Targeted Application of Conventional and Slow-Release ISCO to Eliminate Residual TCE in Groundwater at the Aquifer-Confining Unit Boundary

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Background/Objectives. Despite multiple efforts to completely remove trichloroethylene (TCE) from groundwater in the source area at a former waste-water treatment plant located at Naval Air Station Pensacola, Florida (NAS Pensacola), concentrations of TCE greater than 1,000 micrograms per liter (µg/L) continue to persist. Previously collected membrane interface probe (MIP) data and the sampling of monitoring wells installed in 2016 indicate the residual TCE is located in a narrow zone between 40- to 50-feet below land surface at the base of the sandy aquifer, which is underlain by a thick confining unit of silty clay. TCE trapped in the silty clay re-enters the sandy aquifer by back-diffusion and by the advection of clean groundwater from the confined aquifer upwards through the silty clay. To meet State and Federally mandated remediation goals at the site, the residual TCE at depth will be targeted for elimination by a combination of conventional and slow-release ISCO approaches.

Approach/Activities. Bench-scale total oxidant demand (TOD) tests were performed on cores of aquifer and confining unit sediments collected in 2017 from the 40- to 50-ft depth interval in the residual source area. The cores were collected in liners advanced using a Geoprobe. In general, TOD was less than 10 grams per kilogram (g/kg) in the sandy aquifer, and greater than 10 g/kg in the silty clay. The current approach to eliminate residual TCE will be to inject permanganate into the sandy aquifer and use a combination of injected and slow-release permanganate in the silty clay confining unit. In order to cost effectively determine the zone of influence of the added permanganate, borehole and surface EM measurements will be used before, during, and following ISCO. During the summer of 2017, EM measurements were conducted to document ambient, pre-ISCO conditions.

Results/Lessons Learned. Residual TCE was located in discrete zones at the base of a sandy aquifer. TCE also had entered, however, the underlying confining unit, as the clay contains silt. The collection of cores from the confining unit confirmed the presence of these silty layers within the clay, and also revealed that the silty layers where characterized by higher water content than the surrounding clay. The difference in water content (and, hence, capacity to contain residual TCE), occurred over a distance of less than 1 inch. The borehole EM measurements provided an additional line of evidence of the location of the aquifer-confining unit boundary. This highly discretized stratigraphic data will be synthesized to target for ISCO those areas of the aquifer and aquifer-confining unit boundary that harbor residual TCE.