GeoResearch

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November 11, 1993

Ms. Tina Berry
UNOCAL CORPORATION
2000 Crow Canyon Place, Suite 400
San Ramon, California 94583

RE: PROPOSAL FOR A GROUND-WATER FEASIBILITY STUDY
UNOCAL SERVICE STATION #5367
500 BANCROFT AVENUE, SAN LEANDRO, CALIFORNIA

Dear Ms. Berry:

GeoResearch is pleased to submit this proposal to conduct a feasibility study for obtaining sufficient data to determine the design parameters for the optimum ground-water remediation system at Unocal Service Station #5367, 500 Bancroft Avenue, San Leandro, California. This proposal is in response to the letter from Alameda County Department of Environmental Health dated October 7, 1993 asking for a Corrective Action Plan, and outlines the environmental services to be provided during the feasibility study at the above-referenced site. These services include the following:

- Slug injection and withdrawal tests on wells MW-1 through MW-3 to identify the hydraulic conductivity and transmissivity of the aquifer;
- Modeling of data gathered during the slug tests to identify the optimum pumping scenario for the site (if pumping is deemed viable after the slug tests);
- Ground-water collection and biosuitability study; and
- A Feasibility Study Report presenting the results of the aquifer test and the ground-water remediation feasibility study.

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SITE BACKGROUND

From information obtained from Unocal, GeoResearch understands that during tank removal operations at the site in 1987, approximately 250 cubic yards of soil was excavated. This soil was remediated on site by completing soil aeration with the treated soil transported off site. Upon completion of the excavation activities, a soil sample was collected at the bottom of the excavation (approximately 22 feet bgs) with the results indicating a concentration of 161.87 milligrams per kilogram (mg/kg) Total Volatile Hydrocarbons.

Subsequent to the soil removal, five on-site and three off-site monitoring wells have been drilled and installed. The analytical results of soil samples collected above first ground water during drilling indicates that concentrations of total petroleum hydrocarbons as gasoline (TPH-G) were not above 20 mg/kg. Based upon the results of the investigations performed at the site to date, soil remediation does not appear to be a concern.

do not agree as of yet

Following completion of the eight monitoring wells, quarterly ground-water sampling has been conducted since 1990. The analytical results of the last quarters sampling (September, 1993) indicated benzene concentrations over 1,000 micrograms per liter (µg/l) in monitoring wells MW-1 and MW-3, over 10 µg/l in wells MW-2, MW-4 and MW-8, and the remainder of the wells were Not-Detected for benzene. The results of the ground-water sampling indicates that detectable concentrations of benzene appears to be confined to the area of the site and immediately across Bancroft Avenue (monitoring well MW-8).

OBJECTIVES

The objectives of completing this feasibility study is to assess aquifer performance in preparation of future ground-water remediation system design at the site and to determine the most feasible ground-water remediation alternative at the site. This information will be presented to Unocal and upon choosing a remedial action option, a Remedial Action Report will be prepared for submittal to Alameda County.

AQUIFER PERFORMANCE TEST

The objective of completing an aquifer performance test is to identify the hydraulic characteristics of the aquifer. This data is necessary in preparing remedial alternatives by identifying the most efficient and productive ground-water pumping schemes. As the lithologic logs prepared by Applied GeoSystems indicate that the saturated zone at the

site consists of primarily clayey silts and silty clays, GeoResearch proposes to complete three slug injection and withdrawal tests at the site. Although a constant discharge aquifer test (pump test) will provide better data on hydraulic characteristics, it is not always feasible to perform a pump test in low permeable soils (silts and clays). Additionally, a slug test will not produce any discharge water, which would need to be disposed, and is not as labor or material extensive as a pump test.

A slug test is performed by injecting or withdrawing a known volume of water (slug) into or from a monitoring well. The rise or decline in water levels are measured in the well utilizing pressure transducers, and the information stored in a data-logger for analyses. GeoResearch has chosen monitoring wells MW-1 through MW-3 for completing slug withdrawal and injection tests. These wells were selected to allow GeoResearch to collect hydraulic information in the area of known contamination and to complete all of the work on site.

This data collected from the slug tests is used to calculate the hydraulic conductivity and the transmissivity of the aquifer. These hydraulic parameters are necessary in choosing and designing a remediation system that will be cost effective and time efficient. The data derived from the slug test will be used in a ground-water model.

GROUND-WATER MODELING

Ground-water modeling is an essential step toward the design of an optimal ground-water remediation system. Aquifer parameters calculated from the slug tests will be used to model the specific yield of a designated well (in gallons per day per foot of drawdown), projected capture zones, and time estimates for remediation.

Analytical and numerical models will be used to evaluate various alternatives for removing ground water from beneath the site. These models will employ hydrogeologic data obtained from the slug tests and previous investigations at the site. Ground-water modeling will give quantitative results of ground-water flow and drawdown in association with different pumping scenarios. The cone of depression for each pumping scenario will be simulated. The most effective pumping alternative, if deemed feasible to pump and treat, will be based on a pumping rate which will contain the contaminant plume.

FEASIBILITY STUDY AND REPORT

A feasibility study will be conducted to assess feasible remedial alternatives to mitigate ground-water contamination at the site. The feasibility study will assess data derived from the slug tests, ground-water modeling, and results of previous investigations conducted at the site to assess the most technically feasible remedial alternatives. Based on

preliminary review of site specific conditions, technically feasible remedial alternatives may include: pump and treat methodology utilizing wells or an interceptor trench, in-situ bioremediation or biosparging, or a combination of the two. Feasible pump and treat alternatives to remediate the plume include: carbon adsorption, air stripping, and bioremediation. Above-ground bioremediation can be conducted using either a biofilm bioreactor or a fluidized bed bioreactor. In-situ bioremediation can be accomplished by inducing air into the aquifer (bio-sparging) to optimize the dissolved oxygen concentration, thereby optimizing aerobic biodegradation. These remedial alternatives will be evaluated on the basis of cost to determine the most technically and economically feasible remedial alternative.

The success of above-ground as well as in-situ bioremediation will depend on the availability of hydrocarbon-oxidizing microorganisms, dissolved oxygen, on microbial respiration rates, and nutrients. Therefore, as part of this feasibility study, GeoResearch recommends a bench-scale biosuitability study. GeoResearch will collect a ground-water sample from monitoring wells MW-1 and MW-2 and analyze the samples for bioparameters, biological oxygen demand (BOD), and chemical oxygen demand (COD). The results of a biosuitability study will either support or negate the feasibility of bioremediation at this site.

The Feasibility Study Report will present results of the aquifer test, ground-water modeling, and biosuitibility study, and include the technical and economic evaluation of the feasible remedial alternatives. In the report GeoResearch will include conclusions on the most technically and economically feasible remedial alternatives to mitigate the ground-water plume at this site.

GeoResearch is prepared to move forward with this project immediately upon your approval. GeoResearch has enclosed a copy of the proposed fees to complete this project for your review. GeoResearch appreciates this opportunity to serve the environmental needs of Unocal CERT. If you have any questions regarding this proposal or the proposed costs, please do not hesitate to call.

Sincerely,

Frank R. Poss
Associate Hydrogeologist

cc: Mr. Scott Seery; Alameda County Department of Environmental Health

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