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REPORT OF FINDINGS
AIR SPARGE PILOT TEST
at
ARCO Station 6148
5131 Shattuck Avenue
Oakland, California
00/07/94
61035.11

Report prepared for

ARCO Products Company
P.O. Box 5811
San Mateo, California 94402

by
RESNA Industries Inc.

Richard H. Walls, P.E. 43139
Senior Project Engineer

REGISTERED PROFESSIONAL ENGINEER
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STATE OF CALIFORNIA

June 7, 1994

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TRANSMITTAL

TO: Ms. Susan Hugo
Alameda County Health Care Services Agency
80 Swan Way, Room 200
Oakland, California 94621

DATE: June 13, 1994
PROJECT NUMBER: 61035.11
SUBJECT: ARCO Station 6148,
5131 Shattuck Avenue, Oakland, California

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David Peterson, Staff Engineer

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REPORT OF FINDINGS
AIR SPARGE PILOT TEST

ARCO Station 6148
5131 Shattuck Avenue
Oakland, California

For ARCO Products Company

1.0 INTRODUCTION

At the request of ARCO Products Company (ARCO), RESNA Industries Inc. (RESNA) performed an one day Air Sparging Pilot Test (AST) and a one day combination Air Sparging/Vapor Extraction Test at ARCO Station No. 6148, 5131 Shattuck Avenue, Oakland, California. These tests were performed to evaluate the feasibility of using air sparging to remove dissolved gasoline hydrocarbons from groundwater beneath the subject site. Work for this program included installing one combination air sparge/vapor extraction well (AS-2/VW-2) and two vapor extraction wells (VW-1 and VW-3), performing a one day pilot sparge test, performing a one day combination air sparge/vapor extraction test, collecting air sparge response data during field testing, collecting groundwater and soil gas samples for laboratory analysis and preparation of this report. This report describes test methods, presents field and laboratory data, and presents conclusions concerning the feasibility of air sparging at the site.

2.0 BACKGROUND

2.1 General

The site is an operating gasoline station located on the southwestern corner of the intersection of 52nd Street and Shattuck Avenue in Oakland, California (Plate 1). The site is on a relatively flat lot at an elevation of approximately 110 feet above mean sea level.

According to information provided by ARCO, there are presently three 12,000 gallon underground gasoline-storage tanks (USTs) located in the western portion of the site. The locations of the USTs and pertinent site features are shown on Plate 2.

2.2 Regional Geology and Hydrogeology

ARCO Station 6148 is located west of the East Bay Hills. This area lies within the Berkeley Alluvial Plain, which is a subarea of the East Bay Alluvial Plain. Soils in this area are mapped as older alluvium which consist of a heterogeneous mixture of poorly consolidated to unconsolidated clay, silt, sand, and gravel units (Helley and others, 1979). The sediments were derived mainly from bedrock underlying the hills and represent successive coalescing alluvial fans deposited during the Pleistocene epoch.

Sediments beneath the East Bay Alluvial Plain are believed to be about 200 feet thick in the Berkeley area. Water-yielding capabilities of the sediments are highly variable. Generally, high yields come only from wells that are screened through several water-bearing sand and gravel beds. Groundwater in the East Bay Plain occurs predominantly under confined conditions and tends to flow toward the San Francisco Bay to the west and southwest (Hickenbottom and Muir, 1988).

3.0 INSTALLATION OF AIR SPARGE WELLS

3.1 Field Work

On July 6, 1993, three soil borings (B-9 through B-11) were drilled and one combination air sparge/vapor extraction well (AS-2/VW-2) and two vapor extraction wells (VW-1 and VW-3

were constructed. All three wells were installed in the southern portion of the site in the vicinity of the former waste-oil tank. The locations of the borings and wells are shown on Plate 2.

Soil samples were collected, as shown on Borings Logs (Appendix A, Plates 2A through 4A), for description and possible laboratory analyses. Laboratory analytical results of soil samples analyzed are shown in Table 1, and copies of laboratory analytical reports are included in Appendix B. Sampling procedures are summarized in Appendix C.

3.2 Subsurface Materials

The earth materials encountered at the site consisted primarily of silty clay to clayey sand and sandy gravel. Graphic interpretations of the soil stratigraphy encountered in the borings from this and previous investigations are shown on Geologic Cross Sections A-A' through C-C' (Plates 3 and 4). The locations of these cross sections are shown on Plate 2.

The earth materials beneath the site were grouped into three general hydrostratigraphic units. Starting at surface grade, beneath sections of asphalt and baserock, a unit of sandy clay and sandy silt overlies a sandy gravel water-bearing unit to depths between 14 and 15 feet. The water-bearing unit consists of fine sandy gravel to depths between approximately 23½ and 24½ feet with clayey fine gravel from approximately 24½ feet to the total depth of borings.

In the vicinity of where the sparge test was performed groundwater was measured at a depth of approximately 17 feet bsg. The sediment immediately below and above groundwater surface is sand and gravel ranging from silty sand to sandy gravel. Above the groundwater surface the thickness of the sand and gravel based unit is limited to approximately four feet. A unit comprised of lower permeability sediments ranging from sandy clay to sandy silt overlies the aquifer sediments to near surface grade.

3.3 Sparge Well Construction

As discussed previously, one combination air sparge/vapor extraction well (AS-2/VW-1) was constructed in boring B-10, using the methods summarized in Appendix C. The air sparge point of well AS-2 was constructed in the bottom of the boring using 2-inch-diameter,

schedule 40, polyvinyl chloride (PVC) pipe, with 2 feet of 2-inch-diameter, 0.020-inch machine slotted PVC at the bottom of the boring, and 2-inch-diameter blank PVC extending to ground surface. The vapor extraction point (VW-2) was constructed in the same boring as the air sparge point, and was screened from a depth of 15 feet to 19½ feet with 4-inch-diameter, schedule 40, PVC 0.1-inch machine slotted screen. The 4-inch well casing extended to within 6-inches of ground surface. Vapor extraction wells VW-1 and VW-3 were also constructed using 4-inch-diameter, schedule 40 PVC with 0.1 inch machine slotted PVC, and were screened from 14 to 24 feet. For specific details of individual well construction see Logs of Borings B-9 through B-11 (Plates 2A through 4A).

4.0 AIR SPARGE PILOT TESTING

4.1 Purpose

Air sparge pilot testing was performed at the site on February 16 and 17, 1994. The purpose of performing the AST was to evaluate the feasibility of removing dissolved and residual gasoline hydrocarbons from the first groundwater surface below the site. The objectives of the AST were to evaluate hydrocarbon removal from the saturated zone as a result of sparging, evaluate the propagation of air and helium injected below the groundwater surface and collect injection flowrate and pressure data for the possible design of an air sparge system.

4.2 Test Procedures

Prior to air sparging, groundwater samples were collected from all onsite sparge and monitoring wells to establish pre-test dissolved total petroleum hydrocarbons as gasoline (TPHg) concentrations in groundwater. This groundwater sampling was performed by EMCON Associates (EMCON) of Sacramento, California, two days prior to sparge testing. The groundwater sampling was performed by EMCON as part of ongoing quarterly groundwater monitoring. On the day of sparge testing, RESNA field personnel collected soil gas samples to establish baseline TPHg vapor concentrations in the vadose zone and collected depth-to-water (DTW) measurements for the sparge wells and monitoring points.

The first part of sparge testing involved sparging only (no vapor extraction). Testing

equipment for this part included a trailer mounted air compressor equipped with air filters capable of removing oil mist, helium tanks filled with 100% pressurized helium, air and helium flowmeters and pressure regulators, monitoring point assemblies to allow for the collection of gas samples from below the groundwater surface and within the vadose zone, and field instruments to measure relative TPHg vapor concentrations and helium content in percentage. For sparging, a 2:1 mixture of air to helium was injected to establish the minimum pressure required to evacuate the sparge well of water. While sparging was ongoing, vadose and saturated zone gas samples were collected for helium and TPHg monitoring. The initial part of the sparge test employed sparge well AS-2 as an injection point while wells MW-2, MW-1, VW-1, MW-3 and VW-3 were used as monitoring points. The distances from AS-2 to the monitoring points ranged from approximately 10 to 26 feet.

The second part of the pilot test included combined sparging and vapor extraction for the purpose of evaluating the effect of sparging on the vapor extraction radius of influence and to demonstrate the ability to capture sparge off-gas using vapor extraction. Equipment used for this phase of testing included the sparge only equipment described above and an internal combustion (IC) engine for vapor extraction. Well VW-1 was used as the extraction well while wells MW-1, MW-2, MW-3 and VW-3 were used as monitoring points. The distances from VW-1 to the monitoring points are approximately 14, 20, 28 and 37 feet respectively. During this phase of testing, sparging was performed as described previously and during vapor extraction vacuum responses were measured at the monitoring points using magnahelic gauges. An air sparge and monitoring well data summary is included in Table 2.

4.3 Sparge Field Results

During the sparge only portion of testing, total air/helium injection to AS-2 was initially achieved at a flowrate of approximately four actual cubic feet per minute (acfm) at an injection pressure of 25 pounds per square inch gauge (psig). Within minutes after sparging was initiated, air bubbles were observed exiting the backfill material surrounding the VW-2 well casing. The presence of standing water inside the monitoring well cover for B-10/AS-2/VW-2 allowed for the observation of air bubbles. The apparent short circuiting of sparge air through the annular space of B-10 suggests that the sparge well seal may be defective. In order to minimize the short circuiting, the injection pressure and flowrate was reduced to determine when the migration of air bubbles through the borehole ceased. Reducing the

air flowrate to 1.5 acfm at a delivery pressure of 9 psig eliminated the bubbling and the sparge test was continued using these test parameters.

Helium was detected in the vadose zone at AS-2 and MW-5 at levels ranging from 0.03% to 4.8%. The distribution of helium gas concentrations in the vadose zone was random and did not appear to increase or decrease significantly as a function of distance from AS-2 or time of sparging. Helium was detected in the vadose zone at all monitoring points at distances up to 26 feet from AS-2. Similar to the vadose zone, helium was detected in the saturated zone at each monitoring point during the test. The concentrations of helium in the saturated zone varied significantly (0.07% - 0.43%) during the early portions of the test. At the end of the one hour test the helium concentrations were more evenly distributed by location with concentrations ranging from 0.21% to 0.34% helium. Vadose and saturated zone helium testing results are summarized in Table 3.

4.4 Sparge and Vapor Extraction Field Results

Test data collected during the combined AST/VET test is summarized in Table 4. During the vapor extraction only portion of the AST/VET, an extraction rate of 25 acfm was achieved at applied vacuums ranging from 28 to 40 inches of water column (IWC). Induced vacuum readings ranged from 0.07 to 0.01 IWC in monitoring points MW-2 and MW-1, respectively. The distances from VW-1 to MW-2 and MW-1 are approximately 14 and 21 feet, respectively.

During the combined portion of the test, vapor extraction continued at an extraction rate of 25 acfm at an applied vacuum of 36 IWC. The helium/air sparge injection flowrate was initiated at 2.5 acfm at an injection pressure of 9 psig. The induced vacuum responses at the onset of sparging ranged from 0.01 (MW-1) to 0.06 (MW-2) IWC. At the conclusion of the test the vacuums had decayed to 0 IWC for MW-1 and 0.03 IWC for MW-2 and MW-3.

4.5 Laboratory Methods and Results

Groundwater and soil gas samples collected during field testing were submitted to Sequoia Analytical Laboratories (Sequoia), of Redwood City, California (Hazardous Waste Testing Laboratory Certification #1210) to be analyzed for total petroleum hydrocarbons as gasoline

(TPHg), and benzene, toluene, ethylbenzene, and total xylenes (BTEX) using Environmental Protection Agency (EPA) Methods 5030/8015/8020. Laboratory analytical results for groundwater and soil gas analytical testing are presented in Table 3.

Results of analyses indicated vadose zone TPHg vapor concentrations at monitoring points MW-1, VW-1, MW-3 and VW-3 all increased between the beginning and the end of the sparge test. The largest increase occurred in VW-1 where concentrations were 2,900 and 8,400 mg/m^3 at the beginning and end of testing, respectively. Dissolved TPHg concentrations in ground water increased from 12,000 to 22,000 parts per billion (ppb) in MW-2, an increase of 45%. At the remainder of the monitoring points, the dissolved TPHg concentrations in groundwater remained essentially unchanged.

4.6 Discussion

The concentrations of helium present in the vadose and saturated zones during the first half of the test varied considerably regardless of the distance from the sparge well. Concentrations of helium in the saturated zone at the end of the test were similar, ranging from 0.21 to 0.34 percent with helium detected as far away as 26 feet from AS-2. The lateral transport of helium in the saturated zone to a distance of 26 feet is unexpected considering that the sparge well screen was installed only 9.5 feet below the groundwater surface.

The silty clay and clayey sand unit above the sparge zone may have acted as a confining layer creating an increase in the vadose zone soil pore pressure and preventing sparge air bubbles from migrating into the vadose zone. Under this scenerio, increased lateral distances of saturated zone helium migration may be possible. Since sparging is usually accompanied by vapor extraction, soil pore pressure increases would not be expected during active remediation. Consequently, the saturated zone helium concentrations measured during the AST do not allow for an estimation of radius of influence.

The changes in dissolved TPHg concentrations appear to be a more suitable indicator of radius of influence. Residual TPHg exists in capillary fringe soil throughout the study zone with concentrations ranging from 65 to 740 ppm at 17 and 18 feet bsg. The increase in dissolved TPHg in MW-2 from 12,000 to 24,000 ppb suggest that residual TPHg was removed from saturated soil and re-dissolved into groundwater as a direct result of sparge

effectiveness. The lack of a corresponding increase in the vadose zone TPHg vapor concentration is unknown.

5.0 CONCLUSIONS

Our evaluation of field and laboratory data includes the following conclusions:

- Test data and the presence of a sand and gravel based sparge media indicate that sparging will remove dissolved and residual TPHg from the saturated zone and thus is a feasible remedial technology for the site.

- An effective sparge radius of influence of approximately 10 - 15 feet can be expected if sparge wells cannot be installed deeper than 10 feet below the groundwater surface.

- A sparge injection rate of approximately 5 acfm at an injection pressure of 10 psig per sparge well will be required.

- A vapor extraction flowrate of approximately 30 acfm per well will be necessary to provide for the ability to capture sparge off-gas from the saturated zone.

6.0 LIMITATIONS

This report was prepared in accordance with generally accepted standards of environmental geological and engineering practice in California at the time this investigation was performed. This assessment was conducted solely for the purpose of evaluating environmental conditions of the soil and groundwater with respect to gasoline related hydrocarbons at the site. No soil engineering or geotechnical references are implied or should be inferred. Evaluation of the geologic conditions at the site for the purpose of this assessment is made from a limited number of observation points. Subsurface conditions may vary away from the data points available.

7.0 DISTRIBUTION

It is recommended that copies of this report be forwarded to:

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8.0 REFERENCES

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TABLE 1
CUMULATIVE RESULTS OF LABORATORY ANALYSES OF SOIL SAMPLES
ARCO Station 6148
Oakland, California
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Sample ID	TPHg	TPHd	B	T	E	X	TOG	RCI
S-17½-B1	470	370	2.3 [1.3]	5.1 [1.8]	5.1 [1.8]	24 [8.8]	<30	NA
S-22½-B1	<1.0	<1.0	0.010	<0.0050	<0.0050	<0.0050	<30	NA
S-26½-B1	2.0	<1.0	0.026	0.014	0.011	0.049	<30	MA
S-12-B2	<1.0	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<30	NA
S-17-B2	740	540	2.3 [4.3]	13 [92]	7.7 [57]	41 [360]	<30	NA
S-25½-B2	<1.0	<1.0	0.015	0.016	<0.0050	0.019	<30	NA
S-30½-B2	<1.0	<1.0	0.015	0.0080	<0.0050	<0.0050	<30	NA
S-10½-B3	<1.0	<1.0	0.0070	<0.0050	<0.0050	<0.0050	<30	NA
S-17½-B3	320	230	0.65	0.65	2.3	5.9	<30	NA
S-26½-B3	<1.0	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<30	NA
S-10½-B4	<1.0	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<30	NA
S-15½-B4	<1.0	<1.0	0.010	<0.0050	<0.0050	<0.0050	<30	NA
S-18½-B4	65	41	0.42 [0.46]	0.22 [0.24]	0.54 [1.7]	0.77 [3.2]	<30	NA
S-20-B4	<1.0	<1.0	0.0070	<0.0050	<0.0050	<0.0050	<30	NA
S-9½-B5	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA
S-14½-B5	<1.0	NA	0.13	<0.0050	<0.0050	0.0050	NA	NA
S-31½-B5	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA
S-9½-B6	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA
S-16½-B6*	190	NA	0.24	0.55	1.0	1.3	NA	NA
S-27½-B6	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA
S-10-B7	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA
S-15-B7	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA
S-29½-B7	<1.0	NA	<0.0050	<0.0050	<0.0050	0.025	NA	NA
S-9½-B8	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA
S-14½-B8	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA
S-33½-B8	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA

See notes on page 4 of 4.

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TABLE 1
CUMULATIVE RESULTS OF LABORATORY ANALYSES OF SOIL SAMPLES
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Oakland, California
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Sample ID	TPHg	TPHd	B	T	E	X	TOG	RCI
S-6-TB1	<1.0	NA	<0.0050	0.014	<0.0050	0.018	NA	NA
S-9½-TB1	<1.0	NA	<0.0050	0.011	<0.0050	0.029	NA	NA
S-15-TB1	2.5	NA	0.12	0.042	0.014	0.027	NA	NA
S-5½-TB2	<1.0	NA	<0.0050	0.014	<0.0050	0.011	NA	NA
S-9½-TB2	<1.0	NA	<0.0050	0.015	<0.0050	0.012	NA	NA
S-15-TB2	5.3	NA	0.84	0.062	0.13	0.21	NA	NA
S-6½-TB3	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA
S-9½-TB3	<1.0	NA	<0.0050	<0.0050	<0.0050	0.013	NA	NA
S-15-TB3	3.2	NA	0.11	0.079	0.023	0.12	NA	NA
S-6½-TB4	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA
S-9½-TB4	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA
S-15-TB4	470	NA	0.76	0.17	4.7	15	NA	NA
S-6½-TB5	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA
S-9½-TB5	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA
S-15-TB5	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA
S-6½-TB6	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA
S-12-TB6	20	NA	<0.0050	<0.0050	0.074	0.61	NA	NA
S-15½-TB6	25	NA	0.30	2.4	1.0	6.3	NA	NA
S-28-TB6	<1.0	NA	0.0054	0.025	<0.0050	0.016	NA	NA
S-5-TB7	<1.0	NA	<0.0050	0.0059	<0.0050	0.032	NA	NA
S-12-TB7	3.9	NA	0.23	0.35	0.054	0.50	NA	NA
S-15-TB7	28	NA	1.4	3.9	0.80	4.7	NA	NA
S-16½-TB7	610	NA	4.1	36	15	91	NA	NA
S-4½-TB8	<1.0	NA	0.014	0.036	<0.0050	0.019	NA	NA
S-9½-TB8	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA
S-15-TB8	<1.0	NA	0.0090	0.034	0.0072	0.029	NA	NA
S-18-TB8	<1.0	NA	0.0095	0.020	<0.0050	0.015	NA	NA

See notes on page 4 of 4.

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TABLE 1
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Oakland, California
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Sample ID	TPHg	TPHd	B	T	E	X	TOG	RCI
S-3½-TB9	<1.0	NA	<0.0050	0.0087	<0.0050	0.0069	NA	NA
S-9½-TB9	6.7	NA	0.019	0.024	0.049	0.45	NA	NA
S-15-TB9	3.9	NA	0.092	0.020	0.014	0.51	NA	NA
S-5-TB10	<1.0	NA	<0.0050	<0.0050	<0.0050	0.0080	NA	NA
S-9½-TB10	<1.0	NA	0.011	0.020	<0.0050	0.0071	NA	NA
S-14½-TB10	<1.0	NA	0.011	0.016	<0.0050	0.0078	NA	NA
S-6½-TB11	<1.0	NA	0.020	0.016	<0.0050	0.011	NA	NA
S-9½-TB11	<1.0	NA	0.080	0.012	<0.0050	0.028	NA	NA
S-15-TB11	19	NA	1.9	0.080	0.51	0.83	NA	NA
B9-1-5	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA
B9-2-9.5	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA
B9-3-14.5	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA
B9-5-25	<1.0	NA	0.0060	<0.0050	<0.0050	<0.0050	NA	NA
B10-3-16	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA
B10-6-28	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA
B11-3-14.5	<1.0	NA	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA
B11-5-24.5	4.1	NA	0.20	0.52	0.13	0.66	NA	NA
SP-(A-D) other analyses: lead 0.22	4.3	NA	0.014	0.094	0.12	0.60	NA	pH 6.6 ignitability >100° reactivities none

See notes on page 4 of 4.

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TABLE 1
CUMULATIVE RESULTS OF LABORATORY ANALYSES OF SOIL SAMPLES
ARCO Station 6148
Oakland, California
(Page 4 of 4)

Notes:

All results shown in parts per million (ppm)

TPHg: Total petroleum hydrocarbons as gasoline by EPA method 5030/8015/8020.

TPHd: Total petroleum hydrocarbons as diesel by EPA method 3550/8015. Laboratory reported samples matrix contained high boiling point fuel mixture calculated as diesel, possibly weathered gasoline.

B: Benzene, T: Toluene, E: Ethylbenzene, T: Total Xylene isomers;

BTEX: Measured by EPA method 8030/8015/8020.

TOG: Total oil and grease by Standard Method 5520 E&F.

[ ]: BTEX detected using EPA Method 8240.

RCI: Reactivity, corrosivity, and ignitability.

NA: Not analyzed.

*: Laboratory reported this as a gas and non-gas mix.

<: Results reported as less than the detection limit.

Sample Identification:

S-20-B4
- Boring number
- Depth in feet
- Soil sample

B11-5-24.5
- Depth in feet
- Sample number
- Boring number

SP-(A-D)
- Composite sample
- Soil pile

TABLE 2
SPARGE AND VAPOR EXTRACTION WELL DATA SUMMARY
ARCO Station 6148
Oakland, California

Well ID	Well Type	Depth-to-Water	Screened Interval	Depth of Well
AS-2	Sparge	17.04	24.5 to 26.5	26.5
VW-1	Vadose	16.64	14 to 24	24
VW-2	Vadose	16.64	15 to 20	20
VW-3	Vadose	16.96	14 to 24	24
MW-1	Monitoring	17.14	13 to 26	26
MW-2	Monitoring	16.82	14 to 26	26
MW-3	Monitoring	16.98	14 to 26	26

Notes:
Measurements in feet below ground surface.

TABLE 3
AIR SPARGE TEST FIELD MONITORING DATA
ARCO Station 6148
Oakland, California

February 16, 1994

Time	AS-2	MW-2	MW-1	VW-1	MW-3	VW-3
Pre-Sparge	$TPHg_{GW}$ = 180	$TPHg_{GW}$ = 12,000 $TPHg_V$ = 4,900	$TPHg_{GW}$ = 150 $TPHg_V$ = <5.0	$TPHg_{GW}$ = FP $TPHg_V$ = 2,900	$TPHg_{GW}$ = 11,000 $TPHg_V$ = 620	$TPHg_{GW}$ = 70,000 $TPHg_V$ = 2,900
4:45 (start sparge)	Q_A = 2.0 Q_H = 1.0 P_i = 9.0	—	—	—	—	
4:45-5:00		H_V = 0.13 H_S = 0.40	H_V = 0.09 H_S = 0.07	H_V = 0.15 H_S = 0.43	H_V = 0.21 H_S = 0.37	H_V = 0.32 H_S = 0.03
5:00-5:15		H_V = 0.05 H_S = 0.16	H_V = 0.28 H_S = 0.40	H_V = 0.03 H_S = 0.11	H_V = 0.18 H_S = 0.39	H_V = 0.66 H_S = 0.38
5:15-5:30		H_V = 1.5 H_S = 0.37	H_V = 0.14 H_S = 0.26	H_V = 0.03 H_S = 0.52	H_V = 0.00 H_S = 0.49	H_V = 0.49 H_S = 0.26
5:30-5:45		H_V = 4.8 H_S = 0.25	H_V = 0.07 H_S = 0.22	H_V = 0.00 H_S = 0.21	H_V = 0.04 H_S = 0.34	H_V = 0.47 H_S = 0.22
5:45 (end sparge)	$TPHg_{GW}$ = 220	$TPHg_{GW}$ = 22,000 $TPHg_V$ = 4,600	$TPHg_{GW}$ = 140 $TPHg_V$ = 300	$TPHg_{GW}$ = FP $TPHg_V$ = 8,400	$TPHg_{GW}$ = 10,000 $TPHg_V$ = 1,400	$TPHg_{GW}$ = 61,000 $TPHg_V$ = 3,700
Distance from sparge well		10'6"	14'	14'2"	14'7"	26'6"

See notes on page 2 of 2

TABLE 3
AIR SPARGE TEST DATA
ARCO Station 6148
Oakland, California
(Page 2 of 2)

Notes:

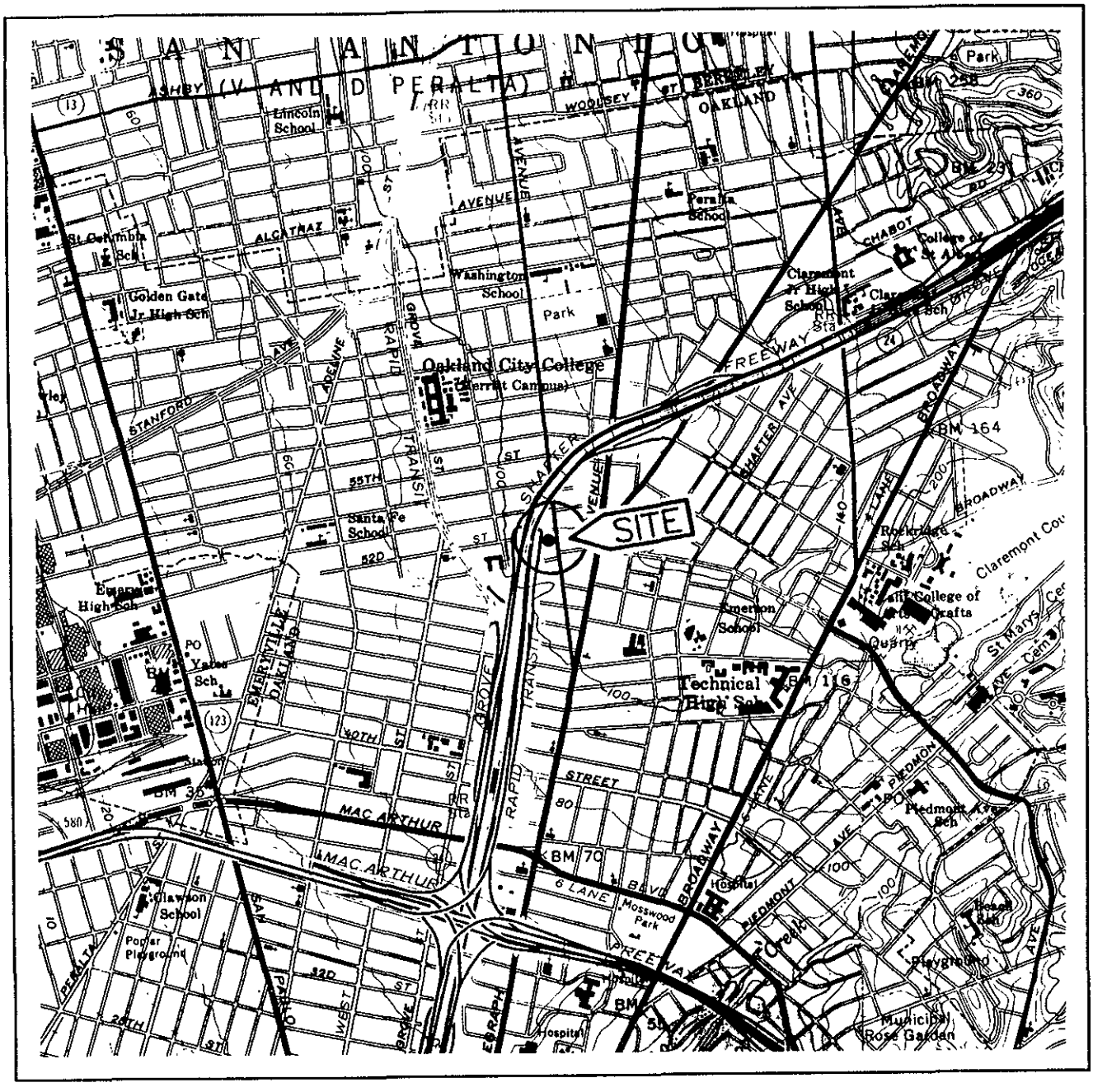
TPHg:	Total petroleum hydrocarbons as gasoline.
$TPHg_v$:	Concentrations of TPHg vapor in soil gas measured in mg/m^3.
$TPHg_{GW}$:	Concentrations of TPHg dissolved in groundwater measured in parts per billion.
Q_A:	Injection rate of sparge air measured in actual cubic feet per minute.
Q_H:	Injection rate of helium measured in actual cubic feet per minute.
P_i:	Combined air and helium injection pressure measured in pounds per square inch.
H_v:	Levels of helium in vadose zone measured in percent.
H_s:	Levels of helium in saturated zone measured in percent.
—:	Not applicable, not sampled, or not measured.

TABLE 4
COMBINATION VAPOR EXTRACTION/AIR SPARGE TEST FIELD MONITORING DATA
ARCO Station 6148
Oakland, California

February 17, 1994

Influent Air Stream from VW-1				Injection Well AS-2		Observation Wells			
						MW-2	MW-3	MW-1	VW-3
Elapsed Time (min)	Flow Rate (acfm)	Applied Vacuum ("H_2O)	OVM Readings (ppm)	Flow Rate (acfm)	Applied Pressure (psi)	Induced Vacuum ("H_2O)	Induced Vacuum ("H_2O)	Induced Vacuum ("H_2O)	Induced Vacuum ("H_2O)
0	25	28	5,700			0.07	0.06	0.04	0.02
15	25	38	5,800			0.07	0.06	0.02	0.03
30	25	40	4,900			0.07	0.05	0.01	0.02
45	25	39	8,750			0.06	0.05	0.01	0.03
60	25	38	5,110			0.06	0.05	0.01	0.03
		Begin Air Sparging							
75	25	38	6,400	2.5	9	0.03	0.03	0.00	0.01
90	25	36	6,120	2.5	9	0.03	0.03	0.00	0.01
105	25	35	6,500	2.5	9	0.03	0.03	0.00	0.02
120	25	35	5,470	2.5	9	0.03	0.03	0.00	0.01
Distance from extraction well VW-1 (feet):						14'3"	20'2"	28'	37'10"

Notes:
acfm = actual cubic feet per minute
" H_2O = inches of water column
ppm = parts per million
No detectable background fluctuations in atmospheric pressure.



Source: U.S. Geological Survey
7.5-Minute Quadrangles
Oakland East/Oakland West, California
Photorevised 1980

N

Approximate Scale

2000 1000 0 2000

feet

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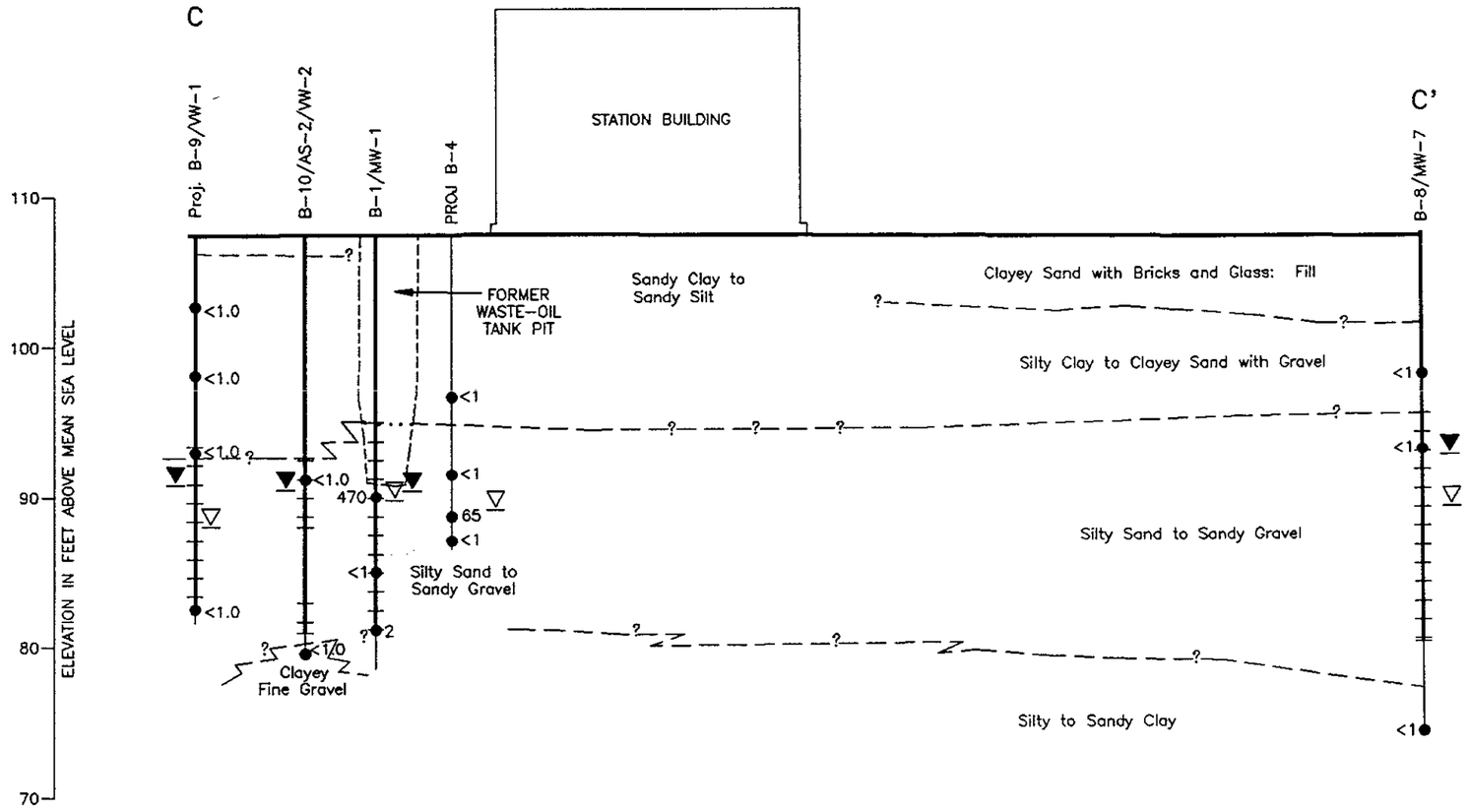
SITE VICINITY MAP
ARCO Station 6148
5131 Shattuck Avenue
Oakland, California

PLATE
1



EXPLANATION

740 = Laboratory analyzed soil sample showing concentration of TPHg in parts per million

= Well casing

= Well screen

= Boring

▽ = Initial water level in boring

▼ = Static water level in well (2-16-94)

Approximate Horizontal Scale

20 10 0 20 40

feet

Approximate Vertical Scale

10 5 0 10 20

feet

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PROJECT 61035.11 6103511C

GEOLOGIC CROSS SECTION C-C'
ARCO Station 6148
5131 Shattuck Avenue
Oakland, California

PLATE 4

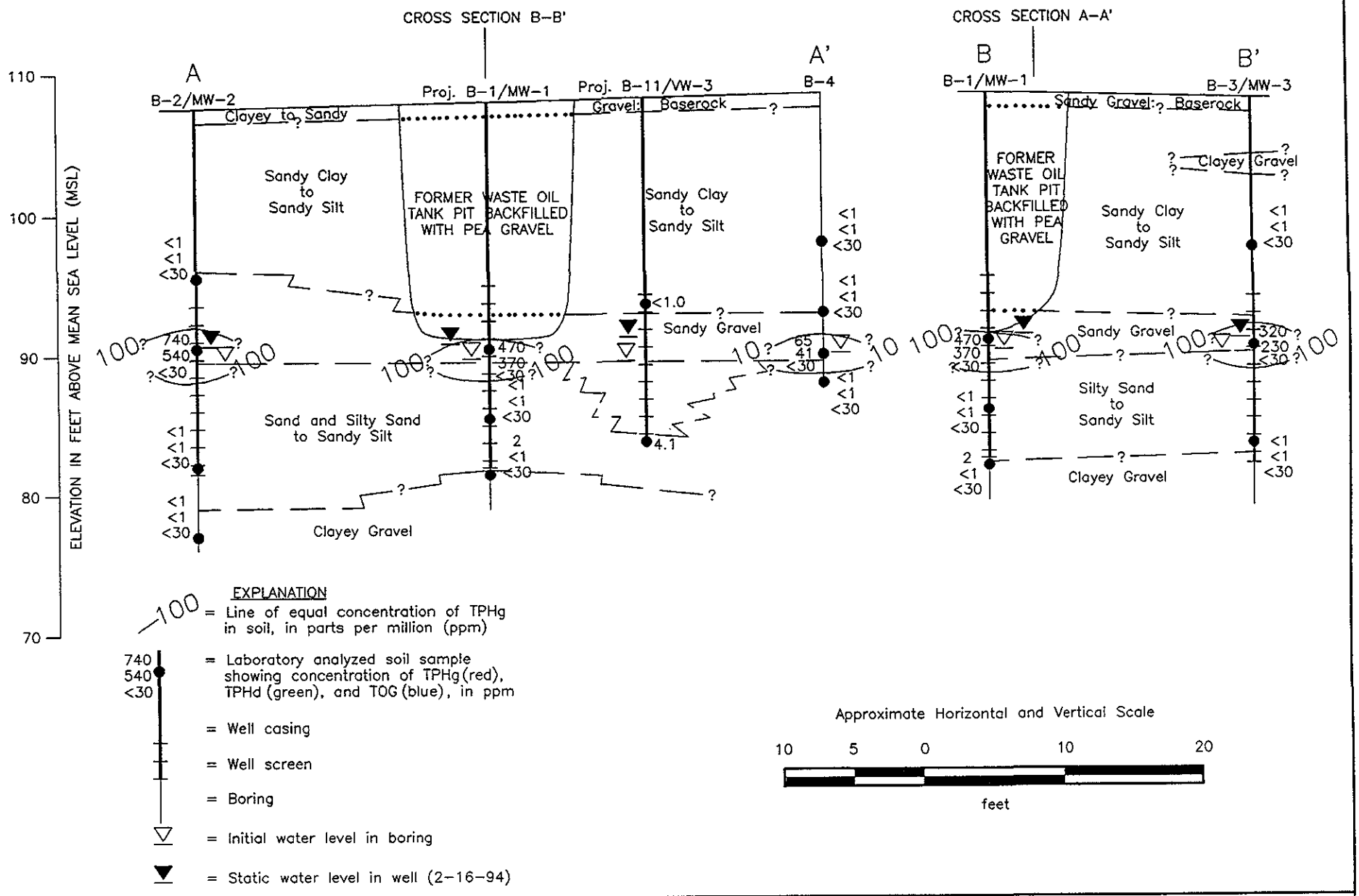

PLATE 3

GEOLOGIC CROSS SECTIONS A-A' AND B-B'
ARCO Station 6148
5131 Shattuck Avenue
Oakland, California

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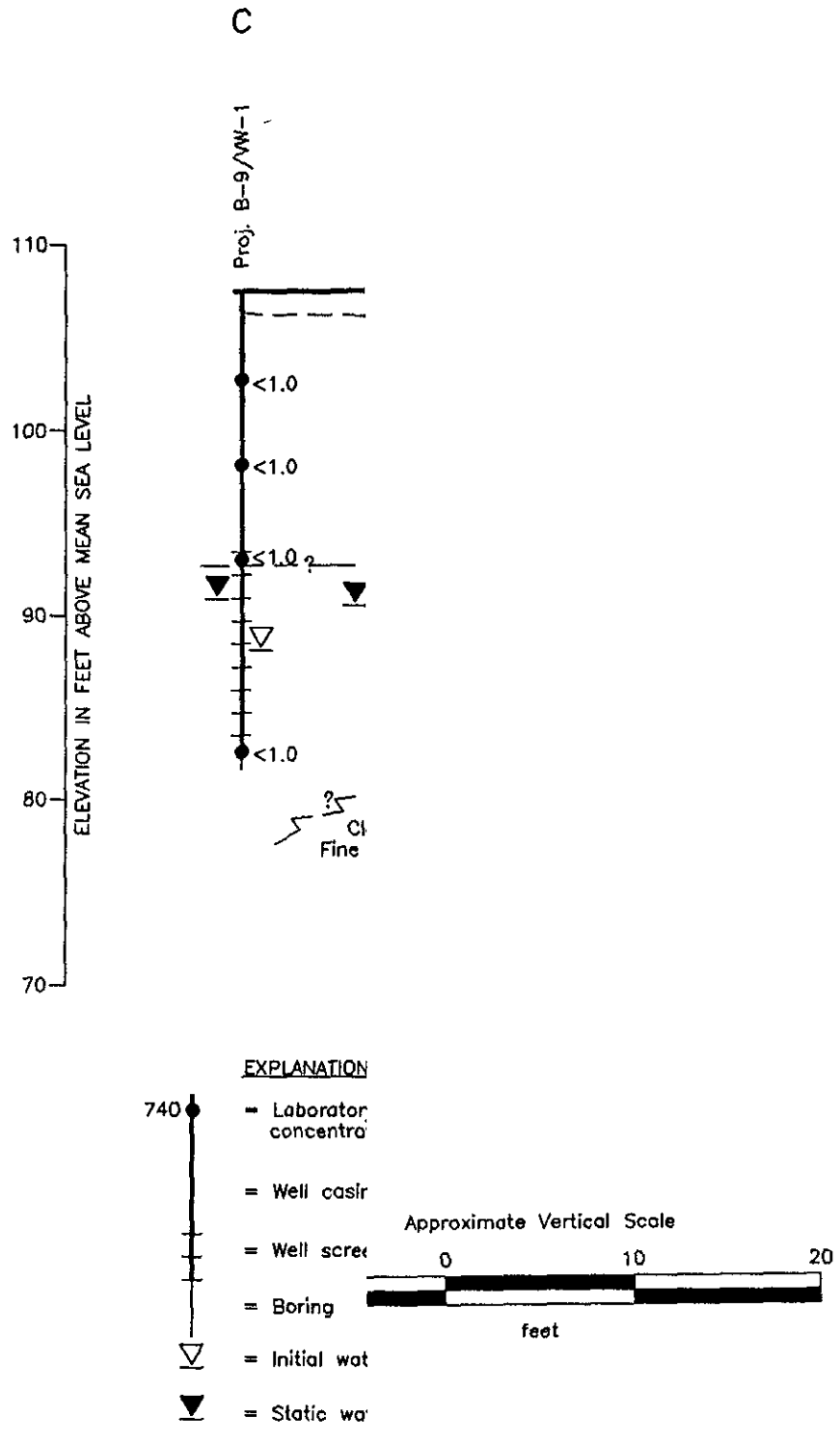

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PLATE 4

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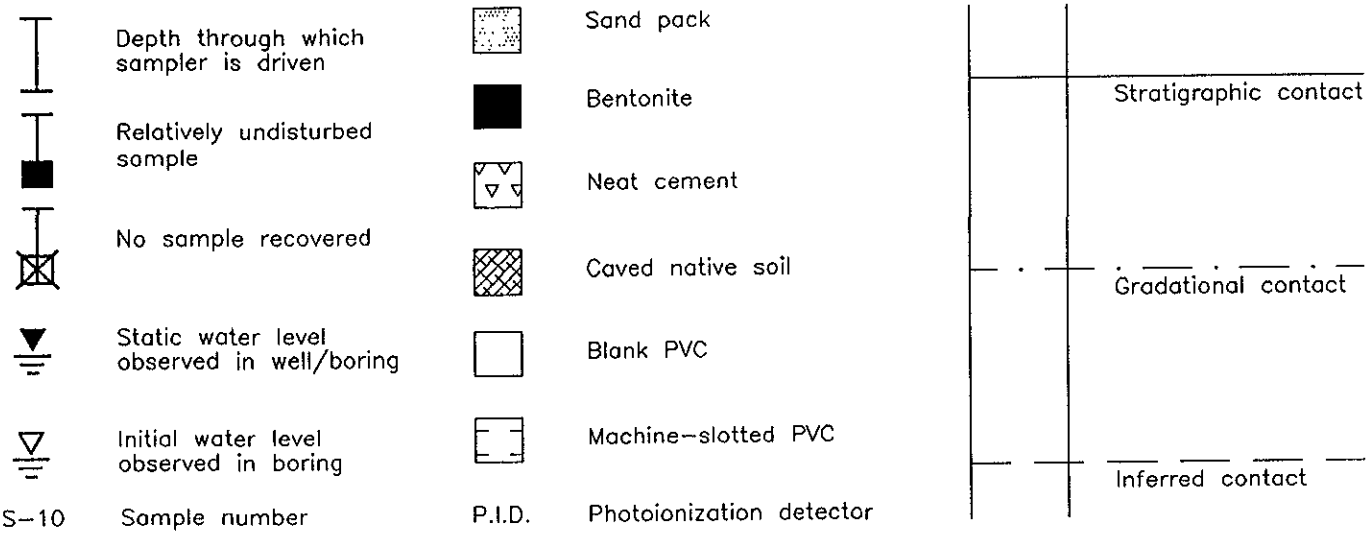
APPENDIX A

BORING LOGS

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISION		LTR	DESCRIPTION
COARSE-GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravels or gravel-sand mixtures, little or no fines.
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines.
		GM	Silty gravels, gravel-sand-silt mixtures.
		GC	*Clayey gravel, gravel-sand* -clay mixtures.
	SAND AND SANDY SOILS	SW	Well-graded sand or gravelly sands, little or no fines.
		SP	Poorly-graded sands or gravelly sands, little or no fines.
		SM	Silty sands, sand-silt mixtures.
		SC	Clayey sands, sand-clay mixtures.

MAJOR DIVISION		LTR	DESCRIPTION
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.
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		OL	Organic silts and organic silt-clays of low plasticity.
	SILTS AND CLAYS LL>50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		CH	Inorganic clays of high plasticity, fat clays.
		OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils.



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.

GRADATIONAL AND INFERRED CONTACT 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.

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UNIFIED SOIL CLASSIFICATION SYSTEM AND SYMBOL KEY
ARCO Station 6148
5131 Shattuck Avenue
Oakland, California

PLATE 1A

Total depth of boring: 25-1/2 feet
Diameter of boring: 12 inches
Date drilled: 7-6-93
Drilling Company: Exploration Geoservices
Driller: John
Drilling method: Hollow-Stem Auger

Casing diameter: 4 inches
Casing material: Sch 40 PVC
Slot size: 0.1-inch
Sand size: 3/8" pea gravel
Screen Interval: 14 feet to 24 feet
Field Geologist: Zbig Ignatowicz

Signature of Registered Professional: Richard Walls
Registration No.: C043139 State: CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
					Asphalt over base course.	
2				ML	Sandy silt, dark brown, slightly damp, no to low plasticity, hard.	
4	S-5	23 30 41				
6						
8						
10	S-9.5	27 50/3				
12						
14	S-14.5	21 50/6		GP	Sandy fine gravel, dark yellowish-brown, damp, very dense.	
16						
18				▽		
20	S-19.5	23 50/5			Wet; odor.	
22						
24	S-25	16 26 30		SM	Silty sand, yellowish-brown, wet, very dense.	
26					Total Depth = 25-1/2 feet.	
28						
30						
32						
34						
36						
38						
40						

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PROJECT: 61035.11

LOG OF BORING B-9/VW-1
ARCO Station 6148
5131 Shattuck Avenue
Oakland, California

PLATE
2A

Total depth of boring:	28 feet	Casing diameter:	2 inches/4 inches
Diameter of boring:	12 inches	Casing material:	Sch 40 PVC
Date drilled:	7-6-93	Slot size:	0.020-inch
Drilling Company:	Exploration Geoservices	Sand size:	3/8" gravel/No. 3 Sand
Driller:	John	Screen Interval:	24.5 feet to 26.5/15 feet to 19.5 feet
Drilling method:	Hollow-Stem Auger	Field Geologist:	Zbig Ignatowicz

Signature of Registered Professional: Richard Wells

Registration No.: C043139 State: CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
					Asphalt over base course.	
2				CL/ML	Sandy clay to sandy silt, dark brown, slightly damp, low to medium plasticity, very stiff.	
4						
6	S-6	19 14 15				
8						
10		20 45		ML	Sandy silt, ~20% fine-grained sand, brown, slightly damp, no to low plasticity, hard.	
12	S-11	50/4				
14		14 20			More gravelly, gravel up to ~30%.	
16	S-15.5	26		GP	Sandy gravel, ~40% fine-grained sand, fine gravel, dark greenish-gray, damp, dense.	
18						
20		20 32			Wet	
22	S-20.5	44			Clayey gravel.	
24		13 19		SM	Silty sand, yellowish-brown, wet, dense.	
26	S-25.5	22				
28	S-28	20 35 50/3		GC	Clayey fine gravel, yellowish-brown, wet, very dense.	
30					Total Depth = 28 feet.	
32						
34						
36						
38						
40						

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PROJECT: 61035.11

LOG OF BORING B-10/AS-2/VW-2
ARCO Station 6148
5131 Shattuck Avenue
Oakland, California

PLATE 3A

Total depth of boring:	25 feet	Casing diameter:	4 inches
Diameter of boring:	12 inches	Casing material:	Sch 40 PVC
Date drilled:	7-6-93	Slot size:	0.10-inch
Drilling Company:	Exploration Geoservices	Sand size:	3/8" pea gravel
Driller:	John	Screen Interval:	14 feet to 24 feet
Drilling method:	Hollow-Stem Auger	Field Geologist:	Zbig Ignatowicz

Signature of Registered Professional: Richard Walls

Registration No.: C043139 State: CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
					Asphalt over base course.	
2				ML	Sandy silt, with some clay, dark brown, damp, low plasticity, very stiff.	
4		9				
6	S-5	10 12				
8						
10	S-10	17 25 45				
12						
14	S-14.5	20 50/6		GP	Sandy gravel, dark gray, moist, very dense; odor.	
16						
18				▽		
20	S-19.5	22 50/6			Wet.	
22						
24	S-24.5	22 50/3		SM	Silty sand, dark yellowish-brown, wet, very dense.	
26					Total Depth = 25 feet.	
28						
30						
32						
34						
36						
38						
40						

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PROJECT: 61035.11

LOG OF BORING B-11/VW-3

ARCO Station 6148
5131 Shattuck Avenue
Oakland, California

PLATE 4A

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APPENDIX B

CHAIN OF CUSTODY RECORDS AND LABORATORY ANALYSES REPORTS FOR SOIL SAMPLES

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: John Young

Project: 61035.10, Arco 6148

Enclosed are the results from 8 soil samples received at Sequoia Analytical on July 7,1993. The requested analyses are listed below:

SAMPLE #	SAMPLE DESCRIPTION	DATE OF COLLECTION	TEST METHOD
3G42901	Soil, B9-1-5	7/6/93	EPA 5030/8015/8020
3G42902	Soil, B9-2-9.5	7/6/93	EPA 5030/8015/8020
3G42903	Soil, B9-3-14.5	7/6/93	EPA 5030/8015/8020
3G42904	Soil, B9-5-25	7/6/93	EPA 5030/8015/8020
3G42905	Soil, B10-3-16	7/6/93	EPA 5030/8015/8020
3G42906	Soil, B10-6-28	7/6/93	EPA 5030/8015/8020
3G42907	Soil, B11-3-14.5	7/6/93	EPA 5030/8015/8020
3G42908	Soil, B11-5-24.5	7/6/93	EPA 5030/8015/8020

Please contact me if you have any questions. In the meantime, thank you for the opportunity to work with you on this project.

Very truly yours,

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

RESNA	Client Project ID:	61035.10, Arco 6148	Sampled: Jul 6, 1993
3315 Almaden Expwy., Suite 34	Sample Matrix:	Soil	Received: Jul 7, 1993
San Jose, CA 95118	Analysis Method:	EPA 5030/8015/8020	Reported: Jul 19, 1993
Attention: John Young	First Sample #:	3G42901	

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit mg/kg	Sample I.D. 3G42901 B9-1-5	Sample I.D. 3G42902 B9-2-9.5	Sample I.D. 3G42903 B9-3-14.5	Sample I.D. 3G42904 B9-5-25	Sample I.D. 3G42905 B10-3-16	Sample I.D. 3G42906 B10-6-28
Purgeable Hydrocarbons	1.0	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Benzene	0.0050	N.D.	N.D.	N.D.	0.0060	N.D.	N.D.
Toluene	0.0050	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Ethyl Benzene	0.0050	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Total Xylenes	0.0050	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Chromatogram Pattern:		--	--	--	Discrete Peak	--	--

Quality Control Data

Report Limit Multiplication Factor:	1.0	1.0	1.0	1.0	1.0	1.0
Date Analyzed:	7/13/93	7/13/93	7/13/93	7/13/93	7/13/93	7/13/93
Instrument Identification:	GCHP-18	GCHP-18	GCHP-18	GCHP-18	GCHP-18	GCHP-18
Surrogate Recovery, %: (QC Limits = 70-130%)	96	96	98	100	102	105

Purgeable Hydrocarbons are quantitated against a fresh gasoline standard.
Analytes reported as N.D. were not detected above the stated reporting limit.

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

RESNA	Client Project ID:	61035.10, Arco 6148	Sampled:	Jul 6, 1993
3315 Almaden Expwy., Suite 34	Sample Matrix:	Soil	Received:	Jul 7, 1993
San Jose, CA 95118	Analysis Method:	EPA 5030/8015/8020	Reported:	Jul 19, 1993
Attention: John Young	First Sample #:	3G42907		

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit mg/kg	Sample I.D. 3G42907 B11-3-14.5	Sample I.D. 3G42908 B11-5-24.5
Purgeable Hydrocarbons	1.0	N.D.	4.1
Benzene	0.0050	N.D.	0.20
Toluene	0.0050	N.D.	0.52
Ethyl Benzene	0.0050	N.D.	0.13
Total Xylenes	0.0050	N.D.	0.66
Chromatogram Pattern:		--	Gas

Quality Control Data

Report Limit Multiplication Factor:	1.0	1.0
Date Analyzed:	7/13/93	7/13/93
Instrument Identification:	GCHP-18	GCHP-18
Surrogate Recovery, %: (QC Limits = 70-130%)	99	107

Purgeable Hydrocarbons are quantitated against a fresh gasoline standard.
Analytes reported as N.D. were not detected above the stated reporting limit.

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

SEQUOIA ANALYTICAL
680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: John Young

Client Project ID: 61035.10, Arco 6148
Matrix: Soil
QC Sample Group: 3G42901-8

Reported: Jul 19, 1993

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-Benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	R. Geckler	R. Geckler	R. Geckler	R. Geckler
Conc. Spiked:	0.20	0.20	0.20	0.60
Units:	mg/Kg	mg/Kg	mg/Kg	mg/Kg
LCS Batch#:	BLK070993	BLK070993	BLK070993	BLK070993
Date Prepared:	7/9/93	7/9/93	7/9/93	7/9/93
Date Analyzed:	7/9/93	7/9/93	7/9/93	7/9/93
Instrument I.D.#:	GCHP-18	GCHP-18	GCHP-18	GCHP-18
LCS % Recovery:	105	105	105	105
Control Limits:	60-140	60-140	60-140	60-140
MS/MSD Batch #:	3FD5801	3FD5801	3FD5801	3FD5801
Date Prepared:	7/9/93	7/9/93	7/9/93	7/9/93
Date Analyzed:	7/9/93	7/9/93	7/9/93	7/9/93
Instrument I.D.#:	GCHP-18	GCHP-18	GCHP-18	GCHP-18
Matrix Spike % Recovery:	85	90	95	95
Matrix Spike Duplicate % Recovery:	85	95	95	95
Relative % Difference:	0.0	5.4	0.0	0.0

Quality Assurance Statement: All standard operating procedures and quality control requirements have been met.
SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

Please Note:
The LCS is a control sample of known, interferent free matrix that is analyzed using the same reagents, preparation and analytical methods employed for the samples. The LCS % recovery data is used for validation of sample batch results. Due to matrix effects, the QC limits for MS/MSD's are advisory only and are not used to accept or reject batch results.

ARCO Products Company
Division of AtlanticRichfieldCompany

Task Order No. 65035.10

Chain of Custody

ARCO Facility no. 6148	City (Facility) OAKLAND	Project manager (Consultant) RESNA (JOHN YOUNG)	Laboratory name SEQUOIA
ARCO engineer Michael Whelan	Telephone no. (ARCO)	Telephone no. (Consultant) (408) 264-9723	Fax no. (Consultant) (408) 264-2435
Consultant name RESNA	Address (Consultant) 3315 ALMADEN EXP. SAN JOSE, CA 95118		Contract number

Method of shipment

Special detection Limit/reporting

Special QA/QC

Remarks

Lab number

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Matrix: Water	Matrix: Other	Preservation: Ice	Preservation: Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH EPA M602/8020/8015	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals ☐ VOA ☐ Semi VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org./DHS ☐ Lead EPA 7420/7421 ☐		
B4-1-5		1	X			X		11-6-93			X											
B4-2-9.5		1	X			X					X											
B4-3-14.5		1	X			X					X											
B4-4-19.5		1	X			X																
B4-5-25		1	X			X					X											
B12-1-6		1	X			X																
B10 2-11		1	X			X																
B6 3-16		1	X			X					X											
B10 4-21		1	X			X																
B10-5-26		1	X			X																
B10-6-28		1	X			X					X											
B11-1-5		1	X			X																
B11-2-10		1	X			X																
B11-3-14.5		1	X			X					X											
B11-4-19.5		1	X			X																
B11-5-24.5		1	X			X					X											

Condition of sample:		Temperature received:	
Relinquished by sampler [signature]	Date 11-7-93 Time 10:00	Received by [signature]	
Relinquished by [signature]	Date Time	Received by	
Relinquished by	Date Time	Received by laboratory	Date Time

Turnaround time

- Priority Rush 1 Business Day ☐
- Rush 2 Business Days ☐
- Expedited 5 Business Days ☐
- Standard 10 Business Days ☐

Distribution: White copy — Laboratory; Canary copy — ARCO Environmental Engineering; Pink copy — Consultant

APPC-3292 (2-91)

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

RESNA - San Jose
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: John Young

Project: 61035.10/Arco 6148, Oakland

Enclosed are the results from 1 soil sample received at Sequoia Analytical on July 7,1993. The requested analyses are listed below:

SAMPLE #	SAMPLE DESCRIPTION	DATE OF COLLECTION	TEST METHOD
3G21401	Soil, SP-(A-D)	7/6/93	TCLP TPH-g BTEX TPH - EPA 5030/8015 Corrosivity Ignitability Reactivity STLC Lead

Please contact me if you have any questions. In the meantime, thank you for the opportunity to work with you on this project.

Very truly yours,

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

RESNA - San Jose	Client Project ID:	61035.10/Arco 6148, Oakland	Sampled:	Jul 6, 1993
3315 Almaden Expwy., Suite 34	Sample Matrix:	TCLP extract	Received:	Jul 7, 1993
San Jose, CA 95118	Analysis Method:	EPA 5030/8015/8020	Reported:	Jul 9, 1993
Attention: John Young	First Sample #:	3G21401		

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit mg/L	Sample I.D. 3G21401 SP-(A-D)
Low/Medium B.P. Hydrocarbons	0.050	4.3
Benzene	0.00050	0.014
Toluene	0.00050	0.094
Ethyl Benzene	0.00050	0.12
Total Xylenes	0.00050	0.60
Chromatogram Pattern:		--

Quality Control Data

Report Limit Multiplication Factor:	20
Date Analyzed:	7/9/93
Instrument Identification:	GCHP-2
Surrogate Recovery, %: (QC Limits = 70-130%)	98

Purgeable Hydrocarbons are quantitated against a fresh gasoline standard.
Analytes reported as N.D. were not detected above the stated reporting limit.

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

RESNA - San Jose	Client Project ID:	61035.10/Arco 6148, Oakland	Sampled:	Jul 6, 1993
3315 Almaden Expwy., Suite 34	Sample Matrix:	Soil	Received:	Jul 7, 1993
San Jose, CA 95118	Analysis Method:	EPA 5030/8015	Reported:	Jul 9, 1993
Attention: John Young	First Sample #:	3G21401		

TOTAL PURGEABLE PETROLEUM HYDROCARBONS

Analyte	Reporting Limit mg/kg	Sample I.D. 3G21401 SP-(A-D)
Low/Medium B.P. Hydrocarbons	1.0	24
Chromatogram Pattern:		Gas

Quality Control Data

Report Limit Multiplication Factor:	2.0
Date Analyzed:	7/8/93
Instrument Identification:	GCHP-7
Surrogate Recovery: (QC Limits = 70-130%)	110

Purgeable Hydrocarbons are quantitated against a fresh gasoline standard.
Analytes reported as N.D. were not detected above the stated reporting limit.

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

RESNA - San Jose	Client Project ID:	61035.10/Arco 6148, Oakland	Sampled:	Jul 6, 1993
3315 Almaden Expwy., Suite 34	Sample Descript:	Soil, SP-(A-D)	Received:	Jul 7, 1993
San Jose, CA 95118			Analyzed:	Jul 7, 8, 1993
Attention: John Young	Lab Number:	3G21401	Reported:	Jul 9, 1993

CORROSIVITY, IGNITABILITY, AND REACTIVITY

Analyte	Detection Limit	Sample Results
Corrosivity:		
pH	N.A.	6.6
Ignitability:		
Flashpoint (Pensky-Martens), °C	25	> 100 °C
Reactivity:		
Sulfide, mg/kg	13	N.D.
Cyanide, mg/kg	0.50	N.D.
Reaction with water	N.A.	Negative

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

SEQUOIA ANALYTICAL
680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

RESNA - San Jose
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: John Young

Client Project ID: 61035.10/Arco 6148, Oakland
Matrix: Liquid
QC Sample Group: 3G21401

Reported: Jul 9, 1993

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-Benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	M. Nipp	M. Nipp	M. Nipp	M. Nipp
Conc. Spiked:	10	10	10	30
Units:	µg/L	µg/L	µg/L	µg/L
LCS Batch#:	GBLK070993	GBLK070993	GBLK070993	GBLK070993
Date Prepared:	N.A.	N.A.	N.A.	N.A.
Date Analyzed:	7/9/93	7/9/93	7/9/93	7/9/93
Instrument I.D.#:	GCHP-2	GCHP-2	GCHP-2	GCHP-2
LCS % Recovery:	97	97	97	97
Control Limits:	80-120	80-120	80-120	80-120
MS/MSD Batch #:	3FD3403	3FD3403	3FD3403	3FD3403
Date Prepared:	N.A.	N.A.	N.A.	N.A.
Date Analyzed:	7/9/93	7/9/93	7/9/93	7/9/93
Instrument I.D.#:	GCHP-2	GCHP-2	GCHP-2	GCHP-2
Matrix Spike % Recovery:	89	91	91	87
Matrix Spike Duplicate % Recovery:	98	99	97	100
Relative % Difference:	9.6	8.4	6.4	14

Quality Assurance Statement: All standard operating procedures and quality control requirements have been met.
SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

Please Note:
The LCS is a control sample of known, interferent free matrix that is analyzed using the same reagents, preparation and analytical methods employed for the samples. The LCS % recovery data is used for validation of sample batch results. Due to matrix effects, the QC limits for MS/MSD's are advisory only and are not used to accept or reject batch results.

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

RESNA - San Jose
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: John Young

Client Project ID: 61035.10/Arco 6148, Oakland
Matrix: Soil
QC Sample Group: 3G21401

Reported: Jul 9, 1993

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-Benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	C. Donohue	C. Donohue	C. Donohue	C. Donohue
Conc. Spiked:	0.20	0.20	0.20	0.60
Units:	mg/kg	mg/kg	mg/kg	mg/kg
LCS Batch#:	GBLK070893	GBLK070893	GBLK070893	GBLK070893
Date Prepared:	7/8/93	7/8/93	7/8/93	7/8/93
Date Analyzed:	7/8/93	7/8/93	7/8/93	7/8/93
Instrument I.D.#:	GCHP-7	GCHP-7	GCHP-7	GCHP-7
LCS % Recovery:	95	100	100	97
Control Limits:	60-140	60-140	60-140	60-140
MS/MSD Batch #:	3FD4305	3FD4305	3FD4305	3FD4305
Date Prepared:	7/8/93	7/8/93	7/8/93	7/8/93
Date Analyzed:	7/8/93	7/8/93	7/8/93	7/8/93
Instrument I.D.#:	GCHP-7	GCHP-7	GCHP-7	GCHP-7
Matrix Spike % Recovery:	80	85	90	90
Matrix Spike Duplicate % Recovery:	80	85	90	90
Relative % Difference:	0.0	0.0	0.0	0.0

Quality Assurance Statement: All standard operating procedures and quality control requirements have been met.

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

Please Note:
The LCS is a control sample of known, interferent free matrix that is analyzed using the same reagents, preparation and analytical methods employed for the samples. The LCS % recovery data is used for validation of sample batch results. Due to matrix effects, the QC limits for MS/MSD's are advisory only and are not used to accept or reject batch results.

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

RESNA - San Jose
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: John Young

Client Project ID: 61035.10/Arco 6148, Oakland
Matrix: Soil

QC Sample Group: 3G21401

Reported: Jul 9, 1993

QUALITY CONTROL DATA REPORT

ANALYTE	pH	Flashpoint	Reactive Cyanide	Reactive Sulfide
Method:	EPA 9045	EPA 1010	SW 846	EPA 9030
Analyst:	K. Follett	K. Newberry	A. Savva	K. Follett
Units:	pH units	°C	mg/L	mg/L
Date:	7/2/93	7/2/93	7/6/93	7/6/93
Sample #:	3G04601	3FE7701	3G04001	3G04001
Sample Concentration:	8.6	>100	N.D.	N.D.
Sample Duplicate Concentration:	8.5	>100	N.D.	N.D.
% RPD:	1.2	0.0	0.0	0.0
Control Limits:	0-30	±5.0	±20	0-30

Quality Assurance Statement: All standard operating procedures and quality control requirements have been met.

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

RESNA - San Jose	Client Project ID:	61035.10/Arco 6148, Oakland	Sampled:	Jul 6, 1993
3315 Almaden Expwy., Suite 34	Sample Descript:	Soil, SP(A-D)	Received:	Jul 7, 1993
San Jose, CA 95118			Analyzed:	see below
Attention: John Young	Lab Number:	3G21401	Reported:	Jul 13, 1993

LABORATORY ANALYSIS

Analyte	Date Analyzed	Detection Limit mg/L	Sample Result mg/kg
Lead (STLC)	7/13/93	0.025	0.22

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

SEQUOIA ANALYTICAL
680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

RESNA - San Jose
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: John Young

Client Project ID: 61035.10/Arco 6148, Oakland
Matrix: Liquid

QC Sample Group: 3G21401

Reported: Jul 13, 1993

QUALITY CONTROL DATA REPORT

ANALYTE	Lead

Method:	EPA 239.2
Analyst:	J. Martinez
Conc. Spiked:	0.050
Units:	mg/L
LCS Batch#:	BLK071393
Date Prepared:	7/12/93
Date Analyzed:	7/13/93
Instrument I.D.#:	MV-1
LCS % Recovery:	106
Control Limits:	75-125

MS/MSD Batch #:	3G21401
Date Prepared:	7/12/93
Date Analyzed:	7/13/93
Instrument I.D.#:	MV-1
Matrix Spike % Recovery:	107
Matrix Spike Duplicate % Recovery:	110
Relative % Difference:	2.8

Quality Assurance Statement: All standard operating procedures and quality control requirements have been met.

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

Please Note:
The LCS is a control sample of known, interferent free matrix that is analyzed using the same reagents, preparation and analytical methods employed for the samples. The LCS % recovery data is used for validation of sample batch results. Due to matrix effects, the QC limits for MS/MSD's are advisory only and are not used to accept or reject batch results.

ARCO Products Company
Division of AtlanticRichfieldCompany

Task Order No. 68035.10

Chain of Custody

ARCO Facility no. 6148	City (Facility) OAKLAND	Project manager (Consultant) RESNA (JOHN YOUNG)	Laboratory name SEQUOIA
ARCO engineer MICHAEL WHELAN	Telephone no. (ARCO)	Telephone no. (Consultant) 408/264-7723	Fax no. (Consultant) (408)264-2435
Consultant name RESNA	Address (Consultant) 3315 ALMADEN EXP. SAN JOSE, CA 95118		Contract number

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Matrix: Water	Matrix: Other	Preservation: Ice	Preservation: Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TCLP EPA M602/8020/8015	TPH Modified 8015 Gas ☒ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals ☐ VOA ☐ Semi VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org./DHS ☐ Lead EPA 7420/7421 ☐	STLC Cd	RCT
SP-A		1	X			X		7-6-93	Composite		X	X									X	X
SP-B		1	X			X			Acts		X	X									X	X
SP-C		1	X			X			Over		X	X									X	X
SP-D		1	X			X		↓	↓		X	X									X	X

Remarks: ~~24~~ 48 hours turn around

Special detection Limit/reporting

Special QA/QC

Method of shipment

Lab number

Turnaround time

- Priority Rush 1 Business Day
- Rush 2 Business Days ☒
- Expedited 5 Business Days ☐
- Standard 10 Business Days ☐

Condition of sample:		Temperature received:	
Relinquished by sampler: [signature]	Date 7-7-93 Time 10:00	Received by	
Relinquished by	Date Time	Received by	
Relinquished by	Date Time	Received by laboratory	Date Time

Distribution: White copy — Laboratory; Canary copy — ARCO Environmental Engineering; Pink copy — Consultant
APPC-3292 (2-91)

RESNA
Working to Restore Nature

APPENDIX C

FIELD PROTOCOL

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FIELD PROTOCOL

The following presents RESNA Industries' field protocol for a typical site investigation involving gasoline hydrocarbon-impacted soil and/or groundwater.

Site Safety Plan

The Site Safety Plan describes the safety requirements for the evaluation of gasoline hydrocarbons in soil, groundwater, and the vadose-zone at the site. The site Safety Plan is applicable to personnel of RESNA Industries and its subcontractors. RESNA Industries personnel and subcontractors of RESNA Industries scheduled to perform the work at the site are briefed on the contents of the Site Safety Plan before work begins. A copy of the Site Safety Plan is available for reference by appropriate parties during the work. A site Safety Officer is assigned to the project.

Sampling of Stockpiled Soil

One composite soil sample is collected for each 50 cubic yards of stockpiled soil, and for each individual stockpile composed of less than 50 cubic yards. Composite soil samples are obtained by first evaluating relatively high, average, and low areas of hydrocarbon concentration by digging approximately one to two feet into the stockpile and placing the intake probe of a field calibrated OVM against the surface of the soil; and then collecting one sample from the "high" reading area, and three samples from the "average" areas. Samples are collected by removing the top one to two feet of soil, then driving laboratory-cleaned brass sleeves into the soil. The samples are sealed in the sleeves using aluminum foil, plastic caps, and plastic zip-lock bags or aluminized duct tape; labeled; and promptly placed in iced storage for transport to the laboratory, where compositing is performed.

Soil Borings

Prior to the drilling of borings and construction of monitoring wells, permits are acquired from the appropriate regulatory agency. In addition to the above-mentioned permits, encroachment permits from the City or State are acquired if drilling of borings offsite on City or State property is necessary. Copies of the permits are included in the appendix of the project report. Prior to drilling, Underground Service Alert (USA) is notified of our intent to drill, and known underground utility lines and structures are approximately marked.

The borings are drilled by a truck-mounted drill rig equipped with 8- or 10-inch-diameter, solid-stem or hollow-stem augers. Other methods such as rotary or casing hammer may be used if special conditions are encountered. The augers, sampling equipment and other equipment that comes into contact with the soil are steam-cleaned prior to drilling each boring to minimize the possibility of cross-contamination. Sampling equipment is cleaned with a trisodium phosphate solution and rinsed with clean water between samples. After

drilling the borings, monitoring wells are constructed in the borings, or neat-cement grout with bentonite is used to backfill the borings to the ground surface.

Borings for groundwater monitoring wells are drilled to a depth of no more than 20 feet below the depth at which a saturated zone is first encountered, or a short distance into a stratum beneath the saturated zone which is of sufficient texture, moisture, and consistency to be judged as a perching layer by the field geologist, whichever is shallower. Drilling into a deeper aquifer below the shallowest aquifer is begun only after a conductor casing is properly installed and allowed to set, to seal the shallow aquifer.

Drill Cuttings

Drill cuttings subjectively evaluated as containing gasoline hydrocarbons at levels greater than 100 parts per million (ppm) are separated from those subjectively evaluated as containing gasoline hydrocarbons at levels less than 100 ppm. Evaluation is based either on subjective evidence of soil discoloration, or on measurements made using a field calibrated OVM. Readings are taken by placing a soil sample into a ziplock-type plastic bag and allowing volatilization to occur. The intake probe of the OVM is then inserted into the headspace created in the plastic bag immediately after opening it. The drill cuttings from the borings are placed in labeled 55-gallon drums approved by the Department of Transportation, or on plastic at the site, and covered with plastic. The cuttings remain the responsibility of the client.

Soil Sampling in Borings

Soil samples are collected at no greater than 5-foot intervals from the ground surface to the total depth of the borings. The soil samples are collected by advancing the boring to a point immediately above the sampling depth, and then driving a California-modified, split-spoon sampler containing brass sleeves through the hollow center of the auger into the soil. (A standard penetrometer, which does not contain liners, may be used to collect samples when laboratory analysis for volatile components is not an issue. The sampler and brass sleeves are laboratory-cleaned, steam-cleaned, or washed thoroughly with Alconox® and water, prior to each use. The sampler is driven with a standard 140-pound hammer repeatedly dropped 30 inches. The number of blows to drive the sampler each successive six inches are counted and recorded to evaluate the relative consistency of the soil. When necessary, the sampler may be pushed by the drill rig hydraulics. In this case, the pressure exerted (in pounds per square inch) is recorded.

The samples selected for laboratory analysis are removed from the sampler and quickly sealed in their brass sleeves with aluminum foil, plastic caps, and plastic zip-lock bags or aluminized duct tape. The samples are then labeled, promptly placed in iced storage, and delivered to a laboratory certified by the State of California to perform the analyses requested.

One of the samples in brass sleeves not selected for laboratory analysis at each sampling interval is tested in the field using an OVM that is field calibrated at the beginning of each day it is used. This testing is performed by inserting the intake probe of the OVM into the headspace in the plastic bag containing the soil sample as described in the Drill Cuttings section above. The OVM readings are presented in Logs of Borings included in the project report.

Logging of Borings

A geologist is present to log the soil cuttings and samples using the Unified Soil Classification System. Samples not selected for chemical analysis, and the soil in the sampler shoe, are extruded in the field for inspection. Logs include texture, color, moisture, plasticity, consistency, blow counts, and any other characteristics noted. Logs also include subjective evidence for the presence of gasoline hydrocarbons, such as soil staining, noticeable or obvious product odor, and OVM readings.

Monitoring Well Construction

Monitoring wells are constructed in selected borings using clean 2- or 4-inch-diameter, thread-jointed, Schedule 40 polyvinyl chloride (PVC) casing. No chemical cements, glues, or solvents are used in well construction. Each casing bottom is sealed with a threaded end-plug, and each casing top with a locking plug. The screened portions of the wells are constructed of machine-slotted PVC casing with 0.020-inch-wide (typical) slots for initial site wells. Slot size for subsequent wells may be based on sieve analysis and/or well development data. The screened sections in groundwater monitoring wells are placed to allow monitoring during seasonal fluctuations of groundwater levels.

The annular space of each well is backfilled with No. 2 by 12 sand or similar sorted sand (groundwater monitoring wells), or pea gravel (vapor extraction wells) to approximately two feet above the top of the screened casing for initial site wells. The sand pack grain size for subsequent wells may be based on sieve analysis and/or well development data. A 1- to 2-foot-thick bentonite plug is placed above the sand as a seal against cement entering the filter pack. The remaining annulus is then backfilled with a slurry of water, neat cement, and bentonite to approximately one foot below the ground surface.

An aluminum utility box with a PVC apron is placed over each wellhead and set in concrete placed flush with the surrounding ground surface. Each wellhead cover has a seal to protect the monitoring well against surface-water infiltration and requires a special wrench to open. The design discourages vandalism and reduces the possibility of accidental disturbance of the well.

Groundwater Monitoring Well Development

The monitoring wells are developed by bailing or over-pumping and surge-block techniques. The wells are either bailed or pumped, allowed to recharge, and bailed or pumped again until the water removed from the wells is determined to be clear. Turbidity measurements (in NTUs) are recorded during well development and are used in evaluating well development. The development method used, initial turbidity measurement, volume of water removed, final turbidity measurement, and other pertinent field data and observations are recorded. The wells are allowed to equilibrate for at least 48 hours after development prior to sampling. Water generated by well development is stored in 17E Department of Transportation (DOT) 55-gallon drums on site, and remains the responsibility of the client.

Sample Labeling and Handling

Sample containers are labeled in the field with the job number, unique sample location, depth, and date, and promptly placed in iced storage for transport to the laboratory. A Chain of Custody Record is initiated by the field geologist and updated throughout handling of the samples, and accompanies the samples to a laboratory certified by the State of California for the analyses requested. Samples are transported to the laboratory promptly to help ensure that recommended sample holding times are not exceeded. Samples are properly disposed of after their useful life has expired.

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Working to Restore Nature

APPENDIX D

CHAIN OF CUSTODY RECORDS AND LABORATORY ANALYSIS REPORTS FOR VAPOR SAMPLES

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: John Young

Project: Arco 6148, Oakland

Enclosed are the results from 11 air samples received at Sequoia Analytical on February 17,1994. The requested analyses are listed below:

SAMPLE #	SAMPLE DESCRIPTION	DATE OF COLLECTION	TEST METHOD
4B92801	Air, AS-MW1-1	2/16/94	EPA 5030/8015 Mod./8020
4B92802	Air, AS-MW1-2	2/16/94	EPA 5030/8015 Mod./8020
4B92803	Air, AS-MW2-1	2/16/94	EPA 5030/8015 Mod./8020
4B92804	Air, AS-MW2-2	2/16/94	EPA 5030/8015 Mod./8020
4B92805	Air, AS-MW3-1	2/16/94	EPA 5030/8015 Mod./8020
4B92806	Air, AS-MW3-2	2/16/94	EPA 5030/8015 Mod./8020
4B92807	Air, AS-VW1-1	2/16/94	EPA 5030/8015 Mod./8020
4B92808	Air, AS-VW1-2	2/16/94	EPA 5030/8015 Mod./8020
4B92809	Air, AS-VW2-1	2/16/94	EPA 5030/8015 Mod./8020
4B92810	Air, AS-VW3-1	2/16/94	EPA 5030/8015 Mod./8020
4B92811	Air, AS-VW3-2	2/16/94	EPA 5030/8015 Mod./8020

Please contact me if you have any questions. In the meantime, thank you for the opportunity to work with you on this project.

Very truly yours,

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

1994

RESNA	Client Project ID:	Arco 6148, Oakland	Sampled:	Feb 16, 1994
3315 Almaden Expwy., Suite 34	Sample Matrix:	Air	Received:	Feb 17, 1994
San Jose, CA 95118	Analysis Method:	EPA 5030/8015 Mod./8020	Reported:	Feb 23, 1994
Attention: John Young	First Sample #:	4B92801		

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit µg/L	Sample I.D. 4B92801 AS-MW1-1	Sample I.D. 4B92802 AS-MW1-2	Sample I.D. 4B92803 AS-MW2-1	Sample I.D. 4B92804 AS-MW2-2	Sample I.D. 4B92805 AS-MW3-1	Sample I.D. 4B92806 AS-MW3-2
Purgeable Hydrocarbons	5.0	N.D.	300	4,900	4,600	620	1,400
Benzene	0.050	N.D.	6.0	33	66	9.4	N.D.
Toluene	0.050	0.088	N.D.	270	250	0.73	N.D.
Ethyl Benzene	0.050	N.D.	N.D.	44	23	0.94	N.D.
Total Xylenes	0.050	0.28	0.84	190	160	2.6	1.2
Chromatogram Pattern:		Gas	Gas + Non-Gas Mix < C8	Gas + Non-Gas Mix < C8	Gas + Non-Gas Mix < C8	Gas + Non-Gas Mix < C8	Gas + Non-Gas Mix < C8

Quality Control Data

Report Limit Multiplication Factor:	1.0	2.5	100	50	5.0	10
Date Analyzed:	2/17/94	2/17/94	2/17/94	2/17/94	2/17/94	2/17/94
Instrument Identification:	GCHP-2	GCHP-17	GCHP-17	GCHP-17	GCHP-2	GCHP-2
Surrogate Recovery, %: (QC Limits = 70-130%) * Coelution confirmed.	99	178*	121	155*	186*	225*

Purgeable Hydrocarbons are quantitated against a fresh gasoline standard.
Analytes reported as N.D. were not detected above the stated reporting limit.

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

RESNA	Client Project ID:	Arco 6148, Oakland	Sampled: Feb 16, 1994
3315 Almaden Expwy., Suite 34	Sample Matrix:	Air	Received: Feb 17, 1994
San Jose, CA 95118	Analysis Method:	EPA 5030/8015 Mod./8020	Reported: Feb 23, 1994
Attention: John Young	First Sample #:	4B92807	

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit µg/L	Sample I.D. 4B92807 AS-VW1-1	Sample I.D. 4B92808 AS-VW1-2	Sample I.D. 4B92809 AS-VW2-1	Sample I.D. 4B92810 AS-VW3-1	Sample I.D. 4B92811 AS-VW3-2
Purgeable Hydrocarbons	5.0	2,900	8,400	660	2,900	3,700
Benzene	0.050	220	680	29	200	230
Toluene	0.050	190	430	0.84	16	19
Ethyl Benzene	0.050	14	19	0.75	6.3	7.6
Total Xylenes	0.050	43	54	1.1	19	23
Chromatogram Pattern:		Gas + Non-Gas Mix < C8	Gas + Non-Gas Mix < C8	Gas + Non-Gas Mix < C8	Gas + Non-Gas Mix < C8	Gas + Non-Gas Mix < C8

Quality Control Data

Report Limit Multiplication Factor:	50	100	10	50	50
Date Analyzed:	2/17/94	2/18/94	2/17/94	2/17/94	2/17/94
Instrument Identification:	GCHP-2	GCHP-3	GCHP-3	GCHP-3	GCHP-3
Surrogate Recovery, %: (QC Limits = 70-130%)	124	80	121	98	94

Purgeable Hydrocarbons are quantitated against a fresh gasoline standard.
Analytes reported as N.D. were not detected above the stated reporting limit.

SEQUOIA ANALYTICAL

VTague

Vickie Tague
Project Manager

SEQUOIA ANALYTICAL
680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: John Young

Client Project ID: Arco 6148, Oakland
Matrix: Liquid

QC Sample Group: 4B92801, 5-7

Reported: Feb 23, 1994

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl Benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	J. Minkel	J. Minkel	J. Minkel	J. Minkel
MS/MSD Batch#:	4B84501	4B84501	4B84501	4B84501
Date Prepared:	-	-	-	-
Date Analyzed:	2/17/94	2/17/94	2/17/94	2/17/94
Instrument I.D.#:	GCHP-2	GCHP-2	GCHP-2	GCHP-2
Conc. Spiked:	10 µg/L	10 µg/L	10 µg/L	30 µg/L
Matrix Spike % Recovery:	94	95	95	93
Matrix Spike Duplicate % Recovery:	98	99	100	100
Relative % Difference:	4.2	4.1	5.1	7.3
LCS Batch#:	-	-	-	-
Date Prepared:	-	-	-	-
Date Analyzed:	-	-	-	-
Instrument I.D.#:	-	-	-	-
LCS % Recovery:	-	-	-	-
% Recovery Control Limits:	71-133	72-128	72-130	71-120

Quality Assurance Statement: All standard operating procedures and quality control requirements have been met.

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

Please Note:
The LCS is a control sample of known, interferent free matrix that is analyzed using the same reagents, preparation, and analytical methods employed for the samples. The matrix spike is an aliquot of sample fortified with known quantities of specific compounds and subjected to the entire analytical procedure. If the recovery of analytes from the matrix spike does not fall within specified control limits due to matrix interference, the LCS recovery is to be used to validate the batch.

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: John Young

Client Project ID: Arco 6148, Oakland
Matrix: Liquid

QC Sample Group: 4B92802-4

Reported: Feb 23, 1994

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl Benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	J. Minkel	J. Minkel	J. Minkel	J. Minkel
MS/MSD Batch#:	4B74510	4B74510	4B74510	4B74510
Date Prepared:	-	-	-	-
Date Analyzed:	2/17/94	2/17/94	2/17/94	2/17/94
Instrument I.D.#:	GCHP-17	GCHP-17	GCHP-17	GCHP-17
Conc. Spiked:	10 µg/L	10 µg/L	10 µg/L	30 µg/L
Matrix Spike % Recovery:	94	95	94	93
Matrix Spike Duplicate % Recovery:	94	95	94	97
Relative % Difference:	0.0	0.0	0.0	4.2
LCS Batch#:	-	-	-	-
Date Prepared:	-	-	-	-
Date Analyzed:	-	-	-	-
Instrument I.D.#:	-	-	-	-
LCS % Recovery:	-	-	-	-
% Recovery Control Limits:	71-133	72-128	72-130	71-120

Quality Assurance Statement: All standard operating procedures and quality control requirements have been met.

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

Please Note:
The LCS is a control sample of known, interferent free matrix that is analyzed using the same reagents, preparation, and analytical methods employed for the samples. The matrix spike is an aliquot of sample fortified with known quantities of specific compounds and subjected to the entire analytical procedure. If the recovery of analytes from the matrix spike does not fall within specified control limits due to matrix interference, the LCS recovery is to be used to validate the batch.

SEQUOIA ANALYTICAL
680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: John Young

Client Project ID: Arco 6148, Oakland
Matrix: Liquid

QC Sample Group: 4B92808

Reported: Feb 23, 1994

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl Benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	J. Minkel	J. Minkel	J. Minkel	J. Minkel
MS/MSD Batch#:	4BA1301	4BA1301	4BA1301	4BA1301
Date Prepared:	-	-	-	-
Date Analyzed:	2/18/94	2/18/94	2/18/94	2/18/94
Instrument I.D.#:	GCHP-3	GCHP-3	GCHP-3	GCHP-3
Conc. Spiked:	10 µg/L	10 µg/L	10 µg/L	30 µg/L
Matrix Spike % Recovery:	86	85	85	87
Matrix Spike Duplicate % Recovery:	100	99	100	100
Relative % Difference:	15	15	16	14
LCS Batch#:	-	-	-	-
Date Prepared:	-	-	-	-
Date Analyzed:	-	-	-	-
Instrument I.D.#:	-	-	-	-
LCS % Recovery:	-	-	-	-
% Recovery Control Limits:	71-133	72-128	72-130	71-120

Quality Assurance Statement: All standard operating procedures and quality control requirements have been met.

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

Please Note:
The LCS is a control sample of known, interferent free matrix that is analyzed using the same reagents, preparation, and analytical methods employed for the samples. The matrix spike is an aliquot of sample fortified with known quantities of specific compounds and subjected to the entire analytical procedure. If the recovery of analytes from the matrix spike does not fall within specified control limits due to matrix interference, the LCS recovery is to be used to validate the batch.

SEQUOIA ANALYTICAL
680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: John Young

Client Project ID: Arco 6148, Oakland
Matrix: Liquid

QC Sample Group: 4B92809-11

Reported: Feb 23, 1994

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl Benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	J. Minkel	J. Minkel	J. Minkel	J. Minkel
MS/MSD Batch#:	4B84502	4B84502	4B84502	4B84502
Date Prepared:	-	-	-	-
Date Analyzed:	2/17/94	2/17/94	2/17/94	2/17/94
Instrument I.D.#:	GCHP-3	GCHP-3	GCHP-3	GCHP-3
Conc. Spiked:	10 µg/L	10 µg/L	10 µg/L	30 µg/L
Matrix Spike % Recovery:	100	100	100	100
Matrix Spike Duplicate % Recovery:	100	100	100	100
Relative % Difference:	0.0	0.0	0.0	0.0
LCS Batch#:	-	-	-	-
Date Prepared:	-	-	-	-
Date Analyzed:	-	-	-	-
Instrument I.D.#:	-	-	-	-
LCS % Recovery:	-	-	-	-
% Recovery Control Limits:	71-133	72-128	72-130	71-120

Quality Assurance Statement: All standard operating procedures and quality control requirements have been met.

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

Please Note:
The LCS is a control sample of known, interferent free matrix that is analyzed using the same reagents, preparation, and analytical methods employed for the samples. The matrix spike is an aliquot of sample fortified with known quantities of specific compounds and subjected to the entire analytical procedure. If the recovery of analytes from the matrix spike does not fall within specified control limits due to matrix interference, the LCS recovery is to be used to validate the batch.

ARCO Products Company
Division of AtlanticRichfieldCompany

Task Order No. 6148-93-3

Chain of Custody

ARCO Facility no. 6148	City (Facility) OAKLAND	Project manager (Consultant) JOHN C. YOUNG	Laboratory name SEQUOIA
ARCO engineer MICHAEL WHELAN	Telephone no. (ARCO)	Telephone no. (Consultant) 264-7723	Fax no. (Consultant) 264-2435
Consultant name RESNA	Address (Consultant) 3315 ALMADEN EXPY., SUITE 34, SAN JOSE, CA		Contract number 07-073

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Matrix: Water	Matrix: Other AIR	Preservation: Ice	Preservation: Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH EPA M602/8020/8015	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals ☐ Semi VOA ☐ VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org./DHS ☐ Lead EPA 7420/7421 ☐		
AS-MW1-1					X			2/16/94			X										01	
AS-MW1-2					X			2/16/94			X										02	
AS-MW2-1					X			2/16/94			X										03	
AS-MW2-2					X			2/16/94			X										04	
AS-MW3-1					X			2/16/94			X										05	
AS-MW3-2					X			2/16/94			X										06	
AS-VW1-1					X			2/16/94			X										07	
AS-VW1-2					X			2/16/94			X										08	
AS-VW2-1					X			2/16/94			X										09	
AS-VW3-1					X			2/16/94			X										10	
AS-VW3-2					X			2/16/94			X										11	

Method of shipment

Special detection Limit/reporting

Special QA/QC

Remarks

Lab number 9402928

Turnaround time

- Priority Rush 1 Business Day ☐
- Rush 2 Business Days ☐
- Expedited 5 Business Days ☐
- Standard 10 Business Days ☐

Condition of sample: good

Temperature received: cool

	Date	Time		Date	Time
Relinquished by sampler	2/17/94	10:35	Received by	2/17/94	10:35
Relinquished by	2/17/94	12:00	Received by		
Relinquished by			Received by laboratory	2/17/94	12:00

Distribution White copy — Laboratory, Canary copy — ARCO Environmental Engineering; Pink copy — Consultant

APPC-3292 (2-91)

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: John Young

Project: ARCO 6148, Oakland

Enclosed are the results from 3 air samples received at Sequoia Analytical on February 18,1994. The requested analyses are listed below:

SAMPLE #	SAMPLE DESCRIPTION	DATE OF COLLECTION	TEST METHOD
4BB3901	Air, AS-INF-60	2/17/94	EPA 5030/8015 Mod./8020
4BB3902	Air, AS-INF-120	2/17/94	EPA 5030/8015 Mod./8020
4BB3903	Air, AS-EFF-120	2/17/94	EPA 5030/8015 Mod./8020

Please contact me if you have any questions. In the meantime, thank you for the opportunity to work with you on this project.

Very truly yours,

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

RECEIVED
MAR - 7 1994
RESNA
SAN JOSE

RESNA	Client Project ID:	ARCO 6148, Oakland	Sampled:	Feb 17, 1994
3315 Almaden Expwy., Suite 34	Sample Matrix:	Air	Received:	Feb 18, 1994
San Jose, CA 95118	Analysis Method:	EPA 5030/8015 Mod./8020	Reported:	Mar 2, 1994
Attention: John Young	First Sample #:	4BB3901		

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit µg/L	Sample I.D. 4BB3901 AS-INF-60	Sample I.D. 4BB3902 AS-INF-120	Sample I.D. 4BB3903 AS-EFF-120
Purgeable Hydrocarbons	5.0	7,300	2,200	35
Benzene	0.050	140	78	4.7
Toluene	0.050	830	110	1.3
Ethyl Benzene	0.050	120	37	0.48
Total Xylenes	0.050	370	140	2.0
Chromatogram Pattern:		Gas + Non-Gas Mix <C8	Gas + Non-Gas Mix <C8	Gas + Non-Gas Mix <C8

Quality Control Data

Report Limit Multiplication Factor:	100	50	1.0
Date Analyzed:	2/18/94	2/18/94	2/18/94
Instrument Identification:	GCHP-17	GCHP-17	GCHP-17
Surrogate Recovery, %: (QC Limits = 70-130%)	130	124	112

Purgeable Hydrocarbons are quantitated against a fresh gasoline standard.
Analytes reported as N.D. were not detected above the stated reporting limit.

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

RECEIVED
MAR - 7 1994
RESNA
SAN JOSE

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: John Young

Client Project ID: ARCO 6148, Oakland
Matrix: Liquid

QC Sample Group: 4BB3901-3

Reported: Mar 2, 1994

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl Benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	J. Minkel	J. Minkel	J. Minkel	J. Minkel
MS/MSD Batch#:	4BA1301	4BA1301	4BA1301	4BA1301
Date Prepared:	-	-	-	-
Date Analyzed:	2/18/94	2/18/94	2/18/94	2/18/94
Instrument I.D.#:	GCHP-17	GCHP-17	GCHP-17	GCHP-17
Conc. Spiked:	10 µg/L	10 µg/L	10 µg/L	30 µg/L
Matrix Spike % Recovery:	98	98	97	100
Matrix Spike Duplicate % Recovery:	100	110	110	107
Relative % Difference:	2.0	12	13	6.8
LCS Batch#:	-	-	-	-
Date Prepared:	-	-	-	-
Date Analyzed:	-	-	-	-
Instrument I.D.#:	-	-	-	-
LCS % Recovery:	-	-	-	-
% Recovery Control Limits:	71-133	72-128	72-130	71-120

Quality Assurance Statement: All standard operating procedures and quality control requirements have been met.

SEQUOIA ANALYTICAL

Vickie Tagué
Project Manager

Please Note:
The LCS is a control sample of known, interferent free matrix that is analyzed using the same reagents, preparation, and analytical methods employed for the samples. The matrix spike is an aliquot of sample fortified with known quantities of specific compounds and subjected to the entire analytical procedure. If the recovery of analytes from the matrix spike does not fall within specified control limits due to matrix interference, the LCS recovery is to be used to validate the batch.

ARCO Products Company
Division of AtlanticRichfieldCompany

Task Order No. 6148-93-3

Chain of Custody

ARCO Facility no. 6148	City (Facility) OAKLAND	Project manager (Consultant) JOHN YOUNG	Laboratory name SEQUOIA
ARCO engineer ~~BOB~~ MIKE WHELAN	Telephone no. (ARCO)	Telephone no. (Consultant) 408 264-7723	Fax no. (Consultant) 408 264 2435
Consultant name RESNA INDUSTRIES INC.	Address (Consultant) 3315 ALMADEN EXPRESSWAY STE 34 SJCA 95118		Contract number 07-073

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Matrix: Water	Matrix: Other (VAPOR)	Preservation: Ice	Preservation: Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH Gas EPA M602/8020/8015	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals ☐ Semi VOA ☐ VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org./DHS ☐ Lead EPA 7420/7421 ☐
AS-INF-60					X			2/17/94			X								01	
AS-INF-120					X						X								02	
AS-EFF-120					X						X								03	

Special detection Limit/reporting: 9402839

Method of shipment

Special QA/QC

Remarks

Lab number

Turnaround time
- Priority Rush 1 Business Day ☐
- Rush 2 Business Days ☐
- Expedited 5 Business Days ☐
- Standard 10 Business Days ☐

Condition of sample:

Temperature received:

	Date	Time	
Relinquished by sampler: Dora Beck	2/18/94	1120	Received by: D. SUGARMAN
Relinquished by: D. SUGARMAN	2/18/94	1225	Received by:
Relinquished by:	Date	Time	Received by laboratory: Jan

Date: 2.18.94 Time: 12:25

Distribution. White copy — Laboratory; Canary copy — ARCO Environmental Engineering; Pink copy — Consultant

APPC-3292 (2-91)

RESNA
Working to Restore Nature

APPENDIX E

CHAIN OF CUSTODY RECORDS AND LABORATORY ANALYSIS REPORTS FOR WATER SAMPLES

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA 94063, (415) 364-9600, FAX (415) 364-9233
1900 Bates Avenue, Suite L, Concord, CA 94520, (510) 686-9600, FAX (510) 686-9689
819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: John Young

Project: ARCO 6148, Oakland

Enclosed are the results from 10 water samples received at Sequoia Analytical on February 17,1994. The requested analyses are listed below:

SAMPLE #	SAMPLE DESCRIPTION	DATE OF COLLECTION	TEST METHOD
4BB3001	Water, MW-1-1	2/16/94	EPA 5030/8015 Mod./8020
4BB3002	Water, MW-2-1	2/16/94	EPA 5030/8015 Mod./8020
4BB3003	Water, MW-3-1	2/16/94	EPA 5030/8015 Mod./8020
4BB3004	Water, AS-2-1	2/16/94	EPA 5030/8015 Mod./8020
4BB3005	Water, VW-3-1	2/16/94	EPA 5030/8015 Mod./8020
4BB3006	Water, MW-1-2	2/16/94	EPA 5030/8015 Mod./8020
4BB3007	Water, MW-2-2	2/16/94	EPA 5030/8015 Mod./8020
4BB3008	Water, MW-3-2	2/16/94	EPA 5030/8015 Mod./8020
4BB3009	Water, AS-2-2	2/16/94	EPA 5030/8015 Mod./8020
4BB3010	Water, VW-3-2	2/16/94	EPA 5030/8015 Mod./8020

Please contact me if you have any questions. In the meantime, thank you for the opportunity to work with you on this project.

Very truly yours,

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA 94063, (415) 364-9600, FAX (415) 364-9233
1900 Bates Avenue, Suite L, Concord, CA 94520, (510) 686-9600, FAX (510) 686-9689
819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

RESNA	Client Project ID:	ARCO 6148, Oakland	Sampled:	Feb 16, 1994
3315 Almaden Expwy., Suite 34	Sample Matrix:	Water	Received:	Feb 17, 1994
San Jose, CA 95118	Analysis Method:	EPA 5030/8015 Mod./8020	Reported:	Mar 4, 1994
Attention: John Young	First Sample #:	4BB3001		

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit µg/L	Sample I.D. 4BB3001 MW-1-1	Sample I.D. 4BB3002 MW-2-1	Sample I.D. 4BB3003 MW-3-1	Sample I.D. 4BB3004 AS-2-1	Sample I.D. 4BB3005 VW-3-1	Sample I.D. 4BB3006 MW-1-2
Purgeable Hydrocarbons	50	150	12,000	11,000	180	70,000	140
Benzene	0.50	71	570	500	3.5	8,700	67
Toluene	0.50	N.D.	780	220	17	970	N.D.
Ethyl Benzene	0.50	N.D.	230	450	5.8	3,400	N.D.
Total Xylenes	0.50	1.6	2,100	1,800	31	16,000	1.4
Chromatogram Pattern:		Gas	Gas	Gas	Gas	Gas	Gas

Quality Control Data

Report Limit Multiplication Factor:	1.0	10	40	1.0	200	2.0
Date Analyzed:	2/22/94	2/22/94	2/22/94	2/22/94	2/22/94	2/22/94
Instrument Identification:	GCHP-2	GCHP-2	GCHP-2	GCHP-3	GCHP-3	GCHP-3
Surrogate Recovery, %: (QC Limits = 70-130%)	94	101	101	102	88	83

Purgeable Hydrocarbons are quantitated against a fresh gasoline standard.
Analytes reported as N.D. were not detected above the stated reporting limit.

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA 94063, (415) 364-9600, FAX (415) 364-9233
1900 Bates Avenue, Suite L, Concord, CA 94520, (510) 686-9600, FAX (510) 686-9689
819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: John Young

Client Project ID: ARCO 6148, Oakland
Sample Matrix: Water
Analysis Method: EPA 5030/8015 Mod./8020
First Sample #: 4BB3007

Sampled: Feb 16, 1994
Received: Feb 17, 1994
Reported: Mar 4, 1994

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit µg/L	Sample I.D. 4BB3007 MW-2-2	Sample I.D. 4BB3008 MW-3-2	Sample I.D. 4BB3009 AS-2-2	Sample I.D. 4BB3010 VW-3-2
Purgeable Hydrocarbons	50	22,000	10,000	220	61,000
Benzene	0.50	1,400	560	2.6	7,600
Toluene	0.50	2,400	290	14	920
Ethyl Benzene	0.50	580	500	4.2	2,900
Total Xylenes	0.50	4,600	2,100	35	13,000
Chromatogram Pattern:		Gas	Gas	Gas	Gas

Quality Control Data

Report Limit Multiplication Factor:	40	40	1.0	200
Date Analyzed:	2/22/94	2/22/94	2/22/94	2/22/94
Instrument Identification:	GCHP-3	GCHP-3	GCHP-3	GCHP-3
Surrogate Recovery, %: (QC Limits = 70-130%)	98	104	104	85

Purgeable Hydrocarbons are quantitated against a fresh gasoline standard.
Analytes reported as N.D. were not detected above the stated reporting limit.

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA 94063, (415) 364-9600, FAX (415) 364-9233
1900 Bates Avenue, Suite L, Concord, CA 94520, (510) 686-9600, FAX (510) 686-9689
819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: John Young

Client Project ID: ARCO 6148, Oakland
Matrix: Liquid
QC Sample Group: 4BB3001-3

Reported: Mar 4, 1994

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl Benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	J. Minkel	J. Minkel	J. Minkel	J. Minkel
MS/MSD Batch#:	4BB0301	4BB0301	4BB0301	4BB0301
Date Prepared:	-	-	-	-
Date Analyzed:	2/22/94	2/22/94	2/22/94	2/22/94
Instrument I.D.#:	GCHP-2	GCHP-2	GCHP-2	GCHP-2
Conc. Spiked:	10 µg/L	10 µg/L	10 µg/L	30 µg/L
Matrix Spike % Recovery:	130	100	100	103
Matrix Spike Duplicate % Recovery:	130	100	100	103
Relative % Difference:	0.0	0.0	0.0	0.0
LCS Batch#:	-	-	-	-
Date Prepared:	-	-	-	-
Date Analyzed:	-	-	-	-
Instrument I.D.#:	-	-	-	-
LCS % Recovery:	-	-	-	-
% Recovery Control Limits:	71-133	72-128	72-130	71-120

Quality Assurance Statement: All standard operating procedures and quality control requirements have been met.

SEQUOIA ANALYTICAL

V.T.Tague

Vickie Tague
Project Manager

Please Note:
The LCS is a control sample of known, interferent free matrix that is analyzed using the same reagents, preparation, and analytical methods employed for the samples. The matrix spike is an aliquot of sample fortified with known quantities of specific compounds and subjected to the entire analytical procedure. If the recovery of analytes from the matrix spike does not fall within specified control limits due to matrix interference, the LCS recovery is to be used to validate the batch.

Sequoia Analytical

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RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: John Young

Client Project ID: ARCO 6148, Oakland
Matrix: Liquid
QC Sample Group: 4BB3004-10

Reported: Mar 4, 1994

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl Benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	J. Minkel	J. Minkel	J. Minkel	J. Minkel
MS/MSD Batch#:	4BA9702	4BA9702	4BA9702	4BA9702
Date Prepared:	-	-	-	-
Date Analyzed:	2/22/94	2/22/94	2/22/94	2/22/94
Instrument I.D.#:	GCHP-3	GCHP-3	GCHP-3	GCHP-3
Conc. Spiked:	10 µg/L	10 µg/L	10 µg/L	30 µg/L
Matrix Spike % Recovery:	110	110	120	117
Matrix Spike Duplicate % Recovery:	100	100	100	100
Relative % Difference:	9.5	9.5	18	16
LCS Batch#:	-	-	-	-
Date Prepared:	-	-	-	-
Date Analyzed:	-	-	-	-
Instrument I.D.#:	-	-	-	-
LCS % Recovery:	-	-	-	-
% Recovery Control Limits:	71-133	72-128	72-130	71-120

Quality Assurance Statement: All standard operating procedures and quality control requirements have been met.

Please Note:
The LCS is a control sample of known, interferent free matrix that is analyzed using the same reagents, preparation, and analytical methods employed for the samples. The matrix spike is an aliquot of sample fortified with known quantities of specific compounds and subjected to the entire analytical procedure. If the recovery of analytes from the matrix spike does not fall within specified control limits due to matrix interference, the LCS recovery is to be used to validate the batch.

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

ARCO Products Company
Division of AtlanticRichfieldCompany

Task Order No. 6148-13-5

Chain of Custody

ARCO Facility no. 6148	City (Facility) OAKLAND	Project manager (Consultant) JOHN C. YOUNG	Laboratory name SEQUOIA
ARCO engineer MICHAEL WINEGAR	Telephone no. (ARCO)	Telephone no. (Consultant) 264-7723	Fax no. (Consultant) 264-2435
Consultant name RESNA	Address (Consultant) 3315 NIELSEN EXPY, SUITE 34, SAN JOSE, CA		Contract number 07-073

Sample ID	Lab no	Container no.	Matrix: Soil	Matrix: Water	Matrix: Other	Preservation: Ice	Preservation: Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH Gas EPA M602/8020/8015	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals ☐ Semi VOA ☐ VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org./DHS ☐ Lead EPA 7420/7421 ☐
MW-1-1		1		X				2/16/94			X									-01
MW-1-1		1		X				2/16/94			HOLD									
MW-2-1		1		X				2/16/94			X									-02
MW-2-1		1		X				2/16/94			HOLD									
MW-3-1		1		X				2/16/94			X									-03
MW-3-1		1		X				2/16/94			HOLD									
VES-2-1		1		X				2/16/94			X									-04
VES-2-1		1		X				2/16/94			HOLD									
VW-3-1		1		X				2/16/94			X									05
VW-3-1		2		X				2/16/94			HOLD									
MW-1-2		1		X				2/16/94			X									06
MW-1-2		1		X				2/16/94			HOLD									
MW-2-2		1		X				2/16/94			X									07
MW-2-2		1		X				2/16/94			HOLD									
MW-3-2		1		X				2/16/94			X									08
MW-3-2		2		X				2/16/94			HOLD									

Special detection Limit/reporting: 9402B30

Special QA/QC

Remarks

Lab number: 9402B30

Method of shipment

Condition of sample:

Temperature received: 1.

	Date	Time		Date	Time
Relinquished by sampler	2/17/94	10:35	Received by	2/17/94	10:35
Relinquished by	2/17/94	12:00	Received by		
Relinquished by			Received by laboratory	2/17/94	12:00

Turnaround time

- Priority Rush 1 Business Day ☐
- Rush 2 Business Days ☐
- Expedited 5 Business Days ☐
- Standard 10 Business Days ☐

Distribution: White copy — Laboratory, Canary copy — ARCO Environmental Engineering; Pink copy — Consultant

APPC 3292 (2-91)

ARCO Products Company
Division of AtlanticRichfieldCompany

Task Order No. 6148-93-3

Chain of Custody

ARCO Facility no. 6148	City (Facility) OAKLAND	Project manager (Consultant) JOHN C. YOUNG	Laboratory name SEQUOIA
ARCO engineer MICHAEL WHELAN	Telephone no. (ARCO)	Telephone no. (Consultant) 264-7723	Fax no. (Consultant) 264-2435	Contract number 07-073
Consultant name RESNA	Address (Consultant) 335 ALMADEN EXPY., SUITE 345, SAN JOSE, CA		Method of shipment 9402830

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Matrix: Water	Matrix: Other	Preservation: Ice	Preservation: Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH EPA M602/8020/8015	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals ☐ Semi VOA ☐ VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org./DHS ☐ Lead EPA 7420/7421 ☐		
AS-2-2		1		X				2/16/94			X							09				
AS-2-2		1		X				2/16/94			HOLD											
VW3-2		1		X				2/16/94			X							010				
VW3-2		1		X				2/16/94			HOLD											

Special detection Limit/reporting

Special QA/QC

Remarks

Lab number 9402830

Turnaround time

- Priority (Pressurized) 1 Business Days ☐
- Rush 2 Business Days ☐
- Expedited 5 Business Days ☐
- Standard 10 Business Days ☐

Condition of sample:		Temperature received:	
Relinquished by sampler	Date 2/17/94 Time 10:35	Received by	2/17/94 10:35
Relinquished by	Date 2/17/94 Time 12:05	Received by	
Relinquished by	Date Time	Received by laboratory	Date Time

RESNA Technologies - Restoring Nature

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