Treatability Study Results for In Situ Treatment of Chlorinated Solvents at a Formerly Used Defense Site

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Background/Objectives. The remedial investigation of an undisclosed formerly used defense site that is being managed by DoD determined the existence of chlorinated solvent (primarily TCE) contamination in groundwater in a weathered limestone aquifer unit. A site-specific treatability study using in situ reductive dechlorination technology was planned and conducted at the site. The objective for this treatability study is to assist with the development of alternatives and support decision-making in the upcoming Feasibility Study for this site. The in-situ treatability study injections occurred in 2021, with post-injection monitoring rounds completed in 2021 and 2022.

Approach/Activities. A single injection event was conducted at two separate locations at the site. Each of these locations consisted of two adjacent existing monitoring wells, arranged as a nested pair, one with screen in the upper portion of the limestone aquifer and the other with screen in the lower portion of the limestone aquifer unit. TCE has historically been detected in each of these wells at relatively low levels (single digit to low 100s µg/L). The intent of the treatability study was to inject amendment into the Upper Bern formation using newly installed injection wells located immediately up gradient of the historic well, and then to monitor groundwater parameters in the target (existing) monitoring well, along with several monitoring wells installed immediately downgradient of the target well. For one of these sites, emulsified vegetable oil (EVO) and DHC bacteria were injected, while at the second site, EVO, DHC, and zero-valent iron (ZVI) were injected. Several pre-injection sampling events were conducted to determine groundwater flow direction in the immediate vicinity of each treatability area, as well as to provide baseline contaminant and groundwater quality data at the site.

Results/Lessons Learned. The efficacy of amendment injections has been assessed to date using data from three post-injection monitoring events. These events occurred at the intervals of six week, three months, and six months post-injection. At both study sites, TCE daughter products have been detected alongside one to two order of magnitude reductions in the parent contaminant TCE. Additionally, the groundwater parameters of total organic carbon, dissolved oxygen, oxidation-reduction potential and alternative electron acceptors sulfate and nitrate responded in the direction expected for a reductive dechlorination in situ treatment. There were no sampling parameters included in this study that could be used to assess relative contribution of ZVI versus EVO to chlorinated solvent degradation at the second treatability study site. Additionally, determination of differential contribution is confounded by the in situ (open system) nature of this study, as opposed to more highly controlled laboratory study.