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DATE: April 13, 1994
PROJECT NUMBER: 69036.10
SUBJECT: ARCO Station 2035

FROM: John C. Young

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REPORT OF FINDINGS
AIR SPARGE PILOT TEST
at
ARCO Station 2035
1001 San Pablo Avenue
Albany, California

69036.10

Report prepared for

4/94

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

by
RESNA Industries Inc.

Richard H. Walls

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

John C. Young
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April 13, 1994

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3315 Almaden Expressway, Suite 34
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Report of Findings
Air Sparge Pilot Test

ARCO Station 2035
1001 San Pablo Avenue
Albany, California

For ARCO Products Company

1.0 INTRODUCTION

At the request of ARCO Products Company (ARCO), RESNA Industries Inc. (RESNA) performed an Air Sparging Pilot Test (AST) at ARCO Station 2035, 1001 San Pablo Avenue, Albany, California. The AST was 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 two air sparge wells (AS-1 and AS-2), performing a two day pilot sparge 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 from the sparge test, and presents conclusions concerning the feasibility of air sparging at the site.

2.0 BACKGROUND

2.1 General

ARCO Station 2035 is an operating service station located at the southeast corner of the intersection of Marin and San Pablo Avenues at 1001 San Pablo Avenue in Albany, California. The location of the site is shown on Plate 1, Site Vicinity Map. The site is a

relatively flat, asphalt-and concrete-covered lot. The site is bounded by Marin Avenue and an operating Shell Station to the north, by San Pablo Avenue and the Agricultural Research Station of the University of Berkeley to the west, an auto repair shop to the south, and residential homes to the east.

Four underground gasoline-storage tanks (USTs) were excavated and removed from the northeastern portion of the site in July and August 1991, including one 6,000-gallon UST (T1), two 4,000-gallon USTs (T2 and T3), and one 10,000-gallon UST (T4). A 550-gallon waste-oil tank was removed from the east-central portion of the site in 1977 during ARCO's conversion of the station to a mini-market. Four new 10,000 gallon USTs were placed in a new pit situated in the southeastern portion of the site. The approximate locations of the former and existing USTs, former waste-oil tank, and other pertinent features at the site are shown on Plate 2, Generalized Site Plan.

2.2 Regional Geology and Hydrogeology

ARCO Station 2035 is located within the East Bay Plain in the north-central portion of the Berkeley Alluvial Plain (Hickenbottom and Muir, 1988). The active Hayward Fault is situated approximately 2 miles east of the site. Helley et al. (1979) mapped the earth materials underlying the site area as older Quaternary alluvial deposits composed of a heterogeneous mixture of poorly consolidated to unconsolidated clay, silt, sand and gravel. The site is less than 1,200 feet north of Codornices Creek and approximately 1 mile east of Fleming Point on the eastern shoreline of the San Francisco Bay. The direction of groundwater flow in the vicinity of the site is inferred to be to the west-southwest, based on regional and local topography and drainage patterns.

3.0 INSTALLATION OF AIR SPARGE WELLS

3.1 Field Work

On June 14 through 16, and 21, 1993, five soil borings (B-23 through B-27) were drilled, two air sparge/vapor extraction combination wells (AS-1 and AS-2) and three vapor extraction wells (VW-7 through VW-9) were constructed in the borings. Wells AS-1 and VW-7 were installed in the northern portion of the site near the northern service islands, well AS-2 was

installed in the northwestern portion of the site, well VW-8 was installed in the northeastern portion of the site near the former USTs, and well VW-9 was installed in the western portion of the site near the western service islands. The locations of the borings and wells are shown on Plate 2.

Soil samples were collected, as shown on Logs of Borings (Appendix A, Plates A-2 through A-6), for description and possible laboratory analyses. Laboratory analytical results of soil samples analyzed are shown in Table 1, and copies of laboratory analytical data are included in Appendix B. Sampling procedures are summarized in Appendix C.

3.2 Subsurface Materials

The earth materials encountered at the site during this investigation generally consisted of a fine-grained sandy silt to clay overlying a coarser-grained clayey gravel and clayey to gravelly sand water-bearing unit. Beneath the water-bearing unit in borings B-26 and B-27 a silty clay lower confining unit was encountered. Drilling observations are summarized in the logs of borings, shown on Plates A-2 through A-6. Graphic interpretations of soil stratigraphy beneath the site based on this and previous investigations are shown on geologic Cross Section A-A' (Plate 3). The location of the cross section is shown on Plate 2.

3.3 Sparge Well Construction

Two combination air sparge/vapor extraction wells (AS-1 and AS-2) and three vapor extraction wells (VW-7 through VW-9) were constructed in borings B-23 through B-27, respectively. Vapor extraction wells VW-7 through VW-9 were completed with 4-inch-diameter, Schedule (Sch) 40, polyvinyl chloride (PVC) casing. Well casings were set to 15 feet and screened to 5 feet with 4-inch-diameter 0.1 inch-wide machine slotted, PVC. The air sparge/vapor extraction combination wells were constructed using two 2-inch-diameter, Sch 40, PVC pipes in one boring. The air sparge point was constructed of 2 feet of 0.020-inch-wide machine slotted PVC screen at the bottom of the well, with 2-inch-diameter PVC extending to ground surface. The vapor extraction point consisted of 10 feet of 0.1 inch-wide machine slotted PVC screen set from 5 to 15 feet, with 2-inch-diameter PVC extending to the surface. For specific details of individual well construction see Logs of Borings B-23 through B-27 (Plates A-2 through A-6).

4.0 AIR SPARGE PILOT TESTING

4.1 Purpose

Air sparge pilot testing was performed at the site on August 25 and 26, 1993. The purpose of performing the AST was to evaluate the feasibility of removing dissolved and residual gasoline hydrocarbons from first groundwater beneath the site. To the extent possible, the objectives of the AST were to validate hydrocarbon removal from the saturated zone as a result of sparging, evaluate the propagation of air injected below the groundwater surface, collect injection flowrate and pressure data for the possible design of an air sparge system, and evaluate the effect of vapor extraction on sparging.

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, one day prior to sparge testing. The groundwater sampling was performed by EMCON as part of ongoing quarterly groundwater monitoring. On the day of sparge testing only, 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.

Test equipment for sparging included a trailer mounted air compressor equipped with coalescing air filters, a sparge air flowmeter with pressure regulators, monitoring point assemblies to allow for the collection of gas samples from within the vadose zone, and field instruments to measure relative TPHg vapor concentrations. For the combination sparge/vapor extraction test, test equipment included the sparge equipment described above and an internal combustion (IC) engine for vapor extraction.

For the sparge only test, air was injected to establish the minimum pressure required to evacuate the sparge well of water. While sparging was ongoing, vadose zone gas samples were collected to monitor TPHg concentrations, and vadose zone pore pressure was monitored. At the completion of sparging, groundwater samples were collected from

monitoring points for dissolved TPHg measurements. For the combination sparge/vapor extraction test, sparging was performed as described while vapor extraction was performed in the immediate vicinity of the sparge well.

The sparge test employed air sparge well AS-1 as an injection point while wells RW-1, AS-2, MW-1, and MW-2 were used as monitoring points. The distances from AS-1 to the monitoring points were 22, 27, 45, and 46 feet, respectively. The sparge/vapor extraction test employed air sparge well AS-1 as an injection point, well AS-2 (vent) as a vapor extraction well, and wells VW-5, VW-2 and AS-1 (vent) as monitoring points. The distances from AS-1 to the monitoring points for the combination test ranged from 17 to 27 feet. An air sparge and vapor extraction well data summary is included in Table 2.

4.3 Field Results

While sparging, air injection to AS-2 was initially achieved at a flowrate of approximately 2.5 actual cubic feet per minute (acfm) at a delivery pressure of 24 pounds per square inch (psi). Groundwater elevation rises were observed that ranged from 3.8 feet (RW-1) to 5.7 feet (MW-2). Vadose zone pore pressures during sparging ranged from 17 inches of water column (AS-1) to 0.8 inches of water column (AS-2 vent).

Within approximately 30 minutes after sparging was initiated, the bubbling of water in RW-1 was observed. Bubbling in RW-1 continued during the entire test duration, however, bubbling was not observed in any of the other monitoring points.

During the combination sparge/vapor extraction test, injection into AS-1 occurred at a flowrate of 2.5 acfm and injection pressure of 24 psi and extraction from AS-2 (vent) occurred at approximately 52 acfm. Extraction wellhead vacuum at the beginning of the test was 62 inches of water column and was reduced to 39 inches of water column by the end of the test. The vacuum responses at the monitoring points (VW-2 and VW-5) at the beginning of the combined test were 6.0 and 3.6 inches of water and were reduced to 2.6 and 2.0 inches of water, respectively by the end of the test. Field test data for the sparge and sparge/vapor extraction tests are summarized in Tables 3 and 4.

4.4 Laboratory Methods and Results

Groundwater and soil gas samples collected during field testing were submitted to Sequoia Analytical Laboratories, of Redwood City, California (Hazardous Waste Testing Laboratory Certification #1210) to be analyzed for 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 testing are presented in Table 5.

Soil gas samples collected during sparging indicated TPHg vapor concentrations away from the sparge well either increased slightly (AS-2 vent) or stayed approximately the same (VW-1). Prior to sparging, the concentrations of dissolved TPHg measured in AS-1, AS-2, and MW-2 were 2,400 parts per billion (ppb); 30,000 ppb; and less than 0.5 ppb, respectively. Dissolved TPHg concentrations measured in monitoring points AS-1, AS-2, and MW-2 at the completion of sparging were 460 ppb; 28,000 ppb and less than 0.5 ppb, respectively. Sparge well AS-1 exhibited a significant concentration reduction during the test while TPHg measurements at AS-2 and MW-2 were approximately the same.

Dissolved oxygen concentrations prior and subsequent to the sparge test either decreased (AS-2 and MW-2) or increased only slightly (AS-1).

5.0 CONCLUSIONS

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

- An injection pressure of 24 psi is necessary to achieve an injection flowrate of 2.5 acfm.
- The initial minimum required delivery pressure of injection air did not drop after flow into the sparge points was achieved.
- Bubble propagation occurred from AS-1 to RW-1 (a distance of 22 feet) where vigorous bubbling was observed within 30 minutes after sparging was initiated.
- The concentration of benzene in monitoring point AS-2 (located 27 feet from sparge well AS-1) was reduced 43% from 1,300 ppb to 740 ppb.

- Groundwater elevation rises ranging from 3.3 to 5.7 feet were observed during the sparge test. These elevation rises may be due to either an excessive injection pressure or a pressure buildup caused by a confining layer below the groundwater surface.

- Data obtained from the test suggests that bubble propagation is occurring to distances greater than 20 feet from the sparge well.

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. Groundwater monitoring field procedures and acquisition of groundwater data were performed under the direction of EMCON. With respect to groundwater monitoring, RESNA's scope of work was limited to interpretation of EMCON's field and laboratory data. 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:

Mr. Richard Hiett
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San Francisco Bay Region
2101 Webster Street, Suite 500
Oakland, California 94612

Mr. Barney Chan
Alameda County Health Care Services Agency
80 Swan Way, Room 200
Oakland, California 94621

8.0 REFERENCES

Applied GeoSystems. January 24, 1990. Limited Environmental Site Assessment at ARCO Station 2035. AGS 96036-1.

Helley, E.S., K.R. Lajoie, W.E. Spangle, and M.L. Blair. 1979. Flatland Deposits of the San Francisco Bay Region, California. U.S. Geological Survey Professional Paper 943.

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

RESNA/AGS April 29, 1991. Work Plan for Subsurface Investigations and Remediation at ARCO Station 2035, 1001 San Pablo Avenue, Albany, California. AGS 69036.02.

RESNA/AGS April 29, 1991. Addendum One to Work Plan at ARCO Station 2035, 1001 San Pablo Avenue, Albany, California. AGS 69036.02

RESNA/AGS September 11, 1991. Underground Gasoline-Storage Tank Removal and Replacement. AGS 69036.03.

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RESNA May 29, 1992. Addendum Three to Work Plan at ARCO Station 2035, 1001 San Pablo Avenue, Albany, California. AGS 69036.05

RESNA November 20, 1992. Site Safety Plan for the ARCO Service Station 2035, 1001 San Pablo Avenue, Albany, California. AGS 69036.07S.

RESNA November 30, 1992. Additional Subsurface Environmental Investigation and Vapor Extraction Test at ARCO Station 2035, 1001 San Pablo Avenue, Albany, California. 69036.05

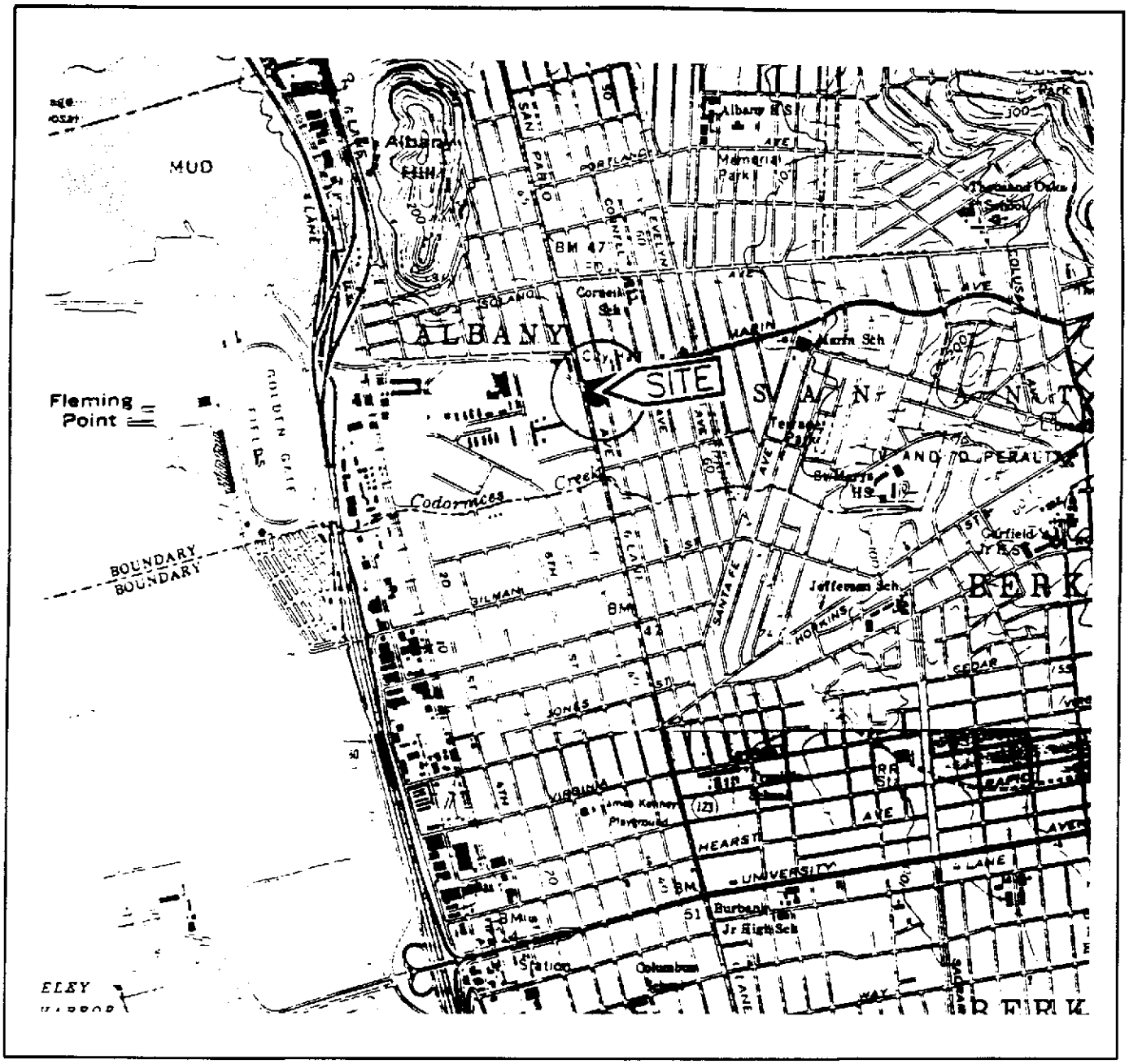
8.0 REFERENCES - (Con't)

RESNA December 29, 1993. Letter Report, Quarterly Groundwater Monitoring Third Quarter 1993 at ARCO Station 2035, 1001 San Pablo Avenue, Albany, California. RESNA 69036.08

State Water Resources Control Board, January 1992. Report on Releases of Hazardous Substances from Underground Storage Tanks. 92-2WP

AERIAL PHOTOGRAPHS

Date	Agency	Type	No.	Scale
03-24-47	Pacific Aerial Surveys	Black and White	AV-11-4-8	1:20,000
09-06-49	Pacific Aerial Surveys	Black and White	AV-28-11-27	1:7,200
05-03-57	Pacific Aerial Surveys	Black and White	AV-253-7-15	1:12,000
05-02-69	Pacific Aerial Surveys	Black and White	AV-902-7-12	1:12,000
05-02-69	Pacific Aerial Surveys	Black and White	AV-902-7-12	1:12,000
09-06-79	Pacific Aerial Surveys	Black and White	AV-1750-7-1	1:12,000
08-03-88	Pacific Aerial Surveys	Black and White	AV-3368-6-16	1:12,000



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

N

Approximate Scale
2000 1000 0 2000
feet

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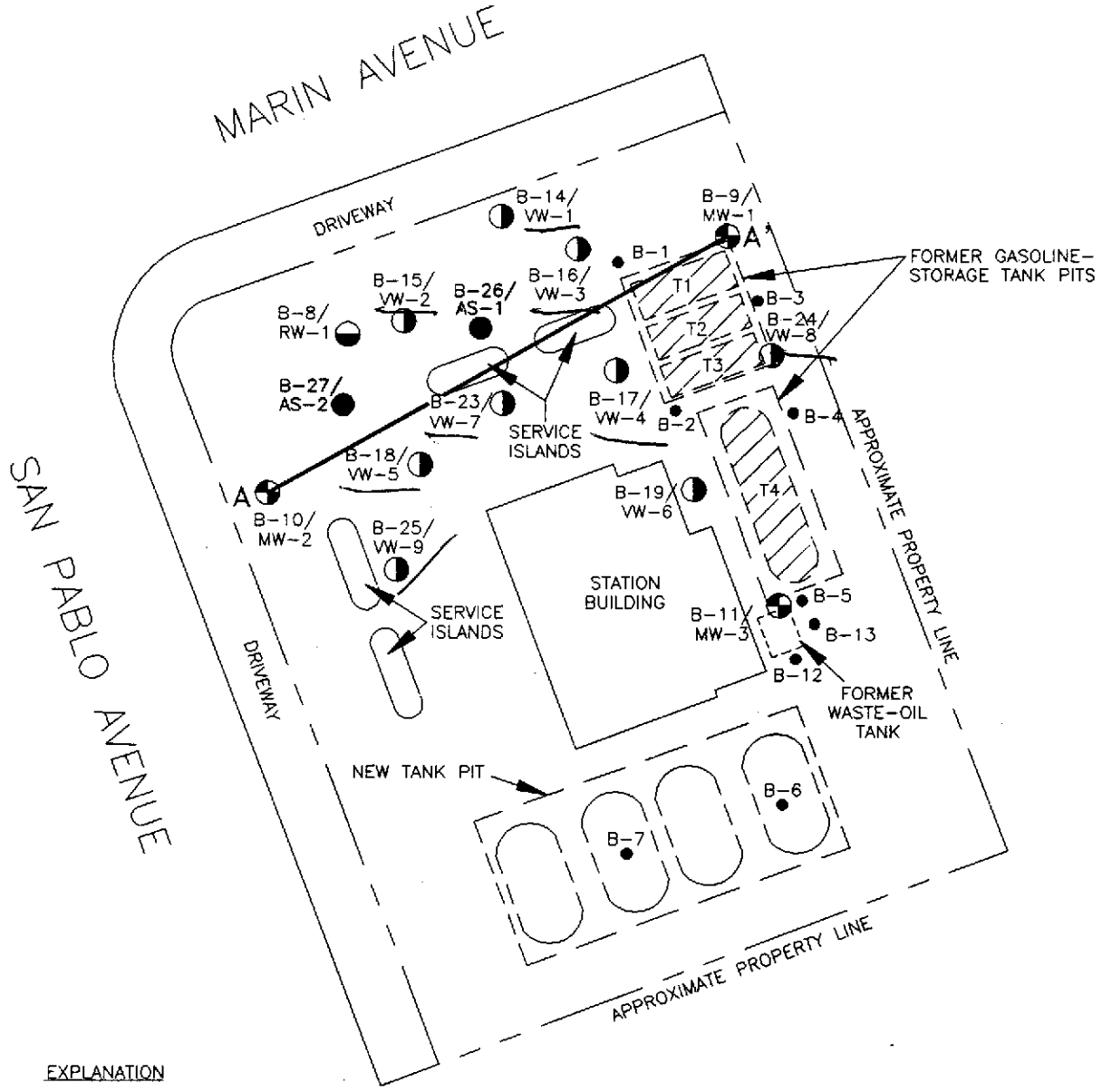
SITE VICINITY MAP
ARCO Station 2035
1001 San Pablo Avenue
Albany, California

PLATE
1



EXPLANATION

B-19/ VW-6 = Boring/vapor extraction well (RESNA, August 1992 and June 1993)

B-8/ RW-1 = Boring/recovery well (Exceltech, October 1991)

B-11/ MW-3 = Boring/monitoring well (Exceltech, October 1991)

AS-2 = Air sparge well (RESNA, June 1993)

B-13 = Soil boring (RESNA, August 1989, June 1991, and August 1992)

A — A' = Geologic cross section

Source: Surveyed by John E. Koch, Land Surveyor. Dated October 29, 1991.

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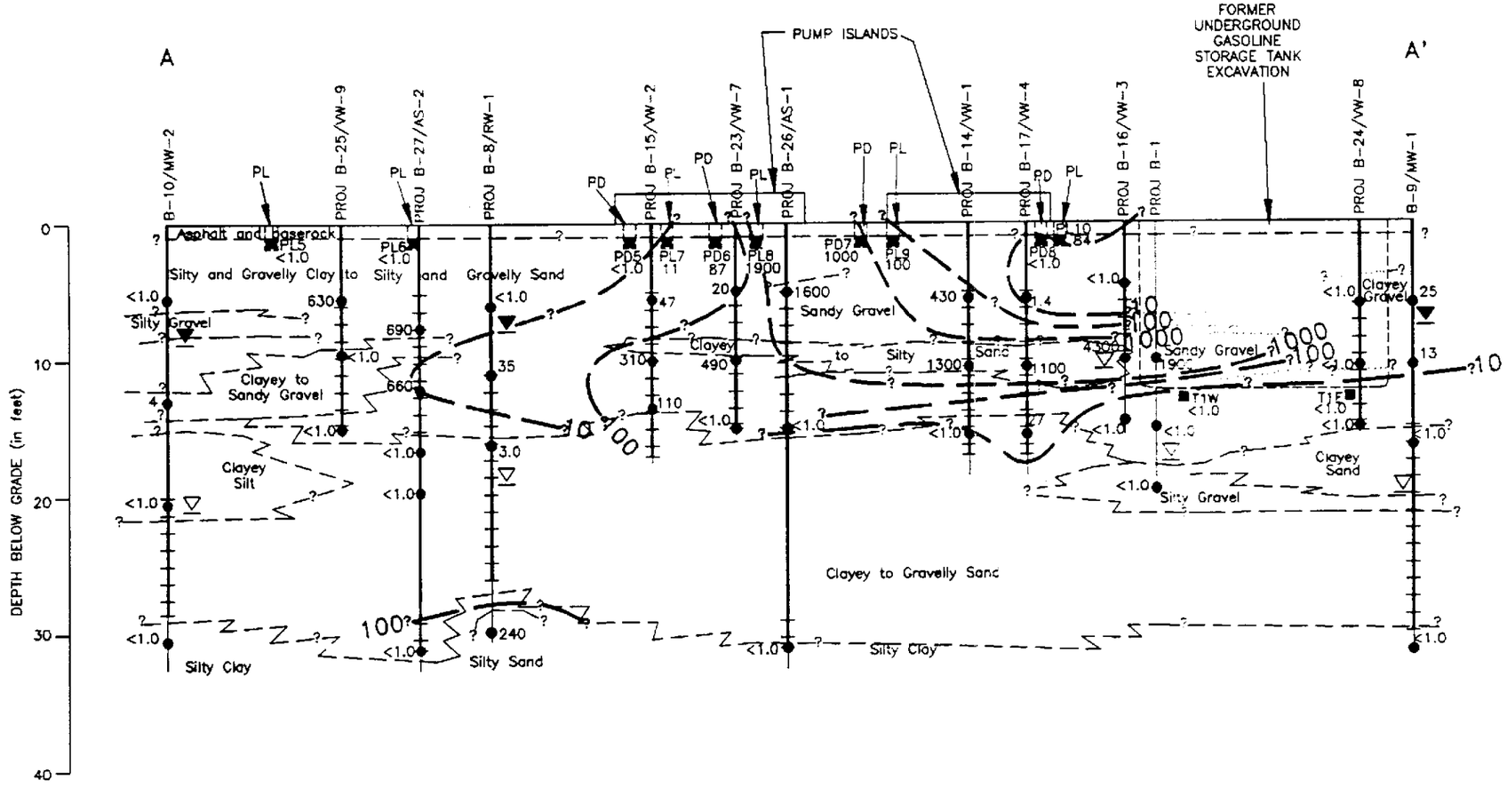
GENERALIZED SITE PLAN
ARCO Station 2035
1001 San Pablo Avenue
Albany, California

PLATE 2



EXPLANATION

1000 = Line of equal concentration of TPHg in soil in parts per million (ppm)

4300 = Laboratory analyzed soil sample showing concentration of TPHg in ppm

= Well casing

= Well screen

= Boring

▽ = Initial water level in boring

PL8 ■ 1,900 = Projected tank pit, product line, or product dispenser soil sample showing concentrations of TPHg in ppm (See plate 1A for sample locations)

PL = Product line trench

PD = Product dispenser trench

Approximate Horizontal Scale

10 5 0 10 20

feet

Approximate Vertical Scale

10 5 0 10 20

feet

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GEOLOGIC CROSS SECTION A-A'
ARCO Station 2035
1001 San Pablo Avenue
Albany, California

PLATE 3

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TABLE 1
CUMULATIVE RESULTS OF LABORATORY ANALYSES OF SOIL SAMPLES
ARCO Station 2035
Albany, California
(Page 1 of 4)

Date Sample ID	TPHg	B	T	E	X	TPHd	VOC,PCB, TOG and SVOC	Cd	Cr	Pb	Ni	Zn
August 1989												
S-10-B1	1,900	<4	15	8	53	NA	NA	NA	NA	NA	NA	NA
S-15-B1	<1.0	<0.005	0.006	0.006	<0.005	NA	NA	NA	NA	NA	NA	NA
S-19½-B1	<1.0	<0.005	<0.005	<0.005	<0.005	NA	NA	NA	NA	NA	NA	NA
S-10-B2	51	1.9	0.35	0.81	4.0	NA	NA	NA	NA	NA	NA	NA
S-14½-B2	<1.0	0.063	<0.005	<0.005	<0.005	NA	NA	NA	NA	NA	NA	NA
S-20-B2	<1.0	0.039	0.044	0.007	0.041	NA	NA	NA	NA	NA	NA	NA
S-10-B3	75	3.1	8.2	1.8	11.0	NA	NA	NA	NA	NA	NA	NA
S-14½-B3	<1.0	0.21	<0.025	<0.025	0.039	NA	NA	NA	NA	NA	NA	NA
S-20-B3	<1.0	<0.005	<0.005	<0.005	<0.005	NA	NA	NA	NA	NA	NA	NA
S-10-B4	2,400	33	140	40	220	NA	NA	NA	NA	NA	NA	NA
S-15-B4	520	<1.0	6.9	6.2	6.3	NA	NA	NA	NA	NA	NA	NA
S-19-B4	<1.0	<0.005	0.007	<0.005	<0.005	NA	NA	NA	NA	NA	NA	NA
S-9½-B5	<1.0	0.007	0.006	<0.005	<0.005	NA	NA	NA	NA	NA	NA	NA
S-15-B5	<1.0	<0.005	0.006	<0.005	<0.005	NA	NA	NA	NA	NA	NA	NA
S-20-B5	<1.0	<0.005	<0.005	<0.005	<0.005	NA	NA	NA	NA	NA	NA	NA
June 1991												
S-5½-B6	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA
S-10½-B6	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA
S-15½-B6	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA
S-17-B6	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA
S-5½-B7	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA
S-10½-B7	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA
S-15½-B7	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA
S-17-B7	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA
S-18½-B7	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA
October 1991												
S-6-B8	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA
S-11-B8	35	1.2	1.7	0.42	2.0	NA	NA	NA	NA	NA	NA	NA
S-16-B8	3.0	0.45	0.13	0.11	0.47	NA	NA	NA	NA	NA	NA	NA
S-30-B8	240	3.6	5.0	4.1	16	NA	NA	NA	NA	NA	NA	NA
S-6-B9	25	0.60	0.58	0.44	1.8	NA	NA	NA	NA	NA	NA	NA
S-10½-B9	13	0.74	0.72	0.18	0.95	NA	NA	NA	NA	NA	NA	NA
S-16-B9	<1.0	0.015	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA
S-31-B9	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA

See notes on Page 4 of 4

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TABLE 1
CUMULATIVE RESULTS OF LABORATORY ANALYSES OF SOIL SAMPLES
ARCO Station 2035
Albany, California
(Page 2 of 4)

Date Sample ID	TPHg	B	T	E	X	TPHd	TOG	VOC,PCB, and SVOC	Cd	Cr	Pb	Ni	Zn
October 1991 cont.													
S-5½-B10	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA	NA
S-13-B10	4.0	0.13	0.15	0.041	0.16	NA	NA	NA	NA	NA	NA	NA	NA
S-20½-B10	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA	NA
S-30½-B10	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA	NA
S-6-B11	<1.0	0.010	<0.0050	<0.0050	<0.0050	3.9	80	ND[b]	<0.50	49	7.7	97	41
S-11-B11	110	<0.0050	<0.0050	<0.0050	0.27	71	43	ND[b]	<0.50	80	5.8	77	69
S-16-B11	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<1.0	57	ND[b]	<0.50	33	7.5	25	45
S-21-B11	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<1.0	74	ND[b]	<0.50	39	7.2	32	56
August 1992													
S-4½-B12	10	<0.0050	<0.0050	0.0070	0.050	45[c]	250	ND	<0.50	59	<5.0	58	40
S-9-B12	9.1	<0.0050	<0.0050	0.0060	0.082	250[e]	100	ND	<0.50	42	<5.0	46	37
S-14½-B12	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<1.0	<50	ND	<0.50	49	7.4	49	69
S-4½-B13	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<1.0	<50	ND	<0.50	68	<5.0	65	43
S-7½-B13	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	1.1[c]	1,800	ND[d]	<0.50	51	<5.0	81	46
S-17½-B13	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<1.0	<50	ND	<0.50	43	5.6	51	69
S-5½-B14	430	4.0	16	7.3	42	NA	NA	NA	NA	NA	NA	NA	NA
S-10½-B14	1,300	20	82	31	170	NA	NA	NA	NA	NA	NA	NA	NA
S-15½-B14	<1.0	0.012	0.034	0.011	0.055	NA	NA	NA	NA	NA	NA	NA	NA
S-5½-B15	47	0.22	0.56	0.76	4.3	NA	NA	NA	NA	NA	NA	NA	NA
S-10-B15	310	3.8	15	7.1	37	NA	NA	NA	NA	NA	NA	NA	NA
S-13½-B15	110	1.5	4.3	2.1	12	NA	NA	NA	NA	NA	NA	NA	NA
S-4½-B16	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA	NA
S-10-B16	4,300	21	110	51	580	NA	NA	NA	NA	NA	NA	NA	NA
S-14½-B16	<1.0	0.010	0.032	0.018	0.18	NA	NA	NA	NA	NA	NA	NA	NA
S-5½-B17	1.4	0.045	0.0080	<0.0050	0.028	NA	NA	NA	NA	NA	NA	NA	NA
S-10½-B17	1,100	16	71	27	140	NA	NA	NA	NA	NA	NA	NA	NA
S-15½-B17	27	2.1	0.40	0.75	1.3	NA	NA	NA	NA	NA	NA	NA	NA
S-5½-B18	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA	NA
S-10½-B18	380	4.8	21	8.7	46	NA	NA	NA	NA	NA	NA	NA	NA
S-15½-B18	2.6	0.78	0.48	0.059	0.29	NA	NA	NA	NA	NA	NA	NA	NA
S-5½-B19	<1.0	0.017	0.0090	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA	NA
S-10½-B19	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA	NA
S-15½-B19	<1.0	0.15	0.012	0.029	0.032	NA	NA	NA	NA	NA	NA	NA	NA

See notes on Page 4 of 4

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TABLE 1
CUMULATIVE RESULTS OF LABORATORY ANALYSES OF SOIL SAMPLES
ARCO Station 2035
Albany, California
(Page 3 of 4)

Date Sample ID	TPHg	B	T	E	X	TPHd	VOC,PCB, TOG and SVOC	Cd	Cr	Pb	Ni	Zn
August 1992 cont.												
S-0821-SPAD	550	2.6	9.5	5.4	47	NA	NA	NA	NA	NA	NA	NA	NA
November 1992												
S-5½-B20	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA	NA
S-9½-B20	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA	NA
S-28-B20	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA	NA
S-5½-B21	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA	NA
S-10½-B21	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA	NA
S-26-B21	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA	NA
S-5½-B22	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA	NA
S-11½-B22	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA	NA
S-26-B22	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA	NA
S-1125/SPA-D	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA	NA
June 1993												
S-5-B23	20	0.22	0.45	0.20	0.76	NA	NA	NA	NA	NA	NA	NA	NA
S-10-B23	490	4.9	19	8.3	50	NA	NA	NA	NA	NA	NA	NA	NA
S-15-B23	<1.0	0.33	0.012	0.014	0.014	NA	NA	NA	NA	NA	NA	NA	NA
S-6-B24	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA	NA
S-10½-B24	310	3.8	15	6.6	38	NA	NA	NA	NA	NA	NA	NA	NA
S-14½-B24	<1.0	0.014	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA	NA
S-5½-B25	630	1.7	0.40	13	36	NA	NA	NA	NA	NA	NA	NA	NA
S-9½-B25	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA	NA
S-15-B25	<1.0	0.017	0.022	<0.0050	0.014	NA	NA	NA	NA	NA	NA	NA	NA
S-5-B26	1,600	7.7	45	28	170	NA	NA	NA	NA	NA	NA	NA	NA
S-15-B26	<1.0	0.18	0.019	0.015	0.047	NA	NA	NA	NA	NA	NA	NA	NA
S-31-B26	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA	NA
S-7½-B27	690	7.4	25	13	64	NA	NA	NA	NA	NA	NA	NA	NA
S-12-B27	660	8.8	33	14	76	NA	NA	NA	NA	NA	NA	NA	NA
S-16½-B27	<1.0	0.061	0.040	0.0090	0.040	NA	NA	NA	NA	NA	NA	NA	NA
S-19½-B27	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA	NA
S-31-B27	<1.0	<0.0050	0.0070	<0.0050	<0.0050	NA	NA	NA	NA	NA	NA	NA	NA

See notes on Page 4 of 4

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TABLE 1
CUMULATIVE RESULTS OF LABORATORY ANALYSES OF SOIL SAMPLES
ARCO Station 2035
Albany, California
(Page 4 of 4)

Results for TPHg, BTEX, TPHd, TOG and metals in parts per million (ppm); and for VOC, PCB and SVOC in parts per billion (ppb).

TPHg: Total petroleum hydrocarbons as gasoline by EPA method 5030/8015/8020.
B: benzene, T: toluene, E: ethylbenzene, X: total xylenes isomers; BTEX analyzed by EPA method 5030/8015/8020.
TPHd: Total Petroleum Hydrocarbons as diesel by EPA method 3550/8015.
TOG: Total oil and grease by Standard method 5520 E&F.
VOC: Volatile organic compounds by EPA method 8240.
PCB: Polychlorinated biphenyls by EPA method 8080.
SVOC: Semi-volatile organic compounds by EPA method 8270.
Cd: Cadmium by EPA method 6010.
Cr: Chromium by EPA method 6010.
Ni: Nickel by EPA method 6010.
Zn: Zinc by EPA method 6010.
Pb: Lead by EPA method 6010.
NA: Not analyzed.
<: Results reported below the laboratory detection limit.
ND: All compounds tested were nondetectable. Detection limits varied for different compounds.
[a]: Sample collected from the saturated zone, analyzed for site characterization purposes only.
[b]: Only VOCs tested.
[c]: Identified as a non-diesel mixture. The mixture in B-12 contained C9-C14 plus >C16 and >C17. The mixture in B-13 was >C17.
[d]: All compounds tested were nondetectable except ethylbenzene.

Sample Identification:

S-26-B22
- S: Soil Sample
- 26: Depth in feet
- B22: Boring number

S-1125-SP2AD
- S: Soil Sample
- 1125: Date sampled
- SP: Soil pile
- 2AD: Composite sample

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TABLE 2
SPARGE AND VAPOR EXTRACTION WELL DATA SUMMARY
ARCO Station 2035
Albany, California
August 25, 1993

Well ID	Well Type	Depth-to-Water	Screened Interval	Depth of Well
AS-1	Sparge	11.12	31 to 29	31
	Vadose	11.12	15 to 5	15
AS-2	Sparge	10.67	31½ to 29½	31½
	Vadose	10.67	15 to 5	15
RW-1	Extraction	10.91	11 to 26	25.0
MW-1	Monitoring	10.55	15 to 29	29.6
MW-2	Monitoring	10.90	20 to 29	28.8

Measurements in feet below ground surface.
Depth-to-water data taken from RESNA's Quarterly Monitoring Report, Third Quarter 1993.
NM = Not measured

TABLE 3
AIR SPARGE TEST DATA
ARCO Station 2035
Albany, California
August 25, 1993

Time	AS-1	RW-1	AS-2	MW-1	MW-2
10:50	Q_A = 0 P_i = 0 P_{VZ} = 0	DTW = 10.9 ΔDTW = 0	P_{VZ} = 0 DTW = 10.5	DTW = 10.5 ΔDTW = 0	DTW = 10.9 ΔDTW = 0
12:00	Q_A = 2.5 P_i = 24 P_{VZ} = 17	DTW = 8.4 ΔDTW = 2.5	P_{VZ} = 1.9	DTW = 8.3 ΔDTW = 2.2	DTW = 7.1 ΔDTW = 3.8
1:00	Q_A = 2.5 P_i = 24 P_{VZ} = 15	DTW = 1.1 ΔDTW = 3.8	P_{VZ} = 0.8	DTW = 7.2 ΔDTW = 3.3	DTW = 5.2 ΔDTW = 5.7
Distance from sparge well	0'	22'	27'	45'	46'

Legend:

Q_A	=	Injection rate of sparge air measured in actual cubic feet per minute.
P_i	=	Sparge air injection pressure measured in pounds per square inch.
P_{VZ}	=	Pore pressure of soil gas in vadose zone measured in inches of water column.
ΔDTW	=	Cumulative change in groundwater elevation during test.

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TABLE 4
AIR SPARGE/VAPOR EXTRACTION TEST - FIELD DATA
ARCO Station 2035
Albany, California
August 26, 1993

Site ID	Initial Vacuum	Final Vacuum	Distance From AS-2
AS-1 (Q_A=25)	2.2	1.0	27
VW-5	3.6	2.0	17
VW-2	6.0	2.6	18
AS-2 (Q_E=52)	62.0	39.0	0

Note: Initial and final vacuums measured in inches of water column.
Q_A = Injection rate of sparge air (acfm)
Q_E = Extraction rate (acfm)

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TABLE 5
AIR SPARGE TEST SUMMARY OF CHEMICAL ANALYSES
ARCO Station 2035
Albany, California
August 25, 1993

Well ID	Pre-Sparge			Post-Sparge			Distance from AS-1
Groundwater							
AS-1	TPHg	=	2,400 ppb	TPHg	=	460 ppb	0
	B	=	78 ppb	B	=	26 ppb	
	DO	=	4.3 ppb	DO	=	4.8 ppm	
AS-2	TPHg	=	30,000 ppb	TPHg	=	28,000 ppb	27
	B	=	1300 ppb	B	=	740 ppb	
	DO	=	5.5 ppm	DO	=	3.7 ppm	
MW-2	TPHg	=	ND	TPHg	=	ND	46
	B	=	ND	B	=	ND	
	DO	=	6.6 ppm	DO	=	3.9 ppm	
Soil Gas							
AS-1	TPHg	=	35,000 mg/m^3	TPHg	=	4,600 mg/m^3	0
VW-1	TPHg	=	13,000 mg/m^3	TPHg	=	12,000 mg/m^3	20
AS-2	TPHg	=	31,000 mg/m^3	TPHg	=	49,000 mg/m^3	27

Legend:
TPHg = Total petroleum hydrocarbons as gasoline
B = Benzene measure
DO = Dissolved oxygen
ppb = Parts per billion
ppm = Parts per million

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APPENDIX A

BORING LOGS

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISION		LTR	DESCRIPTION	MAJOR DIVISION		LTR	DESCRIPTION
COARSE-GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravels or 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, grave-sand-silt mixtures.			OL	Organic silts and organic silt-clays of low plasticity.
		GC	Clayey gravel, 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 or 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.				
		SC	Clayey sands, sand-clay mixtures.	HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils.


Depth through which sampler is driven


Relatively undisturbed sample


No sample recovered


Static water level observed in well/boring


Initial water level observed in boring

S-10 Sample number


Sand pack


Bentonite

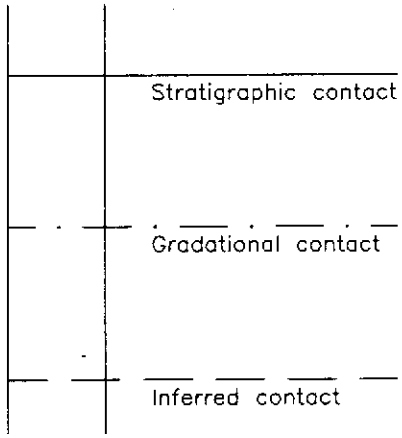

Neat cement


Caved native soil


Blank PVC


Machine-slotted PVC


Pea gravel



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.

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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PROJECT 69036.10

UNIFIED SOIL CLASSIFICATION SYSTEM AND SYMBOL KEY
ARCO Station 2035
1001 San Pablo Avenue
Albany, California

PLATE
A-1

Total depth of boring:	15-1/2 feet	Casing diameter:	4 inches
Diameter of boring:	10 inches	Casing material:	Sch 40 PVC
Date drilled:	6-16-93	Slot size:	0.10-inch
Drilling Company:	Exploration Geoservices	Sand size:	3/8" pea gravel
Driller:	Dave and Dennis	Screen Interval:	6 feet to 15 feet
Drilling method:	Hollow-Stem Auger	Field Geologist:	Erin McLucas

Signature of Registered Professional: _____

Registration No.: CEG 1463 State: CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
2				CL	Concrete (7 inches). Silty clay, black, damp, medium plasticity, stiff.	
4				SC	Clayey sand, trace gravel, tan, damp, dense; abundant black rootlets.	
6	S-5					
8				GP	Sandy gravel, tan to orange, damp, very dense.	
10	S-10			GC	Clayey gravel, olive, damp, very dense.	
12						
14				CL	Sandy clay with silt, light gray to olive with orange mottling, damp, medium plasticity, hard; tan rootlets.	
16	S-15				Total Depth = 15-1/2 feet.	
18						
20						
22						
24						
26						
28						
30						
32						
34						
36						
38						
40						

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PROJECT: 69036.10

LOG OF BORING B-23/VW-7
ARCO Station 2035
1001 San Pablo Avenue
Albany, California

PLATE
A-2

Total depth of boring:	15-1/2 feet	Casing diameter:	4 inches
Diameter of boring:	10 inches	Casing material:	Sch 40 PVC
Date drilled:	6-15-93	Slot size:	0.10-inch
Drilling Company:	Exploration Geoservices	Sand size:	3/8" pea gravel
Driller:	John and Dennis	Screen Interval:	6 feet to 15 feet
Drilling method:	Hollow-Stem Auger	Field Geologist:	Erin McLucas

Signature of Registered Professional: _____

Registration No.: CEG 1463 State: CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0				GP	Asphalt (4 inches).	
2				CL	Sandy gravel, brown, damp, dense.	
4					Silty clay, dark brown to black, damp, medium plasticity, stiff.	
6	S-6	14 50/ 6"		GC	Clayey gravel, fine, orange-brown, damp, very dense.	
8						
10	S-10.5	10 14 30		CL	Silty clay, gray with orange mottling, damp, medium plasticity, hard. With sand.	
12						
14	S-15	13 48 40		GC	Clayey gravel, orange-brown, damp, very dense.	
16					Total Depth = 15 feet.	
18						
20						
22						
24						
26						
28						
30						
32						
34						
36						
38						
40						

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PROJECT: 69036.10

LOG OF BORING B-24/VW-8
ARCO Station 2035
1001 San Pablo Avenue
Albany, California

PLATE
A-3

Total depth of boring:	15-1/2 feet	Casing diameter:	4 inches
Diameter of boring:	10 inches	Casing material:	Sch 40 PVC
Date drilled:	6-21-93	Slot size:	0.10-inch
Drilling Company:	Exploration Geoservices	Sand size:	3/8" pea gravel
Driller:	John and Dennis	Screen Interval:	6 feet to 15 feet
Drilling method:	Hollow-Stem Auger	Field Geologist:	Erin McLucas

Signature of Registered Professional: _____

Registration No.: CEG 1463 State: CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0					Concrete (6-1/2 inches).	
2				CL	Silty clay, dark brown to black, damp, medium plasticity, stiff.	
4				GP	Sandy to clayey gravel, fine grained, brown, damp, very dense.	
6	S-5.5					
8				CL	Silty clay, light gray to blue, damp, medium plasticity, hard.	
10	S-9.5			GP-GC	Sandy to clayey gravel, fine grained, brown to olive, damp, very dense.	
12						
14				CL	Silty clay, light gray to olive with orange and black mottling, damp, medium plasticity, hard.	
15	S-15					
16					Total Depth = 15-1/2 feet.	
18						
20						
22						
24						
26						
28						
30						
32						
34						
36						
38						
40						

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PROJECT: 69036.10

LOG OF BORING B-25/VW-9
ARCO Station 2035
1001 San Pablo Avenue
Albany, California

PLATE
A-4

Total depth of boring:	32-1/2 feet	Casing diameter:	2 inches
Diameter of boring:	12 inches	Casing material:	Sch 40 PVC
Date drilled:	6-16-93	Slot size:	0.10-inch/0.020-inch
Drilling Company:	Exploration Geoservices	Sand size:	3/8" Pea gravel/No. 3 Sand
Driller:	Dave and Dennis	Screen Interval:	5 to 15 feet/29 to 31 feet
Drilling method:	Hollow-Stem Auger	Field Geologist:	Erin McLucas

Signature of Registered Professional: _____

Registration No.: CEG 1463 State: CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
					Concrete (7 inches).	
2				CL	Silty clay, black, damp, medium plasticity, stiff.	
4					Tan to olive.	
6	S-5			GP	Sandy gravel, orange-brown, damp, very dense.	
8				GP-GC	With clay.	
10	S-10			CL	Silty clay with fine sand, light gray, damp, medium plasticity, hard.	
12						
14				CL	Sandy clay, light gray with brown mottling, damp, medium plasticity, hard.	
16	S-15			GP-GC	Sandy gravel with clay, orange-brown, damp, very dense.	
18				▽		
20	S-19				Wet.	
22				SM	Silty sand, fine to medium grained, tan to olive with orange mottling, wet, very dense.	
24						
26	S-25			GP/GC	Sandy to clayey gravel, orange-brown, wet, very dense.	
28						
30						
32	S-31			CL	Silty clay, gray with orange mottling, damp, medium plasticity, hard.	
34					Total Depth = 32-1/2 feet.	
36						
38						
40						

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PROJECT: 69036.10

LOG OF BORING B-26/AS-1
ARCO Station 2035
1001 San Pablo Avenue
Albany, California

PLATE
A-5

Total depth of boring:	32 feet	Casing diameter:	2 inches
Diameter of boring:	12 inches	Casing material:	Sch 40 PVC
Date drilled:	6-16-93	Slot size:	0.10-inch/0.020-inch
Drilling Company:	Exploration Geoservices	Sand size:	3/8" Pea gravel/No. 3 Sand
Driller:	John and Dennis	Screen Interval:	5 to 15 feet/29-1/2 to 31-1/2 feet
Drilling method:	Hollow-Stem Auger	Field Geologist:	Erin McLucas

Signature of Registered Professional: _____

Registration No.: CEG 1463 State: CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0				GP/GW	Asphalt (4 inches).	
2				CL	Sandy gravel, medium brown, damp, dense; baserock.	
4					Silty clay, brown to black, damp, medium plasticity, stiff.	
6	S-5	21 40 35 21			Brown to olive, trace sand and gravel, hard.	
8	S-7.5	48 37 10 18		SM	Silty sand with gravel, brown to olive, damp, very dense.	
10		20 11 15		SP	Gravelly sand, coarse grained, gray to olive, damp, very dense.	
12	S-10	24 9 18		SP	Sand, fine grained with gravel, brown to gray and olive, dense.	
14	S-12	24 10 11 16		GP	Sandy gravel, brown to olive damp, dense.	
16	S-15	13 35 50/6		SM	Silty sand, olive with orange mottling, damp, dense.	
18	S-16.5	22 50 50/4		GP	Sandy gravel, orange brown, damp to wet; with product.	
20	S-19.5	20 31 50/4 22 50/6		CL	Silty clay, light gray to olive with orange mottling, damp, medium plasticity, very stiff.	
22		3 50/5		GP	Sandy gravel, orange-brown, damp, very dense.	
24		24 50/3			Trace silty clay.	
26	S-25	28 30 50/4 31 50/4			Moist.	
28		26 50/6			Wet.	
30		31 50/4				
32	S-31	50/6 27 50/6		CL	Silty clay, trace fine-grained sand, gray with orange mottling, damp, medium plasticity, hard.	
34					Total Depth = 32 feet.	
36						
38						
40						

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PROJECT: 69036.10

LOG OF BORING B-27/AS-2

ARCO Station 2035
1001 San Pablo Avenue
Albany, California

PLATE
A-6

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APPENDIX B

CHAIN OF CUSTODY RECORDS AND LABORATORY ANALYSES REPORTS FOR SOIL SAMPLES

ARCO Products Company
Division of Atlantic Richfield Company

Task Order No. 2035-93-2

Chain of Custody

ARCO Facility no. 2035	City (Facility) ALBANY	Project manager (Consultant) ERIN McLUCAS	Laboratory name SEQUOIA
ARCO engineer MIKE WHELAN	Telephone no. (ARCO) (415) 571-2434	Telephone no. (Consultant) (408) 244-7723	Fax no. (Consultant) (408) 264-2435
Consultant name RESNA INDUSTRIES INC	Address (Consultant) 3315 ALMADEN EXPY, SUITE 34, SAN JOSE 95118		Contract number 07-073

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Water	Other	Preservation: Ice	Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH EPA M8020/8015	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 ☐	HOLD
S-6-B27			✓			✓		6/14													✓
S-7.5-B27											✓				9306895 01						
S-8.5-B27																					✓
S-10.5-B27																					✓
S-12-B27											✓								02		
S-13-B27																					✓
S-14.5-B27																					✓
S-16.5-B27											✓								03		
S-18-B27																					✓
S-19.5-B27											✓								04		JD
S-21-B27																					✓
S-22.5-B27																					✓
S-24-B27																					✓
S-25.5-B27																					✓
S-27-B27																					✓
S-28.5-B27																					✓

Special detection Limit/reporting

Special QA/QC

Remarks

Lab number 9306895

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: COO	
Relinquished by sampler: Erin D. McLucas	Date 6/17/93 Time 2:00	Received by: Rick Adams	
Relinquished by: Rick Adams	Date 6/17/93 Time 7:10	Received by:	
Relinquished by:	Date Time	Received by laboratory:	Date 6/17/93 Time 1510

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

ARCO Products Company
Division of Atlantic Richfield Company

Task Order No. 2035-93-2

Chain of Custody

ARCO Facility no. 2035	City (Facility) ALBANY	Project manager (Consultant) ERIN MC LUCAS	Laboratory name SEQUOIA
ARCO engineer MIKE WHELAN	Telephone no. (ARCO) (415) 571-2434	Telephone no. (Consultant) (408) 264-2723	Fax no. (Consultant) (408) 264-2435	Contract number 07073
Consultant name RESNA INDUSTRIES INC	Address (Consultant) 3315 ALMADEN EXPY, SUITE 34, SAN JOSE CA, 95118		Method of shipment

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Water	Other	Preservation: Ice	Acid	Sampling date	Sampling time	BTEX 8020/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 8010/8010	EPA 8240/8240	EPA 8250/8270	TCLP Metals ☐ VOA ☐	Soil/H2O VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org./DHS ☐ Lead EPA 7420/7421 ☐	HOLD
S-3.1-B27			✓			✓		6/14														✓
S-3.1-B27			✓			✓		6/14			✓				9306895	05						
S-5-B23			✓			✓		6/16			✓									06			
S-10 B23			✓			✓		6/16			✓									07			
S-15-B23			✓			✓		6/16			✓									08			
S-6-B24			✓			✓		6/15			✓									09			
S-10.5-B24			✓			✓		6/15			✓									10			
S-14.5-B24			✓			✓		6/15			✓									11			
Dup-SP-A			✓			✓		6/16														✓
Dup-SP-B			✓			✓		6/16														✓
Dup-SP-C			✓			✓		6/16														✓
Dup-SP-D			✓			✓		6/16														✓

Special detection Limit/reporting

Special QA/QC

Remarks

Lab number 9306895

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: <0 0

	Date	Time		Date	Time
Relinquished by sampler: Erin Mc Lucas	6/17/93	2:00	Received by: David Alderman		
Relinquished by: David Alderman	6/17/93	3:10	Received by		
Relinquished by			Received by laboratory	6/17/93	1510

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

ARCO Products Company
Division of AtlanticRichfieldCompany

Task Order No. 2035-93-2

Chain of Custody

ARCO Facility no. 2035	City (Facility) ALBANY	Project manager (Consultant) ERIN MCLUCAS	Laboratory name SEQUOIA
ARCO engineer MIKE WHELAN	Telephone no. (ARCO) (415)571-2434	Telephone no. (Consultant) (408) 264-7723	Fax no. (Consultant) (408) 264-2435
Consultant name RESNA	Address (Consultant) 3315 ALMADEN EXPY, SUITE 34 SJ 95118		Contract number 07-073

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 (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 Semi-Metals ☐ VOA ☐ VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org./DHS ☐ Lead EPA 7420/7421 ☐	(Lead)
S-2-B26			✓			✓		6/15			✓			9306895					12		
S-10-B26																					✓
S-15-B26											✓								13		
S-21-B26																					✓
S-25-B26																					✓
S-30-B26											✓										✓
S-31-B26			✓			✓		✓			✓										

Special detection Limit/reporting

Special QA/QC

Remarks

Lab number 9306895

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

Relinquished by sampler: Erin W. McLucas	Date 6/17/93	Time 2:00	Received by: David Alderman
Relinquished by: David Alderman	Date 6/17/93	Time 3:10	Received by:
Relinquished by:	Date	Time	Received by laboratory: Rhuby

Date 6/17/93 Time 1510

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

APPC-9292 (2-91)

SEQUOIA ANALYTICAL

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

RESNA	Client Project ID:	Arco 2035-93-2	Sampled:	Jun 14-16, 1993
3315 Almaden Expwy., Suite 34	Sample Matrix:	Soil	Received:	Jun 17, 1993
San Jose, CA 95118	Analysis Method:	EPA 5030/8015/8020	Reported:	Jun 30, 1993
Attention: Erin McLucas	First Sample #:	3F89501		

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit mg/kg	Sample I.D. 3F89501 S-7.5-B27	Sample I.D. 3F89502 S-12-B27	Sample I.D. 3F89503 S-16.5-B27	Sample I.D. 3F89504 S-19.5-B27	Sample I.D. 3F89505 S-31-B27	Sample I.D. 3F89506 S-5-B23
Purgeable Hydrocarbons	1.0	690	660	N.D.	N.D.	N.D.	20
Benzene	0.0050	7.4	8.8	0.061	N.D.	N.D.	0.22
Toluene	0.0050	25	33	0.040	N.D.	0.0070	0.45
Ethyl Benzene	0.0050	13	14	0.0090	N.D.	N.D.	0.20
Total Xylenes	0.0050	64	76	0.040	N.D.	N.D.	0.76
Chromatogram Pattern:		Gas	Gas	Low Gas	--	Discrete Peak	Gas

Quality Control Data

Report Limit Multiplication Factor:	50	50	1.0	1.0	1.0	1.0
Date Analyzed:	6/23/93	6/25/93	6/23/93	6/22/93	6/21/93	6/22/93
Instrument Identification:	GCHP-6	GCHP-18	GCHP-6	GCHP-6	GCHP-18	GCHP-6
Surrogate Recovery, %: (QC Limits = 70-130%)	107	137	107	95	77	129

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

SEQUOIA ANALYTICAL

VM Tague

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 2035-93-2	Sampled: Jun 14-16, 1993
3315 Almaden Expwy., Suite 34	Sample Matrix:	Soil	Received: Jun 17, 1993
San Jose, CA 95118	Analysis Method:	EPA 5030/8015/8020	Reported: Jun 30, 1993
Attention: Erin McLucas	First Sample #:	3F89507	

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit mg/kg	Sample I.D. 3F89507 S-10-B23	Sample I.D. 3F89508 S-15-B23	Sample I.D. 3F89509 S-6-B24	Sample I.D. 3F89510 S-10.5-B24	Sample I.D. 3F89511 S-14.5-B24	Sample I.D. 3F89512 S-5-B26
Purgeable Hydrocarbons	1.0	490	N.D.	N.D.	310	N.D.	1,600
Benzene	0.0050	4.9	0.33	N.D.	3.8	0.014	7.7
Toluene	0.0050	19	0.012	N.D.	15	N.D.	45
Ethyl Benzene	0.0050	8.3	0.014	N.D.	6.6	N.D.	28
Total Xylenes	0.0050	50	0.014	N.D.	38	N.D.	170
Chromatogram Pattern:		Gas	Low Gas	--	Gas	Discrete Peak	Gas

Quality Control Data

Report Limit Multiplication Factor:	100	1.0	1.0	100	1.0	100
Date Analyzed:	6/21/93	6/22/93	6/22/93	6/25/93	6/22/93	6/21/93
Instrument Identification:	GCHP-18	GCHP-1	GCHP-6	GCHP-18	GCHP-1	GCHP-18
Surrogate Recovery, %: (QC Limits = 70-130%)	91	105	101	98	100	132 *

* Coelution confirmed.

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 2035-93-2	Sampled: Jun 14-16, 1993
3315 Almaden Expwy., Suite 34	Sample Matrix:	Soil	Received: Jun 17, 1993
San Jose, CA 95118	Analysis Method:	EPA 5030/8015/8020	Reported: Jun 30, 1993
Attention: Erin McLucas	First Sample #:	3F89513	

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit mg/kg	Sample I.D. 3F89513 S-15-B26	Sample I.D. 3F89514 S-31-B26
Purgeable Hydrocarbons	1.0	N.D.	N.D.
Benzene	0.0050	0.18	N.D.
Toluene	0.0050	0.019	N.D.
Ethyl Benzene	0.0050	0.015	N.D.
Total Xylenes	0.0050	0.047	N.D.
Chromatogram Pattern:		Low Gas	--

Quality Control Data

Report Limit Multiplication Factor:	50	1.0
Date Analyzed:	6/23/93	6/22/93
Instrument Identification:	GCHP-6	GCHP-6
Surrogate Recovery, %: (QC Limits = 70-130%)	112	77

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 2035-93-2
3315 Almaden Expwy., Suite 34	Matrix:	Soil
San Jose, CA 95118		
Attention: Erin McLucas	QC Sample Group: 3F89501-13	Reported: Jun 30, 1993

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-Benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	A. Marait	A. Marait	A. Marait	A. Marait
Conc. Spiked:	0.20	0.20	0.20	0.60
Units:	mg/Kg	mg/Kg	mg/Kg	mg/Kg
LCS Batch#:	BLK062193	BLK062193	BLK062193	BLK062193
Date Prepared:	6/21/93	6/21/93	6/21/93	6/21/93
Date Analyzed:	6/21/93	6/21/93	6/21/93	6/21/93
Instrument I.D.#:	GCHP-18	GCHP-18	GCHP-18	GCHP-18
LCS % Recovery:	105	105	100	103
Control Limits:	60-140	60-140	60-140	60-140
MS/MSD Batch #:	3F74201	3F74201	3F74201	3F74201
Date Prepared:	6/21/93	6/21/93	6/21/93	6/21/93
Date Analyzed:	6/21/93	6/21/93	6/21/93	6/21/93
Instrument I.D.#:	GCHP-18	GCHP-18	GCHP-18	GCHP-18
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

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

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(415) 364-9600 • FAX (415) 364-9233

RESNA	Client Project ID:	Arco 2035-93-2	Sampled: Jun 21, 1993
3315 Almaden Expwy., Suite 34	Sample Matrix:	Soil	Received: Jun 22, 1993
San Jose, CA 95118	Analysis Method:	EPA 5030/8015/8020	Reported: Jul 2, 1993
Attention: Erin McLucas	First Sample #:	3FA5501	

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit mg/kg	Sample I.D. 3FA5501 S-5.5-B25	Sample I.D. 3FA5502 S-9.5-B25	Sample I.D. 3FA5503 S-15-B25
Purgeable Hydrocarbons	1.0	630	N.D.	N.D.
Benzene	0.0050	1.7	N.D.	0.017
Toluene	0.0050	0.40	N.D.	0.022
Ethyl Benzene	0.0050	13	N.D.	N.D.
Total Xylenes	0.0050	36	N.D.	0.014
Chromatogram Pattern:		Gas	--	Low Gas

Quality Control Data

Report Limit Multiplication Factor:	50	1.0	1.0
Date Analyzed:	6/29/93	6/28/93	6/28/93
Instrument Identification:	GCHP-6	GCHP-18	GCHP-18
Surrogate Recovery, %: (QC Limits = 70-130%)	116	93	77

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

SEQUOIA ANALYTICAL

VMTague

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: Erin McLucas

Client Project ID: Arco 2035-93-2
Matrix: Soil
QC Sample Group: 3FA5501-03

Reported: Jul 2, 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#:	BLK062693	BLK062693	BLK062693	BLK062693
Date Prepared:	6/26/93	6/26/93	6/26/93	6/26/93
Date Analyzed:	6/26/93	6/26/93	6/26/93	6/26/93
Instrument I.D.#:	GCHP-18	GCHP-18	GCHP-18	GCHP-18
LCS % Recovery:	95	100	100	100
Control Limits:	60-140	60-140	60-140	60-140
MS/MSD Batch #:	3FA2702	3FA2702	3FA2702	3FA2702
Date Prepared:	6/26/93	6/26/93	6/26/93	6/26/93
Date Analyzed:	6/26/93	6/26/93	6/26/93	6/26/93
Instrument I.D.#:	GCHP-18	GCHP-18	GCHP-18	GCHP-18
Matrix Spike % Recovery:	75	80	80	80
Matrix Spike Duplicate % Recovery:	85	85	85	87
Relative % Difference:	13	6.1	6.1	8.4

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.

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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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APPENDIX D

CHAIN OF CUSTODY RECORDS AND LABORATORY ANALYSIS REPORTS FOR VAPOR SAMPLES

ARCO Products Company
Division of Atlantic Richfield Company

Task Order No.

Chain of Custody

ARCO Facility no. 2035	City (Facility) Albany	Project manager (Consultant) Bruce Maeda	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 95118		Contract number 07-073

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 8010/8010	EPA 8240/8240	EPA 625/8270	TCLP Metals / VOA / Semi VOA	CAM Metals EPA 6010/7000 TTLC / STLC	Lead Org./DHS / Lead EPA 7420/7421
AS-VW-8					X			8-25-93	9:56		X									
AS-VW-1					X				10:21		X									
AS-AS VENT		1			X				10:35		X									
AS-VW-2					X				10:41		X									
AS-VW-5					X				10:53		X									
AS-AS VENT		2			X				10:46		X									
AS-VW-9					X				10:00		X									
AS-AS VENT		-1			X				12:47		X									
AS-AS VENT		2			X				12:54		X									
AS-VW-1					X				13:01		X									
AS-VW-4					X				13:08		X									
AS-VW-8					X				13:15		X									
					X															

9308055

Special detection Limit/reporting

Special QA/QC

Remarks

Lab number 9308C55

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

Condition of sample

Temperature received

Relinquished by sampler	Date	Time	Received by 722 4:07 PM 8/25/93
Relinquished by	Date 8/25	Time	Received by
Relinquished by	Date	Time	Received by laboratory Date 8/25/93 Time 1730

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	Client Project ID:	Arco 2035, Albany	Sampled:	Aug 25, 1993
3315 Almaden Expwy., Suite 34	Sample Matrix:	Air	Received:	Aug 25, 1993
San Jose, CA 95118	Analysis Method:	EPA 5030/8015/8020	Reported:	Aug 31, 1993
Attention: Bruce Maeda	First Sample #:	3HC5501		

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit mg/m³	Sample I.D. 3HC5501 AS-VW-6	Sample I.D. 3HC5502 AS-VW-1	Sample I.D. 3HC5503 AS-AS Vent 1	Sample I.D. 3HC5504 AS-VW-2	Sample I.D. 3HC5505 AS-VW-5	Sample I.D. 3HC5506 AS-AS Vent 2
		9:58	10:21	10:35	10:41	10:53	10:46
Purgeable Hydrocarbons	5.0	1,100	13,000	35,000	7,200	6,100	31,000
Benzene	0.050	73	1,100	2,400	470	400	3,500
Toluene	0.050	60	490	1,500	640	360	1,700
Ethyl Benzene	0.050	5.1	26	91	64	47	86
Total Xylenes	0.050	21	100	280	230	250	270
Chromatogram Pattern:		Gas	Gas + Non-gas < C8	Gas + Non-gas < C8	Gas	Gas	Gas + Non-gas < C8

Quality Control Data

Report Limit Multiplication Factor:	50	250	250	200	500	500
Date Analyzed:	8/26/93	8/26/93	8/26/93	8/26/93	8/26/93	8/26/93
Instrument Identification:	GCHP-2	GCHP-3	GCHP-3	GCHP-2	GCHP-2	GCHP-3
Surrogate Recovery, %: (QC Limits = 70-130%)	116	127	119	128	110	114

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

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RESNA	Client Project ID:	Arco 2035, Albany	Sampled:	Aug 25, 1993
3315 Almaden Expwy., Suite 34	Sample Matrix:	Air	Received:	Aug 25, 1993
San Jose, CA 95118	Analysis Method:	EPA 5030/8015/8020	Reported:	Aug 31, 1993
Attention: Bruce Maeda	First Sample #:	3HC5507		

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit mg/m³	Sample I.D. 3HC5507 AS-VW-4 11:00	Sample I.D. 3HC5508 AS-AS Vent 1 12:47	Sample I.D. 3HC5509 AS-AS Vent 2 12:54	Sample I.D. 3HC5510 AS-VW-1 13:01	Sample I.D. 3HC5511 AS-VW-4 13:08	Sample I.D. 3HC5512 AS-VW-8 13:15
Purgeable Hydrocarbons	5.0	29,000	4,600	49,000	12,000	34,000	5,600
Benzene	0.050	2,300	490	4,700	1,400	2,500	520
Toluene	0.050	1,200	560	2,700	1,000	1,700	320
Ethyl Benzene	0.050	69	57	160	67	86	40
Total Xylenes	0.050	300	220	520	250	270	140
Chromatogram Pattern:		Gas + Non-gas < C8	Gas	Gas+Non-gas < C8	Gas	Gas+Non-gas < C8	Gas

Quality Control Data

Report Limit Multiplication Factor:	200	200	500	250	200	250
Date Analyzed:	8/26/93	8/26/93	8/26/93	8/26/93	8/26/93	8/26/93
Instrument Identification:	GCHP-3	GCHP-2	GCHP-3	GCHP-2	GCHP-3	GCHP-2
Surrogate Recovery, %: (QC Limits = 70-130%)	115	116	112	135*	115	121

*Coelution confirmed

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
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RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: Bruce Maeda

Client Project ID: Arco 2035, Albany
Matrix: Liquid
QC Sample Group: 3HC5501, 4-5, 8, 10, 12

Reported: Aug 31, 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#:	GBLK082693	GBLK082693	GBLK082693	GBLK082693
Date Prepared:	N.A.	N.A.	N.A.	N.A.
Date Analyzed:	8/26/93	8/26/93	8/26/93	8/26/93
Instrument I.D.#:	GCHP-2	GCHP-2	GCHP-2	GCHP-2
LCS % Recovery:	85	85	85	87
Control Limits:	80-120	80-120	80-120	80-120
MS/MSD Batch #:	3HC3601	3HC3601	3HC3601	3HC3601
Date Prepared:	N.A.	N.A.	N.A.	N.A.
Date Analyzed:	8/26/93	8/26/93	8/26/93	8/26/93
Instrument I.D.#:	GCHP-2	GCHP-2	GCHP-2	GCHP-2
Matrix Spike % Recovery:	84	88	84	83
Matrix Spike Duplicate % Recovery:	97	100	97	100
Relative % Difference:	14	13	14	19

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
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RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: Bruce Maeda

Client Project ID: Arco 2035, Albany
Matrix: Liquid
QC Sample Group: 3HC5502-3, 6-7, 9, 11

Reported: Aug 31, 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#:	GBLK082693	GBLK082693	GBLK082693	GBLK082693
Date Prepared:	N.A.	N.A.	N.A.	N.A.
Date Analyzed:	8/26/93	8/26/93	8/26/93	8/26/93
Instrument I.D.#:	GCHP-3	GCHP-3	GCHP-3	GCHP-3
LCS % Recovery:	97	97	99	97
Control Limits:	80-120	80-120	80-120	80-120
MS/MSD Batch #:	3HC3602	3HC3602	3HC3602	3HC3602
Date Prepared:	N.A.	N.A.	N.A.	N.A.
Date Analyzed:	8/26/93	8/26/93	8/26/93	8/26/93
Instrument I.D.#:	GCHP-3	GCHP-3	GCHP-3	GCHP-3
Matrix Spike % Recovery:	96	96	96	93
Matrix Spike Duplicate % Recovery:	99	98	99	100
Relative % Difference:	4.1	3.1	3.1	7.3

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
CHAIN OF CUSTODY

[redacted] 68[redacted]esa[redacted]e Dr[redacted]Red[redacted] City[redacted] 94[redacted] (41[redacted]4-96[redacted]AX [redacted] 36[redacted]3
❑ 819 West Striker Ave. • Sacramento, CA 95834 • (916) 921-9600 FAX (916) 921-[redacted]00
❑ 1900 Bates Ave., Suite LM • Concord, CA 94520 • (510) 686-9600 FAX (510) 686-9689

Company Name: Arco	Project Name: Arco 2035
Address: 1000 SAN PABLO AVE	Billing Address (if different):
City: ALBANY State: CA Zip Code:	
Telephone: FAX #: 408-264-7723	P.O. #:
Report To: Bruce Maeda, REGNA Sampler: S. Ulaeu	QC Data: ❑ Level A (Standard) ❑ Level B ❑ Level C ❑ Level D

Turnaround Time: ❑ 10 Working Days ❑ 3 Working Days ❑ 2 - 8 Hours ❑ 7 Working Days ❑ 2 Working Days ☒ 5 Working Days ❑ 24 Hours

❑ Drinking Water ❑ Waste Water ☒ Other

Analyses Requested

Client Sample I.D.	Date/Time Sampled	Matrix Desc.	# of Cont.	Cont. Type	Sequoia's Sample #	TPHg/BTEX	TPHg/BTEX	%DO2	Comments
1. AS-2(sparge)	8/26/93/3:30		1	GLASS				X	%DO2 -4hr
2. "	3:33		2	VOA'S			X		
3. AS-1(sparge)	8/26/93/3:37		2	VOA'S			X		ANALYZE
4. "	3:40		1	GLASS				X	%DO2 -4hr
5.									
6. MW-2	8/26/93 3:50		1	GLASS				X	%DO2 -4hr
7.	3:55		2	VOA			X		
8. AS-2(vent) - ONLY	8/26/93 12:23		1	TEDLAR		X	930803	01	analyze
9. AS-2 (Vent) - 1	13:53		1	"		X		02	ASAP
10. AS-2 (Vent) - 2	15:00		1	"		X		03	within 72 hours

Relinquished By: Bruce Maeda	Date: 8/26/93	Time: 4:00pm	Received By: Coleman #758	Date: 8/26	Time: 403 PM
Relinquished By: Coleman #758	Date: 8/26/93	Time: 515pm	Received By:	Date:	Time:
Relinquished By:	Date:	Time:	Received By Lab: John Nutter	Date: 8/26/93	Time: 17:15

Were Samples Received in Good Condition? ❑ Yes ❑ No Samples on Ice? ❑ Yes ❑ No Method of Shipment_____ Page __ of __

SEQUOIA ANALYTICAL

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RESNA	Client Project ID:	ARCO 2035, Albany	Sampled:	Aug 26, 1993
3315 Almaden Expwy., Suite 34	Sample Matrix:	Air	Received:	Aug 26, 1993
San Jose, CA 95118	Analysis Method:	EPA 5030/8015/8020	Reported:	Aug 30, 1993
Attention: Bruce Maeda	First Sample #:	3HD0301		

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit mg/m3	Sample I.D. 3HD0301 AS-2(Vent)-Only	Sample I.D. 3HD0302 AS-2(Vent)-1	Sample I.D. 3HD0303 AS-2(Vent)-2
Purgeable Hydrocarbons	5.0	83,000	39,000	26,000
Benzene	0.050	5,700	2,500	1,600
Toluene	0.050	1,900	820	480
Ethyl Benzene	0.050	320	130	69
Total Xylenes	0.050	830	380	190
Chromatogram Pattern:		Gas + Non-Gas Mix <C8	Gas + Non-Gas Mix <C8	Gas + Non-Gas Mix <C8

Quality Control Data

Report Limit Multiplication Factor:	1,000	500	250
Date Analyzed:	8/27/93	8/27/93	8/27/93
Instrument Identification:	GCHP-3	GCHP-3	GCHP-3
Surrogate Recovery, %: (QC Limits = 70-130%)	132*	127	123

* Coelution confirmed.

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

SEQUOIA ANALYTICAL

VM Tague

Vickie Tague
Project Manager

SEQUOIA ANALYTICAL
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RESNA	Client Project ID:	ARCO 2035, Albany
3315 Almaden Expwy., Suite 34	Matrix:	Liquid
San Jose, CA 95118		
Attention: Bruce Maeda	QC Sample Group: 3HD0301-3	Reported: Aug 30, 1993

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-Benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	A. Miraftab	A. Miraftab	A. Miraftab	A. Miraftab
Conc. Spiked:	10	10	10	30
Units:	µg/L	µg/L	µg/L	µg/L
LCS Batch#:	BLK082793	BLK082793	BLK082793	BLK082793
Date Prepared:	-	-	-	-
Date Analyzed:	8/27/93	8/27/93	8/27/93	8/27/93
Instrument I.D.#:	GCHP-3	GCHP-3	GCHP-3	GCHP-3
LCS % Recovery:	110	110	110	110
Control Limits:	80-120	80-120	80-120	80-120
MS/MSD Batch #:	3HB0302	3HB0302	3HB0302	3HB0302
Date Prepared:	-	-	-	-
Date Analyzed:	8/27/93	8/27/93	8/27/93	8/27/93
Instrument I.D.#:	GCHP-3	GCHP-3	GCHP-3	GCHP-3
Matrix Spike % Recovery:	99	100	100	100
Matrix Spike Duplicate % Recovery:	96	98	97	97
Relative % Difference:	1.0	2.0	3.0	3.0

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

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RESNA	Client Project ID:	ARCO 2035, Albany	Sampled:	Aug 26, 1993
3315 Almaden Expwy., Suite 34	Sample Descript:	Water	Received:	Aug 26, 1993
San Jose, CA 95118	Analysis for:	Dissolved Oxygen		
Attention: Bruce Maeda	First Sample #:	3HD3101	Analyzed:	Aug 24, 1993
			Reported:	Sep 1, 1993

LABORATORY ANALYSIS FOR: Dissolved Oxygen

Sample Number	Sample Description	Detection Limit mg/L	Sample Result mg/L
3HD3101	AS-2 (sparge)	0.10	3.7
3HD3102	AS-1 (sparge)	0.10	4.8
3HD3103	MW-2	0.10	3.9

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

SEQUOIA ANALYTICAL

Vickie Tague
Project Manager

Please Note:
Sample temperature at time of analysis was 25.1°C.

SEQUOIA ANALYTICAL

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RESNA	Client Project ID:	ARCO 2035, Albany	Sampled:	Aug 26, 1993
3315 Almaden Expwy., Suite 34	Sample Matrix:	Water	Received:	Aug 26, 1993
San Jose, CA 95118	Analysis Method:	EPA 5030/8015/8020	Reported:	Sep 1, 1993
Attention: Bruce Maeda	First Sample #:	3HD3101		

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit µg/L	Sample I.D. 3HD3101 AS-2 (sparge)	Sample I.D. 3HD3102 AS-1 (sparge)	Sample I.D. 3HD3103 MW-2
Purgeable Hydrocarbons	50	23,000	460	N.D.
Benzene	0.50	740	26	16
Toluene	0.50	1,600	30	N.D.
Ethyl Benzene	0.50	440	2.4	N.D.
Total Xylenes	0.50	3,900	52	N.D.
Chromatogram Pattern:		Gas	Gas	Discrete Peak

Quality Control Data

Report Limit Multiplication Factor:	40	2.0	1.0
Date Analyzed:	8/29/93	8/29/93	8/29/93
Instrument Identification:	GCHP-2	GCHP-2	GCHP-2
Surrogate Recovery, %: (QC Limits = 70-130%)	97	92	92

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