EXECUTIVE SUMMARY

A pre-design data study was conducted in the Fall of 1994 at Operable Unit 1, Hill Air Force Base (Hill AFB), Utah. The purpose of the study was to evaluate the performance of the existing containment system located on the eastern portion of the site and to evaluate additional containment alternatives needed on the western portion of the site. The primary goals of containment are to minimize migration of light non-aqueous phase liquids (LNAPL) and off-base migration of dissolved ground-water contamination, thereby reducing the potential for human exposure posed by the site.

Operable Unit 1 is located on the northeastern border of Hill AFB, and it consists of Landfills (LFs) 3 and 4, Chemical Disposal Pits (CDPs) 1 and 2, Fire Training Areas (FTAs) 1 and 2, the Waste Phenol/Oil Pit (WPOP), and the Waste Oil Storage Tank (WOST). Disposal activities at OU 1 began in 1940 and continued until 1975. Materials disposed or burned at the various areas include waste solvents, industrial sludges, residues from solvent cleaning operations, domestic refuse, sulfuric and chromic acid, methyl ethyl ketone, jet fuel, and waste oil.

The ground-water containment system currently consists of four ground-water extraction wells on the eastern boundary of LF 4, two ground-water extraction wells near the CDPs, one extraction well to the west of LF 4, and a 1,500-foot long extraction trench with two sumps that extends east from FTA 2 to the perimeter road. The system also includes three pumping stations that collect water from hillside springs. Discharge piping connects the extraction well network, and the effluent is pumped to a 250,000 gallon holding tank at the Hill AFB industrial waste treatment plant (IWTP) where the water is treated and disposed.

The evaluation of the performance of the existing containment system is based on data obtained from historical records review, well video surveys, ground-water measurements and potentiometric maps, aquifer tests, a baseline ground-water model simulation, and a ground-water model simulation that represents potential optimization of the existing containment system. The evaluation of all available data suggests that the system could be operated more effectively by improving the current system operation. However, system improvements alone will not achieve ground water capture on the east side of on-Base OU 1 because the current spacing between extraction wells is too great to achieve capture. The ground-water model showed that when the existing system is optimized, the extraction trench can achieve capture on the north side of LFs 3 and 4, but the extraction wells on the east side of LF 4 can not achieve capture.

Recommendations for improving the performance of the existing ground-water containment system at OU 1 consist of implementing operational changes, adding sumps/wells, and reconditioning the existing wells. The improvements range from simple water level probe adjustments to more complex and costly methods such as well reconditioning and performance testing. The greatest improvement to ground-water capture would result from implementing the most complex solutions. The recommended upgrades to the system are listed below.

- Evaluate the nature and cause of the well fouling (i.e., chemical or biotic precipitation)

- Identify reconditioning methods to mitigate the fouling problems

- Redevelop and recondition the wells periodically to maintain well performance

- Optimize the sustainable pumping rate and maximize the capture zone of each well by repositioning the probes that control the extraction well pumps and the sump pumps

- Periodically calibrate the flow meters to ensure that the discharge data are accurate

- Add flow control valves to the well discharge lines to keep the pipes full of fluid, which will allow the flow meters to operate more accurately

- Add run-time meters to monitor the proportion of time the pumps operate

- Assess flow meter and run-time meter data on a monthly basis to identify adjustments that will keep the system operating as effectively as possible, which will maximize the capture zones and decrease wear on the pumps

- Stop pumping from U1-208 and U1-209 because ground-water sampling shows no contaminants occur in these areas

- No recommendations for upgrading extraction wells U1-201 and U1-202 are made at this time. Recommendations will be provided based on the selected west-side containment alternative resulting from the EE/CA.

- Expand the containment system using one of four identified alternatives, which will be evaluated in an EE/CA.

Based on the conceptual hydrogeologic model and available technologies, various containment alternatives were developed to minimize off-Base migration of contaminants. Four containment alternatives were developed for the east side of LF 4 and six containment alternatives were developed for a western extension to the existing system. The four containment alternatives under consideration for the east side of on-Base OU 1, which are listed below, will be further evaluated by an engineering evaluation/cost analysis (EE/CA).

- **Alternative 1**: Install additional extraction wells on the east side of LF 4 between the east end of the existing extraction trench and U1-207. One or two wells may also be needed southeast of U1-207 to achieve capture. The estimated number of additional extraction wells needed is ten.

- **Alternative 2:** Construct a 1400-foot long extraction trench from the east end of the existing extraction trench to 200 feet southeast of U1-207. This alternative would include abandoning the existing extraction wells U1-205 through U1-209.

- **Alternative 3:** Construct a 1400-foot long slurry wall from the eastern end of the extraction trench, following the outside of the perimeter road to 200 feet southeast of U1-207. The existing extraction wells and one additional well would be used as gradient control wells for the wall.

- **Alternative 4:** Construct a 1400-foot long sheet-pile wall along the same transect as the slurry wall in Alternative 3. The existing extraction wells and one additional well would also be used as gradient control in this alternative.

The six alternatives for the west side of on-Base OU 1 listed below were screened to narrow the selection for further evaluation by the EE/CA. These alternatives were screened by simulating each containment scenario with the ground-water model and comparing the effectiveness of each. Additionally, potential slope stability effects from each containment alternative, general implementability aspects, and crude costs were evaluated for each alternative to assist the selection process. The slope stability impacts were evaluated for each containment alternative developed. The six alternatives are listed below:

- **Alternative 1:** Extraction wells along the north and northwest border of the western portion of OU 1. Modeling predicts that this alternative will achieve poor capture. Additionally, ground-water withdrawal will increase the northward hydraulic gradient, potentially drawing the LNAPL into the silty clay, thereby complicating future remedial efforts.

- **Alternative 2:** This alternative is the same as Alternative 1, but with source control wells within the LNAPL plume. Modeling predicts that this alternative will achieve poor capture. Ground-water withdrawal will produce drawdown within the LNAPL plume, which may permit LNAPL to migrate into the silty clay. This would complicate future remedial efforts.

- **Alternative 3:** A 1,350-foot extraction trench along the northern and northwestern border of the western portion of OU 1. Modeling predicts that this alternative will provide very good to excellent containment along the northern and northwestern borders. Ground-water withdrawal will produce drawdown within the LNAPL plume, which may permit LNAPL to migrate into the silty clay. This would complicate future remedial efforts.

- **Alternative 4:** A Y-shaped extraction trench constructed parallel to LNAPL flow in the paleo channel west of the CDPs. Modeling predicts poor containment, especially with respect to contamination that has migrated north of the trench axis. Modeling predicts drawdown will permit LNAPL to migrate into the silty clay, thereby complicating future remedial efforts.

- **Alternative 5:** A series of four separate extraction trenches oriented perpendicular to the paleo channel west of the CDPs. Modeling predicts that this alternative will provide good containment in the source area, although it fails to address contamination that has migrated north of the paleo channel. Modeling predicts some drawdown will be produced that may permit LNAPL to migrate into the silty clay. This would complicate future remedial efforts.

- **Alternative 6:** A cut-off wall with gradient control wells located along the northern and northwestern border of the western portion of OU 1. The cut-off wall would be constructed of sealable-joint sheet piling or a soil-amended bentonite slurry. Modeling predicts that Alternative 6 will provide very good to excellent containment. A predicted slight rise in ground water should provide a buffer against LNAPL-clay interaction, but will not impact slope stability. This alternative has an excellent potential for successfully achieving containment.

Based on the slope stability model, the hillside should remain stable under the ground-water conditions created by each alternative. Based on the results of screening the six alternatives, three preliminary designs were selected for further study under the EE/CA. Alternatives 3, 5, and 6 met the objective to prevent off-Base migration of ground water and LNAPL. The other alternatives were eliminated from further consideration because they were not predicted to provide adequate containment, they may negatively impact future remediation efforts via drawdown and mobilization of the LNAPL into the underlying or surrounding silty clay, or they pose unnecessary risks such as shut-down of an extraction trench which would provide a preferential pathway to contaminant migration.