RESNA
Working to Restore Nature

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# TRANSMITTAL

TO: Ms. Eva Chu
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DATE: June 16, 1994
PROJECT NUMBER: 60006.04
SUBJECT: ARCO Station 6041,
7249 Village Parkway, Dublin, California

FROM: Mr. David Peterson
TITLE: Staff Engineer

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David Peterson, Staff Engineer

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# REPORT OF FINDINGS
# AIR SPARGE PILOT TEST
at
ARCO Station 6041
7249 Village Parkway
Dublin, California

60006.04 June 1994

Report prepared for

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

by
RESNA Industries Inc.


Richard H. Walls

Richard H. Walls, P.E.
Sr. Project Engineer

June 10, 1994

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Report of Findings
Air Sparge Pilot Test

ARCO Station 237
1625 West Highway 140
Merced, California

For ARCO Products Company

## 1.0 INTRODUCTION

At the request of ARCO Products Company (ARCO), RESNA Industries Inc. (RESNA) performed an Air Sparge Pilot Test (AST) and a combination Air Sparge/Vapor Extraction Test at ARCO Station No. 6041, 7249 Village Parkway, Dublin, California. These tests were performed to evaluate the feasibility of using air sparging to remove dissolved and residual gasoline hydrocarbons from groundwater beneath the subject site. Work for this program included installing two air sparge wells (AS-1 and AS-2), and one vapor extraction well (VW-5), performing a one day 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, data evaluation 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

ARCO Station 6041 is located at the northeastern corner of the intersection of Village Parkway and Amador Valley Boulevard in Dublin, California. The location is shown on

Plate 1, Site Vicinity Map. The site is on a relatively flat, predominantly asphalt and concrete covered lot at an elevation of approximately 335 feet above mean sea level. Pertinent site features include four service islands, a station building, four gasoline underground storage tanks (UST's) in the southern part of the site, and the former waste-oil tank pit adjacent to the northern wall of the station building. Pertinent site features are shown on Plate 2, Generalized Site Plan.

Previous Environmental work at the site includes removal of a former waste oil tank and subsurface environmental investigations. The results of the waste oil tank removal (AGS, September 19, 1990) indicate that remediation would not be necessary in regards to the waste oil tank. The Subsurface Environmental Investigation (RESNA, February 12, 1992) and Additional Onsite Subsurface Investigation and Vapor Extraction Test (RESNA, January 29, 1993) revealed that the groundwater and soil beneath southern portion of the site has been impacted by gasoline hydrocarbons. The hydrocarbon impacted soil appears to be located above the local water table (approximately 7 to 12 feet below the ground surface) within capillary fringe. Shallow groundwater, encountered at the site at depths of approximately 10 to 15 feet appears to be partially confined. The lateral extent of gasoline hydrocarbons in the groundwater has been delineated at the site to less than 50 parts per billion (ppb) of TPHg with the exception of the southern and southwestern portions of the site.

## 2.2 Regional Geology and Hydrogeology

ARCO Station 6041 is located in the northwestern end of the Livermore Valley, within the Coast Ranges Geomorphic Province of Northern California. The Livermore Valley is approximately 13 miles long oriented in an east-west direction, approximately 4 miles wide, and is surrounded by hills of the Diablo Range. In the vicinity of the site, the valley floor slopes gently to the south-southeast. Soil in the vicinity of the subject site is mapped as Holocene alluvium that consists of unconsolidated, moderately to poorly sorted silt and clay rich in organic material, interfingered with and graded into coarser grained stream deposits toward higher elevations (Helley and others, 1979). Holocene alluvium (estimated to be 10 to 50 feet thick) overlies Pleistocene alluvium, which consists of weakly consolidated, poorly sorted, irregularly interbedded clay, silt, sand and gravel, and older sedimentary deposits. The Calaveras Fault is situated approximately 1/2-mile west of the site.

The Livermore Valley groundwater basin is divided into subbasins on the basis of fault traces or other hydrogeologic discontinuities (California Department of Water Resources, 1974). The groundwater system in Livermore Valley is a multi-layered system with an unconfined aquifer overlying a sequence of leaky or semi-confined aquifers. The subject site is located within the Dublin groundwater subbasin. The groundwater in this subbasin has been reported to be at depths ranging from 10 to 60 feet below ground surface (Alameda County Flood Control and Water Conservation District [ACFCWCD]), January 16, 1991). The groundwater gradient is generally toward the south-southeast (ACFCWCD, January 16, 1991). The principal streams in the vicinity of the site are Alamo Canal situated about 2/3 of a mile southeast of the site, and Dublin Creek which joins Alamo Canal about 2/3 of a mile south of the site.

## 3.0 INSTALLATION OF AIR SPARGE WELLS

### 3.1 Field Work

On October 12, 1993, three soil borings (B-17 through B-19) were drilled and one vapor extraction well (VW-5) and two air sparge wells (AS-1 and AS-2) were constructed. Vapor extraction well VW-5 and air sparge well AS-1 were installed in the western portion of the site in the vicinity of the service islands. Air sparge well AS-2 was located in the southern portion of the site near the existing USTs. 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 2A through 4A). Results of laboratory analyses for soil samples 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 in borings B-17 through B-19 consisted primarily of silty clay to clayey sand. Graphic interpretations of the soil stratigraphy encountered in the borings from this and previous investigations are shown on Geologic Cross Section C-C' (Plate 3). The location of the cross section is shown on Plate 2.

Beneath the asphalt and baserock four units have been observed. The first unit consists of silty sand and sandy silt to a depth of approximately 8½ feet; the second unit consists of silty clay to depths of between 12½ and 13 feet; the third unit consists of fine-grained clayey sand to depths of approximately 18 to 19½ feet; the bottom unit observed in borings B-18 and B-19 consists of silty clay to unknown depths. Water was encountered in the borings at depths between approximately 10½ and 11 feet. Complete descriptions of the subsurface materials are shown on Plates 2A through 4A, Logs of Borings.

### 3.3 Sparge Well Construction

As discussed previously, one vapor extraction well (VW-5) and two air sparge wells (AS-1 and AS-2) were constructed in borings B-17 through B-19, respectively, using the methods summarized in Appendix C. Vapor extraction well VW-5 was constructed using 4-inch-diameter, Schedule 40 PVC with 0.1 inch machine slots, and was screened from 5 to 15 feet. Air sparge wells AS-1 and AS-2 were constructed in the bottom of the borings using 2-inch-diameter, Schedule 40 PVC pipe, with 2 feet of 2-inch-diameter, 0.020-inch machine slots at the bottom of the borings. For specific details of individual well construction see Logs of Borings B-17 through B-19 (Plates 2A through 4A).

## 4.0 AIR SPARGE PILOT TESTING

### 4.1 Purpose

Air sparge pilot testing was performed at the site on February 23 and 24, 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 selected 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.

Testing equipment included a trailer mounted air compressor equipped with filters capable of removing oil mist, a helium tank 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 the sparge test performed, a 4:1 mixture of air and 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 monitoring and vadose zone gas samples were collected for TPHg and helium monitoring.

The first day of pilot testing (air sparging only) employed air sparge well AS-1 as an injection point while wells VW-5 and MW-1 were used as monitoring points. The distances from AS-1 to the monitoring points are approximately 2-1/2 and 11 feet, respectively. The second phase of testing (day 2) included a combined air sparge and vapor extraction test using AS-1 as the sparge well and VW-5 as the vapor-extraction well. A data summary for the various wells is included in Table 2.

## 4.3 Field Results

During the sparge test total air/helium injection to AS-1 was initially achieved at a flowrate of approximately 3.75 actual cubic feet per minute (acfm) at a delivery pressure of 20 pounds per square inch gauge (psig). Helium was detected in the vadose zone at VW-5 at levels ranging from 13% to 18%. With the exception of an initial helium measurement of 0.11% in MW-1, helium was not detected in the vadose zone at monitoring point MW-1 at

any time during the test. Helium was detected in the saturated zone at monitoring point VW-5 at levels ranging from 0.73% to 8.40% by the end of the test. Helium was not detected in the saturated zone at monitoring point MW-1 at any time during the test.

During the combined air sparge and vapor extraction test, total air/helium injection to AS-1 was initially achieved at a flowrate of 3.5 acfm at a delivery pressure of 20 psi. Vapor extraction occured from VW-5 at an initial flowrate of approximately 27 acfm at a vacuum of 17 inches of water column (IWC). The maximum induced vacuum measured during this portion of the test was in VW-1 at 0.23 IWC. However, during most of the combined test the vacuum response in both MW-1 and VW-1 was either zero or less than 0.1 IWC. Field data is 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 (Sequoia), 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 3.

Soil gas samples collected while sparging only indicated TPHg vapor concentrations in the vadose zone decreased at VW-5 and MW-1. Concentrations of dissolved TPHg in groundwater increased slightly in MW-1 (110 ppb to 840 ppb) and increased significantly in VW-5 (19,000 ppb to 63,000 ppb).

## 5.0 DISCUSSION AND CONCLUSIONS

While sparging (without vapor extraction) the percentage of helium in the saturated zone at VW-5 increased from 0.73 to 8.4 percent; additionally, the percentage of helium in the vadose zone remained relatively constant ranging from 13 to 18 percent. These results suggest that sparge influence was occuring in the immediate vicinity of the sparge well. VW-5 is located 2-1/2 feet from AS-1. With the exception of helium being detected one time at MW-1 (0.11% helium in the vadose zone), during the entire duration of the test,

helium was not detected in either the vadose or saturated zones at MW-1. Because it is expected that, at a minimum, helium would be present in the vadose zone, these results suggest that the migration pathways of helium are being significantly influenced by the subsurface geology in the study zone.

These results are further supported by the field data obtained during the combined air sparge and vapor extraction test. The vacuum response at monitoring point MW-1 (located approximately nine feet from extraction well VW-5) was negligable ranging from zero to 0.06 IWC. The one vacuum response of 0.4 IWC at MW-1 is considered anomolus. Due to the lack of helium and vacuum response data, it appears that air sparging may not be feasible due to the non-homogeneous nature of sediments within both the vadose and saturated zones. The relatively low permeable sediments would likely result in significant channeling of sparge air resulting in incomplete coverage. In addition, the ability to capture off-gas from the saturated zone was not demonstrated during the test and may not be possible.

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

- There were no responses to sparging and vapor extraction observed at distances greater than 2-1/2 feet from the sparge well.

- The ability to capture sparge off-gas utilizing vapor extraction was not demonstrated during the test and may not be possible due to the subsurface geology.

- The sediment types beneath the site suggest that the channeling of sparge air is likely and may result in incomplete remedial coverage. This is supported by the complete lack of response data at a distance of 11 feet from the sparge well.

- Air sparging does not appear to be a feasible method for remediating groundwater beneath the site.

## 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

Alameda County Flood Control and Water Conservation District, Zone 7. January 16, 1991. Fall 1990 groundwater Level Report.

Applied GeoSystems. September 19, 1990. Letter Report Limited Environmental Investigation Related to the Removal of Waste-Oil Tank at ARCO Station 6041, 7249 Village Parkway, Dublin, California. 60006-1.

California Department of Water Resources, 1974. Evaluation of Ground-Water Resources Engineering Livermore and Sunol Valleys; Bulletin No. 118-2, Appendix A.

Chevron Research and Technology Company, Environmental Group, October 10, 1991, Chevron USA Inc. Marketing Department, Vapor Extraction System Performance Study.

Department of Health Services, State of California. October 24, 1990. Summary of California Drinking Water Standards.

PACIFIC AERIAL SURVEYS. Aerial Photographs: AV-253-24-34 (5/16/57), AV-844-20-45 (5/3/68), AV-1498-7-28 (5/5/78), AV-3368-23-41 (8/18/88).

RESNA. August 22, 1991. Work Plan for Subsurface Investigation and Remediation at ARCO Station 6041, 7249 Village Parkway, Dublin, California. 60006.02.

RESNA. August 22, 1991. Addendum One to Work Plan for Subsurface Investigation and Remediation at ARCO Station 6041, 7249 Village Parkway, Dublin, California. 60006.02.

RESNA. February 12, 1992. Subsurface Environmental Investigation at ARCO Station 6041, 7249 Village Parkway, Dublin, California. 60006.02

**REFERENCES**
**(Continued)**

RESNA. March 7, 1992. Letter Report, Quarterly Groundwater Monitoring, Fourth Quarter 1992 at ARCO Station, 6041, 7249 Village Parkway, Dublin, California. 60006.03

RESNA. May 1, 1992. Letter Report, Quarterly Groundwater Monitoring, First Quarter 1992 at ARCO Station, 6041, 7249 Village Parkway, Dublin, California. 60006.03

RESNA. September 25, 1992. Letter Report, Quarterly Groundwater Monitoring, Second Quarter 1992 at ARCO Station, 6041, 7249 Village Parkway, Dublin, California. 60006.03

RESNA. September 29, 1992. Work Plan for Initial Offsite and Additional Onsite Subsurface Investigations at ARCO Station 6041, 7249 Village Parkway, Dublin, California. 60006.04

RESNA. October 23, 1992. Site Safety Plan. 60006.SP

RESNA November 3, 1992. Notification Letter of Vapor Extraction Test to be Performed at ARCO Station 6041, 7249 Village Parkway, Dublin, California. 60006.04

RESNA. December 3, 1992. Letter Report, Quarterly Groundwater Monitoring, Third Quarter 1992 at ARCO Station, 6041, 7249 Village Parkway, Dublin, California. 60006.03

RESNA. January 29, 1993. Additional Onsite Subsurface Investigation and Vapor Extraction Test at ARCO Station 6041, 7249 Village Parkway, Dublin, California. 60006.04

VISTA Environmental Information, Inc. December 15, 1992. Radius Status Report. 3-10264

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TABLE 1
CUMULATIVE LABORATORY ANALYTICAL RESULTS OF SOIL SAMPLES
ARCO Station 6041
Dublin, California
(Page 1 of 3)

| Sample ID | TPHg ppm | B ppm | T | E | X |
|---|---|---|---|---|---|
| September 1991 | | | | | |
| ~~S-9½-B1~~ | ~~150~~ | ~~0.80~~ | 4.2 | 2.4 | 13 |
| S-14½-B1 | <1.0 | 0.0060 | 0.019 | 0.0090 | 0.060 |
| S-21½-B1 | <1.0 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| S-4½-B2 | 2.5 | 0.071 | <0.0050 | 0.093 | 0.017 |
| S-9½-B2 | 6.3 | 0.30 | 0.011 | 0.30 | 0.060 |
| S-15½-B2 | <1.0 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| ~~S-9½-B3~~ | ~~53~~ | ~~1.2~~ | 2.5 | 1.4 | 8.5 |
| S-19½-B3 | <1.0 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| S-0913-SP1(A-D) | 1.9 | 0.027 | <0.0050 | 0.035 | 0.0070 |
| S-0913-SP2(A-D) | 18 | 0.045 | 0.43 | 0.29 | 1.8 |
| October 1992 | | | | | |
| S-5½-B4 | <1.0 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| S-9½-B4 | <1.0 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| S-15½-B4 | <1.0 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| S-5½-B5 | <1.0 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| S-10-B5 | <1.0 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| S-19½-B5 | <1.0 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| S-5½-B6 | <1.0 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| S-10½-B6 | <1.0 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| S-18½-B6 | <1.0 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| S-5½-B7 | <1.0 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| S-10-B7 | <1.0 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| S-5½-B8 | 1.6 | 0.091 | <0.0050 | 0.060 | 0.14 |
| S-10-B8 | <1.0 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |

See Notes on Page 3 of 3

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TABLE 1
CUMULATIVE LABORATORY ANALYTICAL RESULTS OF SOIL SAMPLES
ARCO Station 6041
Dublin, California
(Page 2 of 3)

| Sample ID | TPHg | B | T | E | X |
|---|---|---|---|---|---|
| October 1992 cont. | | | | | |
| S-5½-B9 | 4.1 | 0.21 | 0.018 | 0.11 | 0.26 |
| S-10-B9 | <1.0 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| S-5½-B10 | 16 | 0.26 | 0.69 | 0.30 | 2.1 |
| S-10½-B10 | [illegible] | [illegible] | 74 | 59 | 390 |
| S-1027-SP1(A-D) | <1.0 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| S-1027-SP2(A-D)* | 110 | 0.42 | 2.9 | 2.1 | 12 |
| August 1993 | | | | | |
| S-6-B11 | <1.0 | 0.10 | <0.0050 | <0.0050 | <0.0050 |
| [illegible] | [illegible] | [illegible] | <0.0050 | 8.3 | 210 |
| S-18.5-B11 | <1.0 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| S-6-B12 | <1.0 | 0.16 | 0.017 | 0.016 | 0.050 |
| [illegible] | [illegible] | [illegible] | 2.0 | 13 | 50 |
| S-18.5-B12 | <1.0 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| S-5-B13 | 7.5 | 0.054 | <0.0050 | 0.20 | 0.15 |
| [illegible] | [illegible] | [illegible] | <0.0050 | 8.8 | 7.5 |
| S-20-B13 | 2.3 | 0.020 | <0.0050 | 0.058 | 0.051 |
| S-6.5-B14 | <1.0 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| S-9.5-B14 | 1.4 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| S-5-B15 | <1.0 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| S-9.5-B15 | <1.0 | 0.038 | <0.0050 | <0.0050 | <0.0050 |
| S-6.5-B16 | <1.0 | 0.019 | <0.0050 | 0.018 | 0.031 |
| [illegible] | [illegible] | [illegible] | 1.9 | 9.4 | 2.5 |
| S-18.5-B16 | <1.0 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| 0811-SP-(A-D) | 4.6 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |

STLC Lead: 0.11 Reactivities: none pH: 8.2 Ignitability: >100° C

See Notes on Page 3 of 3

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TABLE 1
CUMULATIVE LABORATORY ANALYTICAL RESULTS OF SOIL SAMPLES
ARCO Station 6041
Dublin, California
(Page 3 of 3)

| Sample ID | TPHg | B | T | E | X |
|---|---|---|---|---|---|
| S-6-B17 | 19 | 0.80 | 0.043 | 1.1 | 0.64 |
| S-10.5-B17 * | 5,100 | 30 | 40 | 72 | 410 |
| S-5.5-B18 | 29 | 1.5 | 0.56 | 2.4 | 0.80 |
| S-10.5-B18 | 4,400 | 20 | 77 | 69 | 450 |
| S-25-B18 | <1.0 | <0.0050 | 0.0070 | 0.0060 | 0.053 |
| S-6-B19 | 20 | 0.22 | 0.39 | 0.24 | 1.7 |
| S-10-B19 | 3,900 | 13 | 55 | 41 | 290 |
| S-20.5-B19 | <1.0 | <0.0050 | <0.0050 | <0.0050 | 0.014 |
| 1012-SP-(A-D) | 96 | 0.031 | 0.110 | 0.100 | 0.670 |
| STLC Lead: 0.18 | Reactivities: none | pH: 8.0 | Ignitability: >100°C | | |

Results measured in part per million (ppm).
TPHg: Total petroleum hydrocarbons as gasoline (analyzed by EPA Method 5030/8015/8020).
B: benzene; T: toluene; E: ethylbenzene; X: total xylenes.
BTEX: Analyzed by EPA Method 5030/8015/8020.
<: Less than the laboratory detection limit.
*: Additional analyses were performed for soil disposal. Results were as follows:
STLC lead by EPA Method 7421; 0.13 mg/L;
corrosivity by EPA 9045; pH = 8.5;
ignitability by EPA 1010; flashpoint >100°C;
reactivity by EPA 9010 and 9030; below detection limit.
Sample Identification:

S-19½-B3
- S: Soil sample
- 19½: Depth in feet
- B3: Boring number

S-1027-SP2(A-D)
- S: Stockpile sample
- 1027: Sampling date
- SP2: Stockpile number
- (A-D): Composite sample A through D

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TABLE 2
SPARGE AND VAPOR EXTRACTION WELL DATA SUMMARY
ARCO Station 6041
Dublin, California

| Well ID | Well Type | Depth-to-Water | Screened Interval | Depth of Well |
|---|---|---|---|---|
| AS-1 | Sparge | 9.00 | 17.5 to 19.5 | 19.5 |
| VW-1 | Vadose | 8.62 | 4 to 9.5 | 9.5 |
| VW-5 | Vadose | 9.00 | 5 to 14.5 | 14.5 |
| MW-1 | Monitoring | 9.26 | 14 to 17.5 | 17.5 |

Measurements in feet below ground surface.

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TABLE 3
AIR SPARGE TEST FIELD DATA
ARCO Station 6041
Dublin, California

**February 23, 1994**

| Time | AS-1 | VW-5 | MW-1 |
|---|---|---|---|
| Pre-Sparge | $TPHg_{GW}$ = 10,000 | $TPHg_{GW}$ = 19,000<br>$TPHg_V$ = 5,000 | $TPHg_{GW}$ = 110<br>$TPHg_V$ = 690 |
| 1:25<br>(start sparge) | $Q_A$ = 3.0<br>$Q_H$ = 0.75<br>$P_i$ = 20.0 | — | — |
| 1:30 | | $H_V$ = 13<br>$H_s$ = 0.73 | $H_V$ = 0.11<br>$H_s$ = 0.00 |
| 1:45 | | $H_V$ = 18<br>$H_s$ = 1.00 | $H_V$ = 0.00<br>$H_s$ = 0.00 |
| 2:00 | | $H_V$ = 17<br>$H_s$ = 3.10 | $H_V$ = 0.00<br>$H_s$ = 0.00 |
| 2:15 | | $H_V$ = 15<br>$H_s$ = 6.60 | $H_V$ = 0.00<br>$H_s$ = 0.00 |
| 2:30 | | $H_V$ = 14<br>$H_s$ = 7.80 | $H_V$ = 0.00<br>$H_s$ = 0.00 |
| 2:45 | | $H_V$ = 14<br>$H_s$ = 3.90 | $H_V$ = 0.00<br>$H_s$ = 0.00 |
| 3:00 | | $H_V$ = 15<br>$H_s$ = 8.40 | $H_V$ = 0.00<br>$H_s$ = 0.00 |
| 3:15<br>(end sparge) | $TPHg_{GW}$ = NS | $TPHg_{GW}$ = 63,000<br>$TPHg_V$ = 3,100 | $TPHg_{GW}$ = 840<br>$TPHg_V$ = 71 |
| Distance from sparge well | | 2'6" | 11'0" |

**Legend:**

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 or not sampled or measured.

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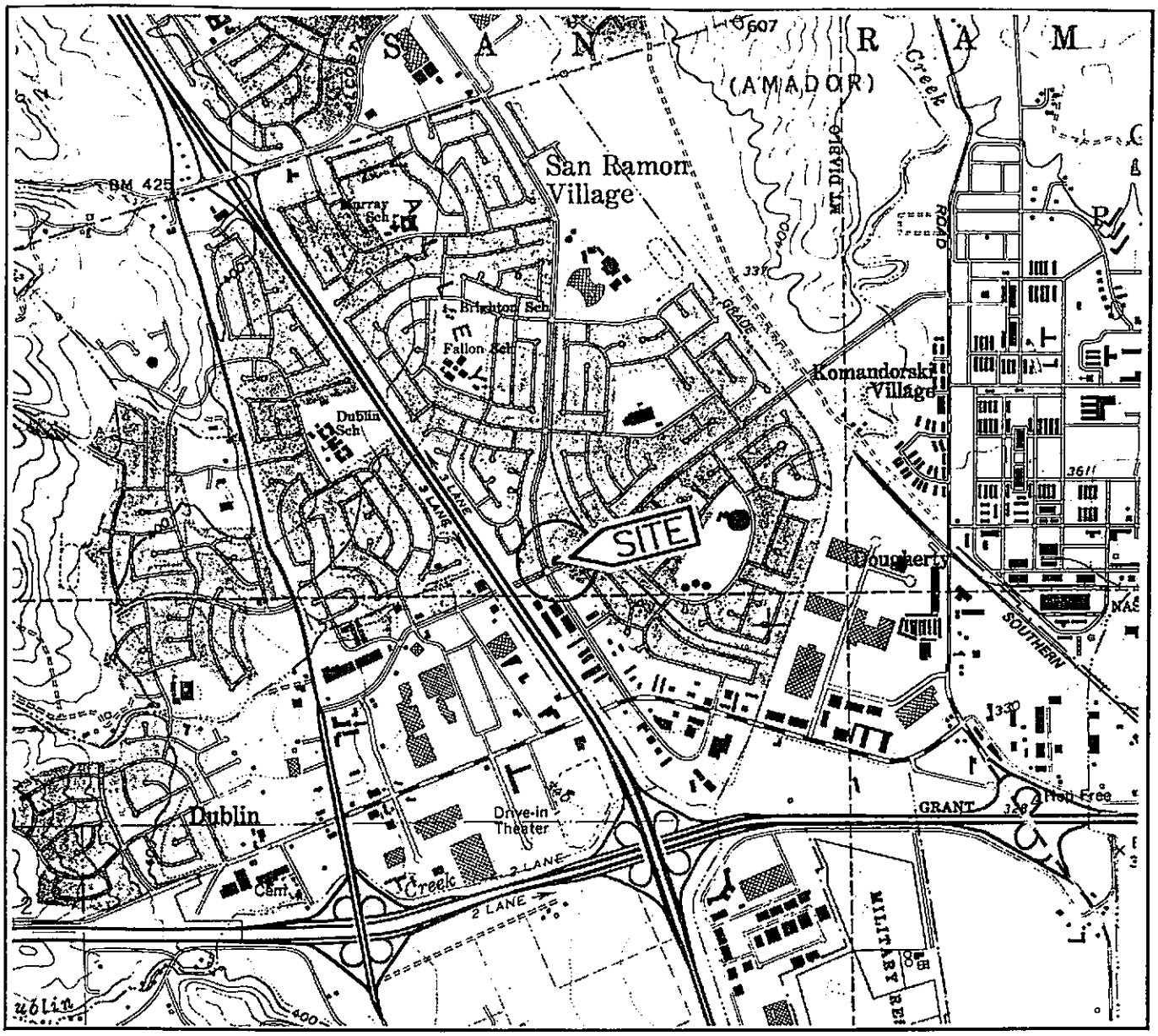
TABLE 4
COMBINATION VAPOR EXTRACTION/AIR SPARGE TEST FIELD DATA
ARCO Station 6041
Dublin, California

**February 24, 1994**

| Influent Air Stream from VW-5 | | | | Injection Well AS-1 | | Observation Wells | |
|---|---|---|---|---|---|---|---|
| Elapsed Time (min) | Flow Rate (acfm) | Applied Vacuum ("$H_2O$) | OVM Readings (ppm) | Flow Rate (acfm) | Applied Pressure (psi) | MW-1 Induced Vacuum ("$H_2O$) | VW-1 Induced Vacuum ("$H_2O$) |
| 0 | 26.7 | 16.9 | 1,200 | | | 0 | 0.01 |
| 25 | 26.7 | 18.3 | 1,649 | | | 0.01 | 0 |
| 40 | 26.7 | 18.9 | 1,471 | | | 0 | 0 |
| 55 | 26.7 | 18.8 | 1,550 | | | 0 | 0 |
| 70 | 26.7 | 18.3 | 1,552 | | | 0 | 0 |
| 85 | 39.1 | 27.9 | 1,685 | | | 0.06 | 0 |
| 100 | 39.1 | 28.5 | 2,389 | | | 0 | 0 |
| 110 | 87.0 | 52.2 | 4,685 | | | 0.40 | 0.23 |
| 130 | 87.0 | 52.2 | 4,473 | | | 0 | 0.20 |
| 135 | 43.5 | 40.5 | 4,712 | | | 0 | 0.12 |
| 137 | Begin Air Sparging | | | | | | |
| 145 | 43.5 | 37.7 | 6,105 | 3.5 | 20 | 0 | +0.12 |
| 160 | 43.5 | 38.7 | 7,263 | 2.5 | 20 | 0.07 | +0.20 |
| 175 | 43.5 | 37.8 | 5,505 | 2.5 | 20 | 0.19 | +0.21 |
| 190 | 43.5 | 38.2 | 5,560 | 2.5 | 15 | 0.08 | +0.13 |
| 205 | 43.5 | 40.3 | 5,930 | 2.0 | 15 | 0 | +0.04 |
| 220 | 43.5 | 40.2 | 7,622 | 2.0 | 15 | 0 | +0.04 |
| Distance from extraction well VW-5 (feet): | | | | 2'6" | | 9'1" | 40'8" |

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




Base: U.S. Geological Survey
7.5-Minute Quadrangle
Dublin, California.
Photorevised 1980

N

LEGEND

⊙ = Site Location

Approximate Scale

2000 1000 0 2000 4000

feet

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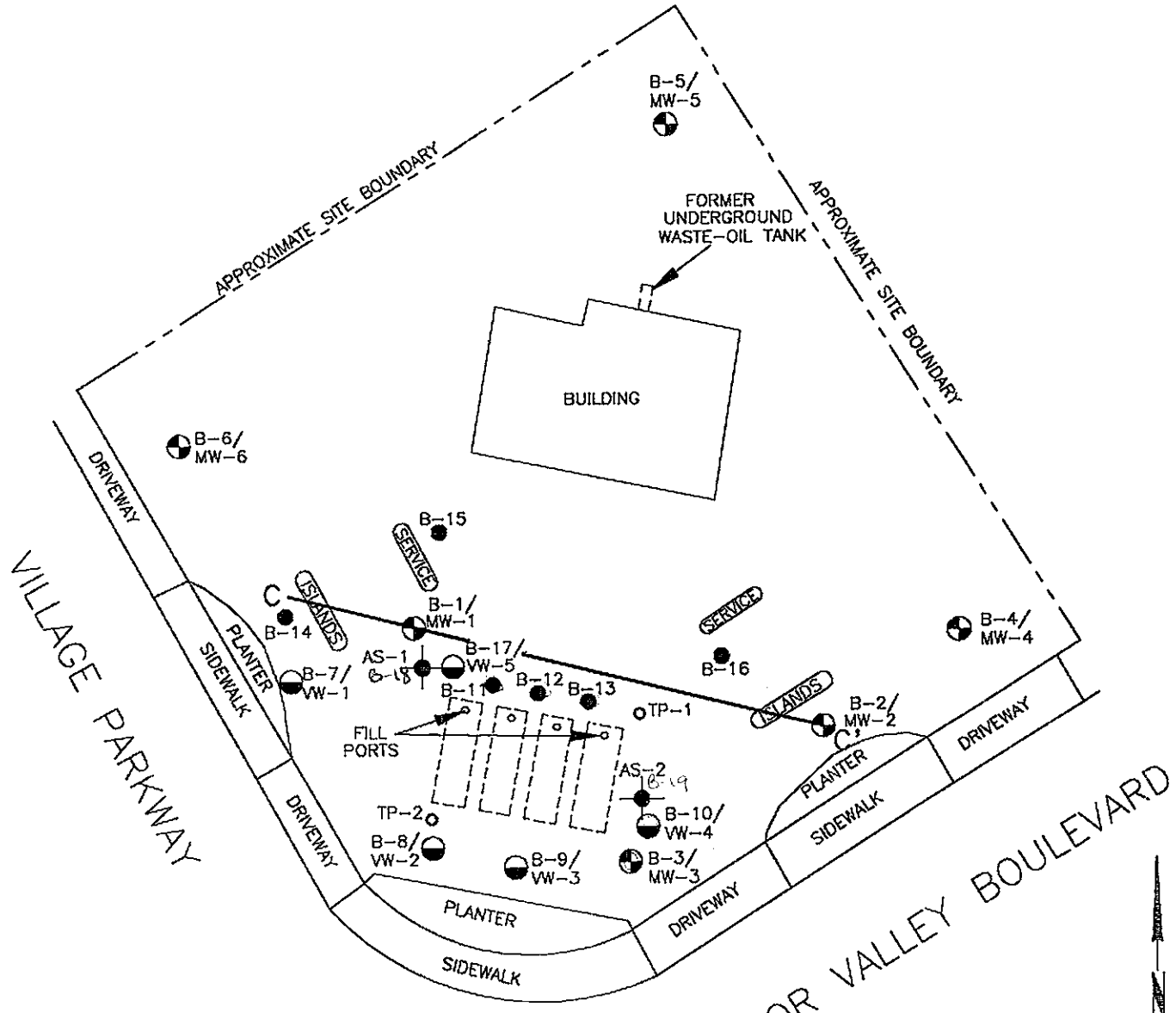
**SITE VICINITY MAP**
**ARCO Service Station 6041**
**7249 Village Parkway**
**Dublin, California**

**PLATE**
**1**




EXPLANATION

- = Tank pit observation well
- B-17/VW-5 = Boring/vapor extraction well (RESNA, October 1992)
- B-6/MW-6 = Boring/groundwater monitoring well (RESNA, September 1991 and October 1992)
- TP-2 = Tank pit observation well
- B-16 = Soil borings (RESNA, August 1993)
- AS-2 = Air-sparging well
- C — C' = Geologic cross section

↑ location where soil sample w/ > 1.0 ppm benzene @ ~ 9.5-11'

Approximate Scale

40 20 0 40 80

feet

Source: Modified from plan supplied by ARCO.

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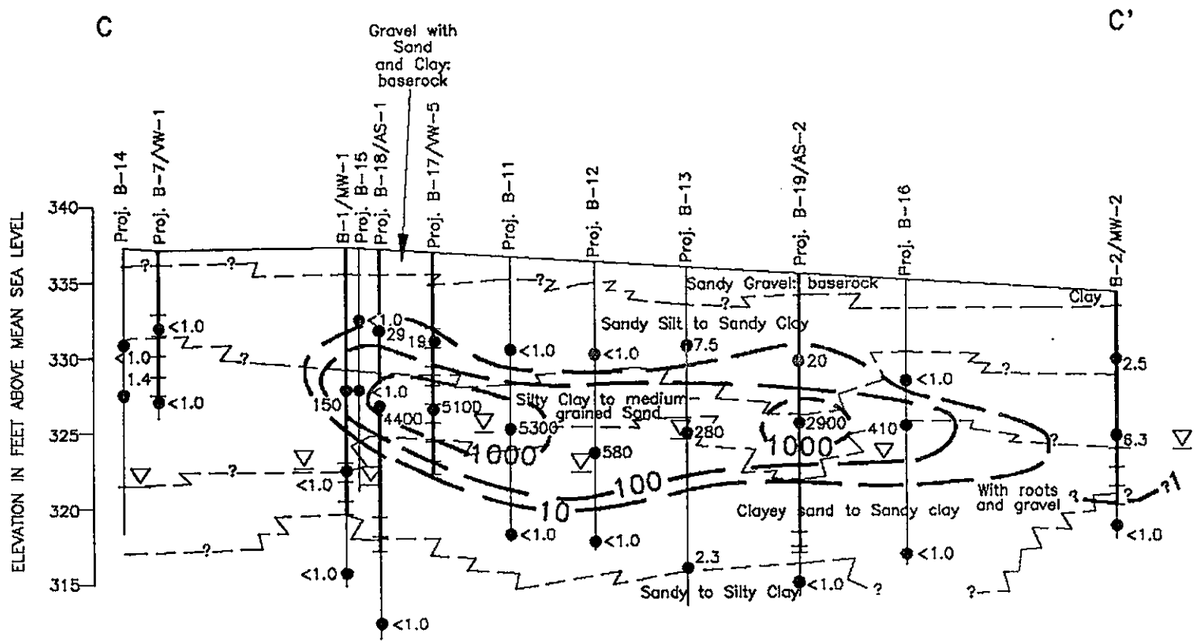
PROJECT 60006.04 6000646

GENERALIZED SITE PLAN
ARCO Service Station 6041
7249 Village Parkway
Dublin, California

PLATE 2




EXPLANATION

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

5,300 = Laboratory analyzed soil sample showing concentration of TPHg in ppm

= Well casing

= Well screen

= Boring

= Initial water level in boring

Approximate Horizontal Scale

20 10 0 20 40

feet

Approximate Vertical Scale

10 5 0 10 20

feet

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GEOLOGIC CROSS SECTION C-C'
ARCO Service Station 6041
7249 Village Parkway
Dublin, California

PLATE 3

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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. |


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

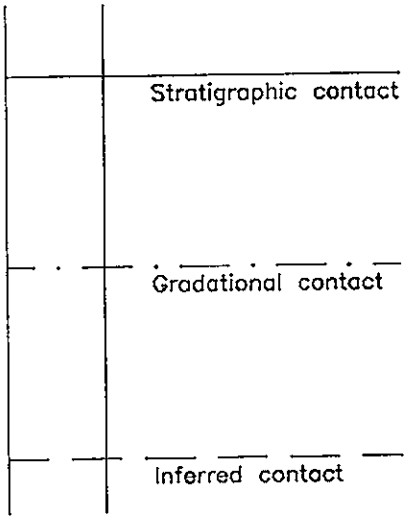

Neat cement


Caved native soil


Blank PVC


Machine-slotted PVC

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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UNIFIED SOIL CLASSIFICATION SYSTEM AND SYMBOL KEY
ARCO Station 6041
7249 Village Parkway
Dublin, California

PLATE 1A

Total depth of boring: 14 1/2 feet
Diameter of boring: 12 inches
Date drilled: 10/12/93
Drilling Company: Exploration Geoservices
Driller: Dave and Dennis
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: 5 feet to 14 1/2 feet
Field Geologist: Erin Krueger

Signature of Registered Professional: Richard H. Wells
Registration No.: C63139 State: CA

| P.I.D. | Sample No. | Blows | Depth | USCS Code | Description | Well Const. |
|---|---|---|---|---|---|---|
| | | | | | 4 inches of asphalt. | |
| | | | | GP | Sandy gravel, tan, damp, dense; baserock. | |
| | | | 2 | SM | Silty sand fine-grained, gray, damp, medium dense; roots. | |
| | | | 4 | | Pieces of 1/4" plywood and coarse gravel; fill. | |
| | | | | | Hand auger to 5 feet. | |
| | S-6 | 4 6 8 | 6 | | | |
| | | | 8 | | | |
| | | | | CL | Silty clay trace gravel, black, damp to wet, medium plasticity, stiff; contains gypsum crystals. | |
| | S-10.5 | 6 8 9 | 10 | | Blocky structure containing liquid with sheen, wet around gravel. | |
| | | | 12 | SC | Fine-grained clayey sand trace gravel, dark gray, moist to wet, medium dense, wet around gravel and water in rootholes. | |
| | | 9 11 14 | 14 | | Total Depth of Boring = 14 1/2 feet. | |
| | | | 16 | | | |
| | | | 18 | | | |
| | | | 20 | | | |
| | | | 22 | | | |
| | | | 24 | | | |
| | | | 26 | | | |
| | | | 28 | | | |
| | | | 30 | | | |
| | | | 32 | | | |
| | | | 34 | | | |
| | | | 36 | | | |
| | | | 38 | | | |
| | | | 40 | | | |

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PROJECT: 600006.04

# LOG OF BORING B-17/VW-5

ARCO Station 6041
7249 Village Parkway
Dublin, California

PLATE 2A

Total depth of boring: 25 1/2 feet
Diameter of boring: 8 inches
Date drilled: 10/12/93
Drilling Company: Exploration Geoservices
Driller: Dave and Dan Jr.
Drilling method: Hollow-Stem Auger

Casing diameter: 2 inches
Casing material: Sch 40 PVC
Slot size: 0.020-inch
Sand size: No. 3 Sand
Screen Interval: 17 1/2 feet to 19 1/2 feet
Field Geologist: Erin Krueger

Signature of Registered Professional: Richard H. Walls
Registration No.: C43139 State: CA

| P.I.D. | Sample No. | Blows | Depth | USCS Code | Description | Well Const. |
|---|---|---|---|---|---|---|
| | | | | | 4 inches of asphalt. | |
| | | | | GP | Sandy gravel, tan, damp, dense; baserock. | |
| | | | 2 | SM | Hand auger to 4 feet. | |
| | S-5.5 | 4 6 7 | 4 | | Silty sand fine-grained, gray, damp, medium dense; roots. | |
| | | | 6 | | | |
| | | | 8 | | | |
| | | | | CL | Silty clay, black, damp to wet, medium plasticity, stiff; wet around roots and gravel. | |
| | S-10.5 | 2 3 7 | 10 | | | |
| | | | 12 | | | |
| | | | | SC | Clayey sand fine-grained, trace gravel, gray, moist to wet, loose; wet around gravel, wet around roots, blocky structure. | |
| | | 2 3 4 2 3 4 5 6 7 8 8 8 10 | 14 | | | |
| | | | 16 | | | |
| | | | 18 | | Medium dense. | |
| | | | | CL | Silty clay, gray, damp to wet, medium plasticity, stiff; wet in rootholes, blocky structure. | |
| | | 4 4 5 6 9 14 20 | 20 | | | |
| | | | 22 | | | |
| | | | 24 | | | |
| | | | | | Total Depth of Boring = 25 1/2 feet. | |
| | | | 26 | | | |
| | | | 28 | | | |
| | | | 30 | | | |
| | | | 32 | | | |
| | | | 34 | | | |
| | | | 36 | | | |
| | | | 38 | | | |
| | | | 40 | | | |

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Working to Restore Nature

PROJECT: 600006.04

# LOG OF BORING B-18/AS-1

ARCO Station 6041
7249 Village Parkway
Dublin, California

PLATE 3A

| | | | |
|---|---|---|---|
| Total depth of boring: | 21 feet | Casing diameter: | 2 inches |
| Diameter of boring: | 8 inches | Casing material: | Sch 40 PVC |
| Date drilled: | 10/12/93 | Slot size: | 0.020-inch |
| Drilling Company: | Exploration Geoservices | Sand size: | No. 3 Sand |
| Driller: | John and Danny Jr. | Screen Interval: | 16 1/2 feet to 18 1/2 feet |
| Drilling method: | Hollow-Stem Auger | Field Geologist: | Erin Krueger |

Signature of Registered Professional: Richard H. Wells

Registration No.: C43139 State: CA

| P.I.D. | Sample No. | Blows | Depth | USCS Code | Description | Well Const. |
|---|---|---|---|---|---|---|
| | | | 0 | GP | 4 inches of asphalt. Sandy gravel, tan, damp, dense; baserock. | |
| | | | 2 | SM | Fine-grained silty sand, gray, damp, medium dense; roots. | |
| | S-6 | 3 4 7 | 6 | | | |
| | | | 8 | | | |
| | S-10 | 5 7 8 | 10 | ▽ CL | Silty clay, black, damp to wet, medium plasticity, stiff; wet fine gravel rootholes, gypsum crystals. | |
| | | | 12 | | | |
| | | | 14 | SC | Fine-grained clayey sand, trace gravel, tan to gray, damp to wet, loose; wet gravel and rootholes. | |
| | S-15.5 | 3 4 5 | 16 | | | |
| | | | 18 | | | |
| | S-20.5 | 4 6 8 | 20 | CL | Silty clay, tan and gray, damp to wet, medium plasticity, stiff. | |
| | | | 22 | | Total Depth of Boring = 21 feet. | |
| | | | 24 | | | |
| | | | 26 | | | |
| | | | 28 | | | |
| | | | 30 | | | |
| | | | 32 | | | |
| | | | 34 | | | |
| | | | 36 | | | |
| | | | 38 | | | |
| | | | 40 | | | |

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PROJECT: 600006.04

# LOG OF BORING B-19/AS-2

ARCO Station 6041
7249 Village Parkway
Dublin, California

PLATE 4A

# 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: ARCO 6041, Dublin

Enclosed are the results from 8 soil samples received at Sequoia Analytical on October 14,1993. The requested analyses are listed below:

| SAMPLE # | SAMPLE DESCRIPTION | DATE OF COLLECTION | TEST METHOD |
|---|---|---|---|
| 3J82601 | Soil, S-6-B17 | 10/12/93 | EPA 5030/8015/8020 |
| 3J82602 | Soil, S-10.5-B17 | 10/12/93 | EPA 5030/8015/8020 |
| 3J82603 | Soil, S-5.5-B18 | 10/12/93 | EPA 5030/8015/8020 |
| 3J82604 | Soil, S-10.5-B18 | 10/12/93 | EPA 5030/8015/8020 |
| 3J82605 | Soil, S-25-B18 | 10/12/93 | EPA 5030/8015/8020 |
| 3J82606 | Soil, S-6-B19 | 10/12/93 | EPA 5030/8015/8020 |
| 3J82607 | Soil, S-10-B19 | 10/12/93 | EPA 5030/8015/8020 |
| 3J82608 | Soil, S-20.5-B19 | 10/12/93 | 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

VMTague

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 6041, Dublin | Sampled: | Oct 12, 1993 |
| 3315 Almaden Expwy., Suite 34 | Sample Matrix: | Soil | Received: | Oct 14, 1993 |
| San Jose, CA 95118 | Analysis Method: | EPA 5030/8015/8020 | Reported: | Oct 21, 1993 |
| Attention: John Young | First Sample #: | 3J82601 | | |

## TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

| Analyte | Reporting Limit mg/kg | Sample I.D. 3J82601 S-6-B17 | Sample I.D. 3J82602 S-10.5-B17 | Sample I.D. 3J82603 S-5.5-B18 | Sample I.D. 3J82604 S-10.5-B18 | Sample I.D. 3J82605 S-25-B18 | Sample I.D. 3J82606 S-6-B19 |
|---|---|---|---|---|---|---|---|
| Purgeable Hydrocarbons | 1.0 | 19 | 5,100 | 29 | 4,400 | N.D. | 20 |
| Benzene | 0.0050 | 0.80 | 30 | 1.5 | 20 | N.D. | 0.22 |
| Toluene | 0.0050 | 0.043 | 40 | 0.56 | 77 | 0.0070 | 0.39 |
| Ethyl Benzene | 0.0050 | 1.1 | 72 | 2.4 | 69 | 0.0060 | 0.24 |
| Total Xylenes | 0.0050 | 0.64 | 410 | 0.80 | 450 | 0.053 | 1.7 |
| Chromatogram Pattern: | | Gas | Gas | Gas | Gas | Gas | Gas |

**Quality Control Data**

| | | | | | | |
|---|---|---|---|---|---|---|
| Report Limit Multiplication Factor: | 1.0 | 200 | 2.0 | 1,000 | 1.0 | 1.0 |
| Date Analyzed: | 10/18/93 | 10/18/93 | 10/19/93 | 10/19/93 | 10/18/93 | 10/18/93 |
| Instrument Identification: | GCHP-6 | GCHP-7 | GCHP-6 | GCHP-6 | GCHP-6 | GCHP-7 |
| Surrogate Recovery, %: (QC Limits = 70-130%) | 133* | 119 | 140 | 101 | 103 | 103 |

*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

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


| | | | | |
|---|---|---|---|---|
| RESNA | Client Project ID: | ARCO 6041, Dublin | Sampled: | Oct 12, 1993 |
| 3315 Almaden Expwy., Suite 34 | Sample Matrix: | Soil | Received: | Oct 14, 1993 |
| San Jose, CA 95118 | Analysis Method: | EPA 5030/8015/8020 | Reported: | Oct 21, 1993 |
| Attention: John Young | First Sample #: | 3J82607 | | |

## TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

| Analyte | Reporting Limit mg/kg | Sample I.D. 3J82607 S-10-B19 | Sample I.D. 3J82608 S-20.5-B19 |
|---|---|---|---|
| Purgeable Hydrocarbons | 1.0 | 2,900 | N.D. |
| Benzene | 0.0050 | 13 | N.D. |
| Toluene | 0.0050 | 55 | N.D. |
| Ethyl Benzene | 0.0050 | 41 | N.D. |
| Total Xylenes | 0.0050 | 290 | 0.014 |
| Chromatogram Pattern: | | Gas | Gas |

**Quality Control Data**

| | | |
|---|---|---|
| Report Limit Multiplication Factor: | 200 | 1.0 |
| Date Analyzed: | 10/19/93 | 10/18/93 |
| Instrument Identification: | GCHP-6 | GCHP-6 |
| Surrogate Recovery, %: (QC Limits = 70-130%) | 120 | 82 |

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 6041, Dublin |
| 3315 Almaden Expwy., Suite 34 | Matrix: | Soil |
| San Jose, CA 95118 | | |
| Attention: John Young | QC Sample Group: 3J82601-8 | Reported: Oct 21, 1993 |

## QUALITY CONTROL DATA REPORT

| ANALYTE | Benzene | Toluene | Ethyl-Benzene | Xylenes |
|---|---|---|---|---|
| **Method:** | EPA 8020 | EPA 8020 | EPA 8020 | EPA 8020 |
| **Analyst:** | A. Maralit | A. Maralit | A. Maralit | A. Maralit |
| **Conc. Spiked:** | 0.20 | 0.20 | 0.20 | 0.60 |
| **Units:** | mg/kg | mg/kg | mg/kg | mg/kg |
| **LCS Batch#:** | BLK101893 | BLK101893 | BLK101893 | BLK101893 |
| **Date Prepared:** | 10/18/93 | 10/18/93 | 10/18/93 | 10/18/93 |
| **Date Analyzed:** | 10/18/93 | 10/18/93 | 10/18/93 | 10/18/93 |
| **Instrument I.D.#:** | GCHP-6 | GCHP-6 | GCHP-6 | GCHP-6 |
| **LCS % Recovery:** | 90 | 105 | 105 | 107 |
| **Control Limits:** | 60-140 | 60-140 | 60-140 | 60-140 |
| **MS/MSD Batch #:** | 3J70801 | 3J70801 | 3J70801 | 3J70801 |
| **Date Prepared:** | 10/18/93 | 10/18/93 | 10/18/93 | 10/18/93 |
| **Date Analyzed:** | 10/18/93 | 10/18/93 | 10/18/93 | 10/18/93 |
| **Instrument I.D.#:** | GCHP-6 | GCHP-6 | GCHP-6 | GCHP-6 |
| **Matrix Spike % Recovery:** | 80 | 90 | 95 | 93 |
| **Matrix Spike Duplicate % Recovery:** | 85 | 90 | 100 | 100 |
| **Relative % Difference:** | 6.1 | 0.0 | 5.1 | 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.

**ARCO Products Company**
Division of AtlanticRichfieldCompany

**Task Order No.** 6041-92-2

**Chain of Custody**

| | | | |
|---|---|---|---|
| ARCO Facility no. 6041 | City (Facility) DUBLIN | Project manager (Consultant) JOHN YOUNG / ERIN KRUEGER | 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 INDUSTRIES | Address (Consultant) 3315 ALMADEN EXPY, SUITE 34, SAN JOSE 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 Metals ☐ VOA ☐ Semi VOA ☐ | CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐ | Lead Org./DHS ☐ Lead EPA 7420/7421 ☐ | HOLD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S-6-B17 | | | ✓ | | | ✓ | | 10/12/93 | 9:45 | | ✓ | | | 9310826-01A | | | | | | | |
| S-10.5-B17 | | | | | | | | | 9:50 | | ✓ | | | | | | | -02A | | | |
| S-5.5-B18 | | | | | | | | | 12:45 | | ✓ | | | | | | | -03A | | | |
| S-10.5-B18 | | | | | | | | | 13:05 | | ✓ | | | | | | | -04A | | | |
| S-25-B18 | | | | | | | | | 14:10 | | ✓ | | | | | | | -05A | | | |
| S-6-B19 | | | | | | | | | 15:20 | | ✓ | | | | | | | -06A | | | |
| S-10-B19 | | | | | | | | | 15:30 | | ✓ | | | | | | | -07A | | | |
| S-15.5-B19 | | | | | | | | | 15:45 | | | | | | | | | | | | ✓ |
| S-20.5-B19 | | | | | | | | | 16:00 | | ✓ | | | | | | | -08A | | | |

Special detection Limit/reporting

Special QA/QC

Remarks

OCT 14

Lab number 9310826

Turnaround time

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

Method of shipment

Condition of sample:

Temperature received:

| | | | |
|---|---|---|---|
| Relinquished by sampler: Erin Krueger | Date 10/14/93 | Time 9:15 | Received by |
| Relinquished by | Date 10/14 | Time 1100 | Received by |
| Relinquished by | Date | Time | Received by laboratory: A. Nguyen — Date 10/14 — Time 1100 |

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

ARPC-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 6041, Dublin

Enclosed are the results from 1 soil sample received at Sequoia Analytical on October 14,1993. The requested analyses are listed below:

| SAMPLE # | SAMPLE DESCRIPTION | DATE OF COLLECTION | TEST METHOD |
|---|---|---|---|
| 3J69301 | 1012-SP(A-D) | 10/12/93 | TCLP BTEX<br>EPA 5030/8015<br>STLC Lead<br>Corrosivity<br>Ignitability<br>Reactivity |

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

VMTague

Vickie Tague
Project Manager

# SEQUOIA ANALYTICAL

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(415) 364-9600 • FAX (415) 364-9233


| | | | | |
|---|---|---|---|---|
| RESNA | Client Project ID: | Arco 6041, Dublin | Sampled: | Oct 12, 1993 |
| 3315 Almaden Expwy., Suite 34 | Sample Matrix: | TCLP Extract of Soil | Received: | Oct 14, 1993 |
| San Jose, CA 95118 | Analysis Method: | EPA 5030/8020 | Reported: | Oct 18, 1993 |
| Attention: John Young | First Sample #: | 3J69301 | | |

## BTEX DISTINCTION

| Analyte | Reporting Limit µg/L | Sample I.D. 3J69301 1012-SP (A-D) |
|---|---|---|
| Benzene | 0.50 | 31 |
| Toluene | 0.50 | 110 |
| Ethyl Benzene | 0.50 | 100 |
| Total Xylenes | 0.50 | 670 |

**Quality Control Data**

| | |
|---|---|
| Report Limit Multiplication Factor: | 20 |
| Date Analyzed: | 10/15/93 |
| Instrument Identification: | GCHP-3 |
| Surrogate Recovery, %: (QC Limits = 70-130%) | 115 |

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 6041, Dublin | Sampled: | Oct 12, 1993 |
| 3315 Almaden Expwy., Suite 34 | Sample Matrix: | Soil | Received: | Oct 14, 1993 |
| San Jose, CA 95118 | Analysis Method: | EPA 5030/8015 | Reported: | Oct 18, 1993 |
| Attention: John Young | First Sample #: | 3J69301 | | |

## TOTAL PURGEABLE PETROLEUM HYDROCARBONS

| Analyte | Reporting Limit mg/kg | Sample I.D. 3J69301 1012-SP(A-D) |
|---|---|---|
| Purgeable Hydrocarbons | 1.0 | 96 |
| Chromatogram Pattern: | | Gas |

**Quality Control Data**

| | |
|---|---|
| Report Limit Multiplication Factor: | 1.0 |
| Date Analyzed: | 10/14/93 |
| Instrument Identification: | GCHP-6 |
| 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**

VMTague

Vickie Tague
Project Manager

# SEQUOIA ANALYTICAL

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(415) 364-9600 • FAX (415) 364-9233


| | | | | |
|---|---|---|---|---|
| RESNA | Client Project ID: | Arco 6041, Dublin | Sampled: | Oct 12, 1993 |
| 3315 Almaden Expwy., Suite 34 | Sample Descript: | STLC Extract of Soil, 1012-SP(A-D) | Received: | Oct 14, 1993 |
| San Jose, CA 95118 | | | Analyzed: | see below |
| Attention: John Young | Lab Number: | 3J69301 | Reported: | Oct 18, 1993 |

## LABORATORY ANALYSIS

| Analyte | Date Analyzed | Detection Limit mg/L | Sample Result mg/L |
|---|---|---|---|
| Lead | 10/18/93 | 0.025 | 0.18 |

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

**SEQUOIA ANALYTICAL**

Vickie Tague
Project Manager

3J69301.RES <3>

# SEQUOIA ANALYTICAL

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(415) 364-9600 • FAX (415) 364-9233


| | | | | |
|---|---|---|---|---|
| RESNA | Client Project ID: | Arco 6041, Dublin | Sampled: | Oct 12, 1993 |
| 3315 Almaden Expwy., Suite 34 | Sample Descript: | Soil, 1012-SP(A-D) | Received: | Oct 14, 1993 |
| San Jose, CA 95118 | | | Analyzed: | Oct 14-18, 1993 |
| Attention: John Young | Lab Number: | 3J69301 | Reported: | Oct 18, 1993 |

## CORROSIVITY, IGNITABILITY, AND REACTIVITY

| Analyte | Detection Limit | Sample Results |
|---|---|---|
| Corrosivity: | | |
| pH | N.A. | 8.0 |
| 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

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 6041, Dublin |
| 3315 Almaden Expwy., Suite 34 | Matrix: | Soil |
| San Jose, CA 95118 | | |
| Attention: John Young | QC Sample Group: 3J69301 | Reported: Oct 18, 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#:** | BLK101493 | BLK101493 | BLK101493 | BLK101493 |
| **Date Prepared:** | 10/14/93 | 10/14/93 | 10/14/93 | 10/14/93 |
| **Date Analyzed:** | 10/14/93 | 10/14/93 | 10/14/93 | 10/14/93 |
| **Instrument I.D.#:** | GCHP-6 | GCHP-6 | GCHP-6 | GCHP-6 |
| **LCS % Recovery:** | 95 | 95 | 95 | 95 |
| **Control Limits:** | 60-140 | 60-140 | 60-140 | 60-140 |
| **MS/MSD Batch #:** | 3J47403 | 3J47403 | 3J47403 | 3J47403 |
| **Date Prepared:** | 10/14/93 | 10/14/93 | 10/14/93 | 10/14/93 |
| **Date Analyzed:** | 10/14/93 | 10/14/93 | 10/14/93 | 10/14/93 |
| **Instrument I.D.#:** | GCHP-6 | GCHP-6 | GCHP-6 | GCHP-6 |
| **Matrix Spike % Recovery:** | 90 | 95 | 95 | 95 |
| **Matrix Spike Duplicate % Recovery:** | 95 | 100 | 100 | 100 |
| **Relative % Difference:** | 5.4 | 5.1 | 5.1 | 5.1 |

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

**SEQUOIA ANALYTICAL**

VM 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 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 6041, Dublin |
| 3315 Almaden Expwy., Suite 34 | Matrix: | Soil |
| San Jose, CA 95118 | | |
| Attention: John Young | QC Sample Group: 3J69301 | Reported: Oct 18, 1993 |

## QUALITY CONTROL DATA REPORT

| ANALYTE | Benzene | Toluene | Ethyl-Benzene | Xylenes | Lead |
|---|---|---|---|---|---|
| **Method:** | EPA 8020 | EPA 8020 | EPA 8020 | EPA 8020 | EPA 239.2 |
| **Analyst:** | A. Miraftab | A. Miraftab | A. Miraftab | A. Miraftab | J. Martinez |
| **Conc. Spiked:** | 10 | 10 | 10 | 30 | 0.050 |
| **Units:** | µg/L | µg/L | µg/L | µg/L | mg/L |
| **LCS Batch#:** | BLK101593 | BLK101593 | BLK101593 | BLK101593 | BLK101893 |
| **Date Prepared:** | - | - | - | - | 10/18/93 |
| **Date Analyzed:** | 10/15/93 | 10/15/93 | 10/15/93 | 10/15/93 | 10/18/93 |
| **Instrument I.D.#:** | GCHP-3 | GCHP-3 | GCHP-3 | GCHP-3 | MV-1 |
| **LCS % Recovery:** | 95 | 96 | 96 | 97 | 102 |
| **Control Limits:** | 80-120 | 80-120 | 80-120 | 80-120 | 75-125 |
| **MS/MSD Batch #:** | 3J50706 | 3J50706 | 3J50706 | 3J50706 | 3J76301 |
| **Date Prepared:** | - | - | - | - | 10/18/93 |
| **Date Analyzed:** | 10/15/93 | 10/15/93 | 10/15/93 | 10/15/93 | 10/18/93 |
| **Instrument I.D.#:** | GCHP-3 | GCHP-3 | GCHP-3 | GCHP-3 | MV-1 |
| **Matrix Spike % Recovery:** | 100 | 100 | 100 | 103 | 90 |
| **Matrix Spike Duplicate % Recovery:** | 100 | 100 | 98 | 100 | 89 |
| **Relative % Difference:** | 0.0 | 0.0 | 2.0 | 3.3 | 1.1 |

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

**SEQUOIA ANALYTICAL**

VMTague

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 | Client Project ID: | Arco 6041, Dublin |
| 3315 Almaden Expwy., Suite 34 | Matrix: | Solid |
| San Jose, CA 95118 | | |
| Attention: John Young | QC Sample Group: 3J69301 | Reported: Oct 18, 1993 |

## QUALITY CONTROL DATA REPORT

| ANALYTE | pH | Flashpoint | Reactive Cyanide | Reactive Sulfide |
|---|---|---|---|---|
| **Method:** | EPA 9045 | EPA 1010 | SW-846 | SW-846 |
| **Analyst:** | Y. Arteaga | K. Newberry | M. Nguyen | K. Newberry |
| **Units:** | N/A | °C | mg/kg | mg/kg |
| **Date:** | 10/14/93 | 10/12/93 | 10/12/93 | 10/12/93 |
| **Sample #:** | 3J68601 | 3J52701 | 3J30501 | 3J30501 |
| **Sample Concentration:** | 7.7 | >100°C | N.D. | N.D. |
| **Sample Duplicate Concentration:** | 7.7 | >100°C | N.D. | N.D. |
| **% RPD:** | 0.0 | 0.0 | 0.0 | 0.0 |
| **Control Limits:** | 0-30% | ±5.0°C | ±20% | ±20% |

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

**SEQUOIA ANALYTICAL**

Vickie Tague
Project Manager

[redacted]AR[redacted]Pro[redacted]s C[redacted]pan[redacted] [redacted] [redacted] [redacted] [redacted] [redacted] [redacted] [redacted] [redacted] [redacted] [redacted] [redacted] [redacted]ain [redacted]Cus[redacted]

Division of AtlanticRichfieldCompany

**Task Order No.** 6041-92-L

| | | | |
|---|---|---|---|
| ARCO Facility no. 6041 | City (Facility) DUBLIN | Project manager (Consultant) JOHN YOUNG / ERIN KRUEGER | 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 07-073 |
| Consultant name RESNA INDUSTRIES | Address (Consultant) 3315 ALMADEN EXPY, SUITE 34 SAN JOSE 95118 | | Method of shipment Sequoia |

| Sample I.D. | Lab no. | Container no. | Matrix: Soil | Water | Other | Preservation: Ice | Acid | Sampling date | Sampling time | BTEX TCLP 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 ☐ | STLC LEAD | RCI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1012-SP-A | | | ✓ | | | ✓ | | 10/12/93 | 17:50 | ✓ | | ✓ | | | | | | | | | ✓ | ✓ |
| 1012-SP-B | | | ✓ | | | ✓ | | ↓ | ↓ | | | | | | | | | | | | | |
| 1012-SP-C | | | ✓ | | | ✓ | | | | | | | | | | | | | | | | |
| 1012-SP-D | | | ✓ | | | ✓ | | | | | | | | | | | | | | | | |

Special detection Limit/reporting: 1

Special QA/QC

Remarks: Composite 4 to 1

OCT = 11

Lab number: 9310693-01

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: Erin D. Krueger | 10/14/93 | 9:15 |
| Relinquished by: [signature] | 10/14 | 1100 |
| Relinquished by: | | |

Received by: [signature]

Received by:

Received by laboratory: A. Nagi — Date 10/14 — Time 1100

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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# APPENDIX D

# CHAIN OF CUSTODY RECORDS AND LABORATORY ANALYSIS REPORTS FOR VAPOR AND 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 6041, Dublin

Enclosed are the results from 4 air samples received at Sequoia Analytical on February 24,1994. The requested analyses are listed below:

| SAMPLE # | SAMPLE DESCRIPTION | DATE OF COLLECTION | TEST METHOD |
|---|---|---|---|
| 4BE2201 | Air, AS-MW1 | 2/23/94 | EPA 5030/8015 Mod./8020 |
| 4BE2202 | Air, AS-VW5 | 2/23/94 | EPA 5030/8015 Mod./8020 |
| 4BE2203 | Air, 2AS-MW1 | 2/23/94 | EPA 5030/8015 Mod./8020 |
| 4BE2204 | Air, 2AS-VW5 | 2/23/94 | 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

VMTClark

Vickie Tague Clark
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 6041, Dublin | Sampled: Feb 23, 1994 |
| 3315 Almaden Expwy., Suite 34 | Sample Matrix: | Air | Received: Feb 24, 1994 |
| San Jose, CA 95118 | Analysis Method: | EPA 5030/8015 Mod./8020 | Reported: Mar 8, 1994 |
| Attention: John Young | First Sample #: | 4BE2201 | |

## TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

| Analyte | Reporting Limit µg/L | Sample I.D. 4BE2201 AS-MW1 | Sample I.D. 4BE2202 AS-VW5 | Sample I.D. 4BE2203 2AS-MW1 | Sample I.D. 4BE2204 2AS-VW5 |
|---|---|---|---|---|---|
| Purgeable Hydrocarbons | 5.0 | 690 | 5,000 | 71 | 3,100 |
| Benzene | 0.050 | N.D. | 110 | 1.8 | 82 |
| Toluene | 0.050 | N.D. | 8.2 | 1.7 | 31 |
| Ethyl Benzene | 0.050 | N.D. | 27 | 2.8 | 29 |
| Total Xylenes | 0.050 | N.D. | 4.9 | 12 | 99 |
| Chromatogram Pattern: | | Non-Gas Mix < C8 | Gas + Non-Gas Mix < C8 | Gas | Gas + Non-Gas Mix < C8 |

**Quality Control Data**

| | | | | |
|---|---|---|---|---|
| Report Limit Multiplication Factor: | 50 | 50 | 10 | 50 |
| Date Analyzed: | 2/25/94 | 2/25/94 | 2/25/94 | 2/25/94 |
| Instrument Identification: | GCHP-3 | GCHP-3 | GCHP-7 | GCHP-7 |
| Surrogate Recovery, %: (QC Limits = 70-130%) | 73 | 71 | 108 | 120 |

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

**SEQUOIA ANALYTICAL**

VMT Clark

Vickie Tague Clark
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 6041, Dublin
Matrix: Liquid
QC Sample Group: 4BE2201-2

Reported: Mar 8, 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#: | 4BA5201 | 4BA5201 | 4BA5201 | 4BA5201 |
| Date Prepared: | - | - | - | - |
| Date Analyzed: | 2/25/94 | 2/25/94 | 2/25/94 | 2/25/94 |
| 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: | 98 | 94 | 93 | 93 |
| Matrix Spike Duplicate % Recovery: | 100 | 100 | 100 | 100 |
| Relative % Difference: | 2.0 | 6.2 | 7.3 | 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.

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 Clark
Project Manager

Sequoia Analytical

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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 6041, Dublin
Matrix: Liquid
QC Sample Group: 4BE2203-4

Reported: Mar 8, 1994

## QUALITY CONTROL DATA REPORT

| ANALYTE | Benzene | Toluene | Ethyl Benzene | Xylenes |
|---|---|---|---|---|
| Method: | EPA 8020 | EPA 8020 | EPA 8020 | EPA 8020 |
| Analyst: | T. Costello | T. Costello | T. Costello | T. Costello |
| MS/MSD Batch#: | 4BD0602 | 4BD0602 | 4BD0602 | 4BD0602 |
| Date Prepared: | 2/25/94 | 2/25/94 | 2/25/94 | 2/25/94 |
| Date Analyzed: | 2/25/94 | 2/25/94 | 2/25/94 | 2/25/94 |
| Instrument I.D.#: | GCHP-7 | GCHP-7 | GCHP-7 | GCHP-7 |
| Conc. Spiked: | 10 µg/L | 10 µg/L | 10 µg/L | 30 µg/L |
| Matrix Spike % Recovery: | 97 | 97 | 97 | 97 |
| Matrix Spike Duplicate % Recovery: | 98 | 99 | 100 | 100 |
| Relative % Difference: | 1.0 | 2.0 | 3.0 | 3.0 |
| 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 Clark
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.** 6041-92-2

**Chain of Custody**

| | | | |
|---|---|---|---|
| ARCO Facility no. 6041 | City (Facility) DUBLIN | Project manager (Consultant) John Young | Laboratory name SEQUOIA |
| ARCO engineer Mike Whelan | Telephone no. (ARCO) | Telephone no. (Consultant) (408) 264-1723 | Fax no. (Consultant) 264-2435 |
| Consultant name RESNA INDUSTRIES | Address (Consultant) 3315 ALMADEN EXPY, SUITE 34, SJ 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 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-MW4 | | 1 | ½ | | air | | | 2/23/94 | | | ✓ | | | | 9402E22 | | | | | -01 | |
| ASVW5 | | 1 | ½ | | air | | | 2/23/94 | | | ✓ | | | | | | | | | -02 | |
| ASMW1 | | 1 | ½ | | air | | | 2/23/94 | | | ✓ | | | | | | | | | -03 | |
| SASVW5 | | 1 | ½ | | air | | | 2/23/94 | | | ✓ | | | | | | | | | -04 | |

Special detection Limit/reporting

Special QA/QC

Remarks

Lab number 9402E22

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: Craig D. Krueger | Date 2/24/94 | Time 12:30 | Received by: James R Allen |
| Relinquished by: James R Allen | Date 2/24/94 | Time 2:00 | Received by: |
| Relinquished by: | Date | Time | Received by laboratory: S. Dennis — Date 2/24/94 — Time 14:00 |

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

292 (

Sequoia Analytical

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

Project: Arco 6041, Dublin

Enclosed are the results from 3 air samples received at Sequoia Analytical on February 25,1994. The requested analyses are listed below:

| SAMPLE # | SAMPLE DESCRIPTION | DATE OF COLLECTION | TEST METHOD |
|---|---|---|---|
| 4BE7601 | Air, A-VW-5-INF90 | 2/24/94 | EPA 5030/8015 Mod./8020 |
| 4BE7602 | Air, A-VW-5-INF210 | 2/24/94 | EPA 5030/8015 Mod./8020 |
| 4BE7603 | Air, A-VW-5-EFF | 2/24/94 | 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

VM Tague

Vickie Tague
Project Manager

Sequoia Analytical

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819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

| | | | | |
|---|---|---|---|---|
| RESNA | Client Project ID: | Arco 6041, Dublin | Sampled: | Feb 24, 1994 |
| 3315 Almaden Expwy., Suite 34 | Sample Matrix: | Air | Received: | Feb 25, 1994 |
| San Jose, CA 95118 | Analysis Method: | EPA 5030/8015 Mod./8020 | Reported: | Mar 4, 1994 |
| Attention: John Young | First Sample #: | 4BE7601 | | |

## TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

| Analyte | Reporting Limit µg/L | Sample I.D. 4BE7601 A-VW-5-INF90 | Sample I.D. 4BE7602 A-VW-5-INF210 | Sample I.D. 4BE7603 A-VW-5-EFF |
|---|---|---|---|---|
| Purgeable Hydrocarbons | 5.0 | 2,300 | 18,000 | 22 |
| Benzene | 0.050 | 42 | 580 | 0.85 |
| Toluene | 0.050 | 37 | 520 | 0.49 |
| Ethyl Benzene | 0.050 | 39 | 390 | 0.68 |
| Total Xylenes | 0.050 | 110 | 1,000 | 2.0 |
| Chromatogram Pattern: | | Gas + Non-Gas Mix < C8 | Gas + Non-Gas Mix < C8 | Gas |

**Quality Control Data**

| | | | |
|---|---|---|---|
| Report Limit Multiplication Factor: | 50 | 100 | 1.0 |
| Date Analyzed: | 2/25/94 | 2/25/94 | 2/25/94 |
| Instrument Identification: | GCHP-3 | GCHP-2 | GCHP-3 |
| Surrogate Recovery, %: (QC Limits = 70-130%) | 82 | 218* | 73 |

* 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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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 6041, Dublin
Matrix: Liquid
QC Sample Group: 4BE7601, 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#: | 4BA5201 | 4BA5201 | 4BA5201 | 4BA5201 |
| Date Prepared: | - | - | - | - |
| Date Analyzed: | 2/25/94 | 2/25/94 | 2/25/94 | 2/25/94 |
| 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: | 98 | 94 | 93 | 93 |
| Matrix Spike Duplicate % Recovery: | 100 | 100 | 100 | 100 |
| Relative % Difference: | 2.0 | 6.2 | 7.3 | 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.

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

Client Project ID: Arco 6041, Dublin
Matrix: Liquid
QC Sample Group: 4BE7602

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#: | 4BA5201 | 4BA5201 | 4BA5201 | 4BA5201 |
| Date Prepared: | - | - | - | - |
| Date Analyzed: | 2/25/94 | 2/25/94 | 2/25/94 | 2/25/94 |
| 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: | 100 | 100 | 100 | 100 |
| Matrix Spike Duplicate % Recovery: | 87 | 88 | 88 | 87 |
| Relative % Difference: | 14 | 13 | 13 | 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.

**ARCO Products Company**
Division of AtlanticRichfieldCompany

**Task Order No.** 6041-92-2

**Chain of Custody**

| | | | |
|---|---|---|---|
| ARCO Facility no. 6041 | City (Facility) DUBLIN | Project manager (Consultant) JOHN C. YOUNG | Laboratory name SEQUOIA |
| ARCO engineer 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 EXP. SUITE 34, SAN JOSE, CA 95118 | | Contract number 72-073 |

| 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 ☐ VOA ☐ Semi VOA ☐ | CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐ | Lead Org./DHS ☐ Lead EPA 7420/7421 ☐ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A-VW-5-WF90 | 1 | | | | X | | | 2-24-94 | | X | | X | | | | | 9402E76 | | | | -01 |
| A-VW-5-WF210 | 1 | | | | X | | | ↓ | | X | | X | | | | | | | | | -02 |
| A-VW-5-EFF | 1 | | | | X | | | ↓ | | X | | X | | | | | | | | | -03 |

Special detection Limit/reporting

Special QA/QC

Remarks

Lab number 9402E76

Turnaround time

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

Method of shipment

Condition of sample:

Temperature received:

| | Date | Time | |
|---|---|---|---|
| Relinquished by sampler: Dora Buck | 2/25/94 | 11:25 | Received by: Steve Ten 2/25 14:25 |
| Relinquished by: Steve Ten | 2/25 | 12:15 | Received by: |
| Relinquished by: | Date | Time | Received by laboratory: Date 2/25/94 Time 12:15 |

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

Sequoia Analytical

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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 6041, Dublin

Enclosed are the results from 5 water samples received at Sequoia Analytical on February 24,1994. The requested analyses are listed below:

| SAMPLE # | SAMPLE DESCRIPTION | DATE OF COLLECTION | TEST METHOD |
|---|---|---|---|
| 4BF2201 | Water, W-9-AS1 | 2/23/94 | EPA 5030/8015 Mod./8020 |
| 4BF2202 | Water, W-9-MW1 | 2/23/94 | EPA 5030/8015 Mod./8020 |
| 4BF2203 | Water, W-9-VW5 | 2/23/94 | EPA 5030/8015 Mod./8020 |
| 4BF2204 | Water, 2W-MW1 | 2/23/94 | EPA 5030/8015 Mod./8020 |
| 4BF2205 | Water, 2W-VW5 | 2/23/94 | 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

VMT Clark

Vickie Tague Clark
Project Manager

Sequoia Analytical

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819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

| | | | | |
|---|---|---|---|---|
| RESNA | Client Project ID: | Arco 6041, Dublin | Sampled: | Feb 23, 1994 |
| 3315 Almaden Expwy., Suite 34 | Sample Matrix: | Water | Received: | Feb 24, 1994 |
| San Jose, CA 95118 | Analysis Method: | EPA 5030/8015 Mod./8020 | Reported: | Mar 10, 1994 |
| Attention: John Young | First Sample #: | 4BF2201 | | |

## TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

| Analyte | Reporting Limit µg/L | Sample I.D. 4BF2201 W-9-AS1 | Sample I.D. 4BF2202 W-9-MW1 | Sample I.D. 4BF2203 W-9-VW5 | Sample I.D. 4BF2204 2W-MW1 | Sample I.D. 4BF2205 2W-VW5 |
|---|---|---|---|---|---|---|
| Purgeable Hydrocarbons | 50 | 10,000 | 110 | 19,000 | 840 | 63,000 |
| Benzene | 0.50 | 310 | 3.3 | 4,600 | 9.7 | 3,000 |
| Toluene | 0.50 | N.D. | N.D. | N.D. | 0.78 | 2,100 |
| Ethyl Benzene | 0.50 | N.D. | N.D. | 1,900 | 3.9 | 2,500 |
| Total Xylenes | 0.50 | 2,200 | N.D. | N.D. | 5.7 | 13,000 |
| Chromatogram Pattern: | | Gas | Non-Gas Mix C4 - C12 | Gas + Discrete Peak | Gas + Non-Gas Mix > C8 | Gas |

**Quality Control Data**

| | | | | | |
|---|---|---|---|---|---|
| Report Limit Multiplication Factor: | 100 | 1.0 | 100 | 1.0 | 100 |
| Date Analyzed: | 3/1/94 | 3/1/94 | 3/3/94 | 3/2/94 | 3/2/94 |
| Instrument Identification: | GCHP-2 | GCHP-2 | GCHP-2 | GCHP-17 | GCHP-17 |
| Surrogate Recovery, %: (QC Limits = 70-130%) | 88 | 106 | 118 | 114 | 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**

VMTClark

Vickie Tague Clark
Project Manager

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA 94063, (415) 364-9600, FAX (415) 364-9233
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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 6041, Dublin
Matrix: Water
QC Sample Group: 4BF2201-2

Reported: Mar 10, 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#: | 4BG3007 | 4BG3007 | 4BG3007 | 4BG3007 |
| Date Prepared: | - | - | - | - |
| Date Analyzed: | 3/1/94 | 3/1/94 | 3/1/94 | 3/1/94 |
| 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: | 79 | 88 | 88 | 90 |
| Matrix Spike Duplicate % Recovery: | 78 | 88 | 88 | 90 |
| Relative % Difference: | 1.3 | 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.

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 Clark
Project Manager

4BF2201.RES <2>

Sequoia Analytical

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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 6041, Dublin
Matrix: Water
QC Sample Group: 4BF2204-5

Reported: Mar 10, 1994

# QUALITY CONTROL DATA REPORT

| ANALYTE | Benzene | Toluene | Ethyl Benzene | Xylenes |
|---|---|---|---|---|
| Method: | EPA 8020 | EPA 8020 | EPA 8020 | EPA 8020 |
| Analyst: | R. Vincent | R. Vincent | R. Vincent | R. Vincent |
| MS/MSD Batch#: | 4BE4607 | 4BE4607 | 4BE4607 | 4BE4607 |
| Date Prepared: | - | - | - | - |
| Date Analyzed: | 3/2/94 | 3/2/94 | 3/2/94 | 3/2/94 |
| 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: | 95 | 93 | 94 | 93 |
| Matrix Spike Duplicate % Recovery: | 100 | 98 | 97 | 100 |
| Relative % Difference: | 5.1 | 5.2 | 3.1 | 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

VMT Clark

Vickie Tague Clark
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
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 6041, Dublin
Matrix: Water
QC Sample Group: 4BF2203

Reported: Mar 10, 1994

# QUALITY CONTROL DATA REPORT

| ANALYTE | Benzene | Toluene | Ethyl Benzene | Xylenes |
|---|---|---|---|---|
| Method: | EPA 8020 | EPA 8020 | EPA 8020 | EPA 8020 |
| Analyst: | R. Vincent | R. Vincent | R. Vincent | R. Vincent |
| MS/MSD Batch#: | 4BG0205 | 4BG0205 | 4BG0205 | 4BG0205 |
| Date Prepared: | - | - | - | - |
| Date Analyzed: | 3/3/94 | 3/3/94 | 3/3/94 | 3/3/94 |
| 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: | 110 | 100 | 100 | 100 |
| Matrix Spike Duplicate % Recovery: | 110 | 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.

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 Clark
Project Manager

**ARCO Products Company**
Division of AtlanticRichfieldCompany

**Task Order No.** 6041-92-2

**Chain of Custody**

| | | | |
|---|---|---|---|
| ARCO Facility no. 6041 | City (Facility) DUBLIN | Project manager (Consultant) JOHN YOUNG | Laboratory name SEQUOIA |
| ARCO engineer MIKE WHELAN | Telephone no. (ARCO) (415) 571-2149 | Telephone no. (Consultant) (408) 264-7723 | Fax no. (Consultant) 264-2435 | Contract number 07-073 |
| Consultant name RESNA INDUSTRIES | Address (Consultant) 3315 ALMADEN EXPY, SUITE 34, SJ CA 95118 | | Method of shipment |

| 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 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 ☐ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1W-9.5' | | 2 | | ✓ | | ✓ | HCL | 2/23/94 | | | ✓ | | | | | | 9402F22-01 | | | | |
| 1W-14.5' | | 2 | | ✓ | | ✓ | HCL | 2/23/94 | | | ✓ | | | | | | | | | | -02 |
| 1W-19.5' | | 2 | | ✓ | | ✓ | HCL | 2/23/94 | | | ✓ | | | | | | | | | | -03 |
| 2W-14.5' | | 2 | | ✓ | | ✓ | HCL | 2/23/94 | | | ✓ | | | | | | | | | | -04 |
| 2W-19.5' | | 2 | | ✓ | | ✓ | HCL | 2/23/94 | | | ✓ | | | | | | | | | | -05 |

Special detection Limit/reporting

Special QA/QC

Remarks

Lab number 9402F22

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 | Received by |
|---|---|---|---|
| Relinquished by sampler: Ellen W. Krueger | 2/24/94 | 12:30 | James N Allen |
| Relinquished by: James N Allen | 2/24/94 | 7:00 | |
| Relinquished by | Date | Time | Received by laboratory: S. Davis — Date: 2/24/94 — Time: 14:00 |

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

AFP 0-3292 (2-91)