KEYNOTE ADDRESS

DIAGNOSTIC TOOLS FOR PERFORMANCE EVALUATION OF IN-SITU TECHNOLOGIES: IMPLEMENTATION, PERFORMANCE, AND COSTS

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The performance of remediation systems at chlorinated solvent contaminated sites has been historically evaluated using point measurements of dissolved contaminant concentrations in aquifers (e.g., changes in maximum concentrations, plume extent, etc.). Such an approach has significant limitations that may greatly impact the evaluation of technology effectiveness at contaminated sites. First, detailed monitoring conducted of contaminant plumes in granular geologic media has shown that the distribution of dissolved contaminants is often spatially complex due to several factors including spatial variability of contaminant distribution in the subsurface source zone, variability of groundwater flow rate and direction, and variation in water level. This means that it may often be difficult to impossible for typical groundwater monitoring efforts, especially those relying on sparse networks of long-screened wells, to determine where the majority of the contaminant mass is migrating and therefore whether remediation systems are effective in reducing contaminant migration. Second, at sites with complex geologies such as fractured rock sites, the evaluation of in-situ technology performance is even more complicated by contaminant migration through discrete fractures.

To better evaluate the success of in-situ remedial systems at chlorinated solvent contaminated sites, a set of diagnostic tools was used at three hydrogeologically distinct sites employing in-situ chemical and biological treatment technologies over the past several years. These diagnostic tools include technology- and geology-specific tools, as well as those that can be used widely irrespective of the type of technology or site conditions. Mass flux measurement was used as a technology-wide metric of overall system performance since it has the potential to clearly demonstrate a reduction in the rate of contaminant mass release from the treated zone. Innovative technology-specific tools (e.g., molecular tools for in-situ bioremediation) and geology-specific tools (e.g., rock crushing at fractured bedrock sites) were tested for a real-time diagnosis of remedial technology success. Technology- and geology-specific tools evaluated in this study included rock core sampling, isotopic fractionation, molecular tools and integrated conventional techniques. This presentation will summarize the findings of ESTCP project ER-0318 and will detail the performance and cost of four sets of diagnostic tools: (1) depth discrete sampling, (2) mass flux measurement tools, (3) stable carbon isotope sampling, and (4) molecular tools.