



EXECUTIVE SUMMARY

INTERA has been hired as a contractor with Rice University to demonstrate a surfactant/foam aquifer remediation process at Hill Air Force Base, Utah. The surfactant/foam process will be performed at Operable Unit 2 (OU2), located at the northeastern perimeter of the base. The focus of the surfactant/foam project is the use of foam as a mobility control for the surfactant remediation process and the evaluation of the effectiveness and efficiency of using the surfactant/foam process to remediate DNAPL zones.

The surfactant/foam process is divided into two main phases. Phase I is the remediation process development and scale-up, and Phase II is the field demonstration. Phase II, the remediation field demonstration, consists of the following five components: i) the initial field work (Phase IIa); ii) a pre-remediation partitioning interwell tracer test (PITT); iii) the surfactant foam flood; iv) a post-remediation partitioning interwell tracer test (PITT); v) post-remediation confirmation soil borings (Phase IIb).

The objective of the initial field work to be performed for Phase IIa is to obtain the necessary data and to install the wells and equipment required to conduct a demonstration of the surfactant/foam process. Specifically, Phase IIa initial field work activities will include a single well foam generation test to verify the efficacy of the foam application system, drilling and sampling soil borings to characterize the test zone, the construction, completion, and development of injection and extraction wells, the installation of multi-level samplers to be used as monitoring points during the demonstration, and aquifer testing (slug, injection/extraction, and conservative tracer) to obtain parameters necessary for the design of the demonstration.

The single well foam generation test is necessary prior to installing the AATDF test wells. The surfactant/foam process depends on the injection of a gas into a surfactant slug to generate a foam in the aquifer. Although foams have been successfully generated in laboratory column and tank studies, the generation of a foam in a shallow unconfined aquifer such as the one found at OU2 has not yet been attempted. In order to test the efficacy of the in-situ foam generation process and obtain useful design data, a short injection test will be conducted at SB-6, an existing AFCEE SEAR test well, prior to installing the AATDF test wells. SB-6 is located in the deepest portion of the former DNAPL pool that was remediated during the AFCEE SEAR demonstration.

The foam generation test will involve the injection of a small volume of surfactant, while injecting small amounts of gas into the well. During the gas injection, pressures and gas flow rates in the well will be closely monitored to determine if an effective foam been



Phase IIa Work Plan - Initial Field Work
AATDF Surfactant/Foam Process
for Aquifer Remediation

established. After the required data has been acquired the foam will be broken and the surfactant slug will be back produced until the surfactant concentrations in the effluent fall below the CMC and the majority of the injected surfactant has been recovered.

Following the foam generation test, ten boreholes will be drilled, logged, and sampled in the AATDF test area. The borehole locations were chosen based on an analysis of data acquired from reconnaissance borings that were drilled and sampled in the spring of 1996. During the drilling, sediment samples will be collected with a large diameter split spoon from the DNAPL zone in each boring. Samples will be preserved in toluene in the field to minimize the loss of volatile organic contaminants. The samples will then be shipped to Rice University to be analyzed by gas chromatograph (GC) for DNAPL saturations.

Each soil boring in the test array will be completed as a 4" well with a stainless steel screen installed in the DNAPL zone. Water quality parameters such as temperature, conductance, and pH will be monitored during development to gage the progress of the effort. Three of the wells in the centerline of the test array will be fitted with multi-level samplers. Each of the multi-level samplers will provide monitoring points at three different levels in the zone of interest. During well construction, the stratigraphic levels to be monitored will be straddled with short well screens which are separated by blank casing. After the multi-level samplers are inserted into the well, these screened intervals will be isolated by inflating packers to seat them in the blank casing sections. The multi-level samplers will be fitted with sampling ports, pneumatic pumps, and pressure transducers to monitor each of the isolated screened intervals.

Once the wells have been completed and developed, an aquifer testing program designed to determine the hydrogeological parameters of the saturated zone will commence. First, a slug test will be conducted in each well. During the slug test, the water level in the well will be changed instantaneously and then be allowed to recover. Downhole pressure transducers connected to a DAS will be used to electronically record aquifer responses to the slug tests.

After the slug tests have been completed, a short term injection/extraction test using the central injector and extractor will then be conducted. The injection and extraction rates will be used to approximate those to be used during the actual surfactant/foam process demonstration. This test will provide an empirical data set that can be used to calibrate and verify the numerical UTCHEM simulations used to design the flood.

A conservative tracer will be added to the injectate during this test to provide a measurement of residence time, swept volume, and dispersion in the aquifer. Table salt (NaCl) will be used as the conservative tracer, and the conductivity of the effluent from the



Phase IIa Work Plan - Initial Field Work
AATDF Surfactant/Foam Process
for Aquifer Remediation

extractor will be automatically monitored and recorded electronically during the injection/extraction test. Water samples will be collected from each well during the aquifer testing task to provide a contamination baseline for the project. These samples will be sent to Rice University for DNAPL analyses.

The predicted length of the Phase IIa initial field work is 3 months. This phase of the surfactant/foam project began on October 9, 1996, and is projected to end on January 10, 1997. The results of the Phase IIa work will be presented in the final Surfactant/Foam Process for Aquifer Remediation Project report to be completed in August, 1997.