Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906

• FREMONT • COSTA MESA • SACRAMENTO • HOUSTON

ANALYSIS REPORT

togwater.rpt

Report Prepared for:
Applied GeoSystems
43255 Mission Boulevard
Fremont, CA 94539
Attention: Jon Luellen

Date Received: 11-21-89
Laboratory Number: 91131W01
Project #: 18061-5
Sample #: W-15-MW2
Matrix: Water

Parameter	Result (mg/L)	Detection Limit (mg/L)	Date Analyzed
TPH as Oil and Grease	ND	5	12-05-89

mg/L = milligrams per liter = ppm
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.

PROCEDURES

TPH as Oil and Grease: Total Petroleum Hydrocarbons as Oil and Grease are measured by extraction and gravimetric analysis according to Standard Method 503A/E.

Laura Kuck, Laboratory Manager

12-07-89
Date Reported

Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906

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REPORT
SUPPLEMENTAL SUBSURFACE INVESTIGATION, QUARTERLY GROUND-WATER MONITORING, AND EVALUATION OF SOIL REMEDIATION ALTERNATIVES

at

Unocal Service Station No. 5484
18950 Lake Chabot Road
Castro Valley, California

7/3/90

AGS Job No. 18061-5

Report prepared for

Unocal Corporation
2000 Crow Canyon Place
Suite 400
San Ramon, California

by
Applied GeoSystems

Joan Tiernan
Registered Civil Engineer
Reg. No. C044600

Ashraf M. Mirza
Branch Manager

July 3, 1990

Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906

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July 3, 1990
AGS 18061-5

Mr. Ron Bock
Unocal Corporation
2000 Crow Canyon Place
Suite 400
San Ramon, California 94583

Subject: Executive Summary of Report on Supplemental Subsurface Investigation, Ground-Water Monitoring, and Evaluation of Soil Remediation Alternatives at Unocal Service Station No. 5484, 18950 Lake Chabot Road, Castro Valley, California.

Mr. Bock:

The enclosed report presents the results of our supplemental subsurface investigation, and quarterly ground-water monitoring and sampling of the wells, at Unocal Service Station No. 5484, Castro Valley, California. This report also presents the results of our evaluation of alternatives for mitigating the hydrocarbon-impacted soil in the southern portion of the site.

At the request of Unocal Corporation (Unocal), Applied GeoSystems (AGS) subcontracted a drilling contractor to drill five additional soil borings (B-7 through B-11) at the southern portion of the site, to further delineate the vertical and lateral extent of hydrocarbon impact to subsurface soil.

Results of laboratory analyses of the soil samples from these borings indicated up to 220 parts per million (ppm) total petroleum hydrocarbons as gasoline (TPHg) and no halogenated volatile organic compounds (VOCs) at the southern portion of the site. Analysis of soil samples collected from a boring downgradient of the former waste-oil underground storage tank (UST) indicated no detectable concentrations of total oil and grease (TOG).

AGS also conducted monitoring and sampling of ground water in wells at and downgradient of the site. AGS personnel visited the site on November 17 and 21, 1989, to measure depths to ground water, to perform subjective evaluations on initial water samples, and to purge and collect water samples from onsite monitoring wells MW-2 and MW-6 and offsite

monitoring wells MW-4 and MW-5. Results of laboratory analyses of ground-water samples from wells MW-4 and MW-6 indicated no TPHg or benzene, toluene, ethylbenzene, and total xylenes (BTEX). The water sample from MW-5 showed a trace amount of total xylenes (0.63 parts per billion [ppb]) only. In water samples collected from well MW-2 detectable levels of BTEX and 720 ppb TPHg were found. Overall, a concentration decrease or no change from the previous sampling episode in June 1989 was observed.

The ground-water gradient direction has been evaluated since mid-1988 to be to the southwest, which is confirmed during this investigation. The results of this limited subsurface environmental investigation suggest that small concentrations of dissolved hydrocarbon have migrated a relatively short distance (less than 120 feet) from the area of the gasoline UST pit, toward the south in the direction of wells MW-2 and MW-5. On the basis of laboratory analysis of ground-water samples collected from the downgradient and crossgradient wells MW-2 and MW-5, there is no evidence that VOCs have migrated from the area of the former waste-oil UST.

At Unocal's request, AGS has evaluated the need for, and feasibility of, alternative methods of mitigating hydrocarbons in soil in the southern portion of the property. The three alternatives evaluated include: (1) excavation of impacted soil for aeration or offsite disposal; (2) in situ soil-vapor extraction and treatment, and (3) ground-water monitoring, conducting a fate and transport analysis, and no further soil remedial action.

Alternative 1 is not economically feasible because of the need to shut down the service station (for a second time); the high cost associated with excavating under city sidewalk; space limitation for onsite aeration of the impacted soil; and the high costs associated with transportation and disposal of the untreated soil.

Alternative 2, in situ vapor extraction, is also not technically and economically feasible because the subsurface soils and bedrock are relatively impermeable and the ground water is shallow. Removal of hydrocarbon vapors from such soils and ground-water conditions may take a very long time, requiring dewatering, and may not clean up the soil homogeneously or to desirable levels.

Therefore, on the basis of our evaluation, AGS recommends implementing alternative 3: install a monitoring well immediately downgradient of the former waste-oil tank and monitor for TOG, VOC, and BTEX; continue the quarterly monitoring of MW-2, MW-4, MW-5, and MW-6 for BTEX and TPHg; conducting an environmental fate and transport analysis on the impacted soil remaining beneath the city sidewalk; and no further soil remedial action at this time.

AGS recommends that copies of this report be submitted to Mr. Scott Seery of the Alameda County Health Care Services Agency, Department of Environmental Health, Hazardous Materials Division, 80 Swan Way, Room 200, Oakland, California 94621, and Mr. Lester Feldman of the California Regional Water Quality Control Board, San Francisco Bay Region, 1800 Harrison Street, Suite 700, Oakland, California 94612. Please call if you have any questions.

Sincerely,
Applied GeoSystems

Parnian Kaboli
Senior Project Manager

Enclosure: Report on Supplemental Subsurface Investigation, Quarterly Ground-Water Monitoring, and Evaluation of Soil Remediation Alternatives

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Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906

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REPORT
SUPPLEMENTAL SUBSURFACE INVESTIGATION, QUARTERLY GROUND-WATER MONITORING, AND EVALUATION OF SOIL REMEDIATION ALTERNATIVES

at

Unocal Service Station No. 5484
18950 Lake Chabot Road
Castro Valley, California

for Unocal Corporation

INTRODUCTION

At the request of Unocal Corporation (Unocal), Applied GeoSystems (AGS) conducted a limited supplemental subsurface environmental investigation at Unocal Station No. 5484, at 18950 Lake Chabot Road in Castro Valley, California. The investigation included drilling five soil borings in the southern portion of the site, collecting soil samples from the borings for laboratory analysis, measuring depths to ground water, purging existing monitoring wells, and collecting ground-water samples for laboratory analysis. This report presents our findings, conclusions, and recommendations.

Field work performed during this phase of the site investigation was completed in accordance with procedures described in AGS's November 8, 1989, letter to the Alameda County Health Care Services Agency (ACHCSA).

Site Description and Background

Unocal Station No. 5484 is at the southeastern corner of the intersection of Lake Chabot Road and Quail Avenue in Castro Valley, California, at an elevation of approximately 230 feet above mean sea level as shown on the Site Vicinity Map (Plate P-1). The site is bounded on the north by residential properties, and by a community center and park properties (administered by the Hayward Area Recreation and Park District) on the south and east. There are several commercial businesses and two vacant lots west of the property across Lake Chabot Road.

Facilities at the site include a service station building, two service islands, two 12,000-gallon gasoline underground storage tanks (USTs) in the south-central portion of the site, and one 280-gallon waste-oil UST north of and adjacent to the station building. The locations of the tanks and other pertinent features at the site, are shown on the Generalized Site Plan, Plate P-2.

Until mid-1989 two 10,000-gallon gasoline USTs were located in the tank pit and one 280-gallon waste-oil UST was located in an area just south of the station building, as shown on Plate P-2. AGS understands that the gasoline USTs were used to store regular-unleaded gasoline and premium-unleaded gasoline. On the basis of information obtained from Unocal, it seems that leaks occurred in the fiberglass adapter and the sub-pump swing joint of the gasoline USTs. All three tanks were excavated and replaced in June 1989.

Previous Work

In July 1988 AGS observed the drilling of three soil borings at the site and installed ground-water monitoring wells MW-1, MW-2, and MW-3 in those borings, to evaluate ground-water conditions near the gasoline USTs (AGS Report No. 18061-1, August 30, 1988). The approximate locations of these wells are shown on Plate P-2.

At the request of Unocal, AGS periodically monitored and sampled ground water from three monitoring wells between October 1988 and June 1989, to evaluate the trends of hydrocarbons in ground water near the gasoline UST pit. On October 14, 1988, AGS personnel observed a 9-inch-thick layer of brown floating product on the water surface in monitoring well MW-3. Subsequently, the wells were monitored on a monthly basis and floating product, when present, was removed from well MW-3. The floating product in MW-3 gradually decreased and none was observed in the May 1989 episode. The well was destroyed in June 1989 during overexcavation of the tank pit (AGS Report No. 18061-2 January 6, 1989; February 9, 1989; September 11, 1989).

In May 1989 AGS observed the drilling of three additional soil borings and constructed monitoring wells (MW-4, MW-5, and MW-6) in those borings to further delineate the extent and concentrations of dissolved hydrocarbons in ground water. Ground-water monitoring wells MW-4 and MW-5 were constructed in borings drilled offsite and downgradient of the tank pit. Monitoring well MW-6 was installed onsite and upgradient of the tank pit (AGS Report No. 18061-3, September 11, 1989). The approximate locations of the monitoring wells are shown on Plate P-2.

In June 1989 Paradiso Construction Company, of Oakland, California, (Paradiso), under contract to Unocal, excavated and removed the three USTs. At Unocal's request, AGS observed the excavation and replacement of the two gasoline USTs and the waste-oil UST, and conducted related field testing and soil sampling. Approximately 1,800 cubic yards of soil containing petroleum hydrocarbons were excavated in two phases from beneath and around the former tanks. The gasoline tank pit was excavated to approximately 15 feet and the waste-oil tank pit was excavated to approximately 10 feet. Two onsite wells, MW-1 and MW-3, were destroyed as a result of tank excavation and replacement activities. After excavation of the gasoline USTs, associated product lines, and soil surrounding the tank pits, the two USTs were replaced with new 12,000-gallon tanks and a new waste-oil UST was installed to the north of the station building. The former waste-oil UST pit was backfilled. This work resulted in a shutdown of the service station for approximately 3 months.

The excavated soil was aerated and subsequently hauled offsite by Paradiso for disposal. AGS understands that Paradiso disposed of the soil at the Redwood Class III Sanitary Landfill in Novato, California.

Copies of the certified analysis results (CARs) of soil samples AGS collected from the excavation pits during the tank removals were submitted to Unocal and the ACHCSA in September 1989. Laboratory testing of soil samples indicated detectable levels of hydrocarbons in subsurface soil and bedrock beneath and adjacent to the gasoline and waste-oil UST pits. The highest concentrations of total petroleum hydrocarbons as gasoline (TPHg), up to 4,300 parts per million (ppm), were detected in soil during the first phase of excavation in the southwest corner of the gasoline UST pit, in the downgradient direction of ground-water flow. Laboratory testing of the soil, after the completion of the second phase of soil excavation indicated that almost all of the hydrocarbon-containing soil had

been excavated in the area of the gasoline UST pit and service islands. Visual observation and field testing during excavation indicated that some hydrocarbon-impacted soil remained only in the area beneath the City sidewalk southwest of the gasoline UST pit.

Laboratory analysis of discrete soil samples collected on July 11, 1989, from native soil beneath the former waste-oil tank (at depths ranging from approximately 7 to 10 feet below the ground surface) indicated no volatile organic compounds (VOCs), total oil and grease (TOG) ranging from 1,300 to 1,800 ppm, and TPHg ranging from 87 to 480 ppm.

Local Geology and Hydrogeology

The subject site is in the northwestern corner of the Castro Valley ground-water basin adjacent to the eastern margin of the San Francisco Bay Plain. Ground water in the Castro Valley area is unconfined (Hickenbottom and Muir, 1988) and has been found in some of the sandstone and conglomerate units and fractures in other rock types.

Recharge to the ground-water in the area occurs mainly as a result of direct precipitation that falls on the adjacent hills. Water reaches the ground-water reservoir through seepage from streams, infiltration through the soil, and subsurface inflow from adjacent soil and bedrock units.

Sedimentary rocks in the region include consolidated or highly compacted sandstone, shale, mudstone, and chert; some volcanic rocks and consolidated conglomerates also are present locally (Hickenbottom and Muir, 1988). Sediments forming these units were deposited during Jurassic, Cretaceous, and Tertiary times. These sediments were complexly folded and faulted toward the end of the Tertiary period.

The geologic materials encountered at the site are primarily weathered mudstone and siltstone. Approximately 5 feet of sandy clay, 5 feet of clayey gravel, and 3 feet of clay are present below the ground surface, with underlying sandstone and unweathered mudstone. The upper few feet of weathered mudstone, siltstone, and sandstone units are highly fractured. The majority of the moisture observed appears to be associated with these fractures.

FIELD WORK

Site Preparation

Prior to commencing field work, AGS obtained a Groundwater Protection Ordinance Permit for drilling soil borings from the Alameda County Flood Control and Water Conservation District (ACFCWCD). A copy of the ACFCWCD permit is included in Appendix A. At least 48 hours prior to drilling, Underground Service Alert was contacted to help locate public utility lines in the site area. Field work was performed in accordance with AGS' Site Safety Plan No. 18061-3S, May 22, 1989, presented in Appendix B.

Drilling

AGS visited the site on November 17 and 18, 1989, to observe the drilling of five 8-inch-diameter soil borings. Borings B-7 through B-11 were drilled in the downgradient direction of ground-water flow from the tank pit excavation. The borings were advanced to depths between approximately 15-1/2 feet (boring B-8) and 20-1/2 feet (boring B-7). The approximate locations of borings B-7 through B-11 are shown on Plate P-2. Drill cuttings

generated during drilling were placed on and covered with plastic at the site pending the results of laboratory analyses of soil samples.

On November 22, 1989, 4 days after the completion of drilling, a Solinst water-level indicator was used in the boreholes to measure the water depths (see Appendix B). Ground-water was encountered in boring B-7 at a depth of 8.70 feet, in B-8 at 10.75 feet, in B-9 at 6.48 feet, in B-10 at 12.65 feet, and in B-11 at 8.28 feet. On December 11, 1989, borings B-7 through B-11 were backfilled from total depth to ground surface.

Soil Sampling

Soil samples were collected from the borings at 5-foot intervals beginning at a depth of approximately 4 feet below the ground surface, and were subsequently logged according to Unified Soil Classification System (summarized on Plate P-3), and are presented on the Logs of Borings, Plates P-4 through P-8.

Chain-of-Custody Records (CCRs) were initiated in the field and the soil samples were transported to a state-certified laboratory for analysis. Copies of the CCRs are presented in Appendix C.

Standard field procedures are described in Appendix B. An organic vapor meter (OVM) was used to estimate concentrations of hydrocarbon vapors in the soil samples. The OVM readings are shown on the Logs of Borings in the column labeled "P.I.D." (photoionization detector). Hydrocarbon vapor concentrations in the samples ranged from 0 to approximately 257 parts per million (ppm).

On December 11, 1989, AGS collected three samples from the stockpiled drill cuttings. The three samples were composited at the AGS laboratory and analyzed for TPHg and TOG.

Ground-Water Monitoring and Sampling

AGS visited the site on November 17 and November 21, 1989. Depths to ground water were measured, initial water samples were subjectively evaluated, and ground-water samples were collected from onsite monitoring wells MW-2 and MW-6 and offsite monitoring wells MW-4 and MW-5 after those wells were purged. An initial sample of ground water was collected from each well and checked for floating product, sheen, and emulsion. No floating product, sheen, or emulsion was observed in any of the water samples on either of the site visits. The results of the water-level measurements and subjective evaluations of ground water are presented in Table 1. The sampling procedures are described in Appendix B. CCRs were initiated and copies are presented in Appendix C.

SITE GEOLOGY

Geologic materials encountered during drilling at the site consisted primarily of silty to sandy clay with gravel, with underlying shale bedrock. The silty clay is tan, yellow-brown, or gray-green near the ground surface, and sometimes is mottled green and brown from depths between approximately 5 and 12 feet. The silty clay is of medium plasticity, and is stiff to hard. The shale bedrock, encountered between 8 and 12 feet below the surface, is typically black, dry to slightly damp, and hard. Plate P-9 represents two geologic cross sections and Plate P-2 indicates the reference locations of these cross sections.

ANALYSES OF SOIL SAMPLES

Ten soil samples collected from the soil borings, from depths ranging from 4 to 19-1/2 feet below the ground surface, were submitted to the AGS laboratory (Certificate No. 153) in Fremont, California. They were analyzed for TPHg by modified Environmental Protection Agency (EPA) Method 8015, and for benzene, toluene, ethylbenzene, and xylenes (BTEX) by EPA Method 8020. Two soil samples from boring B-11, almost downgradient of the waste-oil tank, were also analyzed for TOG by Standard Method 503E. Five soil samples from B-7, B-8, and B-11, downgradient and next to the former waste-oil tank, were delivered to the Anametrix, Inc., laboratory (Certificate No. 151) in San Jose, California, to be analyzed for halogenated VOCs by EPA Method 8010. The results of laboratory analysis are shown in Table 2. Analysis of soil samples indicated up to 220 ppm TPHg and corresponding low BTEX concentrations. The highest concentrations of TPHg were detected in borings B-10 and B-8 at depths of 9-1/2 to 10 feet approximately 1-1/2 to 2 feet below the ground-water surface. Analysis of soil samples from boring B-11 indicated no TOG. Analysis of soil samples from borings B-7, B-8 and B-11, indicated no VOCs.

Results of analysis of a composite soil sample from the drill cuttings indicated 2.4 ppm TPHg and no TOG (Table 2). Certified analysis reports (CARs) are included in Appendix C. At the request of Unocal, AGS arranged to have the soil cuttings removed from the site for disposal at the Class III Davis Street Transfer Station on Davis Street in San Leandro, California.

ANALYSES OF GROUND WATER SAMPLES

Water samples from wells MW-2, MW-4, MW-5, and MW-6 were delivered to the AGS laboratory for analysis for TPHg by modified EPA Method 8015, and for BTEX by EPA Method 8020. Water samples from wells MW-2 and MW-5 also were analyzed for TOG by Standard Method 503E at AGS laboratory and for VOCs by EPA Method 601 at the Anametrix laboratory.

Analysis of water samples from the off-site monitoring wells MW-4 and MW-5 indicated no TPHg or BTEX (except for a trace amount of total xylenes in the water from MW-5). No TOG or VOCs were found in water samples collected from MW-5.

Analysis of the water sample from the on-site well MW-2 indicated that concentrations of TPHg increased slightly from 550 to 720 parts per billion (ppb), concentrations of benzene, toluene, and ethylbenzene decreased, and total xylenes remained the same since the previous monitoring episode (June 1989). No TOG or VOC were detected in this well. Laboratory results for TPHg and BTEX analyses are presented in Table 3. Laboratory results for TOG and VOC analyses are presented in Table 4. Copies of the CARs are included in Appendix C.

GROUND-WATER DIRECTION EVALUATION

The elevation of the top of each well casing was surveyed to a local benchmark by Ron Archer Civil Engineer, Inc. in June 1989. Ground-water depths, measured on November 21, 1989, were subtracted from the wellhead elevations to calculate water-level elevations in the

wells (Table 5). Plate P-11 presents a graphic interpretation of the ground-water gradient based on the November 21, 1989, measurements. The direction of ground-water flow, evaluated from Plate P-11, is toward the southwest, with a gradient of 0.08, or approximately 8 feet vertical per 100 feet horizontal.

The ground-water flow direction and gradient, in the shallow unconfined ground-water system beneath the site, appears to be controlled by local topography and the bedrock surface underlying the site area. The site is situated on the side of a small hill, and a park lies adjacent to, and upgradient of the site. According to the station manager and one local resident, ground-water levels in the area of the site appear to be affected by frequent watering of the park property.

EVALUATION OF ALTERNATIVES FOR MITIGATING HYDROCARBON-IMPACTED SOIL

We have evaluated the need for, and feasibility of, remedial alternatives for the hydrocarbon impacted soil that remains in place the southern portion of the property. The three alternatives evaluated include: (1) excavation and aeration, or offsite disposal; (2) in situ soil-vapor extraction and treatment; and (3) continued ground-water monitoring, fate and transport analysis, and no further remedial action at this time. The following subsections discuss the requirements, technical feasibility, and cost-effectiveness of each alternative.

Excavation and Aeration, or Offsite Disposal

Excavation and aeration of the impacted soil beneath the city sidewalk would be extremely difficult to implement due to permitting, traffic control, the limited size of the work area,

and limited space for stockpiling soil. Additionally, the previous excavation episode in the summer of 1989 resulted in the station being shut down for approximately 3 months. Renewed excavation and aeration activities would probably result in another shutdown of the station and an unreasonable additional loss of revenue for the station. AGS understands that Unocal requested authorization from the California Regional Water Quality Control Board (CRWQCB) to stockpile and aerate soil excavated from the site at a nearby Unocal station located in Castro Valley, at which soil excavation was conducted recently, and that permission for such activity was denied. Therefore we infer that offsite aeration will not be approved by the agencies in the future. ???

Because of the remaining hydrocarbon concentrations in the soil, and because aeration is not feasible, it is probable that the majority of the excavated soil would need to be hauled directly to a Class I disposal facility for disposal. AGS has estimated the costs associated with excavation, analysis, transportation and disposal of every 500 cubic yards of excavated soil in a Class I landfill would be approximately on the order of one-quarter million dollars. Since the volume of impacted soil is not well defined and may exceed 500 cubic yards, this alternative is not economically feasible.

In Situ Soil-Vapor Extraction and Treatment

At Unocal's request, AGS contacted a subcontractor specializing in in situ soil-vapor extraction and treatment of hydrocarbon-impacted soil. On November 22, 1989, AGS met with Terra Vac, of San Leandro, California, to assess the feasibility and estimate the cost of instituting a vapor-extraction program to remediate the soil.

It was concluded that potential complications associated with a vapor-extraction remediation program at this site include (1) the necessity to draw down the ground- water due to shallow water table and to treat and dispose of the water, which will add to the total cost and will put additional space constraints on the station. (2) the low permeability of the subsurface materials at the site, which does not allow efficient vapor extraction. Terra Vac estimated that the total cost to implement such a program would be in excess of $100,000 for each year and could not realistically estimate the duration of the effectiveness of this alternative.

Ground-Water Monitoring, Fate and Transport Analysis, and No Remedial Action

Because relatively low levels of hydrocarbons have been detected in soil and ground water, the need for remediation may be precluded by performing of a fate and transport analysis. This type of analysis is used to assess the potential impact of TPHg on soil and ground water downgradient. The study will include, but is not limited to, identification of potential receptors of petroleum hydrocarbons in soil and ground-water from the site area, a search of public records to identify wells within 1/2 mile of the site, an assessment of the potential impacts of dissolved hydrocarbon concentrations in ground water on beneficial uses of ground water, and an analysis of the general ground-water quality at the site. If the impacts are minimal, this tends to support the "no action" alternative.

Monitoring of ground-water conditions in wells MW-2, MW-4, MW-5, and MW-6 would be continued on a quarterly basis. The purposes of this monitoring effort would be to evaluate trends in the concentrations of dissolved hydrocarbons with time in ground water beneath and downgradient of the site, and to evaluate any changes in the direction of the ground-water gradient. To help better evaluate the impacts of hydrocarbons on ground water, one more monitoring well downgradient of the waste-oil tank is recommended to monitor for

TOG, BTEX, and VOCs. The approximate cost for performing a fate and transport analysis, installing one more monitoring well, ground-water monitoring, and quarterly report preparation for one year would be approximately $32,000.

SUMMARY

Approximately 1,800 cubic yards of soil containing hydrocarbon compounds were excavated and removed from the site when the gasoline- and waste-oil USTs were removed and replaced between June and August 1989. Visual observation and field testing during excavation indicated that some hydrocarbon-impacted soil remains in the area beneath the City sidewalk southwest of the gasoline UST pit excavation.

The results of this ground-water monitoring episode indicated that dissolved hydrocarbons have migrated about 120 feet toward the south from the area of the gasoline UST pit. The maximum concentration of dissolved hydrocarbons observed in an offsite well was found in downgradient well MW-5 and was 0.63 ppb total xylenes only. The maximum concentration of dissolved hydrocarbons in an onsite monitoring well was 720 ppb TPHg, and 1.4 ppb benzene in well MW-2. Floating product, initially detected on the water in former onsite monitoring well MW-3 in October 1988, was not detected in that well after April 1989, and has not been detected in any of the four existing monitoring wells on, or downgradient of the site.

Laboratory analysis of water samples collected from wells MW-2 and MW-5 indicated no detectable concentrations of dissolved TOG or VOC, which suggests that the former waste-oil UST has not impacted the ground water.

RECOMMENDATIONS

We recommend the following:

- Quarterly monitoring of ground water in monitoring wells MW-2, MW-4, MW-5, and MW-6 be continued. Water samples collected during quarterly monitoring should be analyzed for TPHg and BTEX.

- An additional monitoring well be installed south of ~~MW-2,~~ in the downgradient direction of ground-water flow and the samples analyzed for TPHg, BTEX, and VOCs.

- A fate and transport analysis be carried out to further evaluate potential impacts downgradient associated with the remaining impacted soil beneath the city sidewalk.

- Copies of this report be forwarded to Mr. Scott Seery of the ACHCSA, Department of Environmental Health, Hazardous Materials Division, 80 Swan Way, Room 200, Oakland, California 94621, and Mr. Lester Feldman of the California Regional Water Quality Control Board, San Francisco Bay Region, 1800 Harrison Street, Suite 700, Oakland, California 94612.

LIMITATIONS

This report was prepared in accordance with standards of environmental geological practice generally accepted in California at the time this investigation was performed. This investigation was conducted solely for the purpose of evaluating environmental conditions of the soil and first ground water with respect to hydrocarbon-product contamination in the vicinity of the subject property. No soil engineering or geotechnical recommendations are implied or should be inferred. Evaluation of the geologic conditions at the site for the purpose of this investigation is made from a limited number of observation points. Subsurface conditions may vary away from the data points available. Additional work, including further subsurface investigation, can reduce the inherent uncertainties associated with this type of investigation.

Some of the limitations involved with the portion of the report describing the soil remediation techniques are presented below. The soil remediation techniques are solely for remediating hydrocarbon-product contamination in soil at the site. The effectiveness of the remediation techniques described is not known or examined in this report. The cost estimates stated are approximations and actual costs could vary. The cost estimates are not quotes for performing remediation at the site, but are to be used to compare the costs involved with applying the different remediation techniques. No soil engineering or geotechnical recommendations are implied or should be inferred.

REFERENCES CITED

Applied GeoSystems. August 30, 1988. Report, Subsurface Environmental Investigation at Unocal Service Station No. 5484, 18950 Lake Chabot Road, Castro Valley, California. Job No. 18061-1.

Applied GeoSystems. January 6, 1989. Letter Report, Quarterly Ground-Water Monitoring at Unocal Service Station No. 5484, 18950 Lake Chabot Road, Castro Valley, California. Job No. 18061-2.

Applied GeoSystems. February 9, 1989. Letter Report, Quarterly Ground-Water Monitoring at Unocal Service Station No. 5484, 18950 Lake Chabot Road, Castro Valley, California. Job No. 18061-2.

Applied GeoSystems. March 22, 1989. Letter Work Plan, Delineation of Ground-Water Contamination at Unocal Service Station No. 5484, 18950 Lake Chabot Road, Castro Valley, California. Job No. 18061-3W.

Applied GeoSystems. May 22, 1989. Site Safety Plan. Job No. 18061-3S.

Applied GeoSystems. September 11, 1989. Supplemental Subsurface Environmental Investigation at Unocal Service Station No. 5484, 18950 Lake Chabot Road, Castro Valley, California. Job No. 18061-3.

Hickenbottom, Kelvin, and Muir, Kenneth. June 1988. Geohydrology and Groundwater Quality Overview, East Bay Plain Area, Alameda County, California, 205(J) Report. Alameda County Flood Control and Water Conservation District.

TABLE 1
CUMULATIVE RESULTS OF SUBJECTIVE ANALYSES
OF WATER IN WELLS
Unocal Service Station No. 5484
18950 Lake Chabot Road
Castro Valley California
(page 1 of 2)

Well	Date	Depth to Water*	Inches of Floating Product	Sheen	Emulsion
MW-1	7/88	5.16	NONE	NONE	NONE
	10/88	7.10	NONE	NONE	NONE
	11/2/88	6.08	NONE	NONE	NONE
	11/9/88	6.14	NONE	NONE	NONE
	12/15/88	6.51	NONE	SLIGHT	NONE
	1/3/89	5.10	NONE	NONE	NONE
	1/16/89	4.75	NONE	NONE	NONE
	2/15/89	5.13	NONE	NONE	NONE
	3/17/89	3.68	NONE	NONE	NONE
	4/14/89	3.12	NONE	NONE	NONE
	5/19/89	3.46	NONE	NONE	NONE
	6/89	Well destroyed during tank excavation			
MW-2	7/88	6.85	NONE	NONE	NONE
	10/88	7.81	NONE	SLIGHT	NONE
	11/2/88	7.83	NONE	NONE	NONE
	11/9/88	7.98	NONE	NONE	NONE
	12/15/88	7.89	NONE	NONE	NONE
	1/3/89	6.50	NONE	NONE	NONE
	1/16/89	6.02	NONE	NONE	NONE
	2/15/89	5.22	NONE	NONE	NONE
	3/17/89	3.98	NONE	NONE	NONE
	4/14/89	3.83	NONE	NONE	NONE
	5/19/89	4.85	NONE	NONE	NONE
	6/29/89	7.24	NONE	NONE	NONE
	11/17/89	7.73	NONE	NONE	NONE
	11/21/89	7.24	NONE	NONE	NONE

See notes on page 2 of 2.

TABLE 1
CUMULATIVE RESULTS OF SUBJECTIVE
ANALYSES OF WATER IN WELLS
Unocal Service Station No. 5484
18950 Lake Chabot Road
Castro Valley California
(page 2 of 2)

Well	Date	Depth to Water*	Inches of Floating Product	Sheen	Emulsion
MW-3	7/88	7.49	NONE	NONE	NONE
	10/88	9.06	9.0	NA	NA
	11/2/88	9.12	11.5	NA	NA
	11/9/88	7.60	0.75	NA	NA
	12/15/88	7.97	6.72	NA	NA
	1/3/89	7.20	1.08	NA	NA
	1/16/89	6.36	2.64	NA	NA
	2/15/89	5.16	0.12	NA	NA
	3/17/89	5.01	0.48	NA	NA
	4/14/89	4.71	<0.01	HEAVY	NONE
	5/19/89	5.49	NONE	MODERATE	NONE
	6/89	Well destroyed during tank excavation			
MW-4	6/29/89	9.95	NONE	NONE	NONE
	11/17/89	10.56	NONE	NONE	NONE
	11/21/89	10.83	NONE	NONE	NONE
MW-5	6/29/89	9.03	NONE	NONE	NONE
	11/17/89	--	NONE	NONE	NONE
	11/21/89	9.56	NONE	NONE	NONE
MW-6	8/1/89	7.34	NONE	NONE	NONE
	11/17/89	8.36	NONE	NONE	NONE
	11/21/89	8.59	NONE	NONE	NONE

* = Depth to water measured in feet below top of casing.
NA = Not applicable
-- = Not recorded

TABLE 2
RESULTS OF ANALYSES OF SOIL SAMPLES
Unocal Station No. 5484
18950 Lake Chabot Road
Castro Valley, California
(November; December 1989)
(Page 1 of 2)

Sample Number	TPHg	B	T	E	X	EPA 8010	TOG
Soil Borings							
S-5.0-B7	<2	<0.050	<0.050	<0.050	0.090	NA	NA
S-10.0-B7	6.1	0.062	0.540	160	0.910	NA	NA
S-15.0-B7	NA	NA	NA	NA	NA	ND	NA
S-20.0-B7	NA	NA	NA	NA	NA	ND	NA
S-5.0-B8	NA	NA	NA	NA	NA	ND	NA
S-[illegible]	[illegible]	0.340	0.910	4.1	23.0	NA	NA
S-10.0-B8	NA	NA	NA	NA	NA	ND	NA
S-15.0-B8	[illegible]	0.120	0.430	1.1	5.90	NA	NA
S-10.0-B9	86	1.1	0.670	2.0	3.70	NA	NA
S-17.0-B9	3.7	<0.050	0.092	0.076	0.130	NA	NA
S-[illegible]	[illegible]	0.270	<0.050	5.6	16.0	NA	NA
S-19.5-B10	16	0.081	0.120	0.620	1.80	NA	NA
S-10.0-B11	45	0.074	0.330	1.2	3.10	NA	<50
S-14.5-B11	NA	NA	NA	NA	NA	ND	NA
S-15.0-B11	3.4	<0.050	0.061	0.086	2.50	NA	<50

Results in parts per million (ppm).
See further notes on page 2 of 2.

TABLE 2
RESULTS OF ANALYSES OF SOIL SAMPLES
Unocal Station No. 5484
18950 Lake Chabot Road
Castro Valley, California
(November; December 1989)
(Page 2 of 2)

Sample Number	TPHg	B	T	E	X	VOC	TOG
Composite Soil Sample (Soil Cuttings)							
S-1211-1(A,B,C)	2.4	NA	NA	NA	NA	NA	<50

Results in parts per million (ppm).
TPHg = Total petroleum hydrocarbons as gasoline.
B = Benzene
T = Toluene
E = Ethylbenzene
X = Total xylene isomers
VOC = Environmental Protection Agency Method 8010 analysis for halogenated volatile organic compounds.
TOG = total oil and grease (Standard Method 503A/E)
< = Less than the reported limit of detection for the method of analysis used
--- = Not analyzed for the indicated compound or constituent
ND = No detectable concentrations of volatile organic compounds tested for by EPA Method 8010 were found (see Laboratory Reports in Appendix).
Sample designation:

S-5.0-B7
- B7 — Designation of sample locations
- 5.0 — Top of 6-inch sample interval in feet below grade
- S — Sample matrix (S = soil)

TABLE 3
CUMULATIVE RESULTS OF LABORATORY ANALYSES
OF GROUND-WATER SAMPLES FOR TPHG AND BTEX
Unocal Service Station No. 5484
18950 Lake Chabot Road
Castro Valley, California

Sample	Date	TPHg	B	T	E	X
W-7-MW1	7/88	540	6.1	82.7	35.6	180.3
W-8-MW1	10/88	1,420	13.2	4.1	163.8	58.1
W-5-MW1	1/89	410	6.5	10.4	11.8	44.2
	6/89	Well destroyed during tank excavation				
W-9-MW2	7/88	1,080	72	139	33	157.0
W-9-MW2	10/88	1,140	80	10	25	26.0
W-6-MW2	1/89	4,040	103	673	78	527
W-10-MW2	6/89	550	2.7	1.9	10	34
W-15-MW2	11/89	720	1.4	1.4	5.9	34
W-9-MW3	7/88	7,800	385	640	369	2,258
	10/88	Well not sampled				
	1/89	Well not sampled				
	6/89	Well destroyed				
W-14-MW4	6/89	<20	<0.50	<0.50	<0.50	<0.50
W-11-MW4	11/89	<20	<0.50	<0.50	<0.50	<0.50
W-11-MW5	6/89	<20	0.83	<0.50	0.57	0.94
W-16-MW5	11/89	<20	<0.50	<0.50	<0.50	0.63
W-12-MW6	8/89	26	<0.50	<0.50	<0.50	0.50
W-9-MW6	11/89	<20	<0.50	<0.50	<0.50	<0.50

Results in parts per billion (ppb)
BTEX = benzene, ethylbenzene, toluene, and total xylene isomers
TPHg = total petroleum hydrocarbons as gasoline
< = Less than the reported limit of detection for the method of analysis used
Sample designation: W-12-MW6

- W — Water sample
- 12 — Approximate depth of sample
- MW6 — Monitoring well (MW) number

TABLE 4
RESULTS OF LABORATORY ANALYSES OF
GROUND-WATER SAMPLES FOR TOG AND VOC
UNOCAL Service Station No. 5484
18950 Lake Chabot Road
Castro Valley, California

Sample	Date	TOG	VOC
W-15-MW2	11/21/89	<5,000	NA
W-8-MW2	11/17/89	NA	ND
W-16-MW5	11/21/89	<5,000	NA
W-7-MW5	11/17/89	NA	ND

Results in parts per billion (ppb)
TOG = total oil and grease (Standard Method 503A/E)
VOC = halogenated volatile organic compounds (EPA Method 601)
< = Less than the reported limit of detection for the method of analysis used
NA = Not analyzed
ND = No targeted Method 601 compounds were detected
Sample designation: W-16-MW5

- W: Water sample
- 16: Approximate depth of sample
- MW5: Monitoring well (MW) number

TABLE 5
GROUND-WATER ELEVATION DIFFERENCES
Unocal Service Station No. 5484
18950 Lake Chabot Road
Castro Valley, California
(measured on November 21, 1989)

Monitoring Well Number	Top of Casing (C)	Static Water Depth (W)	Water level Elevation (C - W)
MW-1	Well destroyed during tank excavation		
MW-2	228.88	7.24	221.64
MW-3	Well destroyed during tank excavation		
MW-4	227.75	10.83	216.92
MW-5	225.10	9.56	215.54
MW-6	239.00	8.59	230.41

Measurements are in feet. Depth measured from top of casing.

TABLE 6
COSTS ASSOCIATED WITH EXCAVATION
Unocal Service Station No. 5484
18950 Lake Chabot Road
Castro Valley, California

Excavation	$6,000
Loading and transportation	$6,000
Backfill and Compaction	$20,000
Disposal at Class I landfill*	$64,000
Laboratory analysis (2 week return)	$8,000
County tax (10% of Class I disposal fee)	$6,000
State tax (65% of Class I disposal fee)	$40,000
Engineering & Management	$8,000
ORDER-OF-MAGNITUDE COST	$158,000

* Assume 550 cubic yards of soil containing 100 ppm or greater TPHg.

Source: U.S. Geological Survey
7.5-Minute Quadrangle
Hayward, California
Photorevised 1980

N

Approximate Scale

2000 1000 0 2000 4000

feet

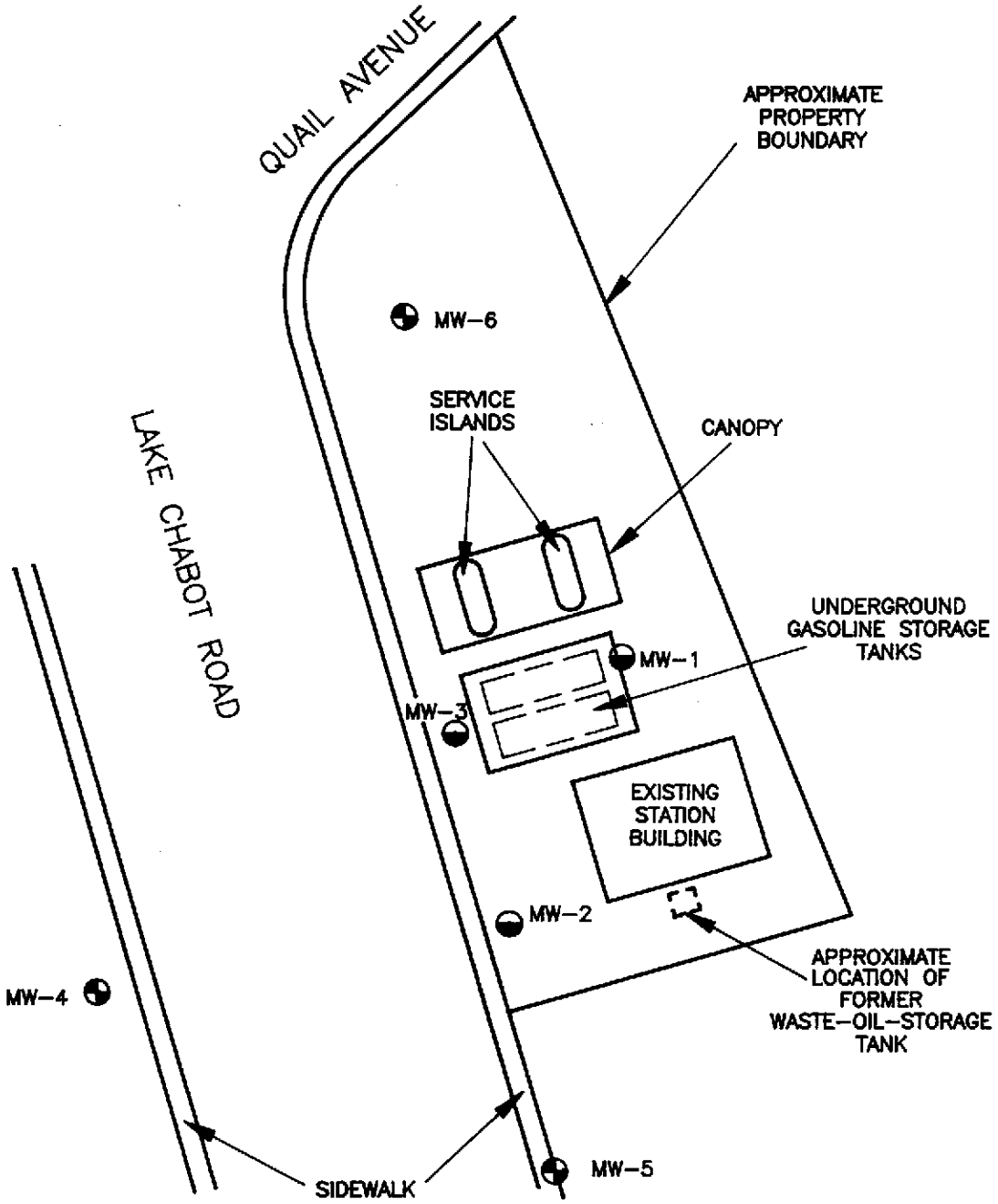
Applied GeoSystems

PROJECT NO. 18061-5

SITE VICINITY MAP

Unocal Station No. 5484
18950 Lake Chabot Road
Castro Valley, California

PLATE
P - 1



MW-6 = Monitoring well installed by Applied GeoSystems (1989)

MW-3 = Monitoring well installed by Applied GeoSystems (1988)

Source: Surveyed by Ron Archer, Civil Engineer, Inc.

N

Approximate Scale

40 20 0 40 80

feet

Applied GeoSystems

PROJECT NO. 18061-5

GENERALIZED SITE PLAN
Unocal Station No. 5484
18950 Lake Chabot Road
Castro Valley, California

PLATE

P - 2

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		LTR	DESCRIPTION	MAJOR DIVISIONS		LTR	DESCRIPTION
Coarse-grained soils	Gravel and gravelly soils	GW	Well-graded gravels of gravel-sand mixtures, little or no fines	Fine-grained soils	Silts and clays LL<50	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		GM	Silty gravels, gravel-sand-silt mixtures			OL	Organic silts and organic silt-clays of low plasticity
		GC	Clayey gravels, gravel-sand-clay mixtures		Silts and clays LL>50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils. Elastic silts
	Sand and sandy soils	SW	Well-graded sand of gravelly sands, little or no fines			CH	Inorganic clays of high plasticity, fat clays
		SP	Poorly-graded sands or gravelly sands, little or no fines			OH	Organic clays of medium to high plasticity, organic silts
		SM	Silty sands, sand-silt mixtures	Highly organic soils		PT	Peat and other highly organic soils
		SC	Clayey sands, sand-clay mixtures				


Depth through which sampler is driven


Relatively undisturbed sample


No sample recovered


Static water level observed in well


Initial water level observed in boring

S-10 Sample number


Sand pack


Bentonite annular seal


Neat cement annular seal


Caved native soil


Blank PVC


Machine-slotted PVC

P.I.D. Photoionization detector

BLOWS REPRESENT THE NUMBER OF BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES TO DRIVE THE SAMPLER THROUGH EACH 6 INCHES OF AN 18-INCH PENETRATION.

DASHED LINES SEPARATING UNITS ON THE LOG REPRESENT APPROXIMATE BOUNDARIES ONLY. ACTUAL BOUNDARIES MAY BE GRADUAL. LOGS REPRESENT SUBSURFACE CONDITIONS AT THE BORING LOCATION AT THE TIME OF DRILLING ONLY.

Applied GeoSystems

PROJECT NO. 18061-5

UNIFIED SOIL CLASSIFICATION SYSTEM AND SYMBOL KEY
Unocal Station No. 5484
18950 Lake Chabot Road
Castro Valley, California

PLATE
P - 3

Total depth of boring: 20-1/2 feet **Diameter of boring:** 4 inches **Date drilled:** 11-17-89

Casing diameter: N/A **Length:** N/A **Slot size:** N/A

Screen diameter: N/A **Length:** N/A **Material type:** N/A

Drilling Company: Environmental Exploration, Inc. **Driller:** Tom, Tim and Tom

Method Used: Hollow-Stem Auger **Field Geologist:** Mark Armstrong

Signature of Registered Professional: _____

Registration No.: _____ **State:** CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0						
					Asphalt underlain by baserock.	
				CL	Silty clay, with gravel, tan, damp, medium plasticity, stiff.	
2						
4						
	S-5	50	120		Green and brown mottled, hard.	
6						
	S-7.5	50	220		Grades more gravelly	
8						
10	S-10	50	210			
12					Siltstone; brown and green, hard, sandy, weathered.	
14		18				
	S-15	45	280		Green-tan, damp, clayey.	
16						
18					Shale, black, dry, hard.	
20	S-20	50	18			
					Total Depth = 20-1/2 feet.	

Applied GeoSystems

PROJECT NO. 18061-5

LOG OF BORING B-7

Unocal Station No. 5484
18950 Lake Chabot Road
Castro Valley, California

PLATE

P - 4

Total depth of boring: 15-1/2 feet **Diameter of boring:** 4 inches **Date drilled:** 11-17-89

Casing diameter: N/A **Length:** N/A **Slot size:** N/A

Screen diameter: N/A **Length:** N/A **Material type:** N/A

Drilling Company: Environmental Exploration, Inc. **Driller:** Tom, Tim and Tom

Method Used: Hollow-Stem Auger **Field Geologist:** Mark Armstrong

Signature of Registered Professional: _____

Registration No.: _____ **State:** CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0					Asphalt underlain by baserock.	
2				CL	Silty clay, with gravel, tan, slightly damp, medium plasticity, hard.	
4		30				
	S-5.5	35	1.0		Silty gravelly clay.	
6		35				
8						
10		31				
	S-10	35	4.74			
12		35			Siltstone, gray-brown to tan, hard, weathered.	
14						
	S-14.5	50	18		Shale, black, hard.	
16					Total Depth = 15-1/2 feet.	
18						
20						

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PROJECT NO. 18061-5

LOG OF BORING

Unocal Station No. 5484
18950 Lake Chabot Road
Castro Valley, California

PLATE

P - 5

Total depth of boring: 18 feet **Diameter of boring:** 4 inches **Date drilled:** 11-17-89

Casing diameter: N/A **Length:** N/A **Slot size:** N/A

Screen diameter: N/A **Length:** N/A **Material type:** N/A

Drilling Company: Environmental Exploration, Inc. **Driller:** Tom, Tim and Tom

Method Used: Hollow-Stem Auger **Field Geologist:** Mark Armstrong

Signature of Registered Professional: _____

Registration No.: _____ **State:** CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0					Asphalt underlain by baserock.	
				CL	Silty sandy clay, with trace gravel, tan, dry, medium plasticity, very stiff.	
4		17				
	S-4.5	28 15	118		Green and brown mottled, hard.	
8						
		18			Siltstone, gray-brown, hard, weathered and fractured, green-gray in fractures.	
10	S-10	33 50	[redacted]			
14		23				
	S-14.5	50	114		Clayey, brown, with fragments of gray siltstone/mudstone.	
16		32				
18	S-17	50	5.1		Shale, black.	
					Total Depth = 18 feet.	
20						

Applied GeoSystems

PROJECT NO. 18061-5

LOG OF BORING [redacted]

Unocal Station No. 5484
18950 Lake Chabot Road
Castro Valley, California

PLATE

P - 6

Total depth of boring: 20 feet **Diameter of boring:** 4 inches **Date drilled:** 11-16-89

Casing diameter: N/A **Length:** N/A **Slot size:** N/A

Screen diameter: N/A **Length:** N/A **Material type:** N/A

Drilling Company: Environmental Exploration, Inc. **Driller:** Tom, Tim and Tom

Method Used: Hollow-Stem Auger **Field Geologist:** Mark Armstrong

Signature of Registered Professional: _____

Registration No.: _____ **State:** CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0					Asphalt underlain by baserock.	
					Gravel fill.	
2				CL	Silty sandy clay, with gravel, yellow-brown, damp, medium plasticity, hard, organics.	
4		9				
	S-4.5	18 27	0			
6						
					Siltstone, dark gray and green mottled, hard, weathered and fractured.	
8		17				
		20				
10	S-9.5	22	143			
12						
14						
16		21			Clayey, brown, with fragments of gray and brown siltstone/mudstone.	
		24				
18	S-17	28	224		Brown-black.	
					Shale, black, dry.	
20	S-19.5	80	8.0		Total Depth = 20 feet.	

Applied GeoSystems

PROJECT NO. 18061-5

LOG OF BORING [redacted]

Unocal Station No. 5484
18950 Lake Chabot Road
Castro Valley, California

PLATE

P - 7

Total depth of boring: 18 feet **Diameter of boring:** 4 inches **Date drilled:** 11-16-89

Casing diameter: N/A **Length:** N/A **Slot size:** N/A

Screen diameter: N/A **Length:** N/A **Material type:** N/A

Drilling Company: Environmental Exploration, Inc. **Driller:** Tom, Tim and Tom

Method Used: Hollow-Stem Auger **Field Geologist:** Mark Armstrong

Signature of Registered Professional: _____

Registration No.: _____ **State:** CA

Depth	Sample No.	Blows	[illegible]	USCS Code	Description	Well Const.
0					Asphalt underlain by baserock.	
				CL	Sandy clay, with gravel, gray-green, dry, medium plasticity, hard.	
2						
4		12				
	S-4.5	20 44	3.8			
6						
8						
					Siltstone, dark gray, hard, very weathered and fractured. Grades more sandy.	
10	S-9.5	50	[illegible]			
12						
14		30				
	S-14.5	50	[illegible]		Clayey, brown, with fragments of gray-brown siltstone/ mudstone.	
16						
	S-17	50	.2		Shale, black, slightly damp.	
18					Total Depth = 18 feet.	
20						

Applied GeoSystems

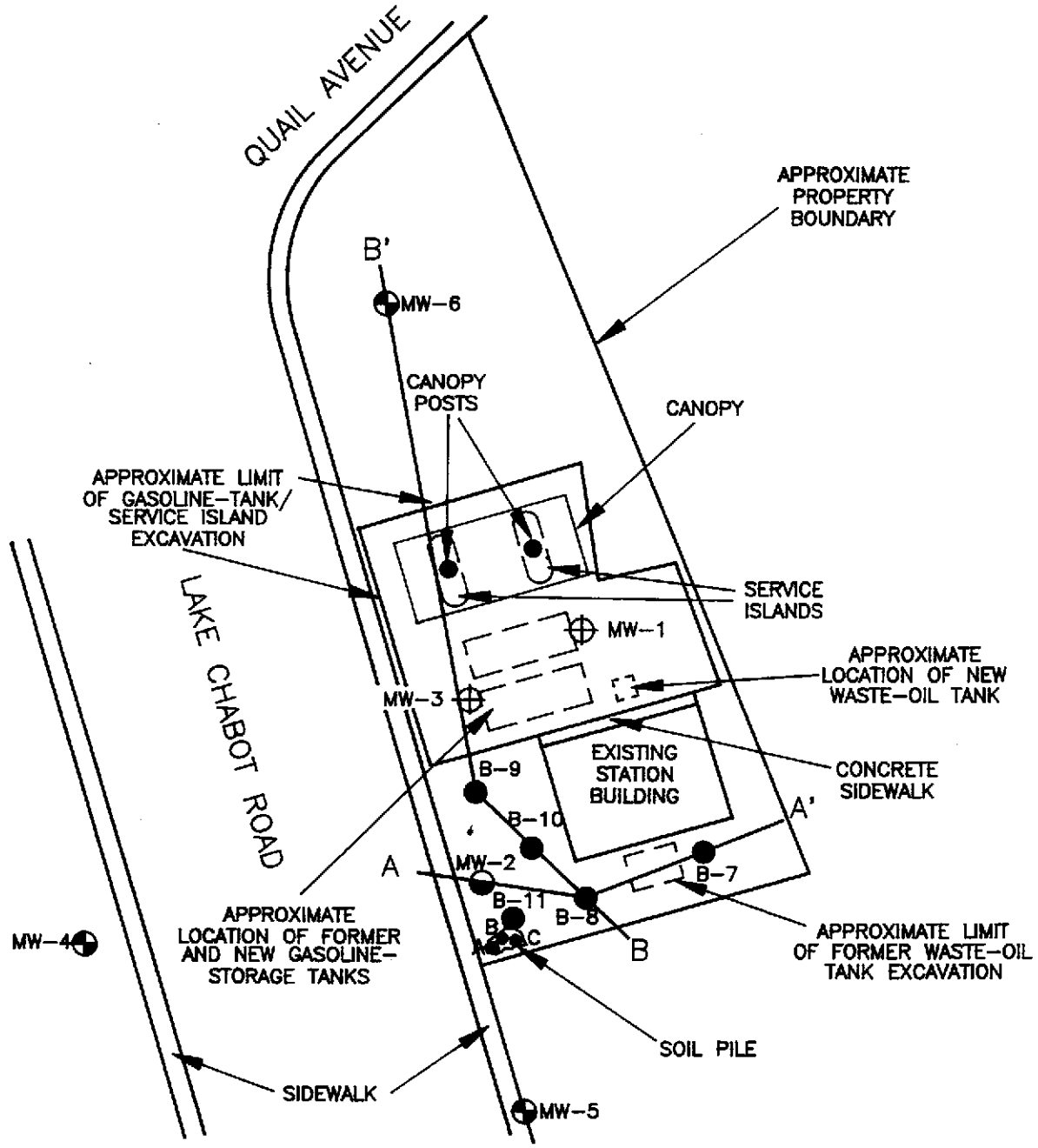
PROJECT NO. 18061-5

LOG OF BORING [illegible]

Unocal Station No. 5484
18950 Lake Chabot Road
Castro Valley, California

PLATE

P - 8



B — B' = Cross section line

C ● = Soil sample point (composited)

B-12 ● = Soil boring

MW-6 ⊕ = Monitoring well installed by Applied GeoSystems (1989)

MW-2 ◒ = Monitoring well installed by Applied GeoSystems (1988)

MW-3 ⊕ = Former monitoring well installed by Applied GeoSystems (1988)

Approximate Scale

40 20 0 40 80

feet

Note: Well head elevations surveyed by Ron Archer, Civil Engineer, Inc.

Applied GeoSystems

PROJECT NO. 18061-5

DETAILED SITE PLAN-
GEOLOGIC CROSS SECTIONS
Unocal Station No. 5484
18950 Lake Chabot Road
Castro Valley, California

PLATE

P - 9

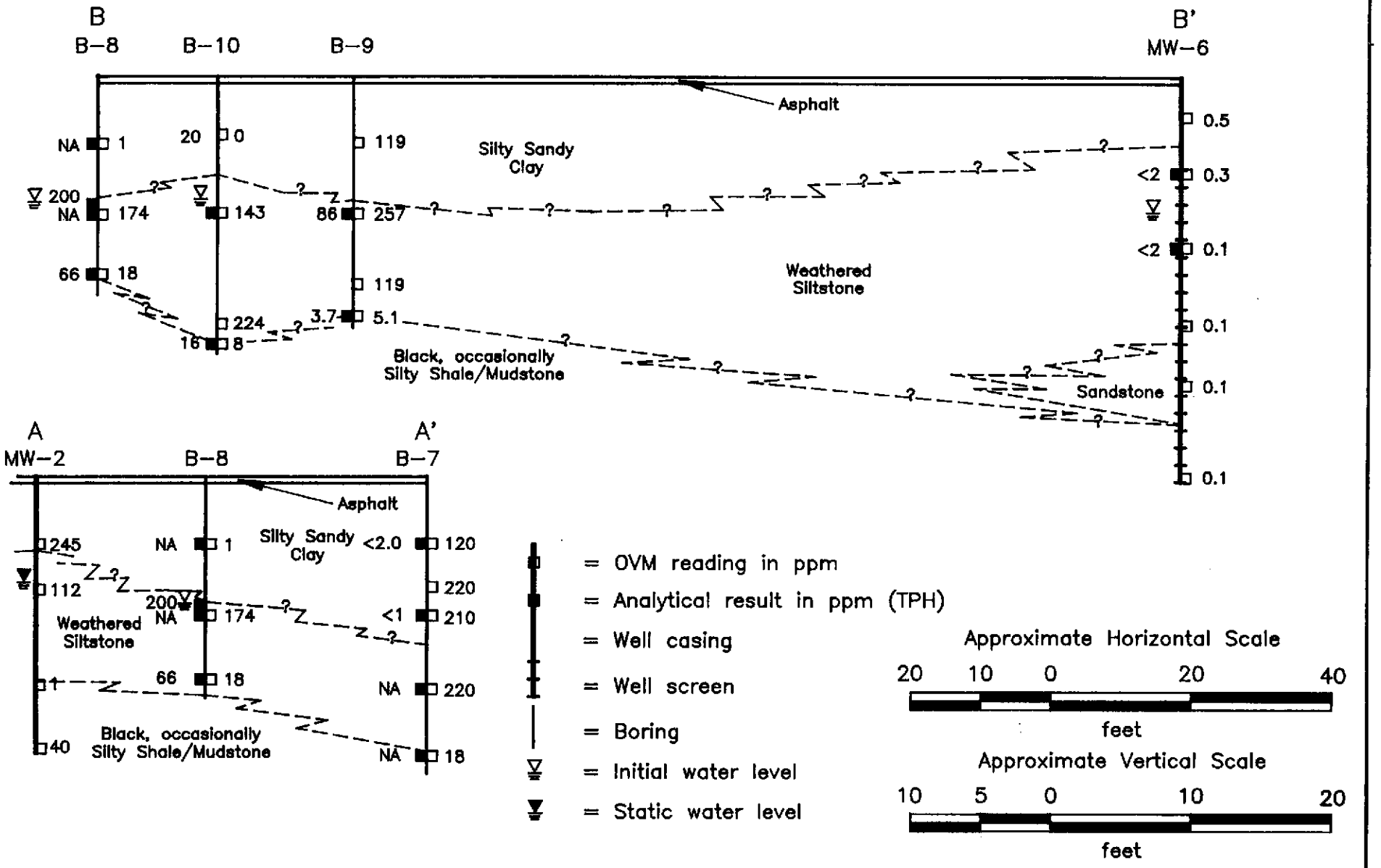
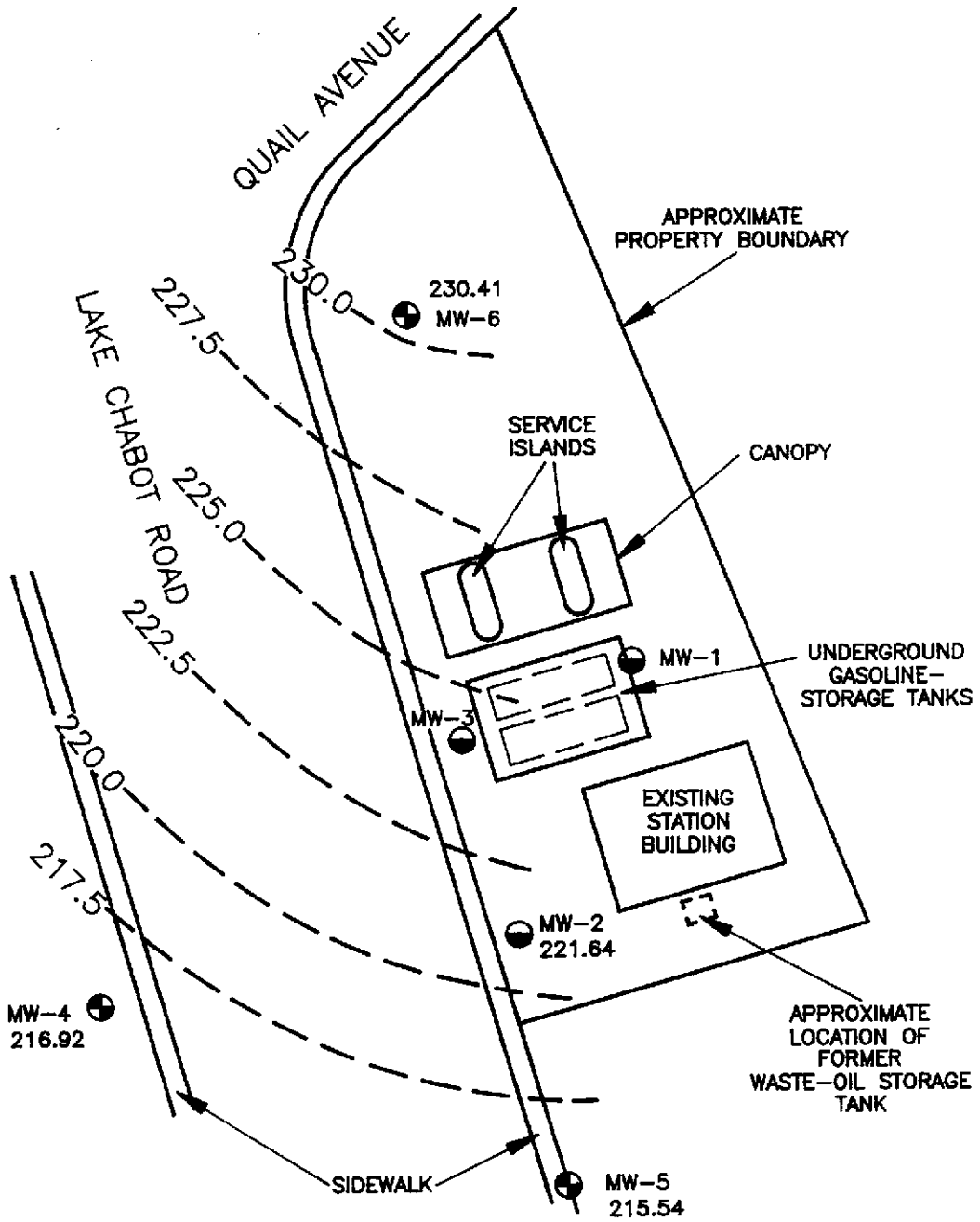


PLATE	GEOLOGIC CROSS SECTION	
P - 10	Unocal Station No. 5484 18950 Lake Chabot Road Castro Valley, California	Applied GeoSystems PROJECT NO. 18061-5



224.00 = Ground-water elevation contour in feet above mean sea level November 21, 1989

MW-6 = Monitoring well installed by Applied GeoSystems (1989)

MW-3 = Monitoring well installed by Applied GeoSystems (1988)

N

Approximate Scale

40 20 0 40 80

feet

Applied GeoSystems

PROJECT NO. 18061-5

GROUND-WATER GRADIENT MAP
(November 21, 1989)
Unocal Station No. 5484
18950 Lake Chabot Road
Castro Valley, California

PLATE

P - 11

ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

5997 PARKSIDE DRIVE • PLEASANTON, CALIFORNIA 94566 • (415) 484-2600

RECEIVED
NOV 15 RECD
ZONE 7 ACFC&WCD

GROUNDWATER PROTECTION ORDINANCE PERMIT APPLICATION

FOR APPLICANT TO COMPLETE

(1) LOCATION OF PROJECT 18950 Lake Chabot Road
Castro Valley California
(Unocal Service Station No. 5484)

(2) CLIENT
Name Unocal Corporation
Address 2175 N. California Blvd. Phone (415) 945-7676
City Walnut Creek, CA. Zip 94596

(3) APPLICANT
Name Applied GeoSystems
Address 43255 Mission Blvd. Phone (415) 657-1906
City Fremont, CA. Zip 94539

(4) DESCRIPTION OF PROJECT
Water Well Construction ___ Geotechnical Investigation
Cathodic Protection ___ General ___
Well Destruction ___ Contamination ✓

(5) PROPOSED WATER WELL USE
Domestic ___ Industrial ___ Irrigation
Municipal ___ Monitoring ___ Other Soil Borings

(6) PROPOSED CONSTRUCTION
Drilling Method:
Mud Rotary ___ Air Rotary ___ Auger ✓
Cable ___ Other ___

DRILLER'S LICENSE NO. C-57 563305

WELL PROJECTS
Drill Hole Diameter N.A. in. Maximum
Casing Diameter N.A. in. Depth N.A. ft.
Surface Seal Depth N.A. ft. Number N.A.

GEOTECHNICAL PROJECTS
Number of Borings 6 Maximum
Hole Diameter 8 in. Depth 15 ft.
Backfill borings with neat cement + bentonite.

(7) ESTIMATED STARTING DATE 11/16/89
ESTIMATED COMPLETION DATE 11/17/89

(8) I hereby agree to comply with all requirements of this permit and Alameda County Ordinance No. 73-68.

APPLICANT'S SIGNATURE Jon R. Zuellen Date 11/8/89

FOR OFFICE USE

PERMIT NUMBER 89666
LOCATION NUMBER

PERMIT CONDITIONS

Circled Permit Requirements Apply

A. GENERAL
(1.) A permit application should be submitted so as t arrive at the Zone 7 office five days prior t proposed starting date.
2. Submit to Zone 7 within 60 days after completic of permitted work the original Department c Water Resources Water Well Drillers Report c equivalent for well projects, or drilling log and location sketch for geotechnical projects.
(3.) Permit is void if project not begun within 9 days of approval date.

B. WATER WELLS, INCLUDING PIEZOMETERS
1. Minimum surface seal thickness is two inches c cement grout placed by tremie.
2. Minimum seal depth is 50 feet for municipal ar industrial wells or 20 feet for domestic, irriga tion, and monitoring wells unless a lesser dept is specially approved.

(C.) GEOTECHNICAL. Backfill bore hole with compacted cut tings or heavy bentonite and upper two feet with com pacted material. In areas of known or suspecte contamination, tremied cement grout shall be used place of compacted cuttings.

D. CATHODIC. Fill hole above anode zone with concre placed by tremie.

E. WELL DESTRUCTION. See attached.

Approved Wyman Hong Date 15 Nov 89
Wyman Hong

219E

APPENDIX B

STANDARD FIELD PROCEDURES

STANDARD FIELD PROCEDURES

Site Safety Plan

Field work performed by Applied GeoSystems on behalf of Unocal was conducted in accordance with Applied GeoSystems' Site Safety Plan No. 18061-3S (Applied GeoSystems, May 22, 1989). This Plan describes the safety requirements for the subsurface environmental investigation and for drilling of soil borings at the site. The Site Safety Plan is applicable to personnel and subcontractors of Applied GeoSystems. Personnel and subcontractors of Applied GeoSystems scheduled to perform work at the site were briefed on the contents of the Site Safety Plan before work began. A copy of the Site Safety Plan was kept at the site, and was available for reference by appropriate parties during work at the site. The Staff Geologist of Applied GeoSystems was the Site Safety Officer.

Borehole Drilling

The borings were drilled with 8-inch-diameter, continuous-flight, hollow-stem augers, with a CME-55 truck-mounted drill rig operated by J-Con Exploration, of Yuba City, California. The augers were steam cleaned before each use to minimize the possibility of cross-contamination.

Soil Sample Collection, Subjective Analysis, and Classification

Soil samples were collected from each of the borings by advancing each boring to a point immediately above the sampling depth and then driving a California-modified, split-spoon sampler (2.5-inch-inside-diameter) into the soil through the hollow center of the auger. The sampler was driven 18 inches with a standard 140-pound hammer repeatedly dropped 30 inches. The number of blows required to drive the sampler each 6-inch increment was counted and recorded to evaluate the relative consistency of the soil. Soil samples were collected from each of the borings at a maximum of 5-foot intervals from the ground surface to total depth of the boring.

After recovering the sampler, the soil samples were removed. A sample was sealed promptly in its brass sleeve with aluminum foil, plastic caps, and tape. It then was labeled and placed in iced storage pending transport to a laboratory certified by the State of California to perform the required testing. A Chain of Custody Record for each sample or set of samples was initiated by the field geologist and are included in Appendix B of this report. A second sleeve was used to subjectively evaluate the soil sample from each sample interval for the presence of hydrocarbons. Any product discoloration was noted on the Log of Boring by the field geologist. An organic vapor meter (OVM) was used to evaluate the organic vapor concentrations present in the soil samples. Readings were collected by placing the rubber cup

skirting the intake probe flush against the end of the soil sample immediately after the sleeve was removed from the sampler. Measurements from instruments such as the OVM can be used to indicate relative organic vapor concentrations in soil but cannot be used to measure the level of hydrocarbon compounds with the precision of laboratory analytical methods.

The Unified Soil Classification System was used to identify the soil encountered in the borings. A copy of this classification system is shown on Plate P-3. Descriptions of the soil encountered in the boring are presented on the Logs of Borings. The OVM readings are shown on the Logs of Borings in the column labeled "P.I.D."

Depth-to-Ground-Water Measurements and Subjective Evaluations of Ground-Water Samples

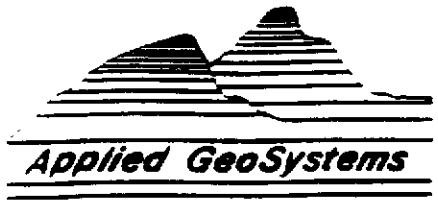
Four days after the completion of borehole drilling, an Applied GeoSystems geologist measured depths to water in the borings with a Solinst electric water-level indicator. That instrument is accurate to the nearest 0.01 foot.

The static water level in each monitoring well was measured to the nearest 0.01 foot with a Solinst electric water-level indicator. Initial samples of ground water were then collected from the wells and checked for floating product, sheen, and emulsion. The samples were collected by gently lowering approximately half the length of a clean Teflon bailer past the air-water interface and collecting a sample from near the surface of the water in each well.

APPENDIX C

CHAIN OF CUSTODY RECORDS
AND
CERTIFIED ANALYTICAL REPORTS

CHAIN OF CUSTODY RECORD



43255 Mission Blvd Suite B Fremont, CA 94539 415/651-

SAMPLER (signature): R Mark Armstrong

Phone: (415) 651-1906

LABORATORY: Applied GeoSystems

TURNAROUND TIME: 2-week

Project Leader: Jon Lueller

Phone No. (415) 651-1906

SHIPPING INFORMATION:

Shipper

Address

Date Shipped

Service Used

Airbill No. Cooler No.

Relinquished by: (signatures)	Received by: (signatures)	Date	T
R. Mark Armstrong	Jon R. Lueller	11-20-89	
Jon R. Lueller			
	Received for laboratory by:	11-21-89	

LABORATORY SHOULD SIGN UPON RECEIPT AND RETURN A COPY OF THIS FORM WITH THE LABORATORY RESULTS

Sample No.	Site Identification	Date Sampled	Analyses Requested	Sample Condition Upon Receipt
S-5-B87	1806-5	11/17/89	TPH-G & BTEX	ECAD
S-10-B87				
S-9.5-B88				
S-15-B88				

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ANALYSIS REPORT

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Report Prepared for:
Applied GeoSystems
43255 Misson Boulevard
Fremont, CA 94539
Attention: Jon R. Luellen

Date Received: 11-21-89
Laboratory Number: 91128S01
Project #: 18061-5
Sample #: S-5-B8 7
Matrix: Soil

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline	ND		2.0		11-29-89	
TEH as Diesel						NR
Benzene	ND		0.050		11-29-89	
Toluene	ND		0.050		11-29-89	
Ethylbenzene	ND		0.050		11-29-89	
Total Xylenes	0.090		0.050		11-29-89	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

12-04-89
Date Reported

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ANALYSIS REPORT

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Report Prepared for:
Applied GeoSystems
43255 Misson Boulevard
Fremont, CA 94539
Attention: Jon R. Luellen

Date Received: 11-21-89
Laboratory Number: 91128S02
Project #: 18061-5
Sample #: S-10-B~~8~~ 7
Matrix: Soil

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline	6.1		2.0		11-29-89	
TEH as Diesel						NR
Benzene	0.062		0.050		11-29-89	
Toluene	0.54		0.050		11-29-89	
Ethylbenzene	0.16		0.050		11-29-89	
Total Xylenes	0.91		0.050		11-29-89	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

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Date Reported

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ANALYSIS REPORT

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Report Prepared for:
Applied GeoSystems
43255 Misson Boulevard
Fremont, CA 94539
Attention: Jon R. Luellen

Date Received: 11-21-89
Laboratory Number: 91128S03
Project #: 18061-5
Sample #: S-9.5-B9 8
Matrix: Soil

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline	200		2.0		11-29-89	
TEH as Diesel						NR
Benzene	0.34		0.050		11-29-89	
Toluene	0.91		0.050		11-29-89	
Ethylbenzene	4.1		0.050		11-29-89	
Total Xylenes	23		0.050		11-29-89	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

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12-04-89
Date Reported

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Report Prepared for:
Applied GeoSystems
43255 Misson Boulevard
Fremont, CA 94539
Attention: Jon R. Luellen

Date Received: 11-21-89
Laboratory Number: 91128S04
Project #: 18061-5
Sample #: S-15-B~~9~~ 8
Matrix: Soil

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline	66		2.0		11-29-89	
TEH as Diesel						NR
Benzene	0.12		0.050		11-29-89	
Toluene	0.43		0.050		11-29-89	
Ethylbenzene	1.1		0.050		11-29-89	
Total Xylenes	5.9		0.050		11-29-89	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

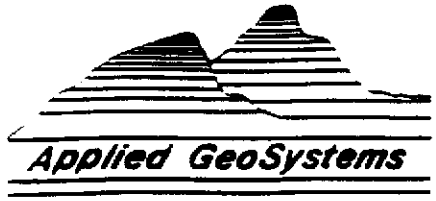
TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

12-04-89
Date Reported

CHAIN OF CUSTODY RECORD



43255 Mission Blvd Suite B Fremont, CA 94539 (415) 651-19

SAMPLER (signature):

Phone: (415) 651-1906

LABORATORY: Applied GeoSystems

TURNAROUND TIME: 2 week

Project Leader: Jon Lueller

Phone No. (415) 651-1906

SHIPPING INFORMATION:

Shipper

Address

Date Shipped

Service Used

Airbill No. Cooler No.

Relinquished by: (signatures)	Received by: (signatures)	Date	Ti
	Jon R. Lueller	11-17-89	8:30
Jon R. Lueller	Received for laboratory by:	11-17-89	8:4

LABORATORY SHOULD SIGN UPON RECEIPT AND RETURN A COPY OF THIS FORM WITH THE LABORATORY RESULTS

Sample No. JRL	Site Identification	Date Sampled	Analyses Requested	Sample Condition Upon Receipt
S-10.0-BH09			X	
S-17.0-BH09			TPHg BTEX	
S-10.0-BH10	5			
S-19.5-BH10	8015	11-16-89		Iced
S-10.0-BH11			TPHg, BTEX, TOG	
S-15.0-BH11			TPHg, BTEX, TOG	

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ANALYSIS REPORT

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Report Prepared for:
Applied GeoSystems
43255 Misson Boulevard
Fremont, CA 94539
Attention: Jon R. Luellen

Date Received: 11-17-89
Laboratory Number: 91119S01
Project #: 18061-5
Sample #: S-10.0-B10 9
Matrix: Soil

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline	86		2.0		11-29-89	
TEH as Diesel						NR
Benzene	1.1		0.050		11-29-89	
Toluene	0.67		0.050		11-29-89	
Ethylbenzene	2.0		0.050		11-29-89	
Total Xylenes	3.7		0.050		11-29-89	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

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Date Reported

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Report Prepared for:
Applied GeoSystems
43255 Misson Boulevard
Fremont, CA 94539
Attention: Jon R. Luellen

Date Received: 11-17-89
Laboratory Number: 91119S02
Project #: 18061-5
Sample #: S-17.0-B10 9
Matrix: Soil

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline	3.7		2.0		11-29-89	
TEH as Diesel						NR
Benzene	ND		0.050		11-29-89	
Toluene	0.092		0.050		11-29-89	
Ethylbenzene	0.076		0.050		11-29-89	
Total Xylenes	0.13		0.050		11-29-89	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

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Report Prepared for:
Applied GeoSystems
43255 Misson Boulevard
Fremont, CA 94539
Attention: Jon R. Luellen

Date Received: 11-17-89
Laboratory Number: 91119S03
Project #: 18061-5
Sample #: S-10.0-B11/0
Matrix: Soil

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline	220		2.0		11-29-89	
TEH as Diesel						NR
Benzene	0.27		0.050		11-29-89	
Toluene	ND		0.050		11-29-89	
Ethylbenzene	5.6		0.050		11-29-89	
Total Xylenes	16		0.050		11-29-89	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

12-04-89
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ANALYSIS REPORT

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Report Prepared for:
Applied GeoSystems
43255 Misson Boulevard
Fremont, CA 94539
Attention: Jon R. Luellen

Date Received: 11-17-89
Laboratory Number: 91119S04
Project #: 18061-5
Sample #: S-19.5-B11/0
Matrix: Soil

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline	16		2.0		11-29-89	
TEH as Diesel						NR
Benzene	0.081		0.050		11-29-89	
Toluene	0.12		0.050		11-29-89	
Ethylbenzene	0.62		0.050		11-29-89	
Total Xylenes	1.8		0.050		11-29-89	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

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12-04-89
Date Reported

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ANALYSIS REPORT

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Report Prepared for:
Applied GeoSystems
43255 Misson Boulevard
Fremont, CA 94539
Attention: Jon R. Luellen

Date Received: 11-17-89
Laboratory Number: 91119S05
Project #: 18061-5
Sample #: S-10.0-B12
Matrix: Soil

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline	45		2.0		11-29-89	
TEH as Diesel						NR
Benzene	0.074		0.050		11-29-89	
Toluene	0.33		0.050		11-29-89	
Ethylbenzene	1.2		0.050		11-29-89	
Total Xylenes	3.1		0.050		11-29-89	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

12-04-89
Date Reported

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ANALYSIS REPORT

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Report Prepared for:
Applied GeoSystems
43255 Misson Boulevard
Fremont, CA 94539
Attention: Jon R. Luellen

Date Received: 11-17-89
Laboratory Number: 91119S06
Project #: 18061-5
Sample #: S-15.0-B12 / 11
Matrix: Soil

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline	3.4		2.0		11-29-89	
TEH as Diesel						NR
Benzene	ND		0.050		11-29-89	
Toluene	0.061		0.050		11-29-89	
Ethylbenzene	0.086		0.050		11-29-89	
Total Xylenes	2.5		0.050		11-29-89	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

12-04-89
Date Reported

Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906

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ANALYSIS REPORT

togsoil.rpt

Report Prepared for:
Applied GeoSystems
43255 Mission Blvd.
Fremont, CA, 94539
Attention: Jon Luellen

Date Received: 11-17-89
Laboratory Number: 91119S05
Project #: 18061-5
Sample #: S-10.0-B12 //
Matrix: Soil

Parameter	Result (mg/kg)	Detection Limit (mg/kg)	Date Analyzed
TPH as Oil and Grease	ND	50	11-29-89

mg/kg = milligrams per kilogram = ppm
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.

PROCEDURES

TPH as Oil and Grease: Total Petroleum Hydrocarbons as Oil and Grease are measured by extraction and gravimetric analysis according to Standard Method 503D/E.

Laura Kuck
Laura Kuck, Laboratory Manager

12-07-89
Date Reported

Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906

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ANALYSIS REPORT

togsoil.rpt

Report Prepared for:
Applied GeoSystems
43255 Mission Blvd.
Fremont, CA, 94539
Attention: Jon Luellen

Date Received: 11-17-89
Laboratory Number: 91119S06
Project #: 18061-5
Sample #: S-15.0-B12 //
Matrix: Soil

Parameter	Result (mg/kg)	Detection Limit (mg/kg)	Date Analyzed
TPH as Oil and Grease	ND	50	11-29-89

mg/kg = milligrams per kilogram = ppm
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.

PROCEDURES

TPH as Oil and Grease: Total Petroleum Hydrocarbons as Oil and Grease are measured by extraction and gravimetric analysis according to Standard Method 503D/E.

Laura Kuck
Laura Kuck, Laboratory Manager

12-07-89
Date Reported

CHAIN OF CUSTODY RECORD

Applied GeoSystems
43255 Mission Blvd Suite B Fremont, CA 94539 415/651-

SAMPLER (signature): R. Mark Armstrong
Phone: (415) 651-1906

LABORATORY: Anametrix, Inc.

TURNAROUND TIME: 1 week

Project Leader: Jon Lvellen
Phone No. (415) 651-1906

SHIPPING INFORMATION:
Shipper
Address
Date Shipped
Service Used
Airbill No. Cooler No.

Relinquished by: (signatures)	Received by: (signatures)	Date	T
R. Mark Armstrong	Jon R. Lvellen	11/29/89	834
Jon R. Lvellen	Received for laboratory by:	10:30 11/20/89	

LABORATORY SHOULD SIGN UPON RECEIPT AND RETURN A COPY OF THIS FORM WITH THE LABORATORY RESULTS

Sample No.	Site Identification	Date Sampled	Analyses Requested	Sample Condition Upon Receipt
S-15-B87				
S-20-B87				
S-5.0-B88				
S-10.0-B88				
S-45-B811		11-16-89		

ANAMETRIX INC
Environmental & Analytical Chemistry
1961 Concourse Drive, Suite E, San Jose, CA 95131
(408) 432-8192 • Fax (408) 432-8198

REPORT

Jon Luellen
Applied GeoSystems
43255 Mission Boulevard
Suite B
Fremont, CA 94539

November 28, 1989
Anametrix W.O.#: 8911148
Date Received : 11/20/89
Project No. : 18061-5

Dear Mr. Luellen:

Your samples have been received for analysis. The REPORT SUMMARY lists your sample identifications and the analytical methods you requested. The following sections are included in this report: RESULTS and QUALITY ASSURANCE.

NOTE: 1) Amounts reported are net values, i.e. corrected for method blank contamination.
2) Samples S-10.0-B~~Ø~~8 and S-14.5-B~~12~~11 had to be diluted due to the nature of the matrix.

If there is any more that we can do, please give us a call. Thank you for using ANAMETRIX, INC.

Sincerely,

ANAMETRIX, INC.

Corinne Pham

Corinne Pham
GC/VOA Supervisor

CP/lm

REPORT SUMMARY
ANAMETRIX, INC. (408) 432-8192

Client : Applied GeoSystems
Address : 43255 Mission Boulevard
Suite B
City : Fremont, CA 94539
Attn. : Jon Luellen

Anametrix W.O.#: 8911148
Date Received : 11/20/89
Purchase Order#: N/A
Project No. : 18061-5
Date Released : 11/28/89

Anametrix I.D.	Sample I.D.	Matrix	Date Sampled	Method	Date Extract	Date Analyzed	Inst I.D.
RESULTS							
8911148-01	S-15-B~~8~~7	SOIL	11/17/89	8010		11/22/89	HP14
8911148-02	S-20-B~~8~~7	SOIL	11/17/89	8010		11/21/89	HP10
8911148-03	S-5.0-B~~8~~8	SOIL	11/17/89	8010		11/21/89	HP10
8911148-04	S-10.0-B~~8~~8	SOIL	11/17/89	8010		11/22/89	HP14
8911148-05	S-14.5-B~~12~~11	SOIL	11/16/89	8010		11/22/89	HP14
QUALITY ASSURANCE (QA)							
10B1121H02	METHOD BLANK	SOIL	N/A	8010		11/21/89	HP10
14B1122H00	METHOD BLANK	SOIL	N/A	8010		11/22/89	HP14
14B1122H01	METHOD BLANK	SOIL	N/A	8010		11/22/89	HP14
SPK112289	METHOD SPIKE	SOIL	N/A	8010		11/22/89	HP14

ORGANIC ANALYSIS DATA SHEET - EPA METHOD 601/8010
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : 18061-5 S-15-B87
Matrix : SOIL
Date sampled : 11/17/89
Date analyzed: 11/22/89
Dilution : NONE

Anametrix I.D. : 8911148-01
Analyst : JW
Supervisor : CP
Date released : 11/28/89
Instrument ID : HP14

CAS #	Compound Name	Reporting Limit (ug/Kg)	Amount Found (ug/Kg)
74-87-3	* Chloromethane	1	ND
74-83-9	* Bromomethane	0.5	ND
75-71-8	* Dichlorodifluoromethane	1	ND
75-01-4	* Vinyl Chloride	0.5	ND
75-00-3	* Chloroethane	0.5	ND
75-09-2	* Methylene Chloride	0.5	ND
79-69-4	* Trichlorofluoromethane	0.5	ND
75-35-4	* 1,1-Dichloroethene	0.5	ND
75-34-3	* 1,1-Dichloroethane	0.5	ND
156-59-2	# Cis-1,2-Dichloroethene	0.5	ND
156-60-5	* Trans-1,2-Dichloroethene	0.5	ND
67-66-3	* Chloroform	0.5	ND
76-13-1	# Trichlorotrifluoroethane	0.5	ND
107-06-2	* 1,2-Dichloroethane	0.5	ND
71-55-6	* 1,1,1-Trichloroethane	0.5	ND
56-23-5	* Carbon Tetrachloride	0.5	ND
75-27-4	* Bromodichloromethane	0.5	ND
78-87-5	* 1,2-Dichloropropane	0.5	ND
10061-02-6	* Trans-1,3-Dichloropropene	0.5	ND
79-01-6	* Trichloroethene	0.5	ND
124-48-1	* Dibromochloromethane	0.5	ND
79-00-5	* 1,1,2-Trichloroethane	0.5	ND
10061-01-5	* cis-1,3-Dichloropropene	0.5	ND
110-75-8	* 2-Chloroethylvinylether	1	ND
75-25-2	* Bromoform	0.5	ND
127-18-4	* Tetrachloroethene	0.5	ND
79-34-5	* 1,1,2,2-Tetrachloroethane	0.5	ND
108-90-7	* Chlorobenzene	0.5	ND
541-73-1	* 1,3-Dichlorobenzene	1	ND
95-50-1	* 1,2-Dichlorobenzene	1	ND
106-46-7	* 1,4-Dichlorobenzene	1	ND
	% Surrogate Recovery	33-134%	45%

ND : Not detected at or above the practical quantitation limit for the method.
* A 601/8010 approved compound (Federal Register, 10/26/84).
# A compound added by Anametrix, Inc.

ORGANIC ANALYSIS DATA SHEET - EPA METHOD 601/8010
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : 18061-5 S-20-B8/7
Matrix : SOIL
Date sampled : 11/17/89
Date analyzed: 11/21/89
Dilution : NONE

Anametrix I.D. : 8911148-02
Analyst : JLO
Supervisor : CP
Date released : 11/28/89
Instrument ID : HP10

CAS #	Compound Name	Reporting Limit (ug/Kg)	Amount Found (ug/Kg)
74-87-3	* Chloromethane	1	ND
74-83-9	* Bromomethane	0.5	ND
75-71-8	* Dichlorodifluoromethane	1	ND
75-01-4	* Vinyl Chloride	0.5	ND
75-00-3	* Chloroethane	0.5	ND
75-09-2	* Methylene Chloride	0.5	ND
79-69-4	* Trichlorofluoromethane	0.5	ND
75-35-4	* 1,1-Dichloroethene	0.5	ND
75-34-3	* 1,1-Dichloroethane	0.5	ND
156-59-2	# Cis-1,2-Dichloroethene	0.5	ND
156-60-5	* Trans-1,2-Dichloroethene	0.5	ND
67-66-3	* Chloroform	0.5	ND
76-13-1	# Trichlorotrifluoroethane	0.5	ND
107-06-2	* 1,2-Dichloroethane	0.5	ND
71-55-6	* 1,1,1-Trichloroethane	0.5	ND
56-23-5	* Carbon Tetrachloride	0.5	ND
75-27-4	* Bromodichloromethane	0.5	ND
78-87-5	* 1,2-Dichloropropane	0.5	ND
10061-02-6	* Trans-1,3-Dichloropropene	0.5	ND
79-01-6	* Trichloroethene	0.5	ND
124-48-1	* Dibromochloromethane	0.5	ND
79-00-5	* 1,1,2-Trichloroethane	0.5	ND
10061-01-5	* cis-1,3-Dichloropropene	0.5	ND
110-75-8	* 2-Chloroethylvinylether	1	ND
75-25-2	* Bromoform	0.5	ND
127-18-4	* Tetrachloroethene	0.5	ND
79-34-5	* 1,1,2,2-Tetrachloroethane	0.5	ND
108-90-7	* Chlorobenzene	0.5	ND
541-73-1	* 1,3-Dichlorobenzene	1	ND
95-50-1	* 1,2-Dichlorobenzene	1	ND
106-46-7	* 1,4-Dichlorobenzene	1	ND
	% Surrogate Recovery	33-134%	51%

ND : Not detected at or above the practical quantitation limit for the method.
* A 601/8010 approved compound (Federal Register, 10/26/84).
\# A compound added by Anametrix, Inc.

ORGANIC ANALYSIS DATA SHEET - EPA METHOD 601/8010
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : 18061-5 S-5.0-B8/8
Matrix : SOIL
Date sampled : 11/17/89
Date analyzed: 11/21/89
Dilution : NONE

Anametrix I.D. : 8911148-03
Analyst : JW
Supervisor : CP
Date released : 11/28/89
Instrument ID : HP10

CAS #	Compound Name	Reporting Limit (ug/Kg)	Amount Found (ug/Kg)
74-87-3	* Chloromethane	1	ND
74-83-9	* Bromomethane	0.5	ND
75-71-8	* Dichlorodifluoromethane	1	ND
75-01-4	* Vinyl Chloride	0.5	ND
75-00-3	* Chloroethane	0.5	ND
75-09-2	* Methylene Chloride	0.5	ND
79-69-4	* Trichlorofluoromethane	0.5	ND
75-35-4	* 1,1-Dichloroethene	0.5	ND
75-34-3	* 1,1-Dichloroethane	0.5	ND
156-59-2	# Cis-1,2-Dichloroethene	0.5	ND
156-60-5	* Trans-1,2-Dichloroethene	0.5	ND
67-66-3	* Chloroform	0.5	ND
76-13-1	# Trichlorotrifluoroethane	0.5	ND
107-06-2	* 1,2-Dichloroethane	0.5	ND
71-55-6	* 1,1,1-Trichloroethane	0.5	ND
56-23-5	* Carbon Tetrachloride	0.5	ND
75-27-4	* Bromodichloromethane	0.5	ND
78-87-5	* 1,2-Dichloropropane	0.5	ND
10061-02-6	* Trans-1,3-Dichloropropene	0.5	ND
79-01-6	* Trichloroethene	0.5	ND
124-48-1	* Dibromochloromethane	0.5	ND
79-00-5	* 1,1,2-Trichloroethane	0.5	ND
10061-01-5	* cis-1,3-Dichloropropene	0.5	ND
110-75-8	* 2-Chloroethylvinylether	1	ND
75-25-2	* Bromoform	0.5	ND
127-18-4	* Tetrachloroethene	0.5	ND
79-34-5	* 1,1,2,2-Tetrachloroethane	0.5	ND
108-90-7	* Chlorobenzene	0.5	ND
541-73-1	* 1,3-Dichlorobenzene	1	ND
95-50-1	* 1,2-Dichlorobenzene	1	ND
106-46-7	* 1,4-Dichlorobenzene	1	ND
	% Surrogate Recovery	33-134%	80%

ND : Not detected at or above the practical quantitation limit for the method.
* A 601/8010 approved compound (Federal Register, 10/26/84).
# A compound added by Anametrix, Inc.

ORGANIC ANALYSIS DATA SHEET - EPA METHOD 601/8010
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : 18061-5 S-10.0-B88
Matrix : SOIL
Date sampled : 11/17/89
Date analyzed: 11/22/89
Dilution : 100

Anametrix I.D. : 8911148-04
Analyst : JCD
Supervisor : CP
Date released : 11/28/89
Instrument ID : HP14

CAS #	Compound Name	Reporting Limit (ug/Kg)	Amount Found (ug/Kg)
74-87-3	* Chloromethane	100	ND
74-83-9	* Bromomethane	50	ND
75-71-8	* Dichlorodifluoromethane	100	ND
75-01-4	* Vinyl Chloride	50	ND
75-00-3	* Chloroethane	50	ND
75-09-2	* Methylene Chloride	50	ND
79-69-4	* Trichlorofluoromethane	50	ND
75-35-4	* 1,1-Dichloroethene	50	ND
75-34-3	* 1,1-Dichloroethane	50	ND
156-59-2	# Cis-1,2-Dichloroethene	50	ND
156-60-5	* Trans-1,2-Dichloroethene	50	ND
67-66-3	* Chloroform	50	ND
76-13-1	# Trichlorotrifluoroethane	50	ND
107-06-2	* 1,2-Dichloroethane	50	ND
71-55-6	* 1,1,1-Trichloroethane	50	ND
56-23-5	* Carbon Tetrachloride	50	ND
75-27-4	* Bromodichloromethane	50	ND
78-87-5	* 1,2-Dichloropropane	50	ND
10061-02-6	* Trans-1,3-Dichloropropene	50	ND
79-01-6	* Trichloroethene	50	ND
124-48-1	* Dibromochloromethane	50	ND
79-00-5	* 1,1,2-Trichloroethane	50	ND
10061-01-5	* cis-1,3-Dichloropropene	50	ND
110-75-8	* 2-Chloroethylvinylether	100	ND
75-25-2	* Bromoform	50	ND
127-18-4	* Tetrachloroethene	50	ND
79-34-5	* 1,1,2,2-Tetrachloroethane	50	ND
108-90-7	* Chlorobenzene	50	ND
541-73-1	* 1,3-Dichlorobenzene	100	ND
95-50-1	* 1,2-Dichlorobenzene	100	ND
106-46-7	* 1,4-Dichlorobenzene	100	ND
	% Surrogate Recovery	33-134%	91%

ND : Not detected at or above the practical quantitation limit for the method.
* A 601/8010 approved compound (Federal Register, 10/26/84).
\# A compound added by Anametrix, Inc.

ORGANIC ANALYSIS DATA SHEET - EPA METHOD 601/8010
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : 18061-5 S-14.5-B1 //
Matrix : SOIL
Date sampled : 11/16/89
Date analyzed: 11/22/89
Dilution : 100

Anametrix I.D. : 8911148-05
Analyst : JLO
Supervisor : CP
Date released : 11/28/89
Instrument ID : HP14

CAS #	Compound Name	Reporting Limit (ug/Kg)	Amount Found (ug/Kg)
74-87-3	* Chloromethane	100	ND
74-83-9	* Bromomethane	50	ND
75-71-8	* Dichlorodifluoromethane	100	ND
75-01-4	* Vinyl Chloride	50	ND
75-00-3	* Chloroethane	50	ND
75-09-2	* Methylene Chloride	50	ND
79-69-4	* Trichlorofluoromethane	50	ND
75-35-4	* 1,1-Dichloroethene	50	ND
75-34-3	* 1,1-Dichloroethane	50	ND
156-59-2	# Cis-1,2-Dichloroethene	50	ND
156-60-5	* Trans-1,2-Dichloroethene	50	ND
67-66-3	* Chloroform	50	ND
76-13-1	# Trichlorotrifluoroethane	50	ND
107-06-2	* 1,2-Dichloroethane	50	ND
71-55-6	* 1,1,1-Trichloroethane	50	ND
56-23-5	* Carbon Tetrachloride	50	ND
75-27-4	* Bromodichloromethane	50	ND
78-87-5	* 1,2-Dichloropropane	50	ND
10061-02-6	* Trans-1,3-Dichloropropene	50	ND
79-01-6	* Trichloroethene	50	ND
124-48-1	* Dibromochloromethane	50	ND
79-00-5	* 1,1,2-Trichloroethane	50	ND
10061-01-5	* cis-1,3-Dichloropropene	50	ND
110-75-8	* 2-Chloroethylvinylether	100	ND
75-25-2	* Bromoform	50	ND
127-18-4	* Tetrachloroethene	50	ND
79-34-5	* 1,1,2,2-Tetrachloroethane	50	ND
108-90-7	* Chlorobenzene	50	ND
541-73-1	* 1,3-Dichlorobenzene	100	ND
95-50-1	* 1,2-Dichlorobenzene	100	ND
106-46-7	* 1,4-Dichlorobenzene	100	ND
	% Surrogate Recovery	33-134%	91%

ND : Not detected at or above the practical quantitation limit for the method.
* A 601/8010 approved compound (Federal Register, 10/26/84).
\# A compound added by Anametrix, Inc.

ORGANIC ANALYSIS DATA SHEET - EPA METHOD 601/8010
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : METHOD BLANK
Matrix : SOIL
Date sampled : N/A
Date analyzed: 11/21/89
Dilution : NONE

Anametrix I.D. : 10B1121H02
Analyst : JLO
Supervisor : CP
Date released : 11/28/89
Instrument ID : HP10

CAS #	Compound Name	Reporting Limit (ug/Kg)	Amount Found (ug/Kg)
74-87-3	* Chloromethane	1	ND
74-83-9	* Bromomethane	0.5	ND
75-71-8	* Dichlorodifluoromethane	1	ND
75-01-4	* Vinyl Chloride	0.5	ND
75-00-3	* Chloroethane	0.5	ND
75-09-2	* Methylene Chloride	0.5	ND
79-69-4	* Trichlorofluoromethane	0.5	ND
75-35-4	* 1,1-Dichloroethene	0.5	ND
75-34-3	* 1,1-Dichloroethane	0.5	ND
156-59-2	# Cis-1,2-Dichloroethene	0.5	ND
156-60-5	* Trans-1,2-Dichloroethene	0.5	ND
67-66-3	* Chloroform	0.5	ND
76-13-1	# Trichlorotrifluoroethane	0.5	0.5
107-06-2	* 1,2-Dichloroethane	0.5	ND
71-55-6	* 1,1,1-Trichloroethane	0.5	ND
56-23-5	* Carbon Tetrachloride	0.5	ND
75-27-4	* Bromodichloromethane	0.5	ND
78-87-5	* 1,2-Dichloropropane	0.5	ND
10061-02-6	* Trans-1,3-Dichloropropene	0.5	ND
79-01-6	* Trichloroethene	0.5	ND
124-48-1	* Dibromochloromethane	0.5	ND
79-00-5	* 1,1,2-Trichloroethane	0.5	ND
10061-01-5	* cis-1,3-Dichloropropene	0.5	ND
110-75-8	* 2-Chloroethylvinylether	1	ND
75-25-2	* Bromoform	0.5	ND
127-18-4	* Tetrachloroethene	0.5	ND
79-34-5	* 1,1,2,2-Tetrachloroethane	0.5	ND
108-90-7	* Chlorobenzene	0.5	ND
541-73-1	* 1,3-Dichlorobenzene	1	1
95-50-1	* 1,2-Dichlorobenzene	1	ND
106-46-7	* 1,4-Dichlorobenzene	1	ND
	% Surrogate Recovery	33-134%	100%

ND : Not detected at or above the practical quantitation limit for the method.
* A 601/8010 approved compound (Federal Register, 10/26/84).
\# A compound added by Anametrix, Inc.

ORGANIC ANALYSIS DATA SHEET - EPA METHOD 601/8010
ANAMETRIX, INC. (408) 432-8192

Sample I.D.	: METHOD BLANK	Anametrix I.D.	: 14B1122H00
Matrix	: SOIL	Analyst	:
Date sampled	: N/A	Supervisor	:
Date analyzed	: 11/22/89	Date released	: 11/28/89
Dilution	: NONE	Instrument ID	: HP14

CAS #	Compound Name	Reporting Limit (ug/Kg)	Amount Found (ug/Kg)
74-87-3	* Chloromethane	1	ND
74-83-9	* Bromomethane	0.5	ND
75-71-8	* Dichlorodifluoromethane	1	ND
75-01-4	* Vinyl Chloride	0.5	ND
75-00-3	* Chloroethane	0.5	ND
75-09-2	* Methylene Chloride	0.5	1.1
79-69-4	* Trichlorofluoromethane	0.5	ND
75-35-4	* 1,1-Dichloroethene	0.5	ND
75-34-3	* 1,1-Dichloroethane	0.5	ND
156-59-2	# Cis-1,2-Dichloroethene	0.5	ND
156-60-5	* Trans-1,2-Dichloroethene	0.5	ND
67-66-3	* Chloroform	0.5	ND
76-13-1	# Trichlorotrifluoroethane	0.5	ND
107-06-2	* 1,2-Dichloroethane	0.5	ND
71-55-6	* 1,1,1-Trichloroethane	0.5	ND
56-23-5	* Carbon Tetrachloride	0.5	ND
75-27-4	* Bromodichloromethane	0.5	ND
78-87-5	* 1,2-Dichloropropane	0.5	ND
10061-02-6	* Trans-1,3-Dichloropropene	0.5	ND
79-01-6	* Trichloroethene	0.5	ND
124-48-1	* Dibromochloromethane	0.5	ND
79-00-5	* 1,1,2-Trichloroethane	0.5	ND
10061-01-5	* cis-1,3-Dichloropropene	0.5	ND
110-75-8	* 2-Chloroethylvinylether	1	ND
75-25-2	* Bromoform	0.5	ND
127-18-4	* Tetrachloroethene	0.5	ND
79-34-5	* 1,1,2,2-Tetrachloroethane	0.5	ND
108-90-7	* Chlorobenzene	0.5	ND
541-73-1	* 1,3-Dichlorobenzene	1	ND
95-50-1	* 1,2-Dichlorobenzene	1	ND
106-46-7	* 1,4-Dichlorobenzene	1	ND
	% Surrogate Recovery	33-134%	95%

ND : Not detected at or above the practical quantitation limit for the method.
* A 601/8010 approved compound (Federal Register, 10/26/84).
\# A compound added by Anametrix, Inc.

ORGANIC ANALYSIS DATA SHEET - EPA METHOD 601/8010
ANAMETRIX, INC. (408) 432-8192

Sample I.D.	: METHOD BLANK	Anametrix I.D.	: 14B1122H01
Matrix	: SOIL	Analyst	: JLO
Date sampled	: N/A	Supervisor	: CVP
Date analyzed	: 11/22/89	Date released	: 11/28/89
Dilution	: NONE	Instrument ID	: HP14

CAS #		Compound Name	Reporting Limit (ug/Kg)	Amount Found (ug/Kg)
74-87-3	*	Chloromethane	1	ND
74-83-9	*	Bromomethane	0.5	ND
75-71-8	*	Dichlorodifluoromethane	1	ND
75-01-4	*	Vinyl Chloride	0.5	ND
75-00-3	*	Chloroethane	0.5	ND
75-09-2	*	Methylene Chloride	0.5	3.6
79-69-4	*	Trichlorofluoromethane	0.5	ND
75-35-4	*	1,1-Dichloroethene	0.5	ND
75-34-3	*	1,1-Dichloroethane	0.5	ND
156-59-2	#	Cis-1,2-Dichloroethene	0.5	ND
156-60-5	*	Trans-1,2-Dichloroethene	0.5	ND
67-66-3	*	Chloroform	0.5	ND
76-13-1	#	Trichlorotrifluoroethane	0.5	0.8
107-06-2	*	1,2-Dichloroethane	0.5	ND
71-55-6	*	1,1,1-Trichloroethane	0.5	ND
56-23-5	*	Carbon Tetrachloride	0.5	ND
75-27-4	*	Bromodichloromethane	0.5	ND
78-87-5	*	1,2-Dichloropropane	0.5	ND
10061-02-6	*	Trans-1,3-Dichloropropene	0.5	ND
79-01-6	*	Trichloroethene	0.5	ND
124-48-1	*	Dibromochloromethane	0.5	ND
79-00-5	*	1,1,2-Trichloroethane	0.5	ND
10061-01-5	*	cis-1,3-Dichloropropene	0.5	ND
110-75-8	*	2-Chloroethylvinylether	1	ND
75-25-2	*	Bromoform	0.5	ND
127-18-4	*	Tetrachloroethene	0.5	ND
79-34-5	*	1,1,2,2-Tetrachloroethane	0.5	ND
108-90-7	*	Chlorobenzene	0.5	ND
541-73-1	*	1,3-Dichlorobenzene	1	1.3
95-50-1	*	1,2-Dichlorobenzene	1	ND
106-46-7	*	1,4-Dichlorobenzene	1	ND
		% Surrogate Recovery	33-134%	76%

ND : Not detected at or above the practical quantitation limit for the method.
* A 601/8010 approved compound (Federal Register, 10/26/84).
\# A compound added by Anametrix, Inc.

HALOGENATED VOLATILE RECOVERY REPORT
EPA METHOD 601/8010

Sample I.D. : METHOD SPIKE
Matrix : WATER
Date sampled : N/A
Date analyzed : 11/22/89

Anametrix I.D. : SPK112289
Analyst : JW
Supervisor : CP
Date released : 11/28/89
Instrument I.D.: HP14

COMPOUND	SPIKE AMT. (ug/L)	MS (ug/L)	REC MS	MSD (ug/L)	REC MSD	RPD	%REC LIMITS
1,1-DICHLOROETHENE	4	5.2	130%	4.6	115%	12%	46 - 149
METHYLENE CHLORIDE	20	17.7	89%	22.6	113%	-24%	46 - 152
trans-1,2-DICHLOROETHENE	4	4.8	120%	5.0	125%	-4%	42 - 167
1,1-DICHLOROETHANE	4	4.6	115%	4.1	103%	11%	68 - 156
1,1,1-TRICHLOROETHANE	4	5.0	125%	5.0	125%	0%	42 - 160
CARBON TETRACHLORIDE	4	5.4	135%	5.1	128%	6%	50 - 167
1,2-DICHLOROETHANE	4	5.5	138%	4.6	115%	18%	36 - 175
TRICHLOROETHENE	4	6.3	158%	5.0	125%	23%	49 - 158
1,2-DICHLOROPROPANE	4	4.2	105%	4.1	103%	2%	74 - 151
cis-1,3-DICHLOROPROPENE	5	5.4	108%	5.5	110%	-2%	50 - 150
trans-1,3-DICHLOROPROPENE	3	3.1	103%	3.4	113%	-9%	35 - 174
1,1,2-TRICHLOROETHANE	4	4.6	115%	4.6	115%	0%	83 - 151
TETRACHLOROETHENE	4	5.8	145%	4.1	103%	34%	60 - 171
CHLOROBENZENE	20	13.2	66%	17.6	88%	-29%	61 - 150
1,1,2,2-TETRACHLOROETHANE	4	3.0	75%	3.5	88%	-15%	63 - 157
1,3-DICHLOROBENZENE	20	14.2	71%	13.3	67%	7%	53 - 136
1,4-DICHLOROBENZENE	20	11.9	60%	12.1	61%	-2%	52 - 123
1,2-DICHLOROBENZENE	20	13.4	67%	12.3	62%	9%	57 - 140

* Limits based on data generated by Anametrix, Inc., November 1989.

CHAIN OF CUSTODY RECORD

Applied GeoSystems
43255 Mission Blvd Suite B Fremont, CA 94539 415/651-1906

SAMPLER (signature): Jon De Lon

Phone: 415 651 1906

LABORATORY: Applied GeoSystems

TURNAROUND TIME: 1-week

Project Leader: Jon Lueller

Phone No. 415 651 1906

SHIPPING INFORMATION:

Shipper

Address

Date Shipped

Service Used

Airbill No. Cooler No.

Relinquished by: (signatures)	Received by: (signatures)	Date	Time
Jon De Lon	Jon R. Lueller	12/11/89	5:10 PM
Jon R. Lueller	Received for laboratory by: Raha	12/14/89	18 PM

LABORATORY SHOULD SIGN UPON RECEIPT AND RETURN A COPY OF THIS FORM WITH THE LABORATORY RESULTS

Sample No.	Site Identification	Date Sampled	Analyses Requested	Sample Condition Upon Receipt
S-1211-1A	1806 61-5	12/11/89	TPH G & TOG	Iced
S-1211-1B				
S-1211-1C				

Composite

Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906

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ANALYSIS REPORT

0212lab.frm

Report Prepared for:
Applied GeoSystems
43255 Misson Boulevard
Fremont, CA 94539
Attention: Jon R. Luellen

Date Received: 12-11-89
Laboratory Number: 91214S01
Project #: 18061-5
Sample #: S-1211-1(ABC)
Matrix: Soil

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline	2.4		2.0		12-12-89	
TEH as Diesel						NR
Benzene						NR
Toluene						NR
Ethylbenzene						NR
Total Xylenes						NR

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

12-14-89
Date Reported

Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906

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ANALYSIS REPORT

togsoil.rpt

Report Prepared for:
Applied GeoSystems
43255 Mission Blvd.
Fremont, CA, 94539
Attention: Jon Luellen

Date Received: 12-11-89
Laboratory Number: 91214S01
Project #: 18061-5
Sample #: S-1211-1ABC
Matrix: Soil

Parameter	Result (mg/kg)	Detection Limit (mg/kg)	Date Analyzed
TPH as Oil and Grease	ND	50	12-13-89

mg/kg = milligrams per kilogram = ppm
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.

PROCEDURES

TPH as Oil and Grease: Total Petroleum Hydrocarbons as Oil and Grease are measured by extraction and gravimetric analysis according to Standard Method 503D/E.

Laura Kuck
Laura Kuck, Laboratory Manager

12-14-89
Date Reported

CHAIN OF CUSTODY RECORD

Applied GeoSystems
43255 Mission Blvd Suite B Fremont, CA 94539 (415) 651-

SAMPLER (signature): R. Mark Armstrong
Phone: (415) 651-1906

LABORATORY: AnametriX, Inc.

TURNAROUND TIME: 2 week

Project Leader: Jon Zuellen
Phone No. (415) 651-1906

SHIPPING INFORMATION:
Shipper
Address
Date Shipped
Service Used
Airbill No. Cooler No.

Relinquished by: (signatures)	Received by: (signatures)	Date	T
R. Mark Armstrong	Jon R. Zuellen	11/20/89	830
Jon R. Zuellen	Raghi Menuchehr	11/29/89	

LABORATORY SHOULD SIGN UPON RECEIPT AND RETURN A COPY OF THIS FORM WITH THE LABORATORY RESULTS

Sample No.	Site Identification	Date Sampled	Analyses Requested	Sample Condition Upon Receipt
W-8- MW2	18061-5	11/17/89	601	ICED
W-7- MW5				

ANAMETRIX INC
Environmental & Analytical Chemistry
1961 Concourse Drive, Suite E, San Jose, CA 95131
(408) 432-8192 • Fax (408) 432-8198

REPORT

Jon Luellen
Applied GeoSystems
43255 Mission Blvd.
Suite B
Fremont, CA 94539

November 28, 1989
Anametrix W.O.#: 8911151
Date Received : 11/20/89
Project No. : 18061-5

Dear Mr. Luellen:

Your samples have been received for analysis. The REPORT SUMMARY lists your sample identifications and the analytical methods you requested. The following sections are included in this report: RESULTS and QUALITY ASSURANCE.

NOTE: Amounts reported are net values, i.e. corrected for method blank contamination.

If there is any more that we can do, please give us a call. Thank you for using ANAMETRIX, INC.

Sincerely,

ANAMETRIX, INC.

Corinne Pham

Corinne Pham
GC/VOA Supervisor

CP/lm

REPORT SUMMARY
ANAMETRIX, INC. (408) 432-8192

Client : Applied GeoSystems
Address : 43255 Mission Blvd.
Suite B
City : Fremont, CA 94539
Attn. : Jon Luellen

Anametrix W.O.#: 8911151
Date Received : 11/20/89
Purchase Order#: N/A
Project No. : 18061-5
Date Released : 11/28/89

Anametrix I.D.	Sample I.D.	Matrix	Date Sampled	Method	Date Extract	Date Analyzed	Inst I.D.
RESULTS							
8911151-01	W-8-MW2	WATER	11/17/89	601		11/21/89	HP14
8911151-02	W-7-MW5	WATER	11/17/89	601		11/21/89	HP14
QUALITY ASSURANCE (QA)							
14B1121H01	METHOD BLANK	WATER	N/A	601		11/21/89	HP14

ORGANIC ANALYSIS DATA SHEET - EPA METHOD 601/8010
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : 18061-5 W-8-MW2
Matrix : WATER
Date sampled : 11/17/89
Date analyzed: 11/21/89
Dilution : NONE

Anametrix I.D. : 8911151-01
Analyst : LY
Supervisor : CP
Date released : 11/28/89
Instrument ID : HP14

CAS #	Compound Name	Reporting Limit (ug/l)	Amount Found (ug/l)
74-87-3	* Chloromethane	1	ND
74-83-9	* Bromomethane	0.5	ND
75-71-8	* Dichlorodifluoromethane	1	ND
75-01-4	* Vinyl Chloride	0.5	ND
75-00-3	* Chloroethane	0.5	ND
75-09-2	* Methylene Chloride	0.5	ND
75-69-4	* Trichlorofluoromethane	0.5	ND
75-35-4	* 1,1-Dichloroethene	0.5	ND
75-34-3	* 1,1-Dichloroethane	0.5	ND
156-59-2	# Cis-1,2-Dichloroethene	0.5	ND
156-60-5	* Trans-1,2-Dichloroethene	0.5	ND
67-66-3	* Chloroform	0.5	ND
76-13-1	# Trichlorotrifluoroethane	0.5	ND
107-06-2	* 1,2-Dichloroethane	0.5	ND
71-55-6	* 1,1,1-Trichloroethane	0.5	ND
56-23-5	* Carbon Tetrachloride	0.5	ND
75-27-4	* Bromodichloromethane	0.5	ND
78-87-5	* 1,2-Dichloropropane	0.5	ND
10061-02-6	* Trans-1,3-Dichloropropene	0.5	ND
79-01-6	* Trichloroethene	0.5	ND
124-48-1	* Dibromochloromethane	0.5	ND
79-00-5	* 1,1,2-Trichloroethane	0.5	ND
10061-01-5	* cis-1,3-Dichloropropene	0.5	ND
110-75-8	* 2-Chloroethylvinylether	1	ND
75-25-2	* Bromoform	0.5	ND
127-18-4	* Tetrachloroethene	0.5	ND
79-34-5	* 1,1,2,2-Tetrachloroethane	0.5	ND
108-90-7	* Chlorobenzene	0.5	ND
95-50-1	* 1,2-Dichlorobenzene	1	ND
541-73-1	* 1,3-Dichlorobenzene	1	ND
106-46-7	* 1,4-Dichlorobenzene	1	ND
	% Surrogate Recovery	51-136%	91%

ND : Not detected at or above the practical quantitation limit for the method.
* A 601/8010 approved compound (Federal Register, 10/26/84).
\# A compound added by Anametrix, Inc.

ORGANIC ANALYSIS DATA SHEET - EPA METHOD 601/8010
ANAMETRIX, INC. (408) 432-8192

Sample I.D.	: 18061-5 W-7-MW5	Anametrix I.D.	: 8911151-02
Matrix	: WATER	Analyst	: LV
Date sampled	: 11/17/89	Supervisor	: cp
Date analyzed	: 11/21/89	Date released	: 11/28/89
Dilution	: NONE	Instrument ID	: HP14

CAS #	Compound Name	Reporting Limit (ug/l)	Amount Found (ug/l)
74-87-3	* Chloromethane	1	ND
74-83-9	* Bromomethane	0.5	ND
75-71-8	* Dichlorodifluoromethane	1	ND
75-01-4	* Vinyl Chloride	0.5	ND
75-00-3	* Chloroethane	0.5	ND
75-09-2	* Methylene Chloride	0.5	ND
75-69-4	* Trichlorofluoromethane	0.5	ND
75-35-4	* 1,1-Dichloroethene	0.5	ND
75-34-3	* 1,1-Dichloroethane	0.5	ND
156-59-2	# Cis-1,2-Dichloroethene	0.5	ND
156-60-5	* Trans-1,2-Dichloroethene	0.5	ND
67-66-3	* Chloroform	0.5	ND
76-13-1	# Trichlorotrifluoroethane	0.5	ND
107-06-2	* 1,2-Dichloroethane	0.5	ND
71-55-6	* 1,1,1-Trichloroethane	0.5	ND
56-23-5	* Carbon Tetrachloride	0.5	ND
75-27-4	* Bromodichloromethane	0.5	ND
78-87-5	* 1,2-Dichloropropane	0.5	ND
10061-02-6	* Trans-1,3-Dichloropropene	0.5	ND
79-01-6	* Trichloroethene	0.5	ND
124-48-1	* Dibromochloromethane	0.5	ND
79-00-5	* 1,1,2-Trichloroethane	0.5	ND
10061-01-5	* cis-1,3-Dichloropropene	0.5	ND
110-75-8	* 2-Chloroethylvinylether	1	ND
75-25-2	* Bromoform	0.5	ND
127-18-4	* Tetrachloroethene	0.5	ND
79-34-5	* 1,1,2,2-Tetrachloroethane	0.5	ND
108-90-7	* Chlorobenzene	0.5	ND
95-50-1	* 1,2-Dichlorobenzene	1	ND
541-73-1	* 1,3-Dichlorobenzene	1	ND
106-46-7	* 1,4-Dichlorobenzene	1	ND
	% Surrogate Recovery	51-136%	99%

ND : Not detected at or above the practical quantitation limit for the method.
* A 601/8010 approved compound (Federal Register, 10/26/84).
\# A compound added by Anametrix, Inc.

ORGANIC ANALYSIS DATA SHEET - EPA METHOD 601/8010
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : METHOD BLANK
Matrix : WATER
Date sampled : N/A
Date analyzed: 11/21/89
Dilution : NONE

Anametrix I.D. : 14B1121H01
Analyst : LY
Supervisor : CP
Date released : 11/28/89
Instrument ID : HP14

CAS #	Compound Name	Reporting Limit (ug/l)	Amount Found (ug/l)
74-87-3	* Chloromethane	1	ND
74-83-9	* Bromomethane	0.5	ND
75-71-8	* Dichlorodifluoromethane	1	ND
75-01-4	* Vinyl Chloride	0.5	ND
75-00-3	* Chloroethane	0.5	ND
75-09-2	* Methylene Chloride	0.5	1.9
75-69-4	* Trichlorofluoromethane	0.5	ND
75-35-4	* 1,1-Dichloroethene	0.5	ND
75-34-3	* 1,1-Dichloroethane	0.5	ND
156-59-2	# Cis-1,2-Dichloroethene	0.5	ND
156-60-5	* Trans-1,2-Dichloroethene	0.5	ND
67-66-3	* Chloroform	0.5	ND
76-13-1	# Trichlorotrifluoroethane	0.5	ND
107-06-2	* 1,2-Dichloroethane	0.5	ND
71-55-6	* 1,1,1-Trichloroethane	0.5	ND
56-23-5	* Carbon Tetrachloride	0.5	ND
75-27-4	* Bromodichloromethane	0.5	ND
78-87-5	* 1,2-Dichloropropane	0.5	ND
10061-02-6	* Trans-1,3-Dichloropropene	0.5	ND
79-01-6	* Trichloroethene	0.5	ND
124-48-1	* Dibromochloromethane	0.5	ND
79-00-5	* 1,1,2-Trichloroethane	0.5	ND
10061-01-5	* cis-1,3-Dichloropropene	0.5	ND
110-75-8	* 2-Chloroethylvinylether	1	ND
75-25-2	* Bromoform	0.5	ND
127-18-4	* Tetrachloroethene	0.5	ND
79-34-5	* 1,1,2,2-Tetrachloroethane	0.5	ND
108-90-7	* Chlorobenzene	0.5	ND
95-50-1	* 1,2-Dichlorobenzene	1	ND
541-73-1	* 1,3-Dichlorobenzene	1	ND
106-46-7	* 1,4-Dichlorobenzene	1	ND
	% Surrogate Recovery	51-136%	93%

ND : Not detected at or above the practical quantitation limit for the method.
* A 601/8010 approved compound (Federal Register, 10/26/84).
# A compound added by Anametrix, Inc.

CHAIN OF CUSTODY RECORD

Applied GeoSystems

43255 Mission Blvd Suite B Fremont, CA 94539 (415) 651-1

SAMPLER (signature): R. Mad Hunter

Phone: (415) 651-1906

LABORATORY: Applied GeoSystems

TURNAROUND TIME: 2 week

Project Leader: Jon Zueller

Phone No. (415) 651-1906

SHIPPING INFORMATION:

Shipper

Address

Date Shipped

Service Used

Airbill No. Cooler No.

Relinquished by: (signatures)	Received by: (signatures)	Date	Ti
R. Mad Hunter	Jon R Zueller		
Jon R. Zueller	Received for laboratory by:	11-20-89	1550

LABORATORY SHOULD SIGN UPON RECEIPT AND RETURN A COPY OF THIS FORM WITH THE LABORATORY RESULTS

Sample No.	Site Identification	Date Sampled	Analyses Requested	Sample Condition Upon Receipt
W-8-MW2	5	11/17/89	TPH-g & BTEX	ICE/HCl
W-11-MW4	1806-			
W-7-MW5				
W-9-MW6				

Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906

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ANALYSIS REPORT

0212lab.frm

Report Prepared for:
Applied GeoSystems
43255 Mission Boulevard
Fremont, CA 94539
Attention: Jon R. Luellen

Date Received: 11-20-89
Laboratory Number: 91126W01
Project #: 18061-5
Sample #: W-8-MW2
Matrix: Water

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline		0.15		0.020	11-27-89	
TEH as Diesel						NR
Benzene		ND		0.00050	11-27-89	
Toluene		ND		0.00050	11-27-89	
Ethylbenzene		ND		0.00050	11-27-89	
Total Xylenes		ND		0.00050	11-27-89	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

12-01-89
Date Reported

Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906
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ANALYSIS REPORT

0212lab.frm

Report Prepared for:
Applied GeoSystems
43255 Mission Boulevard
Fremont, CA 94539
Attention: Jon R. Luellen

Date Received: 11-20-89
Laboratory Number: 91126W02
Project #: 18061-5
Sample #: W-11-MW4
Matrix: Water

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline		ND		0.020	11-27-89	
TEH as Diesel						NR
Benzene		ND		0.00050	11-27-89	
Toluene		ND		0.00050	11-27-89	
Ethylbenzene		ND		0.00050	11-27-89	
Total Xylenes		ND		0.00050	11-27-89	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

12-01-89
Date Reported

Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906

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ANALYSIS REPORT

0212lab.frm

Report Prepared for:
Applied GeoSystems
43255 Mission Boulevard
Fremont, CA 94539
Attention: Jon R. Luellen

Date Received: 11-20-89
Laboratory Number: 91126W03
Project #: 18061-5
Sample #: W-7-MW5
Matrix: Water

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline		ND		0.020	11-27-89	
TEH as Diesel						NR
Benzene		ND		0.00050	11-27-89	
Toluene		ND		0.00050	11-27-89	
Ethylbenzene		ND		0.00050	11-27-89	
Total Xylenes		ND		0.00050	11-27-89	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

12-01-89
Date Reported

Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906

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ANALYSIS REPORT

0212lab.frm

Report Prepared for:
Applied GeoSystems
43255 Mission Boulevard
Fremont, CA 94539
Attention: Jon R. Luellen

Date Received: 11-20-89
Laboratory Number: 91126W04
Project #: 18061-5
Sample #: W-9-MW6
Matrix: Water

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline		ND		0.020	11-27-89	
TEH as Diesel						NR
Benzene		ND		0.00050	11-27-89	
Toluene		ND		0.00050	11-27-89	
Ethylbenzene		ND		0.00050	11-27-89	
Total Xylenes		ND		0.00050	11-27-89	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

12-01-89
Date Reported

CHAIN OF CUSTODY RECORD

Applied GeoSystems
43255 Mission Blvd Suite B Fremont, CA 94539 (415) 651-1906

SAMPLER (signature): R. Mark Armstrong
Phone:

LABORATORY: Applied GeoSystems

TURNAROUND TIME: 2 weeks

Project Leader: J Luellen
Phone No.

SHIPPING INFORMATION:
Shipper
Address
Date Shipped
Service Used
Airbill No. Cooler No.

Relinquished by: (signatures)	Received by: (signatures)	Date	Time
R. Mark Armstrong			
	Received for laboratory by:	11-21-89	1430

LABORATORY SHOULD SIGN UPON RECEIPT AND RETURN A COPY OF THIS FORM WITH THE LABORATORY RESULTS

Sample No.	Site Identification	Date Sampled	Analyses Requested	Sample Condition Upon Receipt
W-15-MW2	18061-5	11-21-89	TPHg & BTEX	HCL, ICED
W-16-MW5			TPHg & BTEX	HCL ICED
W-15-MW2			TOG	ICED
W-16-MW5			TOG	ICED

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ANALYSIS REPORT

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Report Prepared for:
Applied GeoSystems
43255 Mission Boulevard
Fremont, CA 94539
Attention: Jon R. Luellen

Date Received: 11-21-89
Laboratory Number: 91131W01
Project #: 18061-5
Sample #: W-15-MW2
Matrix: Water

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline		0.72		0.020	12-01-89	
TEH as Diesel						NR
Benzene		0.0014		0.00050	12-01-89	
Toluene		0.0014		0.00050	12-01-89	
Ethylbenzene		0.0059		0.00050	12-01-89	
Total Xylenes		0.034		0.00050	12-01-89	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

12-05-89
Date Reported

Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906

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ANALYSIS REPORT

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Report Prepared for:
Applied GeoSystems
43255 Mission Boulevard
Fremont, CA 94539
Attention: Jon R. Luellen

Date Received: 11-21-89
Laboratory Number: 91131W02
Project #: 18061-5
Sample #: W-16-MW5
Matrix: Water

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline		ND		0.020	12-01-89	
TEH as Diesel						NR
Benzene		ND		0.00050	12-01-89	
Toluene		ND		0.00050	12-01-89	
Ethylbenzene		ND		0.00050	12-01-89	
Total Xylenes		0.00063		0.00050	12-01-89	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

12-05-89
Date Reported