CASE STUDY

LARGE TCE PLUME WITH EXTENSIVE DNAPL

RPI GROUP

ABSTRACT

High density sampling program was key to remediation of soil and groundwater impacted by TCE DNAPL at a former industrial site underlain by river deposits and sedimentary bedrock.

CHALLENGES

Impacted alluvium consisted of poorly sorted, fine to coarse grained sand. The source area was underlain by an aquitard of silt and clayey silt where dense non-aqueous phase liquid (DNAPL) pooled at the interface. Impacts did not extend into the underlying claystone bedrock. Solute transport was dictated by physical properties of the DNAPL and by aquifer characteristics such as heterogeneity, anisotropy, variance in matrix density, grain size in the alluvial sands, and gradient. Subtle facies changes resulted in solute concentrations that varied by orders-of-magnitude in distances of only several millimeters.

APPROACH

The high-resolution program consisted of analyzing 1,291 soil samples from 186 borings and 5,515 groundwater (GW) samples from 1,349 monitoring wells (MWs). **Most of the 1,349 MWs were installed post injection. Groundwater and soil samples were analyzed at the RPI Quality Assurance Laboratory at no cost.** Wells were screened across up to five discrete intervals to map solute distributed within the saturated zone of the shallow unconfined aquifer. The data were used to calculate mass flux and mass discharge to develop a high density conceptual site model, evaluate source and plume strength, and calculate injectate loadings. Detailed lithologic logs and sample results were plotted on transect cross-sections to select specific injection target depths. Included in the high-resolution program were performance/confirmatory borings completed to verify reagent distribution within targeted zones.

SOLUTION | BOS 100®

Aqueous Trap & Treat® BOS 100® slurry was injected using an assortment of specialized injection tips with a high-pressure, high-flow-rate pump. Injection durations ranged from 10 to 15 seconds. Injectate exited the tips at velocities that ranged from 197 to over 320 feet per second and was directed at select locations with precision. Groundwater samples were collected frequently before, during, and after slurry injections to monitor remedy performance. Mass discharge was periodically calculated along selected transects to monitor mass reduction, i.e., diminished plume strength over time and to ensure that zero mass flux was maintained at the property boundary.

RESULTS

The DNAPL portion of the plume was reduced from percent-level concentrations (up to 54,770 mg/kg trichloroethylene [TCE] in soil and 1,280 mg/L TCE in groundwater) to closure levels. The dissolved phase plume was also mitigated and site-closure monitoring began in 2011. For more information please see the paper published in the 2012 Battelle Monterey, CA conference proceedings.

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