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Finding TCE in All the Wrong Places: Using Multiple Lines of Evidence to Characterize Contamination in a Glacial Till

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Background/Objectives. Groundwater and soil contaminated with petroleum compounds and chlorinated solvents, including benzene, trichloroethene (TCE) and degradation products, have been studied at a former jet engine shop at the former Grissom Air Force Base for two decades. Historic site characterization and monitoring have documented four discrete groundwater plumes within a shallow aquifer bearing glacial till down to 30 feet below ground surface (bgs). A removal action performed in 2005 removed 859 tons of contaminated soil; however, the excavation was limited to the vadose zone soils and post-removal confirmation sampling identified residual TCE and benzene above regulatory limits in the excavation sidewall and floor, respectively. The 2005 soil removal area coincided with the upgradient extent of the largest historic groundwater plume, but historic soil and groundwater sampling has not documented conclusive source areas for the other three groundwater plumes. To refine the conceptual site model (CSM) and optimize the remedial design (RD) for the site, a multiple line of evidence site characterization program was developed with a Triad approach decision-making framework.

Approach/Activities. Traditional and high resolution site characterization (HRSC) programs were executed in June 2016 including: 1) baseline groundwater monitoring across the existing monitoring well network using fixed-laboratory analyses of volatile organic compounds (VOCs); 2) real-time hydraulic profiling using the GeoProbe® Direct Image® Hydraulic Profiling Tool (HPT); 3) continuous soil core sampling via Direct Push Technology (DPT); 4) discrete-depth groundwater sampling via DPT; and 5) onsite laboratory analysis of groundwater and soil samples for VOCs using Direct Sampling Ion Trap Mass Spectrometry (DSITMS). Over the course of eleven days, over 120 DPT advancements were performed, including: 44 HPT profiles advanced to depths between 20 and 30 feet bgs; 61 DPT advancements for groundwater sampling; and 19 DPT advancements for soil sampling. Target intervals for groundwater sampling were based on elevated hydraulically conductive zones estimated using the HPT. Soil sampling targeted zones with lower estimated hydraulic conductivities where residual source mass and/or back-diffusion may exist.

Results/Lessons Learned. Results from the traditional and HRSC programs will be shown along with comparisons of the respective datasets. Lessons learned from the challenging soil and groundwater sampling programs will be discussed. Additionally, the revised CSM and optimized RD will be presented.