Groundwater Recovery to Natural Biodegradation: Demonstrating a Better Remedial Approach to Closure

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Overview. In a portion of a refinery site located in the Upper Midwest, groundwater has been historically impacted with free product and dissolved phase pentachlorophenol (PCP). A groundwater recovery system, placed in operation in 1996, was designed to provide hydraulic control and prevent PCP migration. Beginning in 2015, a review of existing data indicated that the groundwater recovery system was exacerbating dissolved phase PCP concentrations and subsurface conditions were conducive to natural biodegradation process which would effectively mitigate the downgradient PCP concentrations. To demonstrate that natural biodegradation was capable of mitigating the dissolved phase PCP impacts, the groundwater recovery system was shut down and an enhanced groundwater monitoring program was implemented over the past two years (including natural attenuation / microbial parameters) to collect further data. The resulting lines of evidence and plume stability evaluations (over a 2 year period) have demonstrated that natural attenuation, through a variety of mechanism induced through variable geochemical conditions, has positioned the site for No Further Action.

Background/Objectives. The area of interest is a former wood treating formulation facility (1961-1984) in a small portion of the refinery. Starting in 1996, implemented corrective measures were performed to remove PCP impacted soil and groundwater from beneath the site, and a groundwater and free product collection system was installed and began operation. Remedial efforts continue through until April 2015 via groundwater containment and free product recovery systems, until monitoring results indicated that the systems may not be the best approach for addressing PCP impacts. Additional monitoring and data evaluation was subsequently completed to support the cessation of pumping and the implementation of natural biodegradation in this area of the site.

Approach/Activities. Leading up to and following the shutdown of the groundwater recovery system (in April 2015), enhanced groundwater monitoring was implemented to collect additional natural attenuation, microbial, and other lines of evidence data. Additionally, plume stability and mass flux evaluations were completed to provide further support for natural biodegradation. Two years of data have been collected which has consistently supported the natural attenuation, and currently a limited source area reduction remedy, using in-situ carbon adsorption, is being designed for possible implementation to further enhance conditions to support no further action. To date, all of the supplemental data have supported the alternative approach to the groundwater recovery system with respect to mitigating the impacts to potential receptors downgradient of the site.

Results/Lessons Learned. Through two years of quarterly data, the enhanced data collection demonstrated that natural biodegradation processes are active in the subsurface, and have been facilitated through a variety of mechanisms. Groundwater analytical data downgradient of the source area, following the shutdown of the recovery system, showed dramatic decreases in concentration. Results from both the plume stability and mass flux evaluations indicate that the shutdown of the recovery system has been beneficial, which is primarily attributable to being able to exploit subsurface geochemical conditions to enhance biodegradation. The various lines of evidence evaluations will presented, along with the preliminary design of the source area mass reduction remedy. The source area remedy is likely to be installed in late 2017 to early 2018 and these data will be available for presentation.