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Lessons Learned from Injecting Liquid Activated Carbon Suspension

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Background/Objectives. Powdered activated carbon-based remediation technologies have been implemented for more than a decade. Recent advances have produced a smaller particle size carbon formulation that can be injected under less pressure and subsequently will distribute efficiently in the subsurface. Once injected, this formulation will settle onto the aquifer solids at a distance from the injection location and serve as a colloidal biomatrix where contaminants, key nutrients, electron acceptors, and microbes can be brought together for enhanced biodegradation to occur. The biodegradation frees the sorption sites on the carbon particles and the process begins again. This presentation will track the new carbon formulation from beta testing through a barrier pilot test and a full-scale gird at chlorinated VOC and petroleum hydrocarbon sites, respectively.

Approach/Activities. Beta testing of a new liquid activated carbon suspension occurred at three gas station sites in California. The purpose was to evaluate the distribution of the carbon amendment through visual observation, field parameter measurement and geochemical analysis. The tests also looked at injection characteristics of the formulation and distribution in the subsurface through soil core collection and observation. The lessons learned from the beta testing helped to shape a product suitable for commercial application. This presentation will also describe the field activities and results at: 1) an injection gird application around a single monitoring well impacted by BTEX at Pennsylvania gas station, and 2) a plume migration control barrier on the edge of a mixed chlorinated solvent plume at an industrial site in North Carolina.

Results/Lessons Learned. The beta testing established the value of preliminary soil core and water injection testing, now referred to as design verification testing (DVT), as critical to optimizing injection of this new carbon formulation. The testing included an extensive list of monitoring parameters that were refined to a shorter list best suited to future monitoring of the technology (TOC/DOC, turbidity, ORP, DO). Lastly, the testing helped identify the potential limitations of the technology in terms of a BTEX/TPH threshold.

At the Pennsylvania gas station, significant challenges related to geology and infrastructure were encountered. Despite those issues, rapid sorption of BTEX was observed and an aerobic biological condition established through the co-addition of an oxygen release compound. The site is on a path to regulatory closure.

At the North Carolina industrial site, the sorption characteristics of the various chlorinated solvents in groundwater were better understood at the end of the pilot test. An electron donor (an engineered hydrogen release compound) was added to enhance biodegradation and results obtained demonstrated a strong anaerobic condition. The results of the pilot test informed the full scale design of a series of barriers, which is currently in progress.