Enhanced NAPL Recovery through Combined Surfactant and Hydrogen Peroxide Flushing

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Background/Objectives. Non-aqueous phase liquid (NAPL) is the source of groundwater and soil contamination at many sites and is a technically challenging problem to address in the subsurface. Conventional in situ chemical oxidation (ISCO) implementations are limited to aqueous phase reactions and are unable to address bulk NAPL plumes cost-effectively, typically requiring very large amounts of oxidant to meet cleanup goals. Pump-and-treat approaches for NAPL removal produce very gradual, continuous contaminant extraction and are designed to be in place for years. These systems tend to exhibit reduced effectiveness through time. This presentation will focus on simultaneous application of optimized surfactant blends and low doses of hydrogen peroxide to enhance NAPL removal using SEPR (surfactant enhanced product recovery) technology which greatly improves treatment economics and performance compared to traditional contaminant removal approaches. Surfactants used in the SEPR™ process lower interfacial tension and decrease the capillary forces, which keep NAPL sorbed to soil, resulting in mobility of the NAPL phase. Additionally, simultaneously injected hydrogen peroxide also loosens the NAPL and provides buoyancy, facilitating NAPL transport towards recovery wells. A SEPR alone treatment typically will suffice if the endpoint criteria is NAPL mass removal or NAPL removal to sheen and/or no measureable free product in the monitoring wells. A follow up S-ISCO® (surfactant enhanced in situ chemical oxidation) treatment is recommended when low soil and groundwater remediation criteria are required. Bulk NAPL removal in the preceding SEPR phase provides improved cost/performance of subsequent surfactant enhanced oxidation of the residual soil contamination.

Approach/Activities. Background on the use and benefits of surfactants in remediation will be presented, with field case studies demonstrating the significant advantages of surfactant use for in-situ remediation, particularly for heavy hydrocarbons and NAPL. Field results will cover the enhanced NAPL extraction and substantial contaminant mass reductions achieved using SEPR and S-ISCO technologies.

Results/Lessons Learned. Analysis of field data from a creosote site showed improvement of an existing pump and treat system by 100% to 1,250% at multiple wells following SEPR implementation. At a former wood treating site cleanup objectives were met for addressing creosote DNAPL impacts post SEPR/S-ISCO treatment. Additionally, at an MGP site mass reductions were achieved with a sequential SEPR/S-ISCO implementation where 100% of samples were below TPH C10-C14 criteria levels and 97% of samples reached TPH C15-C36 criteria levels.