Bioaugmentation to Increase Reduction of Residual VC

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Background/Objectives. Jacobs has conducted two innovative pilot studies to evaluate the effectiveness of bioaugmentation to enhance the current remedy and increase reduction of residual vinyl chloride (VC) at a military facility in North Carolina.

At the first site, an AS system operated from October 2010 to March 2012 until milestones for system shutdown were met and MNA was initiated. VC concentrations decreased during AS operation but increased after the AS was shut down and in 2018 and continue to exceed cleanup levels with a maximum concentration of 110 micrograms per liter.

At the second site, a solar-powered 625 square foot subgrade biogeochemical reactor (SBGR) pilot study was implemented in 2015 to accelerate modest natural attenuation rates. Downgradient of the SBGR, concentrations of 1,1,2,2-tetrachloroethane, trichloroethene, and cis-1,2-dichloroethene decreased while VC concentrations increased between May 2015 and June 2016. During the same time, and without outside bioaugmentation, Dehalococcoides increased from 254 cells per milliliter (cells/mL) to 1,550 cells/mL and VC R-Dase increased from below detection limits to 83.2 cells/mL.

Approach/Activities. At the first site, in-well bio-traps were used to evaluate the use of biostimulation, bioaugmentation, or both to stimulate reduction of residual VC. Based on the bio-trap results, bioaugmentation was selected as it promoted VC reduction without having to biostimulate. Injection of a bioaugmentation culture will be conducted via permanent injection wells spaced on 20-foot centers in two areas of highest concentrations. Approximately 2.7 L of bioaugmentation culture will be injected into each injection well and followed by anaerobic chase water to facilitate distribution in the formation. Results will be monitored during three quarterly post-injection groundwater sampling events.

At the second site, a bioaugmentation culture and supplemental liquid substrate will be added to the SBGR and recirculated via existing distribution piping. Operation of the solar powered SBGR will continue and results will be monitored during three quarterly post-injection groundwater sampling events.

Results/Lessons Learned. Implementation of these studies are planned for Fall 2018. It is anticipated that the results of the implementation and up to two rounds of performance monitoring will be available at the time of the presentation. For the first site, this platform will discuss the use of bio-traps to evaluate the need for substrate injections, present analytical results and trends, and outline the cost savings and sustainability implications of being able to avoid biostimulation. For the second site, this platform will present how existing SBGR infrastructure can be used to distribute bioaugmentation culture and additional substrate, and will evaluate analytical results, trends, and lessons learned.