Case Study on Amendment Delivery Methodology for Permeable Reactive Barrier (PRB) Installation in a Challenging Lithology at Shaw AFB, Sumter, South Carolina

Derek Pizarro (dpizarro@astenv.com) and Gary Simpson (gsimpson@astenv.com) (AST Environmental, Inc., Midway, KY)
Douglas Christensen, PE (dchristensen@spectrum-inc.net) and Sri Palakur (spalakur@spectrum-inc.net) (Spectrum Services Group, Inc.)
Jean Chytil, PG (Jean.M.Chytil@usace.army.mil) (USACE-Omaha District)

Background/Objectives. Shaw AFB is a 3,570-acre U.S. DoD facility located near Sumter, South Carolina, active since August 30, 1941. Historical investigations on the western portion of the base identified PCE and TCE contamination in the Upper Black Creek (UBC) Aquifer. A former dry-cleaning facility located on base that operated from c.1955-1968 was the likely source. On-base source remediation utilized peroxone injections in the shallow aquifer and a large full-scale groundwater pump and treat system for the Black Creek Aquifers. Off-Base private properties have been impacted by a low concentration PCE and TCE (up to 50 µg/L) solute plume.

The objective of the project was to install an activated carbon-based amendment (ACBA) PRB at an off-base location within the UBC aquifer in support of the ongoing remedy to reduce PCE and TCE concentrations to below maximum concentration limits (MCLs). This work was completed in Spring 2019.

Approach/Activities. The remedial activities included: a) PRB geometry refinement to finalize both the vertical interval and total length, b) installation of the BOS 100® (selected ACBA) PRB using a unique delivery methodology given the depth of installation, complex lithology, and slurry amendment, and c) post-injection performance monitoring.

The presentation will focus on the unique subsurface delivery methodology. The 650-foot long PRB consisted of the installation 60,000 lbs of ACBA into 130 temporary injection points, each point was oriented in three rows and constructed using a combination of roto-sonic and direct push techniques. Roto-sonic was utilized to pre-drill each injection point to the targeted completion depth (~170 feet), the sonic tooling was extracted, and the vacated borehole was backfilled with a combination of bentonite pellets and 25 to 30% grout as the tooling was removed to prevent bridging. The multiple formations required temporary isolation casings to prevent cross contamination.

Results/Lessons Learned. Distribution of the ACBA was confirmed by small amounts of water and/or amendment slurry surfacing from adjacent points within the PRB and transducer data from downgradient monitoring wells. Active distribution monitoring could have been improved by installing wells within the PRB, but due to budget constraints it was not possible. The injection productivity exceeded that of the pre-drill by ~20% even with two roto-sonic rigs compared to one direct push rig. Injection shot volumes and exit velocities were adjusted based on lithology logs from 10% of the injection points from the Saw Dust Landing formation to the 100-foot clay. Finally, it was determined during the plume refinement effort that the bottom 20 feet of each injection point should be logged to verify the 100-foot clay aquitard would not be penetrated during the injection effort.