Applying High-Resolution Site Characterization to Assess Transport Pathways and Update Conceptual Site Model at HAFB Superfund Site

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Background/Objectives. Operable Unit 2 at the Hill Air Force Base (HAFB) Superfund Site consists of an approximately 20-acre chlorinated solvent groundwater plume originating from an upgradient dense nonaqueous phase liquid (DNAPL) source area; the primary contaminant of concern is TCE. As understood by the current conceptual site model (CSM), the source area contamination is generally contained in sands and gravels within a narrow buried paleochannel incised into an underlying low-permeability clay unit that prevents downward contaminant migration. A vertical containment wall encircling the source area and an associated source recovery well extraction field were constructed in 1996 as a remedy to control groundwater flow into and out of the source area, control the groundwater elevation within the source area, and recover DNAPL. The extraction system has since recovered much of the pooled DNAPL; however, DNAPL remains in isolated areas within the paleochannel and continues to source the TCE groundwater plume that generally flows northeast. Long-term plume monitoring has indicated that the higher concentration portion of the TCE plume (i.e., 1,000 to 10,000 µg/L) is expanding from the source containment area to the east and southeast, through the subject site investigation area. Contaminant migration pathways and transport mechanisms through the containment area and the low-permeability clay unit are not supported by the current CSM.

Approach/Activities. High-resolution investigation activities included completing 20 membrane interface probe-hydraulic profiling tool (MIP-HPT) points along a transect downgradient of the source area and perpendicular to groundwater flow. The MIP-HPT points were advanced to just beneath the clay unit interface (observed at depths from 20 to 30 feet below ground surface [bgs]) or deeper (to 52 feet bgs) to collect detailed vertical contamination profiles and formation hydraulics to identify localized migration pathways. The MIP-HPT investigation collected photoionization detector (PID), flame ionization detector (FID), halogen specific detector (XSD), electrical conductivity (EC), and hydraulic profiling data and was completed in August 2022. Based on the results of the MIP-HPT investigation, two locations along the transect were selected for direct push technology (DPT) borings for soil sample collection (completed in October 2022) and placement of permanent monitoring wells. The DPT borings were field PID screened and logged to 50 feet bgs for comparison to the MIP-HPT data and will be used to further characterize the clay unit lithology and site hydrogeology. The monitoring wells were installed last winter.

Results/Lessons Learned. Results from the MIP-HPT investigation and the DPT soil samples were submitted for laboratory analysis and integrated into the existing site data set. Preliminary findings suggest that localized contaminant migration pathways are present within sand lenses within and, in some cases, over the top of the low-permeability clay unit. The presentation includes technical findings from this investigation and how they were used to update the existing CSM. The hydrogeologic data will ultimately be used to generate an updated 3-D model of the site, revising the current contaminant fate and transport models, to assist in future remedy evaluations.