

Impact of High-Resolution Characterization during Baseline Sampling at Contractors Road Heavy Equipment Area, Kennedy Space Center, Florida

Anne Chrest (anne.m.chrest@nasa.gov) (NASA, Kennedy Space Center, FL, USA)
Rebecca Daprato, Ph.D., P.E. and **Mike Burcham**, E.I.T. (Geosyntec Consultants, Houston, TX, USA)
Jill Johnson, P.G. (Geosyntec Consultants, Pensacola, FL, USA)

Background/Objectives. The National Aeronautics and Space Administration (NASA), Kennedy Space Center (KSC), has adopted high-resolution site characterization (HRSC) sampling techniques during baseline sampling prior to implementation of remedies to confirm and refine the conceptual site model (CSM). Based on implementation of this approach at other sites, NASA has learned that the CSM can change between initial site characterization and the remedial implementation, since there can be several years between these phases. HRSC sampling was performed at Contractors Road Heavy Equipment Area (CRHE) prior to bioremediation implementation to verify the extent of the trichloroethene (TCE) dense non-aqueous phase liquid (DNAPL) source area (defined as the area with TCE above 1% solubility) and its daughter product dissolved plume. The results of high-resolution pre-bioremediation implementation sampling suggested that the TCE source area was larger than originally identified during initial site characterization activities. The identification of the larger TCE source area led to a design refinement that will provide for improved electron donor distribution and an increased likelihood of achieving remedial objectives.

Approach/Activities. HRSC was conducted from 2009 through 2014 to delineate the vertical and horizontal extent of chlorinated volatile organic compounds (CVOCs) in the groundwater. Approximately 2,340 samples were collected from 363 locations using direct push technology (DPT) groundwater sampling techniques. Samples were collected from up to 14 depth intervals at each location using a 4-foot sampling screen. This HRSC approach identified an approximately 3,000 square foot TCE DNAPL source area (maximum detected TCE concentration of 160,000 micrograms per liter [$\mu\text{g/L}$] at DPT0225) within an overall 14-acre vinyl chloride dissolved groundwater plume. The source area is narrow (ranging from ~5 to 40 feet wide) and samples collected from a monitoring well approximately 45 feet to the north of the source area have low level vinyl chloride concentrations, illustrating the strong concentration gradient present in the source area.

Prior to implementation of a bioremediation interim measure, HRSC baseline sampling was conducted. Concentrations of TCE were an order of magnitude lower than previously reported (12,000 $\mu\text{g/L}$ maximum at DPT0225) at locations sampled adjacent to previous sampling locations. To further evaluate the variability in concentrations observed, additional sampling was conducted in 2016. The sampling results from 2016 identified higher concentrations than originally detected within the previously defined source area and the presence of source zone concentrations to the northeast of the previously defined source area (maximum concentration observed 570,000 $\mu\text{g/L}$). The newer data reiterated how complex DNAPL sites can be and the importance of using HRSC techniques to develop a refined CSM with a high level of certainty.

Results/Lessons Learned. This project demonstrated that, due to the complexity of DNAPL source zones, HRSC during pre-implementation baseline sampling in the CRHE TCE source zone was an essential strategy for verifying the treatment area and depth prior to remedy implementation.