

EXECUTIVE SUMMARY

The United States Air Force is conducting a Dense Nonaqueous Phase Liquid (DNAPL) Source Delineation Project at Operable Unit 2 (OU2), Hill Air Force Base (AFB) in Utah. The focus of this project is the use of partitioning interwell tracer tests (PITTs) to determine the volume and extent of DNAPL contamination in a shallow alluvial aquifer at OU2. This Addendum acts as a supplement to the DNAPL Phase I Site Characterization Activities Report (USAF 1998a) and summarizes the information obtained from field work conducted during the additional characterization activities north of the containment wall at OU2. ✓

OU2, located on the northeastern boundary of Hill AFB in Utah, was used from 1967 to 1975 to dispose of unknown quantities of chlorinated organic solvents from degreasing operations (at least 30,000 gallons, perhaps 60,000 gallons). These DNAPLs, primarily trichloroethene (TCE), were placed into at least two unlined disposal trenches underlain by an alluvial aquifer. This shallow unconfined aquifer is composed of a heterogeneous mixture of sand and gravel and is contained in a buried paleochannel eroded into thick clay deposits. A large volume of DNAPL remains in the subsurface, predominantly as an immobile or "residual" phase retained as ganglia by capillary forces in the aquifer's pore spaces. The DNAPL exists also as a mobile phase pooled in topographic lows on the surface of the clay aquiclude. ✓

Site characterization studies conducted during Phase I of the DNAPL Source Delineation Project defined a buried paleochannel incised into the surface of thick clay deposits known as the Alpine Formation in the main DNAPL source zone area of OU2. These structural lows are interpreted to be a stream channel left behind on a remnant of an ancient flood plain. The majority of the original Phase I effort was directed at delineating the extent of the channel in the main OU2 source zone inside the containment wall. This containment wall was installed around the apparent DNAPL source zone at OU2 in the spring of 1997.

The primary objective of the additional DNAPL source zone characterization activities was the delineation of the buried paleochannel and the associated pool of DNAPL outside the containment wall in the northern portion of the site. Another objective for the additional characterization activities was to collect and analyze soil samples from the north pool area for preliminary indications as to the aerial extent of DNAPLs in the buried paleochannel. The data acquired from these additional field activities and presented in this Addendum form the basis of the geosystem model to be used during any subsequent characterization and remediation efforts outside of the containment wall.

The additional characterization activities northeast of the containment wall included:

- Establishing an orthogonal grid across the northern end of the site to provide a reference framework in Utah State Plane Coordinates for the tasks that followed
- Conducting a ground-penetrating radar (GPR) survey designed primarily to delineate the location and width of the buried channel
- Conducting a cone penetrometer test (CPT) survey to provide stratigraphic information on the alluvium in the buried channel
- Advancing 12 soil borings to provide soil samples for analysis, and to calibrate the CPT data to soil types encountered in the alluvium
- Completing a final horizontal and vertical survey of each CPT and boring location.

Over 2,320 linear feet of GPR data were acquired during the GPR survey, which focused on the uncharacterized northern portions of OU2 outside the containment wall. The geometry of the buried channel extends just beyond the northeast corner of the containment wall and trends northeast to southwest. The channel abruptly ends just north of the northern pool area. The termination of the paleochannel is interpreted to be the result of a landslide that translated the channel downslope, leaving a section of the Alpine clay from a higher elevation in its place. A total of 54 locations (approximately 1,615 linear feet) were investigated with CPT direct push technology. Upon completion of the CPT survey, 12 confirmation soil borings were drilled and sampled in the area under investigation.

During the additional site investigation activities, a pool of DNAPL was confirmed to be present outside and northeast of the containment wall, centered around BH-12. DNAPL saturations (the percentage of pore space occupied by DNAPL) calculated with NAPLANAL from volatile organic compound (VOC) analysis of samples collected during the additional characterization activities range from zero percent in areas outside the north pool to 15 percent in the north DNAPL pool. The pool is approximately 80 feet long and 20 to 25 feet wide and is estimated to contain between 4,250 and 5,440 gallons of DNAPL. Samples from the alluvium analyzed for total organic carbon (TOC) yield a fractional organic carbon (f_{oc}) value of less than 0.002 milligrams per milligram (mg/mg). In addition to the TOC analyses, a mineralogical analysis using X-ray diffraction conducted on samples from the alluvium shows that quartz makes up 77 percent to 85 percent of the mass, with the remainder being feldspar, calcite, illite, and dolomite. Eight samples were also collected from different stratigraphic horizons for grain size analysis.

During the investigation, a local low in the clay aquiclude was delineated to the east of the DNAPL pool. Although not a migration pathway for DNAPL, this feature acts as an outlet for VOC-contaminated groundwater to flow from the DNAPL zone off base and down slope to the east.