TCE is greater than 500 mg/L but less than 50,000 mg/L, and MNA where TCE is less than 500 mg/L.

Approach/Activities. The characterization program featured the membrane interface probe/hydraulic profiling tool (MiHPT) and Waterloo Advanced Profiling System (APS), vertically discrete soil/groundwater sampling, and onsite laboratory analysis. This intensive pre-RD characterization program was coupled with 3-D visualization to update the CSM in real time in order to guide subsequent portions of the investigation. This pre-Remedial Design characterization has provided a detailed understanding of site lithologies and hydraulic properties, the overall extent of contamination, and the architecture of the source area.

In addition, a field pilot program is underway to evaluate the best amendment injection strategy for the site and to assess overall ISB performance under field conditions. The ISB pilot program incorporates the use of shear thinning fluid (STF) into the ISB amendments. STFs are a low-cost material that is added to commercially available ISB amendments. They cause the viscosity of the injected amendment to decrease when it encounters lower permeability zones in the subsurface, thus enabling the amendment to more easily penetrate these layers, resulting in more uniform distribution.

Results/Lessons Learned. The characterization and subsequent 3-D visualization of the site lithologies, as derived from the hydraulic profiling tools, revealed that lower permeability silts are directly impacting contaminant transport in some areas of the site. This helped explain why TCE was not being detected at significant concentrations in areas of the site where the plume was thought to be migrating. In areas of the site where high concentrations remained, the hydraulic profiling revealed the presence of previously unidentified silt layers interbedded within the sand unit. Importantly, the characterization program showed that the 50,000 mg/L hotspot is no longer present. This implies that the entire ISCO remedy component is no longer needed, and that the entire site can be treated with ISB and MNA. Elimination of ISCO could represent up to a $3 million savings over the life-cycle of the remedy.

ISB pilot injections and initial monitoring events indicate injections using STFs were completed with relatively high flow rates and low pressures, similar to that of the non-STF ISB area. Preliminary monitoring suggests good electron donor distribution During this presentation, the updated CSM will be presented, and results from the ISB pilot injections and 6 months of monitoring will also be discussed.