EXECUTIVE SUMMARY

PURPOSE AND OBJECTIVE

The objective of this Engineering Evaluation/Cost Analysis (EE/CA) Report is to document the justification for selecting and implementing a non-time-critical removal action at Operable Unit 1 at Hill Air Force Base (Hill AFB) near Ogden, Utah. Since site investigation studies at Operable Unit 1 (OU 1) have determined that contaminants are migrating off-Base via the shallow ground water, Hill AFB is proposing to implement a removal action to contain the contaminated ground water and prevent further off-Base migration. The findings and conclusions of the baseline risk assessment conducted for the site indicate that there are no known users of the shallow off-Base ground water; therefore, there is no immediate human health risk. It is likely, however, that a small amount of contaminated ground water migrates into the Davis-Weber Canal via seeps and springs on the hillside. Under the current schedule, completion of the RI/FS activities and selection of an overall remediation strategy for the site will not occur until September of 1997 (the planned date for signing of the Record of Decision (ROD)). Immediately following the signing of the ROD, the Remedial Design (RD) phase will commence. Consequently, construction of a remedy may not begin until January of 1999. In order to expedite measures to halt the off-Base migration of contaminants as soon as possible, Hill AFB has elected to implement a removal action. According to the NCP, the first step in implementing a non-time-critical removal action is to conduct an EE/CA.

SCOPE OF THE EE/CA

The scope of this EE/CA is to evaluate and recommend measures to achieve containment of contaminated ground water. Previous studies have identified both a dissolved contaminant plume and a light non-aqueous phase liquid (LNAPL) plume at OU 1. Since the existing ground water containment system (which was installed as an interim remedial measure) addresses only contamination in the eastern portion of OU 1, additional containment facilities are needed in the western portion of the site where the LNAPL plume and the most concentrated dissolved contaminant plume are found. In addition, a recent evaluation of the existing ground-water containment system has determined that the system is not achieving containment and therefore needs to be upgraded or modified. This EE/CA evaluates alternatives for achieving containment on both the eastern and western portions of OU 1.

The distinction between the eastern and western portions of on-Base OU 1 was made for the following reasons:

- The eastern portion already has an existing ground water containment system, and therefore, alternatives for this area need to consider using, upgrading, replacing, or abandoning the existing facilities;

- The LNAPL plume and most concentrated dissolved phase plume are located in the western portion, whereas contamination on the eastern portion is relatively low;

- Alternatives for the western portion need to be evaluated with respect to their potential for adversely impacting future remediation efforts on the LNAPL plume;

- Presenting a separate discussion of alternatives for each portion of the site reduces the overall number of alternatives in the document and allows for a more focused evaluation of each area; and

- Potential funding limitations necessitate the division into two smaller but distinct units that can be constructed at a separate time, if necessary.

RECOMMENDED ALTERNATIVE FOR THE WESTERN PORTION OF OU 1

The overall objective of the removal action at OU 1 is to reduce the threat of human exposure associated with off-Base migration of contaminants in ground water. The four alternatives evaluated to achieve this objective for the western portion of OU 1 are:

- Alternative 1: An extraction trench would be installed along the northern and northwestern border of the on-Base portion of OU 1 to create a hydraulic barrier against off-Base migration of contaminants.

- Alternative 2: Four separate extraction trenches would be installed in the sand and gravel channel where the LNAPL plume and most concentrated dissolved contaminant plume are located.

- Alternative 3: A slurry wall would be installed along the northern and northwestern border of the on-Base portion of OU 1 to create a physical barrier against off-Base migration of contaminants.

- Alternative 4: A sheet pile wall would be installed along the northern and northwestern border of the on-Base portion of OU 1 to create a physical barrier against off-Base migration of contaminants.

Based on the engineering evaluation and cost analysis, Alternative 3 is recommended for implementation on the western portion of OU 1. Alternative 3 involves installing a slurry wall along the northern and northwestern borders to act as a physical barrier to off-Base migration of contaminated ground water. Alternative 3 was selected for the following reasons:

- It utilizes a physical barrier in addition to hydraulic controls

- It is the least susceptible to failure (if installed properly)

- It requires the lowest capital investment
- It is the least expensive over the long term (i.e., low operating costs)
- It represents only a minor risk of exposure during implementation

A physical barrier is preferred over a hydraulic barrier because it is a more positive means of containment and it is not as reliant on the operation of electromechanical equipment (i.e., extraction pumps). If a pump in a gradient control well were to fail, there would be adequate time to detect and respond to the problem before any contamination escaped the containment system. This may not be the case with failure of a pump in an extraction trench. Given that there is a steep slope immediately downgradient of the proposed trench location, ground water that migrates through while the pumps are inoperative could not be recovered. A physical barrier would also cutoff potential ground water flow in the sand stringers in the upper portion of the clay in this area of the site. This will minimize the potential for contaminants to migrate horizontally from the incised channel through a sand stringer and subsequently off Base. In addition, a physical barrier minimizes the amount of soil that needs disposal and the amount of ground water that needs to be extracted and subsequently treated at the IWTP. The two alternatives using hydraulic barriers also represented a risk that the resulting drawdown in the water table might allow the LNAPL to migrate into the clay, potentially making future remediation efforts more difficult.

The slurry wall was selected over the sheet pile wall because of the cost, the lower potential for leakage, constructability concerns, and the ability to verify that the wall is being constructed properly. With the sheet pile walls, it is more difficult to assure that all the joints are sealed and that the piles are sufficiently keyed into the clay. In addition, the recent experience with driving sheet piles at the site indicates that the cobbles make driving very difficult and may damage some of the piles, potentially affecting the integrity of the barrier. The sheet pile walls are also susceptible to corrosion.

Since the existing slurry wall at the site is not performing as an effective barrier to ground water flow, there is some concern about the ability to construct a slurry wall that will meet the performance objectives. The reason for its limited effectiveness is believed to be related to poor construction quality control, such that the wall was not properly keyed into the clay. At the time of the installation, little data were available to characterize the subsurface. Since that time, significantly more information regarding the locations and variations of the clay layer has been obtained. In addition, the specification package for the slurry wall will be developed to require the contractor to construct the wall to a specified elevation as opposed to a depth below grade which has been used in the past. For example, the specification will require the contractor to build the slurry wall five feet into the clay or five feet below the elevation of the bottom of the incised channel, whichever is deeper. Permeability and compatibility testing will also be conducted to select a backfill mixture that will meet the permeability and chemical resistance criteria. During construction, two oversight personnel will be used: one to oversee the backfill mixing and one to oversee the trenching and filling. Samples of the backfill mix will be collected periodically and analyzed for permeability, plasticity, grading, and density

analyses. Finally, a prequalification process will be used to make sure that only qualified, experienced slurry wall contractors conduct the work. The site is well suited for application of this technology, and with proper engineering and construction quality control, a slurry wall can be built with a high degree of confidence.

RECOMMENDED ALTERNATIVE FOR THE EASTERN PORTION OF OU 1

The four alternatives evaluated for the eastern portion of OU 1 are:

- Alternative 1: Additional extraction wells would be installed along the east side of Landfill 4 to create a hydraulic barrier to off-Base migration of contaminants.

- Alternative 2: An extraction trench would be installed along the east side of Landfill 4 to create a hydraulic barrier against off-Base migration of contaminants.

- Alternative 3: A slurry wall would be installed along the east side of Landfill 4 to create a physical barrier against off-Base migration of contaminants.

- Alternative 4: A sheet pile wall would be installed along the east side of Landfill 4 to create a physical barrier against off-Base migration of contaminants.

A slurry wall (Alternative 3) is also recommended for implementation on the eastern portion of OU 1. Alternative 3 involves installing a slurry wall along the east side of Landfill 4 to create a physical barrier against off-Base migration of contaminated ground water. Alternative 3 was selected for the following reasons:

- It is consistent with the technology recommended for the western portion of OU 1

- It incorporates and utilizes the existing facilities

- It is the least expensive alternative over the long term

- It is the least susceptible to failure and provides a more positive means of containment.

Although Alternative 3 requires a substantially greater capital investment to implement than Alternative 1 (extraction wells), it is less expensive over the long term because of the lower volume of contaminated ground water that needs to be treated. If the cost to discharge ground water to the IWTP is significantly reduced (this is currently being discussed), Alternative 1 may be slightly less expensive over the long term. However, the wells are susceptible to fouling and would be more maintenance intensive. In

addition, there is some uncertainty regarding the number of wells that will actually be needed to provide containment, which could increase the capital cost of Alternative 1.

There are some concerns with installing a slurry wall at the site, but with proper engineering and construction quality control, a slurry wall can be built with a high degree of confidence.

THE OVERALL CONTAINMENT SYSTEM

The overall system to prevent further off-Base migration of contaminated ground water at OU 1 will be a combination of several elements linked together to form a continuous barrier. The system will consist of the existing extraction trench with the addition of slurry walls and gradient control wells to both the east and west. Currently, the existing trench does achieve capture on the central and eastern portions of its alignment when the pumps are operating. It does not, however, achieve containment because the pumps are only operated intermittently and because the existing sumps and pumps cannot effectively extract ground water from the western/northwestern leg of the trench. The extraction trench will be upgraded by adding a new sump and pump on the northwestern leg and improving the operation of the pumps in the existing sumps. The northwestern leg of the trench will also be extended to the north to bridge the gap between the new slurry wall and the trench. Although the containment system will not rely on the existing slurry wall, the new slurry wall on the east side will be tied into the existing one at the southeastern end. On the west side, the new slurry wall will cross through the existing one and extend farther to the west. Once the various components are installed, the system will operate as one continuous barrier and it will become an integral component of the final remedy for the site.

PROPOSED SCHEDULE

Construction services and equipment are readily available to implement the proposed alternative, although several weeks additional lead time may be necessary to mobilize the backhoe required for deep excavation. Installation of the slurry wall for the western portion of OU 1 is expected to take about two months to complete. Installation of the slurry wall for the eastern portion of OU 1 is expected to take about two to three months. Construction activities for the western containment system are proposed to begin in spring of 1996, after the snowmelt has drained and the ground has dried. Installation of the slurry walls and gradient controls for the western containment system could be completed by the summer of 1996. Construction of the eastern containment system will be dependent upon the availability of funding from Hill AFB, but is tentatively planned to follow construction of the western portion of the system.