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ADDITIONAL SUBSURFACE INVESTIGATION
AND VAPOR EXTRACTION TEST

at
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California

Dec 1992

69028.07

Report prepared for

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

by
RESNA Industries Inc.

Barbara Sieminski
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Assistant Project Geologist

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Engineering Manager

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For ARCO Products Company

INTRODUCTION

At the request of ARCO Products Company (ARCO), RESNA Industries Inc. (RESNA) performed an additional subsurface investigation and vapor extraction test (VET) at ARCO Station 6113, 785 East Stanley Boulevard, Livermore, California. The purpose of this work was to evaluate the extent of gasoline hydrocarbons in the soil and groundwater in the vicinity of active gasoline storage tanks, to further delineate the extent of waste-oil hydrocarbons in soil and groundwater in the vicinity of the former waste-oil tank, and to evaluate the feasibility of vapor extraction as a remediation alternative for the site. Work performed included drilling eight onsite soil borings (B-5 through B-12); constructing five 4-inch-diameter groundwater monitoring wells (MW-5 through MW-9) in borings B-5 through B-7, B-9, and B-11, respectively; constructing two 4-inch-diameter vapor extraction wells (VW-1 and VW-2) in borings B-8 and B-12, respectively; developing groundwater monitoring wells MW-5 through MW-9; measuring groundwater levels; sampling the soil and groundwater; surveying the monitoring wells MW-5 through MW-9; laboratory analyses of selected soil and groundwater samples collected from the borings/wells; performing a VET; and preparing this report presenting field procedures, results and conclusions.

The work was performed in accordance with the Work Plan (RESNA, October 17, 1991) and Addendum to Work Plan (RESNA, March 3, 1992). These documents were approved by the Alameda County Health Care Services Agency (ACHCSA) prior to commencement of the investigation.

SITE DESCRIPTION AND BACKGROUND

General

ARCO Station 6113 is an operating gasoline station and mini-market in a commercial and residential area. It is located on the southwestern corner of East Stanley Boulevard and Murrieta Boulevard in Livermore, California, as shown on the Site Vicinity Map (Plate 1). The site is bounded by East Stanley Boulevard to the north, Murrieta Boulevard to the east, and the Arroyo Mocho Creek to the south and west. An operating Shell Service Station is on the southeastern corner of East Stanley Boulevard and Murrieta Boulevard. The elevation of the site is approximately 457 feet above mean sea level.

Three underground storage tanks (USTs) are present at the site. On January 26, 1989, prior to RESNA involvement with the site, a 280-gallon waste-oil storage tank was excavated and removed from the site (see previous work, below). The former waste-oil tank location is covered by a large concrete utility-pad. The USTs are presently in service at the site. The locations of the former underground waste-oil tank, the existing USTs, and pertinent site features are shown on the Generalized Site Plan (Plate 2).

Regional Geology and Hydrogeology

The site is located in the Livermore Valley, which is an intermontane valley in the Coast Ranges Geomorphic Province. The valley is approximately 13 miles long in an east-west direction and is four miles wide. The valley is surrounded by hills of the Diablo Range (California Department of Water Resources, 1974). The valley floor slopes gently toward the west. The principal streams in the area are the Arroyo Valley and Arroyo Mocho, which flow toward the western end of the valley. Arroyo Mocho is approximately 50 feet south-southwest of the site.

Livermore Valley is underlain by non-water-bearing rocks, water-bearing units, and sediments. The water-bearing units and sediments comprise the Livermore Valley groundwater basin. Water-bearing units include the Tassajara Formation, the Livermore

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Formation, and valley-fill materials (California Department of Water Resources, 1966, 1974). The Livermore Valley groundwater basin is divided into sub-basins on the basis of fault traces or other hydrologic discontinuities (California Department of Water Resources, 1974). The groundwater system in Livermore Valley is a multilayered system with an unconfined aquifer overlying a sequence of leaky or semiconfined aquifers. Groundwater in the basin flows downslope toward the east-west-trending axis of the valley and then flows generally to the west (Alameda County Flood Control and Water Conservation District - Zone 7, 1991).

PREVIOUS WORK

Previous subsurface environmental investigations and other environmental work performed at the site are summarized in Appendix A.

FIELD WORK

Drilling

Permits for well construction were obtained from the Alameda County Flood Control and Water Conservation District (ACFCWCD) prior to drilling. Copies of the permits are included in Appendix B. Seven soil borings (B-5 through B-11) were drilled at the site on June 8 through 15, 1992, and one soil boring (B-12) was drilled at the site on August 4, 1992, under direction of a RESNA geologist. A summary of the field procedures followed by RESNA is included in Appendix B. The work for this site characterization was performed in accordance with the Site Safety Plan (RESNA, May 29, 1992).

Soil borings B-5 through B-8, and B-12 were drilled in the immediate vicinity of the active gasoline-storage tank pit (northeastern portion of the site) to evaluate the presence and extent of gasoline hydrocarbons near the active gasoline-storage tank pit. Groundwater monitoring wells MW-5 through MW-7 were installed in borings B-5 through B-7, respectively, to evaluate the presence and extent of gasoline hydrocarbons in groundwater in the immediate vicinity of the gasoline storage tank pit, and to determine groundwater gradient of the deeper water bearing zone beneath the site. Vapor extraction wells VW-1

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and VW-2 were installed in borings B-8 and B-12, respectively, in order to perform a vapor extraction test and collect data necessary for the evaluation of the feasibility of the vapor extraction as a soil remediation alternative. Soil borings B-9 and B-10 were drilled next to the former waste-oil tank pit (southwestern portion of the site), and groundwater monitoring well MW-8 was installed in boring B-9, to delineate the extent of waste-oil hydrocarbons in soil and groundwater in the immediate vicinity of the former waste-oil tank pit. Soil boring B-11 was drilled in the southeastern portion of the site, and converted to groundwater monitoring well MW-9, to investigate the presence of hydrocarbons in soil and groundwater in the southeastern portion of the site.

Borings B-5 through B-7 and B-9 through B-11 were drilled to depths of 60½ to 71½ feet below the ground surface. Borings B-8 and B-12 were terminated at depths of 46½ and 51 feet below grade, respectively, before the groundwater was encountered.

Soil Sampling and Description

Soil samples were described in accordance with the Unified Soil Classification System and Symbol Key (Plate 3), and collected as indicated on the Logs of Borings B-5 through B-12 (Plates 4 through 25). One hundred two samples were collected for description and possible laboratory analyses at maximum intervals of 5 feet from the ground surface to the total depth of the borings. A summary of the sampling methods used is presented in Appendix C. Field monitoring of organic vapor concentrations in soil samples was performed during drilling using an organic vapor meter (OVM).

Soil cuttings generated from the borings were temporarily stored in the southwestern corner of the property and placed on and covered with plastic sheeting pending proper disposal. The soil cuttings generated on June 8 through 15, 1992, from borings B-5 through B-11, were stored in two separate stockpiles; SP-1 containing cuttings with OVM measurements below 100 ppm; and SP-2 containing cuttings with OVM measurements over 100 ppm. The soil cuttings generated on August 4, 1992, from boring B-12, were stored in one soil pile (SP). After completion of drilling (on June 15, 1992, and on August 4, 1992) four soil samples were collected from each of the stockpiles and submitted for compositing and laboratory analyses. The method used to obtain these samples is described in Appendix C.

Well Construction and Development

Five groundwater monitoring wells (MW-5 through MW-7, MW-8 and MW-9) were constructed in borings B-5 through B-7, B-9 and B-11, respectively; and two vapor extraction wells (VW-1 and VW-2) were constructed in borings B-8 and B-12, respectively. The wells were completed with four-inch diameter schedule 40 polyvinyl chloride (PVC) casing. Well casings were set to depths of approximately 63 to 68 feet in the groundwater monitoring wells, and to depths of approximately 45 to 49½ feet in vapor extraction wells. Screened intervals in groundwater monitoring wells consisted of four-inch-diameter, 0.020-inch machine slotted PVC set from approximately 43 to 63 feet below the ground surface in MW-5, 47 to 67 feet below the ground surface in MW-8, and 48 to 68 feet below the ground surface in MW-6, MW-7 and MW-9. Well casings in vapor extraction wells consisted of four-inch-diameter, 0.100-inch machine slotted PVC set from approximately 25 to 45 feet below the ground surface in VW-1, and 28 to 49½ feet below the ground surface in VW-2.

The groundwater monitoring wells (MW-5 through MW-9) were developed on June 22 and 23, 1992, to remove fine-grained sediments and to allow better communication between the water-bearing zone and the groundwater monitoring well. Development was performed by a professional well development crew (Kvilhaug Drilling of Concord, California) using a combination of surge block and bailing techniques. A description of the methods used to develop the wells is included in Appendix C.

Groundwater Level Measurement and Sampling

Groundwater monitoring wells (previously installed MW-1 through MW-4, and new MW-5 through MW-9) were monitored on June 29, July 28, and August 26, 1992, by EMCON Associates of San Jose, California. Depths-to-water (DTW) were measured in groundwater monitoring wells and water samples were collected and visually inspected for the presence of floating product. Groundwater monitoring wells MW-2 and MW-5 through MW-9 were purged and sampled on June 29, 1992. The remaining wells were dry or contained only residual water.

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Evaluation of Groundwater Elevations

On June 22, 1992, the wellheads for new wells MW-5 through MW-9, and VW-1, and previously installed MW-4 (for comparison) were surveyed for top-of-casing (TOC) elevations to a local National Geodetic Vertical Datum benchmark by John E. Koch, Land Surveyor, of Oakland, California. The results of this wellhead survey are included in Appendix D, Wellhead Survey. Groundwater elevations for each well were calculated by subtracting DTW measurements from the TOC elevation.

Vapor Extraction Test

RESNA performed a one day onsite VET on August 11, 1992, to collect site specific data and evaluate the feasibility of using vapor-extraction as a soil remediation alternative. The VET had three main objectives: (1) to determine what vapor flow rates can be extracted from the wells; (2) to determine the hydrocarbon concentration of extracted vapors; and (3) to estimate an effective radius of influence for the vapor extraction well for future design, if applicable. Approval was obtained from the Bay Area Air Quality Management District (BAAQMD) prior to conducting the test (RESNA, August 4, 1992).

The vapor-extraction equipment consisted of: a six-cylinder internal combustion (I.C.) engine; instrumentation for measuring air velocity, air pressure, temperature, and organic vapor concentrations; and polyvinyl chloride (PVC) piping, fittings, and wellhead connections.

Two vapor extraction wells VW-1, and VW-2, and six existing groundwater monitoring wells MW-3, MW-4, MW-5, MW-6, MW-7 and MW-9 were used during the VET. The location of these wells, as well as other pertinent site features, are shown on the Generalized Site Plan, Plate 2. The VET equipment detailed above was used to apply a vacuum to the vapor extraction wells and induce air flow through the soils. Extracted hydrocarbon vapor was abated through the I.C. engine by combustion and additional treatment thorough a catalytic converter.

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The VET was conducted in two phases. A short-term test (60 minutes) was first performed using each of VW-1 and MW-5 as extraction wells to collect representative influent vapor samples. A longer-term test was then performed on well VW-2 to collect radius of influence data. Prior to the start of the short-term tests, DTW was measured in all onsite monitoring wells.

For the short-term testing, the internal combustion (I.C.) engine was connected to vapor wells VW-1, and MW-5 separately. The engine was operated on each well for at least 30 minutes at the highest flow rate sustainable. When VW-1 was used as the extraction well the test lasted 60 minutes with wells VW-2, MW-4 through MW-7, and MW-9 being used as observation wells. When MW-5 was used as the extraction well the test lasted 110 minutes and wells MW-4, MW-6, MW-7, VW-1, VW-2 and MW-9 were used as the observation wells. Vapor samples were collected from a sample port on the influent side of the I.C. engine using a sample pump and opaque sample bags. Well-head flow rates were measured using a pilot tube velocity-meter installed within the 2-inch PVC pipe manifold. Applied well-head vacuum and induced vacuum responses at observation wells were measured using a magnehelic vacuum gauge placed near the well-heads. Extracted vapors were screened for percent oxygen and organic vapor concentrations using a combination oxygen meter and Lower Explosive Limit (LEL) meter calibrated to methane. During the short-term testing, the well was subjected to different applied vacuums and the resulting extracted air flow rates were measured to determine well characteristics.

For the longer-term test, the I.C. engine was operated on vapor well VW-2 for 170 minutes. Wells VW-1, MW-3, MW-4, MW-5, MW-6, and MW-7 were used as observation wells. Well-head air velocity, applied vacuum, percent oxygen content and organic vapor concentrations were measured every 15 to 30 minutes. To estimate radius of influence, magnehelic vacuum gauges were installed on adjacent vapor wells and groundwater wells to measure induced vacuum response (a secondary indicator of subsurface airflow). The magnehelic gauges were capable of measuring differential pressures as low as 0.01 inches of water column (W.C.). Influent vapor samples were collected after 30 minutes and 120 minutes of operation. An effluent vapor sample was also collected to estimate the efficiency of the I.C. engine.

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Air Sampling

Air samples were collected through a ¼-inch Tygon sample line connected to a stainless steel well head fitting and collected in opaque Mylar air sample bags. Tygon tubing was used to minimize sample loss through adsorption and the possibility of distorted results from sample line contaminated by a previous test run. The samples were sealed in the bags and labeled with the sample number, date, time, and sampler's name. The samples were immediately stored in a cool place for transport to a State Certified analytical laboratory under Chain of Custody documentation.

LABORATORY METHODS

All soil, water and air samples selected for laboratory analyses were preserved as required by the applicable analytical method, and delivered with Chain of Custody Records to selected State-certified laboratories. Soil Samples were delivered to Sequoia Analytical Laboratories of Redwood City, California; water samples to Columbia Analytical Services Inc. of San Jose, California; and air samples to GTEL Analytical Laboratory of Concord, California.

Soil Samples

Soil samples collected from borings B-5 through B-12 were analyzed in accordance with Alameda County Health Care Services Agency (ACHCSA) requirements for the gasoline constituents benzene, toluene, ethylbenzene, total xylenes (BTEX) and total petroleum hydrocarbons as gasoline (TPHg) using modified Environmental Protection Agency (EPA) Methods 5030/8015/8020, and in addition selected soil samples collected from soil borings B-9 and B-10, located next to the former waste-oil tank pit, were analyzed for total petroleum hydrocarbons as diesel (TPHd) using EPA Method 3550/8015; total oil and grease (TOG) using EPA Method 5520 E&F (Gravimetric); volatile organics (VOCs) using EPA Method 8240; and metals cadmium, chromium, nickel, zinc and lead by TCLP.

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Soil samples were selected for laboratory analyses based on:

- o Location above first-encountered groundwater;
- o Location in a potential confining or perching layer below first-encountered groundwater; and
- o Areas where the presence of gasoline or waste oil hydrocarbons was suspected based on OVM readings.

Soil samples collected from the soil stockpiles were composited in the laboratory and analyzed for TPHg and BTEX by EPA Method 5030/8015/8020.

Three soil samples from boring B-5 were analyzed for particle size distribution by weight to aid in future recovery well design.

Water Samples

Water samples obtained from monitoring wells MW-2 and MW-5 through MW-9 were analyzed in accordance with Alameda County Health requirements for BTEX and TPHg by EPA Methods 5030/8020 and DHS LUFT Method. In addition the water sample obtained from groundwater monitoring well MW-8, located near the former waste-oil tank, was analyzed for TPHd by EPA Method 3510; TOG by EPA Method 5520 C&F; VOCs by EPA Method 5030/601; and metals cadmium, chromium, nickel and zinc using EPA Method 6010, and lead using EPA Method 7421.

Air Samples

Air samples collected during the VET were analyzed within 72 hours for BTEX by EPA Method 8020 and for TPHg using modified EPA method 8015.

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FIELD WORK RESULTS

Drilling Observation

The earth materials encountered during this investigation consisted primarily of silty clay to gravelly silt interbedded with discontinuous layers of clayey to sandy gravel and clayey sand. Graphic interpretations of the soil stratigraphy encountered in the borings are shown on Geologic Cross Sections A-A', B-B', C-C', D-D' and E-E' (Plates 26 through 30). The locations of these cross sections are shown on Plate 2.

Groundwater was first encountered in borings B-5 through B-7 and B-9 through B-11 at depths of approximately 53 to 59 feet below ground surface within clayey to sandy gravel. A layer of damp silty clay which may be a local perching or confining layer was encountered beneath this clayey to sandy gravel at the depth of approximately 68 feet in boring B-11 and extended to the total depth of this boring (71½ feet below the ground surface).

A product odor was noted for the soil samples collected from borings B-5 through B-8, B-11 and B-12. OVM measurements of soil samples from these borings ranged from nondetectable to 1416 parts per million (ppm). No product odor was noted for soil samples collected from borings B-9 and B-10. OVM readings are shown on the borings logs (Plates 4 through 25) in the column labeled PID (photoionization detector).

Subjective Groundwater Analyses

According to EMCON's field report sheets initial water samples collected from wells MW-1 through MW-3 and MW-5 through MW-9 showed no evidence of floating hydrocarbon product on June 29, July 28, and August 26, 1992. Groundwater monitoring well MW-4 was dry during all mentioned above monitoring events. Groundwater monitoring well MW-1 contained only residual water trapped at the tip of the well casing during the June monitoring event, and was dry during July and August monitoring events. Groundwater monitoring wells MW-2 and MW-3 contained only residual water during all mentioned above monitoring events. The results of EMCON's field work on the site, including DTW measurements, well purge data sheets, and subjective analyses for the presence of floating

product in the groundwater in the onsite wells are presented on EMCON's field report sheets and EMCON's Summary of Groundwater Monitoring Data. This data is included in Appendix E.

Groundwater Gradient

A perched water-bearing zone containing a limited amount of water was identified at the site between approximately 22 to 43 feet below ground level in wells MW-1 through MW-4, and a deeper water bearing zone was identified at approximately 55 feet below ground level in wells MW-5 through MW-9. The groundwater gradient could not be evaluated for the perched water bearing zone at this time because from June to August the wells installed in this zone were dry or contained only residual water. The groundwater gradient evaluated for the deeper water bearing zone at this site, based on groundwater elevations obtained from wells MW-5 through MW-9 was approximately 0.01 ft/ft, and the gradient direction fluctuated from north-northeast in June, to east-northeast in July, to east in August. The groundwater elevations in groundwater monitoring wells MW-5 through MW-9 have decreased approximately 10 feet since June 1992. Directional variations in the groundwater gradient at the site and the significant decrease in groundwater elevations may result from pumping of nearby existing irrigation wells in the vicinity of the site that may produce artificial, temporary changes in the groundwater elevation and direction of flow.

Depths to groundwater and groundwater elevations are reported in Table 1, Cumulative Groundwater Monitoring Data. Plates 31 through 33, Groundwater Gradient Maps, are graphic interpretations of the groundwater elevations measured on June 29, July 28 and August 26, 1992.

Vapor Extraction Test Field Results

VET Air Flow Rate Measurements

Vacuum and air flow rate data collected during the VET is summarized in Table 2, Vapor Extraction Test Field Monitoring Data. Utilizing the I.C. engine vacuum alone, air flow rates ranging from 11 to 30 standard cubic feet per minute (scfm) could be extracted from

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well VW-1 at applied vacuums ranging from 5 to 15 inches W.C.. To increase well yield, a motor-driven blower unit was engaged to provide additional well vacuum when venting from VW-1. Using this blower, air flow rates ranging from 41 scfm to as high as 50 scfm could be achieved at applied well-head vacuums ranging from 35 to 60 inches W.C.

With the motor-driven blower engaged, well MW-5 and VW-2 yielded sustainable air flow rates of 28 scfm and 48 scfm at applied vacuums of 20-inches and 50-inches of W.C., respectively. Beyond these applied vacuums, due to a relatively low oxygen content from the wells MW-5 (5%) and VW-2 (<12%), higher vacuums and flow rates could not be sustained and blower speed was limited by the operation of the I.C. engine. When higher vacuums and flows were attempted, the I.C. engine would "sputter" indicating imminent shutdown of the engine unless flows were throttled back.

Enclosed in Appendix F are plates that depict the wellhead air flow characteristic curves observed during the VET for wells VW-1, VW-2, and MW-5. The air flow rates observed from wells VW-1 and VW-2 appeared to plateau (maximize or level off) at 50 to 60 inches W.C. for VW-1 and 40 to 50 inches W.C. for VW-2. Vapor extraction well MW-5, a 4-inch-diameter well with 0.020 slot screen, exhibited an increase in induced air flow rate by increasing the applied vacuum to 30 inches W.C. However, the maximum sustainable well yield could not be determined because the low oxygen content (< 5%) of extracted vapor caused the I.C. engine to "sputter".

VET Radius of Influence Measurements

Induced vacuum data collected during the VET is summarized in Table 2. When venting from VW-1, which is screened 26 to 45 feet below grade, induced vacuum responses were about 0.01 inches W.C. at observation wells VW-2, MW-5, MW-6, MW-7 and MW-9 located at distances ranging from 38 feet to 50 feet from VW-1. The highest vacuum impact (0.05 inches W.C.) was observed in well MW-4 located 37 feet from VW-1. These lower vacuum readings are likely the result of the following: (1) the observation wells being spaced greater than 35 feet from the extraction well; (2) the observation wells being screened in different intervals than the extraction well (VW-1 [26 to 45 feet], MW-5, 6, 7, 9 [43 to 68 feet], and

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MW-4 [21 to 27 feet]); and (3) the extraction well VW-1 being screened in the lower permeability soils (silty clays and sandy clays).

An extraction well vacuum of 20 inches W.C. on MW-5 resulted in induced vacuum readings as low as 0.01 and as high as 1.25 inches W.C. in observation wells MW-4 and MW-6, respectively. Lower vacuum readings in VW-1, VW-2 and MW-4 appear to be the result of the observation wells being screened in more impermeable soils (silty clays and silty sands) and in different screened intervals than MW-5 (e.g., MW-5 [43 to 63 feet] and MW-4 [21 to 27 feet]). Though a very high induced vacuum response of 1.25 inches W.C. was observed in well MW-7 located 74 feet away, only 0.015 inches W.C. was observed in MW-9 located 88 feet away despite MW-9 being screened in the same interval as extraction well MW-5, and MW-7. This is most likely due to the fact that in MW-7 the screened soil area above the groundwater table is primarily gravel (USCS classification GC), while the screened soil area in MW-9 above the groundwater table is primarily clayey silt (USCS classification ML). Gravel is much more permeable to air flow than is clayey silt. In addition, MW-9 is 14 feet further from the extraction well than MW-7 and it would also account for some reduction in vacuum impact.

When venting from VW-2, moderate induced vacuum responses were seen in all observation wells (VW-1, MW-3, MW-4 and MW-5), with the exception of MW-6 and MW-7, which showed no vacuum response. The nondetectable induced vacuum response readings in MW-6 and MW-7 are most likely the result of the wells being screened in a different interval (MW-6 and MW-7 [48 to 68 feet]) than VW-2 [28 to 49.5 feet]. The low induced vacuum response in MW-5, despite having 6.5 feet of common screen interval with VW-2 at a depth of 43 to 49.5 feet below grade is likely the result of the wells being spaced far apart and the low permeability soils (silty clays, clayey silts, and clayey gravel) in which VW-2 was screened. The lower induced vacuum reading in VW-1 when venting from VW-2 is most likely the result of the wells being screened in low permeability soils (sandy silts and silty clays) and spaced far apart. MW-4 showed a moderate vacuum impact even though it is screened in a different interval than extraction well VW-2, primarily because it is very close to VW-2, at a distance of 18.1 feet.

RESULTS OF LABORATORY ANALYSES

Soil Samples

Results of laboratory analyses of soil samples are summarized in Table 3, Cumulative Results of Laboratory Analyses of Soil Samples. Chain of Custody forms and laboratory analyses reports for soil samples are included in Appendix G of this report.

Laboratory results of soil samples collected from boring B-5, located in the western vicinity of the active gasoline storage tanks indicated 150 ppm to 1,200 ppm of TPHg in the samples collected from the depths of 20½ to 40½ feet below the ground surface and nondetectable concentrations of TPHg (less than 1 ppm) in the samples collected at the depths of 10½ and 50½ feet below the ground surface. Laboratory results of soil samples collected from borings B-6, B-7, B-8 and B-12 located in the northern, northeastern, eastern and southwestern vicinity of the gasoline-storage tanks, respectively, indicated concentrations of TPHg ranging from nondetectable to 110 ppm. Laboratory results of soil samples collected from boring B-11, located in the southeastern portion of the site, reported nondetectable concentrations of TPHg except for the sample collected at the depth of 30½ feet below ground surface, which indicated a minor concentration of TPHg (5.7 ppm).

Laboratory results of soil samples collected from borings B-9 and B-10, located in the southwestern portion of the site, next to the former waste-oil tank pit, indicated nondetectable concentrations of TPHg, TPHd (less than 1 ppm), and VOCs (37 compounds tested). TOG was detected at a concentration of 74 ppm in the soil sample collected at the depth of 20 ½ feet from boring B-9, at a concentration of 77 ppm in the sample collected at the depth of 45 feet from boring B-10, and was nondetectable in all other samples collected from borings B-9 and B-10. Concentrations of Cd, Cr and Pb were nondetectable (less than 0.010 ppm for Cd and Cr, and less than 0.0050 ppm for Pb), and concentrations of Ni and Zn were low (up to 0.13 ppm and 0.75 ppm, respectively) in the soil samples collected from borings B-9 and B-10. Metals were present in the soil in the vicinity of the former waste-oil tank pit below normal background concentrations (Scott, 1991; Lindsay, 1979). Background concentrations for metals are listed at the bottom of Table 3.

Graphic interpretations of TPHg in soil at depths 14-20½ feet, 29-34½ feet, and 37½-45½ feet are shown on Plates 34 through 36, respectively, and are also summarized in the geologic cross sections on Plates 26 through 30.

Results of laboratory analyses of composite soil samples collected on June 15, 1992, indicated nondetectable TPHg and BTEX in the sample collected from stockpile SP-1, and 24 ppm TPHg and up to 0.45 ppm BTEX in the sample collected from stockpile SP-2. These soil stockpiles were disposed by ARCO's contractor, Dillard Trucking Inc., of Byron, California on June 19, 1992. Results of laboratory analyses of composite soil samples collected on August 4, 1992, from stockpile SP containing drill cuttings generated during drilling B-12, indicated 2.6 ppm TPHg and up to 0.066 ppm BTEX. Soil stockpile SP was disposed by ARCO's contractor, Dillard Trucking Inc., of Byron, California on August 25, 1992. The results of laboratory analyses of stockpile samples are shown on Table 3.

Results of sieve analyses of soil samples collected from boring B-5 indicated that the water bearing zone consists of approximately 75 % coarse sand and gravel, 20 % fine- to medium-grained sand, and 5% silt and clay. Sieve analyses results are included in Appendix F, and are depicted on Plate 37, Particle Size Distribution Graph.

Water Samples

Results of laboratory analyses of water samples are presented in Table 4, Cumulative Results of Groundwater Laboratory Analyses - TPHg and BTEX; and Table 5, Cumulative Results of Groundwater Laboratory Analyses - VOC, TPHd, TOG, and Metals, for June 29, 1992, Chain of Custody records and laboratory analyses reports for groundwater samples are included in Appendix E.

Laboratory analyses of groundwater samples collected from groundwater monitoring wells MW-2 (perched water bearing zone), and MW-8 and MW-9 (deeper water bearing zone) located in the southern portion of the property indicated nondetectable concentrations of TPHg (less than 50 ppb) and BTEX (less than 0.005 ppm).

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Laboratory analyses of groundwater samples collected from wells MW-5, MW-6 and MW-7 installed in the deeper water bearing zone in the vicinity of active gasoline storage tanks indicated up to 8,900 ppb of TPHg, and up to 1,800 ppb of BTEX. Benzene exceeded the State Maximum Contaminant Level (MCL) of 1 ppb in wells MW-5, MW-6 and MW-7. Toluene exceeded the State Action Level (AL) of 100 ppb in wells MW-5 and MW-6.

Laboratory analyses of groundwater samples collected from well MW-8 (deeper water bearing zone), located next to the former waste-oil tank in the deeper water bearing zone indicated nondetectable TPHd, TOG, and VOCs. Metals: chromium, lead, zinc and nickel were detected at concentrations of 1,780 ppm, 143 ppm, 1,310 ppm and 5,100 ppm, respectively, and cadmium was nondetectable (less than 3 ppm) in the groundwater sample collected from this well.

Representations of the interpretations of the extent of TPHg and benzene in groundwater beneath the site are shown on Plate 38, TPHg Concentrations in Groundwater, and Plate 39, Benzene Concentrations in Groundwater.

Air Samples

TPHg concentrations in air samples collected from wells VW-1, VW-2 and MW-5 ranged from 37,000 milligrams per cubic meter (mg/m^3) to 130,000 mg/m^3 , with average concentrations of 66,000 mg/m^3 of TPHg and 570 mg/m^3 of benzene. After abatement by the I.C. engine the TPHg concentration was 630 mg/m^3 when performing the VET on VW-2. Benzene vapor concentrations ranged from 350 to 900 mg/m^3 before abatement, and 33 mg/m^3 after abatement. TPHg destruction efficiency with the I.C. engine was 98.8%, and benzene destruction efficiency was 94%.

Laboratory results for the air samples collected during the VET are summarized in Table 6, Laboratory Analyses of Air Samples. Individual laboratory reports and chain of custody records are contained in Appendix G.

DISCUSSION OF RESULTS

Hydrocarbon Impacted Soil

The presently interpreted extent of hydrocarbon impacted soil beneath the site is presented on the Geologic Cross Sections, Plates 26 through 30, and TPHg Concentrations in Soil contours, Plates 34 through 36. The majority of gasoline hydrocarbons in the soil appear to be concentrated in the northeastern portion of the site in the immediate vicinity of the active gasoline-storage tank pit. Concentrations of TOG were detected in soil in the southwestern portion of the site, in the immediate vicinity of the former waste-oil tank pit. Concentrations of the metals (Cd, Cr, Pb, Zn and Ni) in the soil in the immediate vicinity of the waste-oil tank pit were below typical background concentrations (Scott, 1991, Lindsay, 1979).

Hydrocarbon Impacted Groundwater

Groundwater beneath the site has been impacted by gasoline-related hydrocarbons. The highest TPHg and BTEX concentrations in groundwater appear to be west and north of the active gasoline-storage tank pit (northeastern portion of the site). The groundwater beneath the site appears not to be impacted by waste-oil related hydrocarbons, based on the analytical results from monitoring well MW-8, located next to the former waste oil tank.

Vapor Extraction Testing

VET Air Samples

Laboratory results of air samples and field organic vapor measurements collected from vapor extraction wells VW-1, VW-2 and MW-5 during the VET indicate that petroleum hydrocarbons exist in the area of the active gasoline-storage tanks and its immediate vicinity. During the longer-term test on well VW-2, vapor samples were collected after 30 and 120 minutes of operation. The vapor sample collected after 30 minutes contained TPHg at 52,000 mg/m³. After 120 minutes of operation, organic vapor readings decreased by 28% to 37,000 mg/m³. It is not known whether this low TPHg concentration is the result of an

actual decrease in vapor-phase concentrations with time or due to unsteady state fluctuations. Comparing vapor-phase benzene concentration as a percent of TPHg for all the wells suggests that benzene generally comprised approximately 1.1% of the vapor-phase TPHg concentration. The I.C. engine demonstrated a TPHg destruction efficiency of 98.8% during the VET on VW-2.

VET Hydrocarbon Removal Rate Estimates

Initial hydrocarbon removal rates were estimated from wellhead flow rate and vapor concentration data obtained during the VET. Based on vapor extraction wellhead flow rates ranging from 28 to 48 scfm and vapor-phase TPHg concentrations ranging from 37,000 to 130,000 mg/m³, initial estimated hydrocarbon removal rates from each well ranged from 160 to 330 pounds of TPHg per day (lbs/day) (see Table 7, Estimate Radius of Influence and Projected Initial Hydrocarbon Extraction Rates During Vapor Extraction Test). Equivalent hydrocarbon removal rates in gallons per day (gal/day) ranged from 25 gals/day to 51 gals/day. These initial removal rates typically decrease rapidly with time, depending on site-specific conditions. For vapor well VW-2, hydrocarbon removal rates decreased from 220 lbs/day (35 gals/day) initially to 160 lbs/day (25 gals/day) after 120 minutes of operation.

The large TPHg removal rates observed during the VET suggest that a thermal or catalytic oxidizer may be required for off-gas abatement if a vapor extraction system is installed in the future. A combination thermal/catalytic oxidizer could provide an optimum balance between high destruction efficiencies, large processing rates, and reduced operating costs (compared to catalytic or thermal oxidizer units only).

VET Radius of Influence Estimates

Utilizing induced vacuum and distance measurements obtained during the VET, an effective radius of influence was estimated for the vapor wells at the site. The effective radius of influence is defined as the radial distance from a vapor extraction well at which recorded vacuum levels suggest that subsurface air flow rates are sufficient for remediation. The radius of influence concept assumes that subsurface air flows through homogeneous and isotropic soils and neglects short-circuiting effects.

Methods for estimating an effective radius of influence vary due to the complexity of modeling the vapor extraction process and limited case-study information. RESNA generally assumes that an induced vacuum of 0.25 to 0.50 inches of W.C. is sufficient to induce subsurface airflow within the zone of influence, depending on soil type. Air-modeling studies conducted by others suggest that the distance from the extraction well at which 1 percent of the applied well-head vacuum occurs can be interpreted as an effective radius of influence [Chevron, 1991]. This method is based upon theoretical model predictions which project that 90 percent of the total air extracted from the well flows through soils within the radius of influence when a 1% cut-off is used.

When venting from VW-1 screened 26 to 45 feet below grade, observation wells VW-2 and MW-4 located 54.5 and 37 feet, respectively from VW-1 appeared to be the only wells screened in the same interval and in similar soils (low permeability sandy and silty clays). Using an induced vacuum cut-off of 0.25 to 0.50 inches W.C., and the fact that the observed vacuum responses of 0.01 and 0.05 inches W.C., respectively for VW-2 and MW-4 were significantly less than the cut-off vacuum, RESNA estimates an effective R.O.I of 15 to 20 feet from VW-1. This estimated effective R.O.I is for vadose zone soils in VW-1 (28 to 45 feet below grade).

When venting from VW-2 screened 28 to 49.5 feet below grade, the observed induced vacuum response in VW-1 screened in approximately the same interval and 54.5 feet from VW-2 was 0.095 inches W.C. in VW-1. Since this induced vacuum response was significantly less than the cut-off vacuum of 0.25 to 0.5 inches W.C., RESNA estimates an effective R.O.I of 15 to 20 feet. This estimated effective R.O.I is for the silty clays to sandy silts and clayey silts occurring 28 to 49.5 feet below grade in VW-2.

Despite vapor extraction well MW-5 being screened in a common interval with VW-2, (43 to 49.5 feet below grade), in a zone of clayey gravel, preferential air flow through the more permeable sandy gravel lenses at 53 feet and below; i.e., from MW-6 and MW-7 may have resulted in the negligible induced vacuum response seen in VW-2. These results indicate that there are two distinct soil zones that need to be vapor extracted at the site without creating preferential air flow through a single zone. These soil zones are; (1) Zone A comprised of low permeable silty clays, silty sands and gravelly silts and clays occurring 20

to 50 feet below grade; and (2) Zone B comprised of permeable sandy gravel 50 feet and below.

SUMMARY AND CONCLUSIONS

RESNA concludes the following, based on the results of this investigation:

- o The majority of gasoline hydrocarbons in the soil at the site appear to be in the area of the active gasoline-storage tanks and its immediate vicinity at the depths between approximately 15 and 45 feet below ground surface.
- o The vertical extent of gasoline related hydrocarbons in the soil has been delineated to nondetectable levels of TPHg at the depths of approximately 50 feet below the ground surface. The lateral extent of gasoline related hydrocarbons in the soil at the site has been delineated to less than 100 ppb except west and northwest of the active gasoline-storage tank pit.
- o TOG was detected in the soil samples collected from borings B-9 and B-10, located next to the former waste-oil tank pit, at near laboratory detection limit (50 ppm) concentrations up to 77 ppm. The TOG was not confirmed by other analyses, since no TPHd, TPHg, or BTEX were detected in the soil samples collected from borings B-9 and B-10. VOCs were also not detected, and concentrations of metals (Cd, Cr, Pb, Zn and Ni) were nondetectable or below the range of natural background levels.
- o A perched water-bearing zone was identified at the site at depths between approximately 22 to 43 feet below ground level in wells MW-1 through MW-4. The perched water bearing zones contain limited amount of water, and wells MW-1 through MW-4 often become dry or contain residual water only. A deeper water bearing zone was identified at the site at approximately 55 feet below ground level in wells MW-5 through MW-9. A significant decrease (10 feet) of groundwater elevations was observed in wells MW-5 through MW-9 between June and August 1992. The groundwater gradient of the deeper water bearing zone was estimated to be 0.01 ft/ft, and the gradient direction fluctuated from north-northeast in June, to east-northeast in July, to east in August. Directional variations, and the significant decrease in groundwater elevations may result from pumping of nearby existing irrigation wells in the vicinity of the site that may produce artificial, temporary changes in the groundwater elevation and flow direction.

- o The lateral extent of gasoline hydrocarbons in the groundwater has been delineated to less than 50 ppb of TPHg only in the southern portion of the site.
- o Nondetectable concentrations of TOG (less than 500 ppb), TPHd (less than 50 ppb) and VOCs in groundwater samples collected from monitoring well MW-8 located next to the former waste-oil tank pit suggest that hydrocarbons associated with the former waste-oil tank have not impacted groundwater beneath the site.
- o Laboratory results of air samples and field organic vapor measurements collected from vapor extraction wells VW-1, VW-2 and MW-5 during the VET suggest that petroleum hydrocarbons exist in the area of the active gasoline-storage tanks and its immediate vicinity.
- o Vapor extraction appears to be a viable soil remediation alternative for the remediation of gasoline hydrocarbons from onsite soils. Two distinct soil venting zones appear to exist at the site: (1) Zone A comprised of low permeable silty clays, silty sands and gravelly silts and clays occurring 20 to 50 feet below grade; and (2) Zone B comprised of permeable clayey and sandy gravel 50 feet and below. Construction of vapor extraction wells screened in both zones would result in preferential air flow through the more permeable Zone B soils. Hence, vapor extraction wells screened separately in the two zones may be necessary to affect all areas of concern. An effective radius of influence (R.O.I) of 15 to 20 feet was estimated for vapor wells VW-1 and VW-2 screened in Zone A soils. This R.O.I could be achieved by inducing an applied vacuum and air flow rate of 50 inches W.C., and 48 scfm per extraction well screened in Zone A soils. An effective R.O.I of greater than 75 feet was estimated when venting from Zone B gravel soils. This R.O.I could be achieved by inducing an applied vacuum and air flow rate of 20 inches W.C., and 28 scfm per extraction well screened in Zone B soils. This effective R.O.I. of 75 feet is possible only when the groundwater elevation has dropped sufficiently to expose at least 8 to 10 feet of well screen in the clayey to sandy gravel of Zone B. The effective R.O.I.'s in Zone A and Zone B soils can be increased by use of a larger horsepower blower that would allow greater applied vacuums on the wells and therefore greater air flow rates and induced vacuum responses. These effective R.O.I.'s may not reflect actual conditions observed upon long term operation of an interim soil vapor extraction system.

Additional Subsurface Investigation and VET
ARCO Station 6113, Livermore, California

December 21, 1992
69028.07

DISTRIBUTION

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

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Alameda County Health Care Services Agency
Department of Environmental Health
80 Swan Way, Room 200
Oakland, California 94621

Mr. Eddy So
Regional Water Quality Control Board
San Francisco Bay Region
2101 Webster Street, Suite 500
Oakland, California 94612

Ms. Danielle Stefani
Livermore Fire Department
4550 East Avenue
Livermore, California 94550

LIMITATIONS

This report was prepared in accordance with generally accepted standards of environmental engineering and geological practice in California at the time this investigation was performed. This investigation was conducted solely for the purpose of evaluating environmental conditions of the soil with respect to petroleum hydrocarbons at the subject site in the immediate areas of and related to the gasoline-storage tanks and the former waste-oil tank. No soil engineering or geotechnical implications are stated or should be inferred. Evaluation of the geologic conditions at the site for the purpose of this investigation is made from a limited number of observation points. Subsurface conditions may vary away from the data points available. Additional work, including further subsurface investigation, can reduce the inherent uncertainties associated with this type of investigation.

Additional Subsurface Investigation and VET
ARCO Station 6113, Livermore, California

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ARCO Station 6113, Livermore, California

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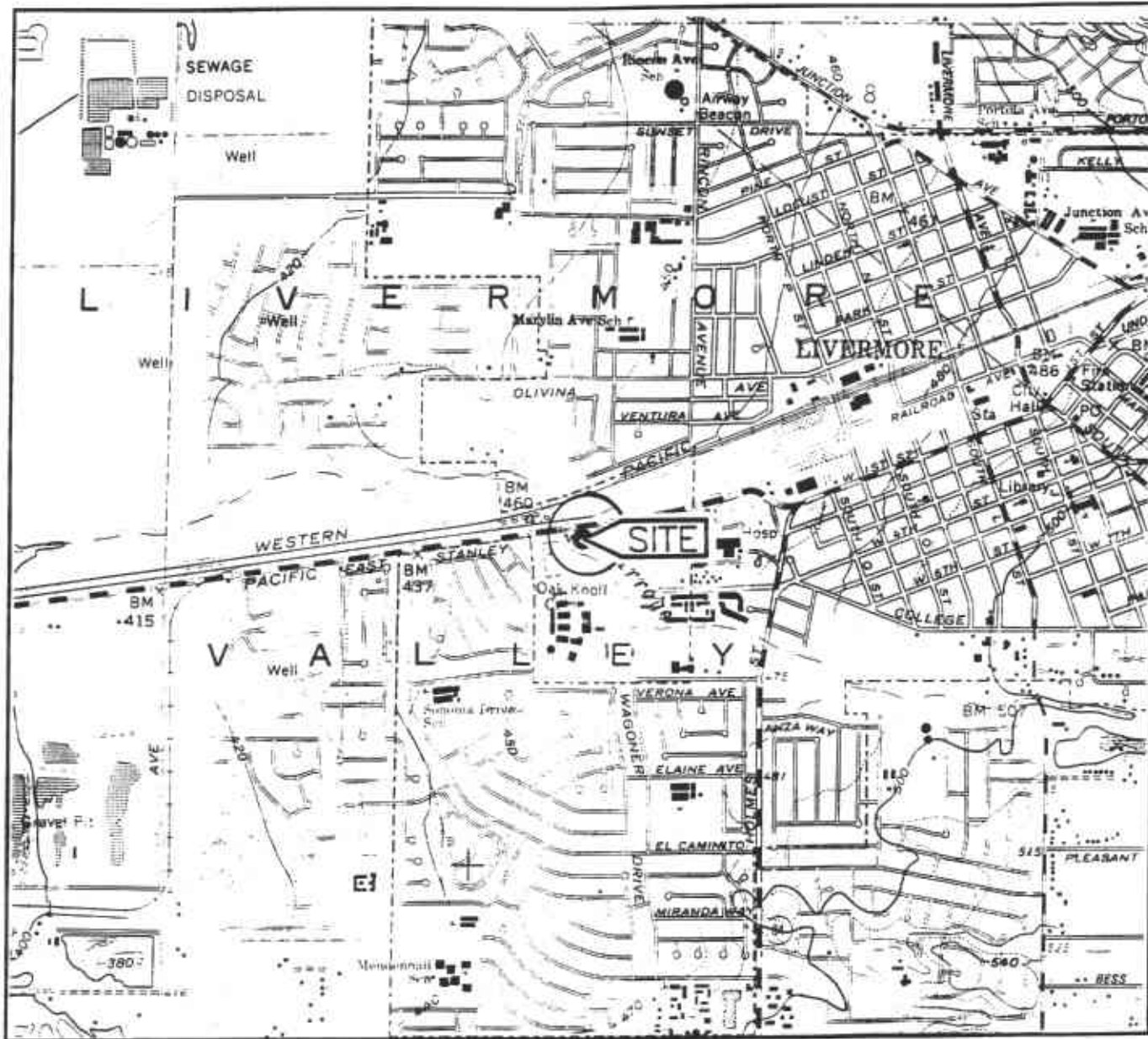
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Additional Subsurface Investigation and VET
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Base: U.S. Geological Survey
 7.5-Minute Quadrangle
 Livermore, California
 Photorevised 1980

LEGEND

● = Site Location



Approximate Scale



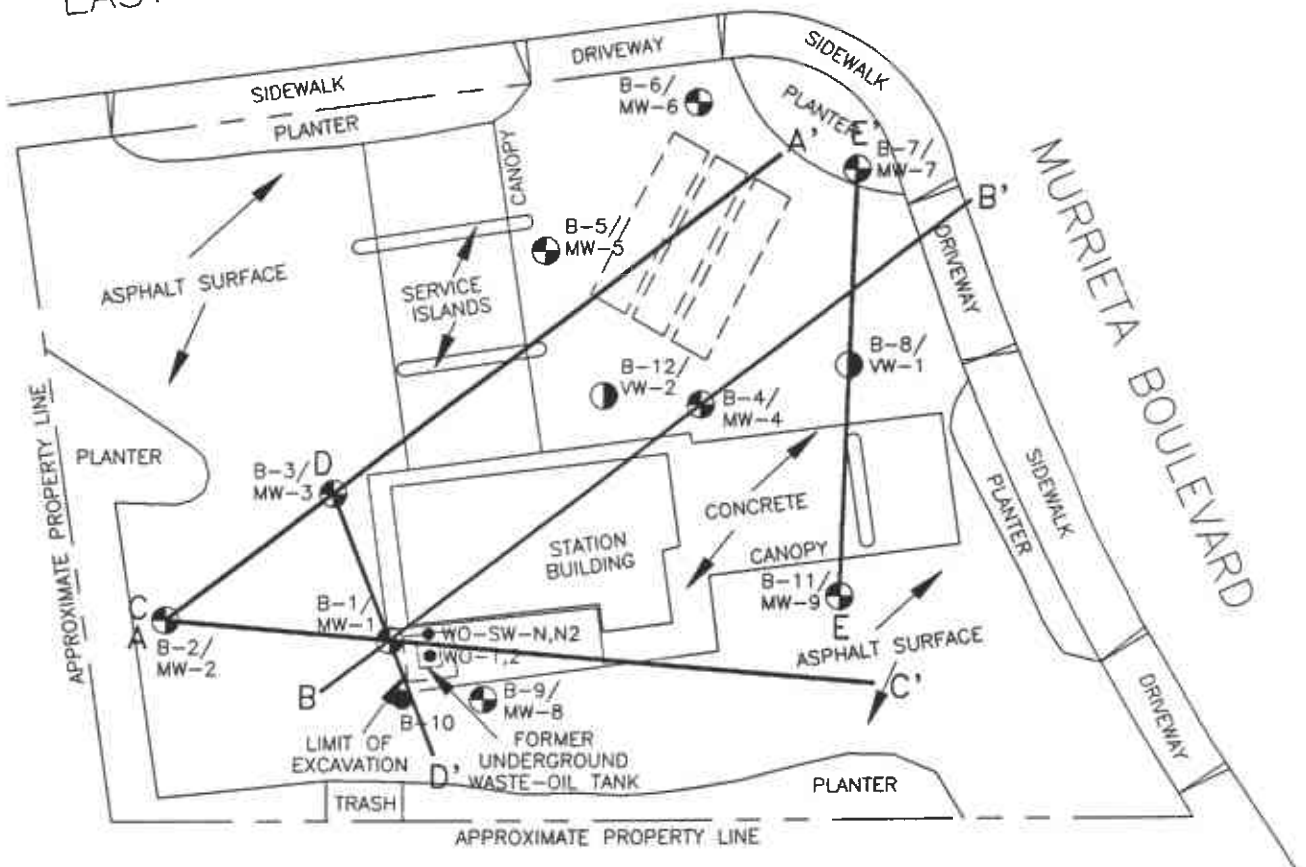
RESNA
Working to Restore Nature

PROJECT 69028.07






**SITE VICINITY MAP
 ARCO Service Station 6113
 785 East Stanley Boulevard
 Livermore, California**

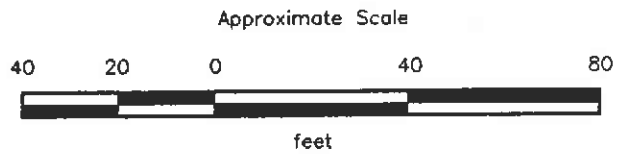
**PLATE
 1**

EAST STANLEY BOULEVARD



EXPLANATION

- B-11/
MW-9  = Boring/monitoring well
(RESNA, 09/89, 02/91, and 06/92)
- B-12/
VW-2  = Boring/vapor extraction well
(RESNA, 06/92)
- B-10  = Boring
(RESNA, 06/92)
- WO-SW-N,N2
 = Soil sample collected by Pacific (1989)
- E — E' = Geologic cross section
-  = Existing gasoline-storage tanks



Source: Modified from plan supplied by Ron Archer, Civil Engineer Inc., October 1988.

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GENERALIZED SITE PLAN
ARCO Service Station 6113
785 East Stanley Boulevard
Livermore, California

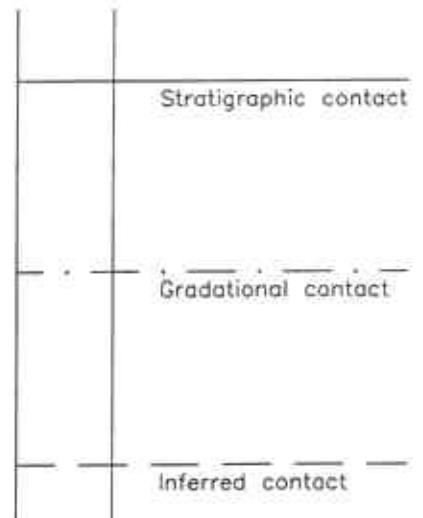
PLATE

2

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISION		LTR	DESCRIPTION	MAJOR DIVISION	LTR	DESCRIPTION	
COARSE- GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravels or gravel-sand mixtures, little or no fines.	FINE- GRAINED SOILS	SILTS AND CLAYS LL<50	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity.
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines.			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		GM	Silty gravels, gravel-sand-silt mixtures.			OL	Organic silts and organic silt-clays of low plasticity.
		GC	Clayey gravel, gravel-sand-clay mixtures.			MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
	SAND AND SANDY SOILS	SW	Well-graded sand or gravelly sands, little or no fines.		SILTS AND CLAYS LL>50	CH	Inorganic clays of high plasticity, fat clays.
		SP	Poorly-graded sands or gravelly sands, little or no fines.			OH	Organic clays of medium to high plasticity, organic silts.
		SM	Silty sands, sand-silt mixtures.			PT	Peat and other highly organic soils.
		SC	Clayey sands, sand-clay mixtures.			HIGHLY ORGANIC SOILS	

- | | | |
|--|---------------------------------|--|
| Depth through which sampler is driven | Sand pack | |
| Relatively undisturbed sample | Bentonite | |
| No sample recovered | Neat cement | |
| Static water level observed in well/boring | Caved native soil | |
| Initial water level observed in boring | Blank PVC | |
| S-10 Sample number | 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 INFERRER 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 PLATE
AND SYMBOL KEY
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California

3

PROJECT **69028.07**

Depth of boring: 64 feet Diameter of boring: 10 inches Date drilled: 06/08/92

Well depth: 63 feet Material type: Sch 40 PVC Casing diameter: 4 inches

Screen interval: 43 to 63 feet Slot size: 0.020-inch

Drilling Company: HEW Drilling Driller: Casto and Marcelino

Method Used: Hollow-Stem Auger Field Geologist: Barbara Sieminski

Signature of Registered Professional: [Signature]

Registration No.: RCE 044600 State: CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0					Asphalt.	
					Asphalt (4 inches).	
				GW	Sandy gravel, brown, damp, dense: baserock.	
				GC	Clayey gravel with sand and cobbles, brown, damp, dense	
2				SP	Color change to gray.	
				GW	Medium- to coarse-grained sand, brown, damp, dense.	
4					Sandy gravel, grayish-brown, damp to moist, medium dense.	
6	S-5.5	5 10 8	0			
8						
10	S-10.5	8 25 25	0		Dense.	
12						
14				ML	Gravelly silt with clay, brown, damp, low plasticity, very stiff.	
16	S-15.5	10 15 20	193	GW/GC	Sandy gravel with clay, gray, damp, dense; obvious product odor.	
18						
20	S-20.5	3 4 6	295	ML	Clayey silt, brown mottled with gray, low plasticity, stiff; obvious product odor.	

(Section continues downward)



PROJECT: 69028.07

LOG OF BORING B-5/MW-5
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California

PLATE

4

Depth	Sample No.	BLOWS	P.I.D.	USCS Code	Description	Well Const.
				GC	Clayey gravel with sand, brown mottled with gray, moist, dense; obvious product odor.	
-52			SC	Clayey sand, medium-grained, brown mottled with gray, moist to wet, dense; obvious product odor.		
-54				GW/GC ▽ =	Sandy gravel with clay, brown, wet, very dense.	
-56	S-55.5	25 50/4	.67			
-60	S-60.5	22 50/5	.45		With cobbles.	
-64	S-63.5	24 50/5	.3			
					Total depth = 64 feet.	
-66						
-68						
-70						
-72						
-74						
-76						
-78						
-80						

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PROJECT 69028.07

LOG OF BORING B-5/MW-5
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California

PLATE
6

Depth of boring: 69 feet Diameter of boring: 10 inches Date drilled: 06/09/92

Well depth: 68 feet Material type: Sch 40 PVC Casing diameter: 4 inches

Screen interval: 48 to 68 feet Slot size: 0.020-inch

Drilling Company: HEW Drilling Driller: Casto and Marcelino

Method Used: Hollow-Stem Auger Field Geologist: Barbara Sieminski

Signature of Registered Professional: [Signature]

Registration No.: RCE 044600 State: CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0					Asphalt.	
				GP	Asphalt (4 inches). Sandy gravel, gray, damp, dense: baserock.	
2				GC	Clayey gravel, brown, damp, dense.	
4				GW	Sandy gravel with cobbles, grayish-brown, moist, medium dense.	
6	S-5.5	10 11 15	8			
10	S-10.5	3 6 10	0	CL	Sandy clay, trace fine gravel, dark brown, damp, low to medium plasticity, stiff.	
14				ML	Gravelly silt with sand, brown, damp, low plasticity, very stiff.	
16	S-15.5	8 11 15	0			
18				ML	Clayey silt with sand, brown mottled with gray, damp, low plasticity, very stiff; noticeable product odor.	
20	S-20.5	6 7 10	33			

(Section continues downward)



LOG OF BORING B-6/MW-6
 ARCO Station 6113
 785 East Stanley Boulevard
 Livermore, California

PLATE
 7

PROJECT: 69028.07

Depth	Sample No.	BLOWS	P.I.D.	USCS Code	Description	Well Const.
22				ML	Clayey silt with sand, brown mottled with gray, damp, low plasticity, very stiff; noticeable product odor.	
24				SC	Clayey sand, brown, moist, loose; obvious product odor.	
26	S-25.5	3 6 8	65	CL	Sandy clay, brown mottled with gray, damp, low to medium plasticity, stiff; obvious product odor.	
28						
30	S-30.5	3 4 7	441	ML	Clayey silt with clayey sand lenses, brown mottled with gray, damp, low plasticity, stiff; obvious product odor.	
32						
34				SC	Clayey sand, fine-grained, brown, moist, loose; obvious product odor.	
36	S-35.5	4 6 9	282	ML	Clayey silt with sand, brown mottled with gray, damp, low plasticity, stiff; obvious product odor.	
38						
40	S-40.5	3 6 8	92		Increasing clay.	
42				CL	Silty clay, brown, damp, medium plasticity, stiff.	
44						
46	S-45.5	4 5 11	26	ML	Clayey silt, brown, damp, low plasticity, very stiff; noticeable product odor.	
48				ML	Gravelly silt, brown, moist, low plasticity, hard; noticeable product odor.	
50	S-50.5	24 27 28	430	GC	Clayey gravel with sand, brown, moist to wet, very dense; obvious product odor.	

(Section continues downward)

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PROJECT 69028.07

LOG OF BORING B-6/MW-6
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California

PLATE
8

Depth	Sample No.	BLOWS	P.I.D.	USCS Code	Description	Well Const.
				ML	Gravelly silt, brown, moist, low plasticity, hard.	
-52				GC	Clayey gravel with sand, brown, moist to wet, very dense; obvious product odor.	
-54				GW/GC	Sandy gravel with clay, brown, wet, very dense.	
-56	S-55.5	20 50/4	34			
-58				GC	Clayey gravel with sand, brown, wet, dense.	
-60	S-60.5	7 23 15	10			
-66	S-65.5	22 50 36	3		Very dense.	
-68	S-68.5	17 40 50/3	0			
-70					Total depth = 69 feet.	
-72						
-74						
-76						
-78						
-80						

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LOG OF BORING B-6/MW-6
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California

PLATE
9

Depth of boring: 68-1/2 feet Diameter of boring: 10 inches Date drilled: 06/10/92

Well depth: 68 feet Material type: Sch 40 PVC Casing diameter: 4 inches

Screen interval: 48 to 68 feet Slot size: 0.020-inch

Drilling Company: HEW Drilling Driller: Casto, Marcelino, and Louis

Method Used: Hollow-Stem Auger Field Geologist: Barbara Sieminski

Signature of Registered Professional: [Signature]

Registration No.: RCE 044600 State: CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0				SM	Silty sand, brown, damp, loose: fill.	
2				GW	Sandy gravel, brown, damp, dense.	
6	S-5.5	7 24 15	0			
10	S-10.5	10 6 8	0	CL	Sandy clay, dark brown, damp, low to medium plasticity, stiff.	
16	S-15.5	5 11 22	0	GC	Clayey gravel with sand, brown, damp, dense. Color change to grayish-brown; increasing sand.	
20	S-20.5	7 21 28	511		Moist; obvious product odor.	

(Section continues downward)



LOG OF BORING B-7/MW-7
 ARCO Station 6113
 785 East Stanley Boulevard
 Livermore, California

PLATE
 10

PROJECT: 69028.07

Depth	Sample No.	BLOWS	P.I.D.	USCS Code	Description	Well Const.
22				GC	Clayey gravel with sand, grayish-brown, moist, dense; obvious product odor.	
24				SC	Clayey sand, fine-grained, grayish-brown, moist, loose; obvious product odor.	
26	S-25.5	3 4 5	502		Increasing clay.	
28				CL	Sandy clay, brown mottled with gray, damp, low to medium plasticity, stiff; obvious product odor.	
30	S-30.5	6 7 11	86	ML	Clayey silt, brown mottled with gray, damp, low plasticity, very stiff; noticeable product odor.	
34				SC	Clayey sand, fine-grained, brown mottled with gray, moist, medium dense.	
36	S-35.5	3 5 8	31	ML	Clayey silt with sand and fine gravel, brown mottled with gray, damp to moist, low plasticity, stiff.	
38						
40	S-40.5	5 6 9	21		No gravel.	
42				CL	Silty clay, brown, damp, medium plasticity, firm.	
44						
46	S-45.5	3 4 8	0	ML	Clayey silt, brown, damp, low plasticity, stiff.	
48				▼ ML	Gravelly silt, brown, damp, low plasticity, hard.	
50	S-50.5	21 27 48	60	GC	Clayey gravel with sand, brown, moist, very dense.	

(Section continues downward)

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LOG OF BORING B-7/MW-7
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California

PLATE
11

Depth	Sample No.	BLOWS	P.I.D.	USCS Code	Description	Well Const.
				ML	Gravelly silt, brown, damp, low plasticity, hard.	
				GC	Clayey gravel with sand, brown, moist, very dense.	
-52						
-54						
-55.5	S-55.5	28 40 48	16	▽ =	Wet.	
-56						
-58						
-60	S-60.5	20 32 27	2		Increasing sand.	
-62						
-64						
-65.5	S-65.5	28 50/5"0				
-66						
-68	S-68	50/1"0				
					Total depth = 68-1/2 feet.	
-70						
-72						
-74						
-76						
-78						
-80						

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LOG OF BORING B-7/MW-7
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California

PLATE
12

Depth of boring: 46-1/2 feet Diameter of boring: 10 inches Date drilled: 06/15/92
 Well depth: 45 feet Material type: Sch 40 PVC Casing diameter: 4 inches
 Screen interval: 25 to 45 feet Slot size: 0.100-inch
 Drilling Company: HEW Drilling Driller: Casto, Marcelino, and Louis
 Method Used: Hollow-Stem Auger Field Geologist: Barbara Sieminski

Signature of Registered Professional [Signature]
 Registration No. RCE 044600 State: CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0					Asphalt.	
				GP	Asphalt (4 inches).	
				SM	Sandy gravel, gray, dry, dense; baserock.	
2				GW	Silty sand, brown, damp, loose.	
4					Sandy gravel with cobbles, grayish-brown, damp, medium dense.	
6	S-5.5	8 11 8	0			
8						
10	S-10.5	7 8 10	0	CL	Sandy clay, dark brown, damp, low to medium plasticity, very stiff.	
12						
14				GW/GC	Sandy gravel with clay, brown, damp, dense.	
16	S-15.5	19 21 17	3			
18						
20	S-20.5	13 19 23	572		Color change to gray; obvious product odor.	
					(Section continues downward)	



LOG OF BORING B-8/VW-1
 ARCO Station 6113
 785 East Stanley Boulevard
 Livermore, California

PLATE
 13

PROJECT: 69028.07

Depth	Sample No.	BLOWS	P.I.D.	USCS Code	Description	Well Const.
-22				GW/GC	Sandy gravel with clay, gray, damp, dense; obvious product odor.	
-24				ML	Clayey silt with sand, grayish-brown with dark gray mottling, damp, low plasticity, stiff; obvious product odor.	
-26	S-25.5	2 6 7	530			
-30	S-30.5	8 9 12	276		Color change to brown mottled with orange and gray; increasing sand.	
-34				ML	Sandy silt, brown mottled with orange, damp, low plasticity, stiff; obvious product odor.	
-36	S-35.5	7 12 16	50	CL	Silty clay, reddish-brown, damp, medium plasticity, very stiff; obvious product odor.	
-38				GC	Clayey gravel with sand, grayish-brown, moist, dense.	
-40	S-40.5	15 21 23	193			
-44				ML	Clayey silt, brown mottled gray, damp, low to medium plasticity, stiff; obvious product odor.	
-46	S-45.5	3 6 6	212			
-48	Total depth = 46-1/2 feet.					
-50						



PROJECT 69028.07

LOG OF BORING B-8/VW-1
 ARCO Station 6113
 785 East Stanley Boulevard
 Livermore, California

PLATE
 14

Depth of boring: 68-1/2 feet Diameter of boring: 10 inches Date drilled: 06/11/92
 Well depth: 67 feet Material type: Sch 40 PVC Casing diameter: 4 inches
 Screen interval: 47 to 67 feet Slot size: 0.020-inch
 Drilling Company: HEW Drilling Driller: Casto, Marcelino, and Louis
 Method Used: Hollow-Stem Auger Field Geologist: Barbara Sieminski

Signature of Registered Professional [Signature]

Registration No.: RCE 044600 State: CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0					Asphalt.	
				GP	Asphalt (4 inches).	
				SM	Sandy gravel, gray, dry, dense; baserock	
2					Silty sand with gravel, brown, damp, loose.	
4				GW	Sandy gravel with cobbles, grayish-brown, damp, medium dense.	
6	S-5.5	5 10 15	0			
8	S-8.5	8 14 29	0			
10	S-10	8 12 9	0			
12						
14						
16	S-15.5	9 11 17	0	ML	Clayey silt, brown, damp, low to medium plasticity, very stiff.	
18				ML	Sandy silt, brown mottled with orange, damp, low plasticity, very stiff.	
20	S-20.5	6 12 16	0			

(Section continues downward)



PROJECT: 69028.07

LOG OF BORING B-9/MW-8
 ARCO Station 6113
 785 East Stanley Boulevard
 Livermore, California

PLATE

15

Depth	Sample No.	BLOWS	P.I.D.	USCS Code	Description	Well Const.
-22				ML	Sandy silt, brown mottled with orange, damp, low plasticity, very stiff.	
-24						
-26	S-25.5	9 19 17	0		With plant roots, hard.	
-28						
-30				SM	Silty sand with gravel, brown, damp, medium dense.	
-30	S-30.5	14 27 47	0			
-32				GC	Clayey gravel, brown mottled with orange, damp, very dense.	
-34						
-36	S-35.5	14 25 27	0		With sand. No water after waiting 10 minutes.	
-38				ML	Clayey silt with clayey sand lenses, brown, damp to moist, low to medium plasticity, stiff.	
-40						
-40	S-40.5	5 6 9	0			
-42				CL	Sandy clay, reddish-brown, damp, medium plasticity, very stiff.	
-44						
-46	S-45.5	4 5 8	0		Increasing sand. Clayey silt, brown, damp, low to medium plasticity, stiff.	
-48				GC	Clayey gravel with sand, brown, moist to wet, very dense.	
-50	S-50.5	26 37 50/4"	0			

(Section continues downward)

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PROJECT 69028.07

LOG OF BORING B-9/MW-8
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California

PLATE
16

Depth	Sample No.	BLOWS	P.I.D.	USCS Code	Description	Well Const.
-52				GC	Clayey gravel with sand, brown, moist to wet, very dense.	
-54						
-56	S-55.5	27 47 50/4"	0	∇ =	Increasing sand, wet.	
-58						
-60	S-60.5	17 32 35	0			
-62						
-64						
-66	S-65.5	15 27 43	0			
-68	S-67.5	22 37 41	0			
-70					Total depth = 68-1/2 feet.	
-72						
-74						
-76						
-78						
-80						

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LOG OF BORING B-9/MW-8
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California

PLATE
17

Depth of boring: 60-1/2 feet Diameter of boring: 8 inches Date drilled: 06/08/92

Well depth: N/A Material type: N/A Casing diameter: N/A

Screen interval: N/A Slot size: N/A

Drilling Company: HEW Drilling Driller: Casto and Marcelino

Method Used: Hollow-Stem Auger Field Geologist: Barbara Sieminski

Signature of Registered Professional: [Signature]

Registration No. RCE 044600 State: CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0					Asphalt.	
				GP	Asphalt (4 inches).	▽▽▽▽
				SM	Sandy gravel, gray, dry, dense; baserock.	▽▽▽▽
2					Silty sand with gravel, brown, damp, loose.	▽▽▽▽
				GW	Sandy gravel with cobbles, grayish-brown, damp, dense.	▽▽▽▽
4						▽▽▽▽
	S-5	8 15 16	0			▽▽▽▽
6						▽▽▽▽
8						▽▽▽▽
	S-10	50 26 27	0		Very dense.	▽▽▽▽
10						▽▽▽▽
12						▽▽▽▽
				ML	Clayey silt, brown, damp, low to medium plasticity, hard.	▽▽▽▽
14						▽▽▽▽
	S-15	10 15 18	0			▽▽▽▽
16						▽▽▽▽
18						▽▽▽▽
				ML	Sandy silt, brown mottled with orange, damp, low plasticity, very stiff.	▽▽▽▽
20						▽▽▽▽
	S-20	7 11 15	0			▽▽▽▽

(Section continues downward)



PROJECT: 69028.07

LOG OF BORING B-10
 ARCO Station 6113
 785 East Stanley Boulevard
 Livermore, California

PLATE
 18

Depth	Sample No.	BLOWS	P.I.D.	USCS Code	Description	Well Const.
22				ML	Sandy silt, brown mottled with orange, damp, low plasticity, very stiff.	▽▽▽▽▽ ▽▽▽▽▽ ▽▽▽▽▽ ▽▽▽▽▽ ▽▽▽▽▽ ▽▽▽▽▽ ▽▽▽▽▽ ▽▽▽▽▽ ▽▽▽▽▽ ▽▽▽▽▽
24	S-25	9 15 28	0		Increasing sand, trace gravel, hard.	
26						
28						
30	S-30	10 17 30	0	GC	Increasing gravel. Clayey gravel with sand, brown mottled with orange, damp, dense.	
32						
34	S-35	13 16 23	0		Increasing sand, moist.	
36						
38				CL	Sandy clay, brown, damp to moist, low to medium plasticity, very stiff.	
40	S-40	5 10 11	0			
42						
44	S-45	5 7 15	0	ML	Clayey silt, brown, moist, low plasticity, stiff.	
46				GC	Clayey gravel with sand, brown, moist, medium dense.	
48						
50	S-50	18 46 48	0		Increasing sand, moist to wet, very dense. (Section continues downward)	



PROJECT 69028.07

LOG OF BORING B-10
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California

PLATE
19

Depth	Sample No.	BLOWS	P.I.D.	USCS Code	Description	Well Const.
-52				GC	Clayey gravel with sand, brown, moist to wet, very dense.	
-54	S-55	27 47	0			
-56		50	4"			
-58					Wet.	
-60	S-60	50 30 38	0	∇ =		
-62					Total depth = 60-1/2 feet.	
-64						
-66						
-68						
-70						
-72						
-74						
-76						
-78						
-80						



PROJECT 69028.07

LOG OF BORING B-10
 ARCO Station 6113
 785 East Stanley Boulevard
 Livermore, California

PLATE
 20

Depth of boring: 71-1/2 feet Diameter of boring: 10 inches Date drilled: 06/12/92

Well depth: 68 feet Material type: Sch 40 PVC Casing diameter: 4 inches

Screen interval: 48 to 68 feet Slot size: 0.020-inch

Drilling Company: HEW Drilling Driller: Casto, Marcelino, and Louis

Method Used: Hollow-Stem Auger Field Geologist: Barbara Sieminski

Signature of Registered Professional: *[Signature]*

Registration No.: RCE 044600 State: CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0					Asphalt.	
				GP	Asphalt (4 inches).	
				SM	Sandy gravel, gray, dry, dense; baserock	
2				GW	Silty sand, dark brown, damp, loose.	
4					Sandy gravel with cobbles, grayish-brown, damp, very dense.	
6	S-5.5	17 21 25	0			
10	S-10.5	5 6 7	0	CL	Sandy clay, trace gravel, dark brown, damp, medium plasticity, stiff.	
16	S-15.5	9 17 19	0	ML	Clayey silt with sand, trace gravel, brown mottled with orange, damp, low plasticity, hard.	
20	S-20.5	7 9 14	0	ML	Sandy silt, grayish-brown, damp, low plasticity, very stiff.	

(Section continues downward)



LOG OF BORING B-11/MW-9
 ARCO Station 6113
 785 East Stanley Boulevard
 Livermore, California

PLATE
 21

PROJECT: 69028.07

Depth	Sample No.	BLOWS	P.I.D.	USCS Code	Description	Well Const.
22				ML	Sandy silt, grayish-brown, damp, low plasticity, very stiff.	
24				SC	Clayey sand with sandy silt lenses, grayish-brown, damp, medium dense.	
26	S-25.5	4 8 11	0			
28				ML	Clayey silt with clayey sand lenses, brown mottled with gray, damp, low plasticity, very stiff.	
30	S-30.5	5 7 11	NM		Noticeable product odor.	
32						
34				ML	Sandy silt with gravel, orange-brown, damp, low plasticity, very stiff.	
36	S-35.5	7 16 36	NM			
38				GC	Clayey gravel, brown mottled with gray and orange, damp, very dense; noticeable product odor.	
40	S-40.5	22 30 25	NM		Increasing sand, becoming moist.	
42						
44					Becoming very moist. No water after waiting 10 minutes.	
46	S-45.5	17 10 14	NM	CL	Sandy clay, reddish-brown, damp, medium plasticity, very stiff.	
48						
50	S-50.5	9 10 11	NM	ML	Clayey silt, brown, damp, low to medium plasticity, very stiff.	

(Section continues downward)

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PROJECT 69028.07

LOG OF BORING B-11/MW-9
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California

PLATE
22

Depth	Sample No.	BLOWS	P.I.D.	USCS Code	Description	Well Const.
-52				ML	Clayey silt, brown, damp, low to medium plasticity, very stiff.	
-54				ML	Gravelly silt with clay, brown, moist, medium plasticity, hard.	
-56	S-55.5	17 43 47	NM	GC	Clayey gravel with sand, brown, wet, very dense.	
-58						
-60	S-60.5	15 23 27	NM	GW/GC	Sandy gravel with clay, brown, wet, very dense.	
-62						
-64						
-66	S-65.5	14 29 42	NM		Increasing sand.	
-68				CL	Silty clay, brown, damp, medium plasticity, very stiff.	
-70	S-71	7 8 10	NM			
-72					Total depth = 71-1/2 feet. NM = Not measured due to OVM malfunction.	
-74						
-76						
-78						
-80						

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LOG OF BORING B-11/MW-9
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California

PLATE
23

Depth of boring: 51 feet Diameter of boring: 12 inches Date drilled: 08/04/92

Well depth: 49-1/2 feet Material type: Sch 40 PVC Casing diameter: 4 inches

Screen interval: 28 to 49-1/2 feet Slot size: 0.100-inch

Drilling Company: Exploration Geoservices Driller: Dave and Fred

Method Used: Hollow-Stem Auger Field Geologist: Barbara Sieminski

Signature of Registered Professional [Signature]

Registration No. RCE 044600 State: CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0					Asphalt (4 inches).	
				GP	Sandy gravel, gray, damp, dense; baserock.	
2				GW-GM	Sandy gravel with silt and cobbles, brown, damp, dense; cobbles up to 4 inch diameter.	
4	S-5	13	0			
		16				
6		19				
8						
10	S-10	30	0			
		18				
		31				
12						
14				GC	Clayey gravel with sand, brown with gray mottling, damp, very dense.	
16	S-15	13	0			
		50/3"		CL	Sandy clay, brown, damp, low plasticity, stiff.	
18						
				GW-GC	Sandy gravel with clay, brown, damp, very dense.	
20	S-20	18	4			
		28				
		32				

(Section continues downward)



LOG OF BORING B-12/VW-2
 ARCO Station 1319
 785 East Stanley Boulevard
 Livermore, California

PLATE
 24

PROJECT: 69028.07

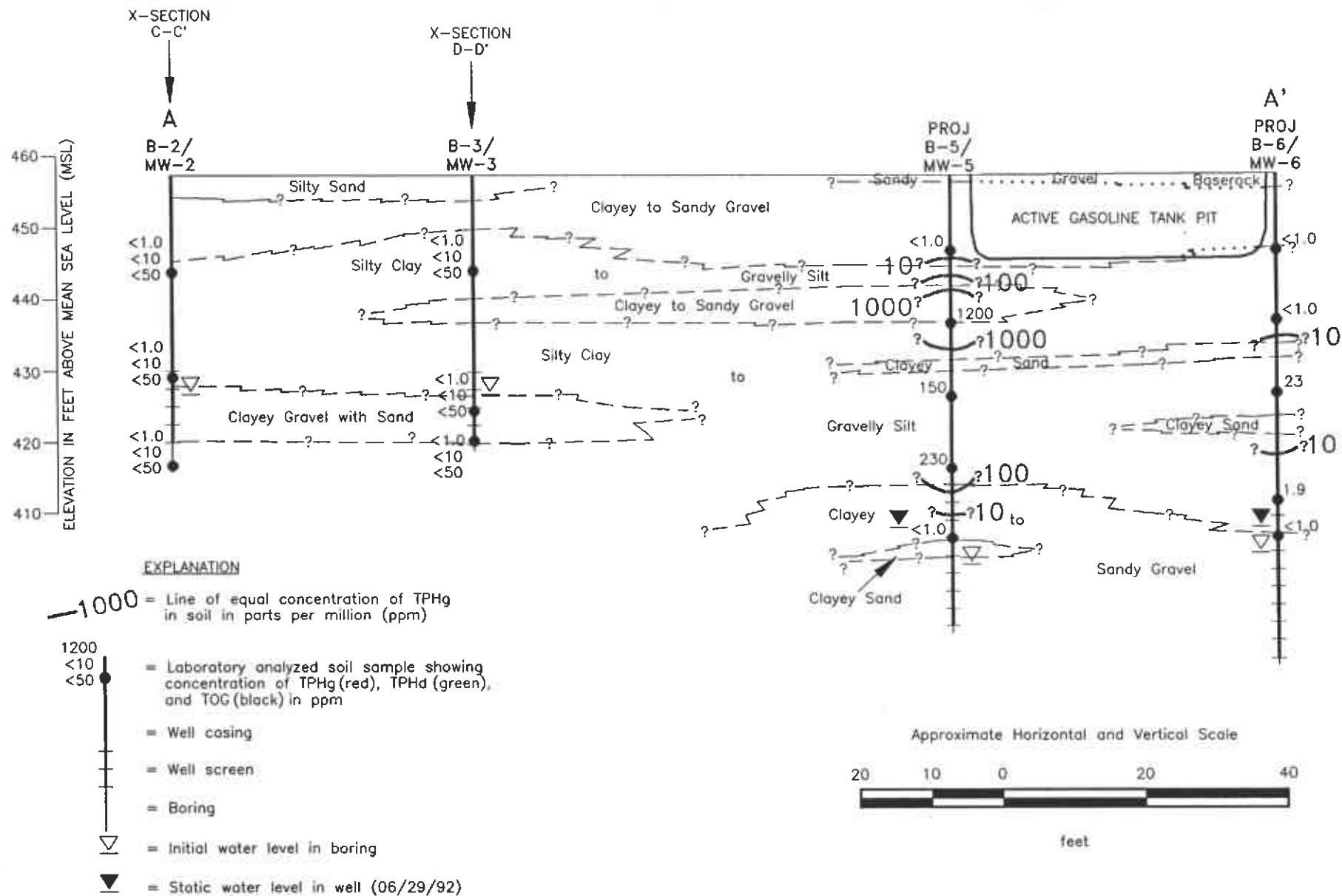
Depth	Sample No.	BLOWS	P.I.D.	USCS Code	Description	Well Const.
-22				GW-GC	Sandy gravel with clay, brown, damp, very dense.	
-24				SC	Clayey sand, brown mottled gray, damp, medium dense.	
-26	S-25	5 7 8	3	CL	Sandy clay with clayey sand lenses, brown mottled gray, damp, low plasticity, stiff.	
-28				ML	Clayey silt with sand, brown mottled gray, damp, low plasticity, hard.	
-30	S-30	13 18 22	2			
-32				ML	Gravelly silt with sand and clay, orange-brown mottled gray, damp, low plasticity, hard; obvious product odor.	
-34						
-36	S-35	11 16 20	46			
-38				GC	Clayey gravel with sand, brown mottled with gray, moist, very dense; obvious product odor.	
-40	S-40	18 24 30	1416			
-42						
-44				CL	Gravelly clay, orange-brown, damp, low plasticity, hard; obvious product odor.	
-46	S-45	8 14 25	46			
-48						
-50	S-50	8 14 18	96		Decreasing gravel.	
					Total depth = 51 feet.	

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PROJECT 69028.07

LOG OF BORING B-12/VW-2
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California

PLATE
25



PLATE

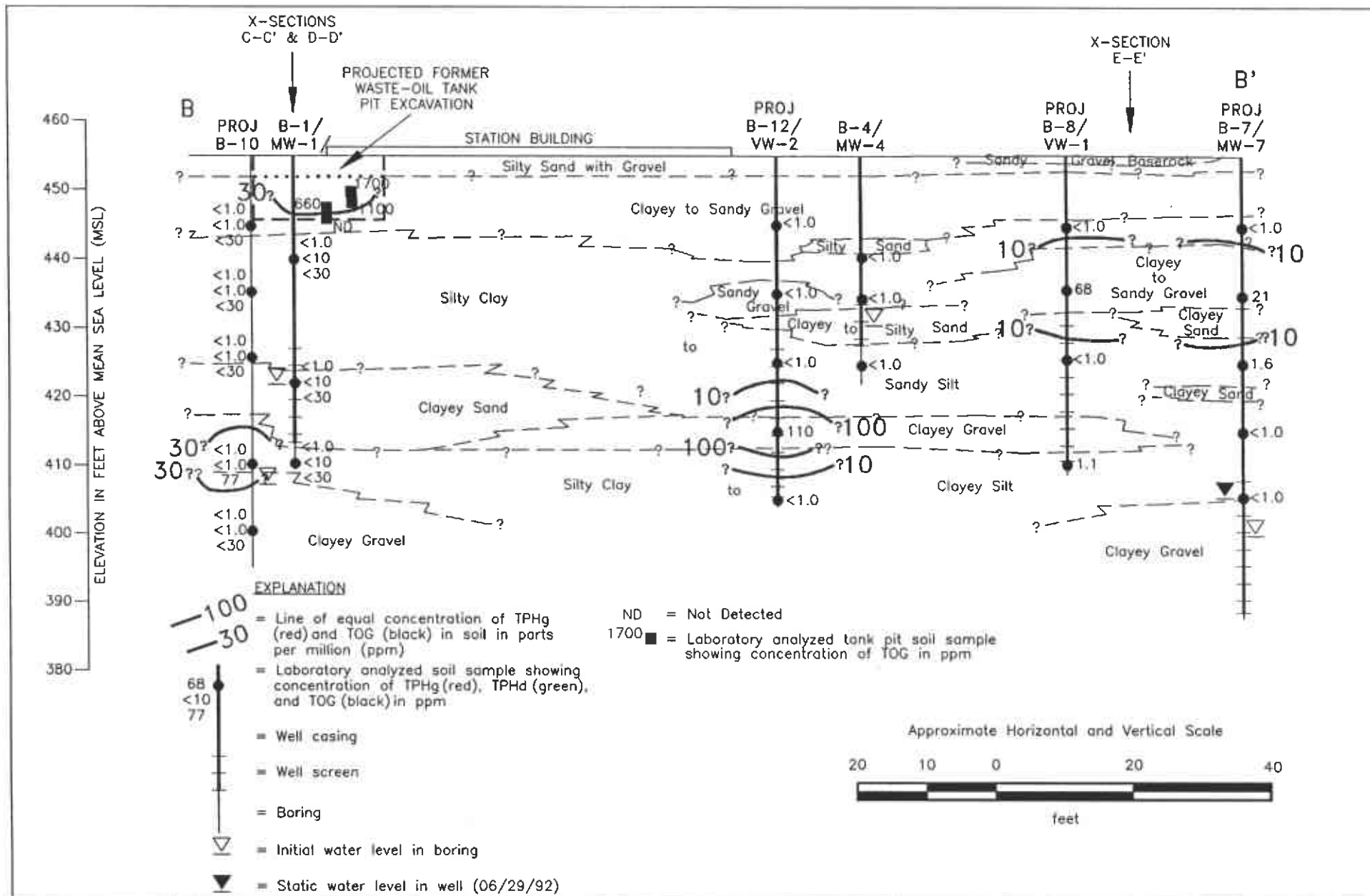
26

GEOLOGIC CROSS SECTION A-A'
ARCO Service Station 6113
785 East Stanley Boulevard
Livermore, California

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PLATE

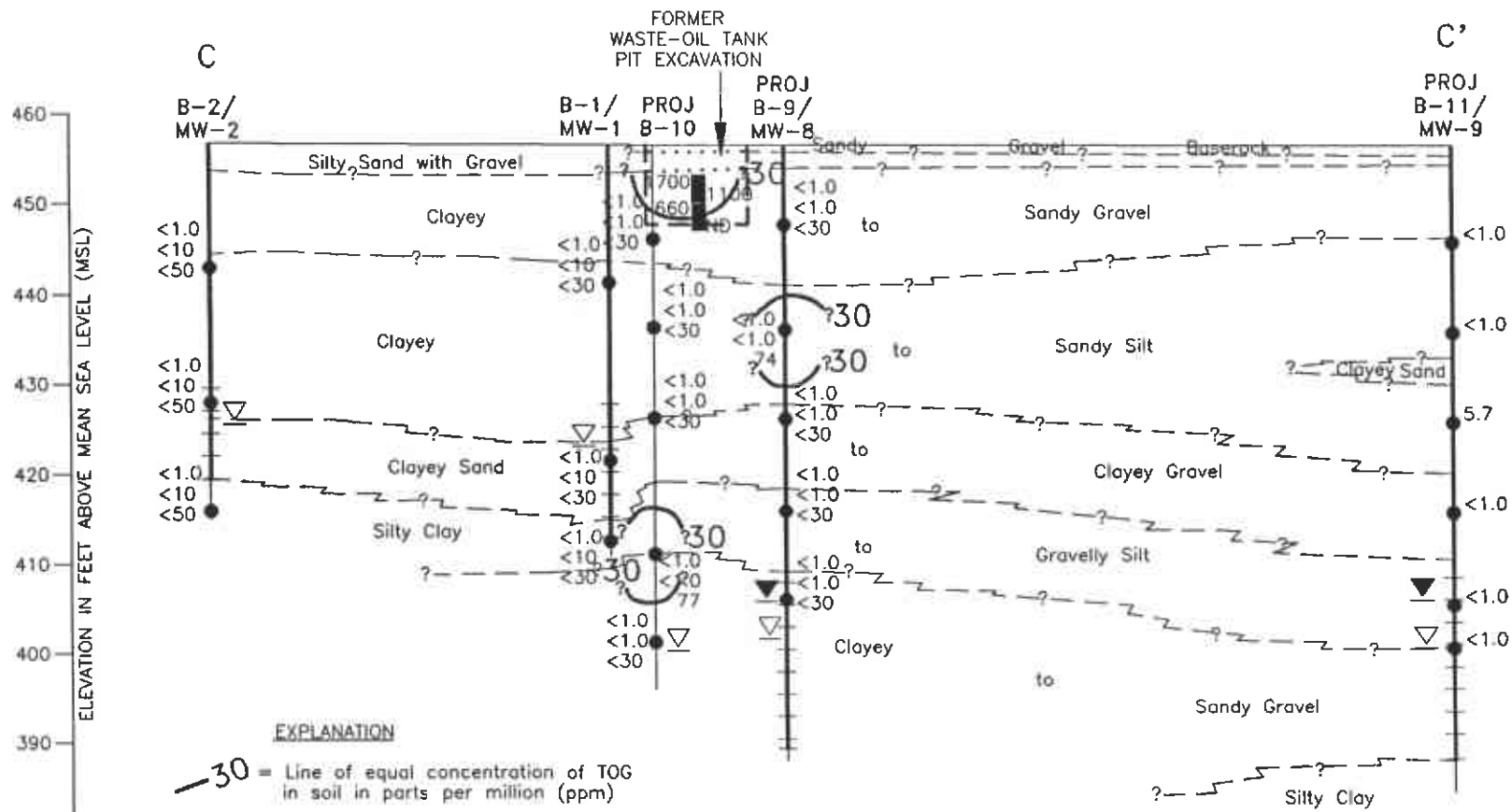
27

GEOLOGIC CROSS SECTION B-B'
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 785 East Stanley Boulevard
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69028.07



EXPLANATION

- 30 = Line of equal concentration of TOG in soil in parts per million (ppm)
- 5.7
<10
74 = Laboratory analyzed soil sample showing concentration of TPHg (red), TPHd (green), and TOG (black) in ppm
- = Well casing
- + = Well screen
- = Boring
- ▽ = Initial water level in boring
- ▼ = Static water level in well (06/29/92)

- ND = Not Detected
- 1700 ■ = Laboratory analyzed tank pit soil sample showing concentration of TOG in ppm

Approximate Horizontal and Vertical Scale



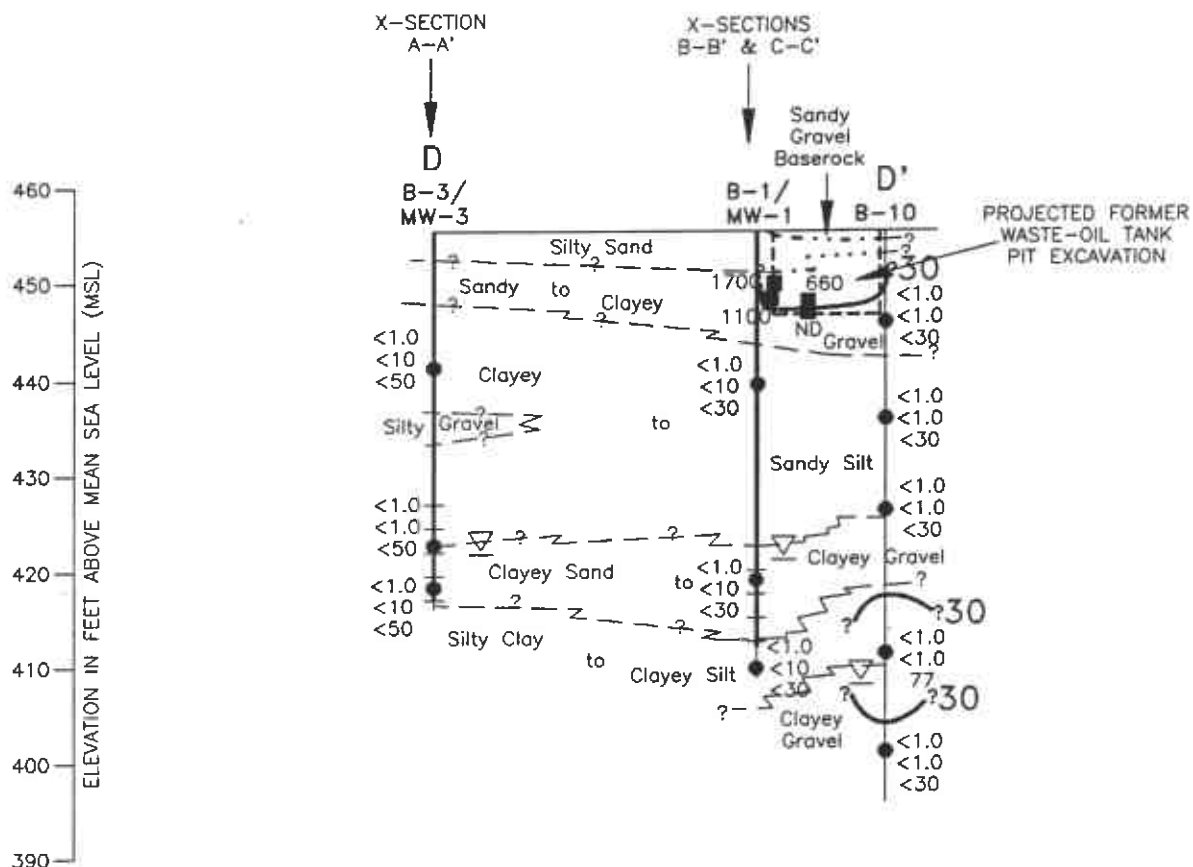
feet

PLATE
28

GEOLOGIC CROSS SECTION C-C'
ARCO Service Station 6113
785 East Stanley Boulevard
Livermore, California

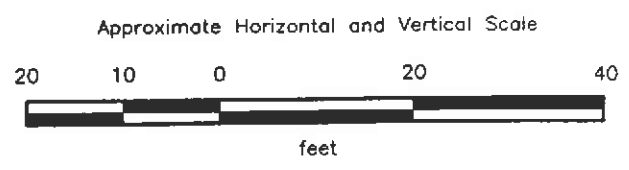


PROJECT 69028.07



EXPLANATION

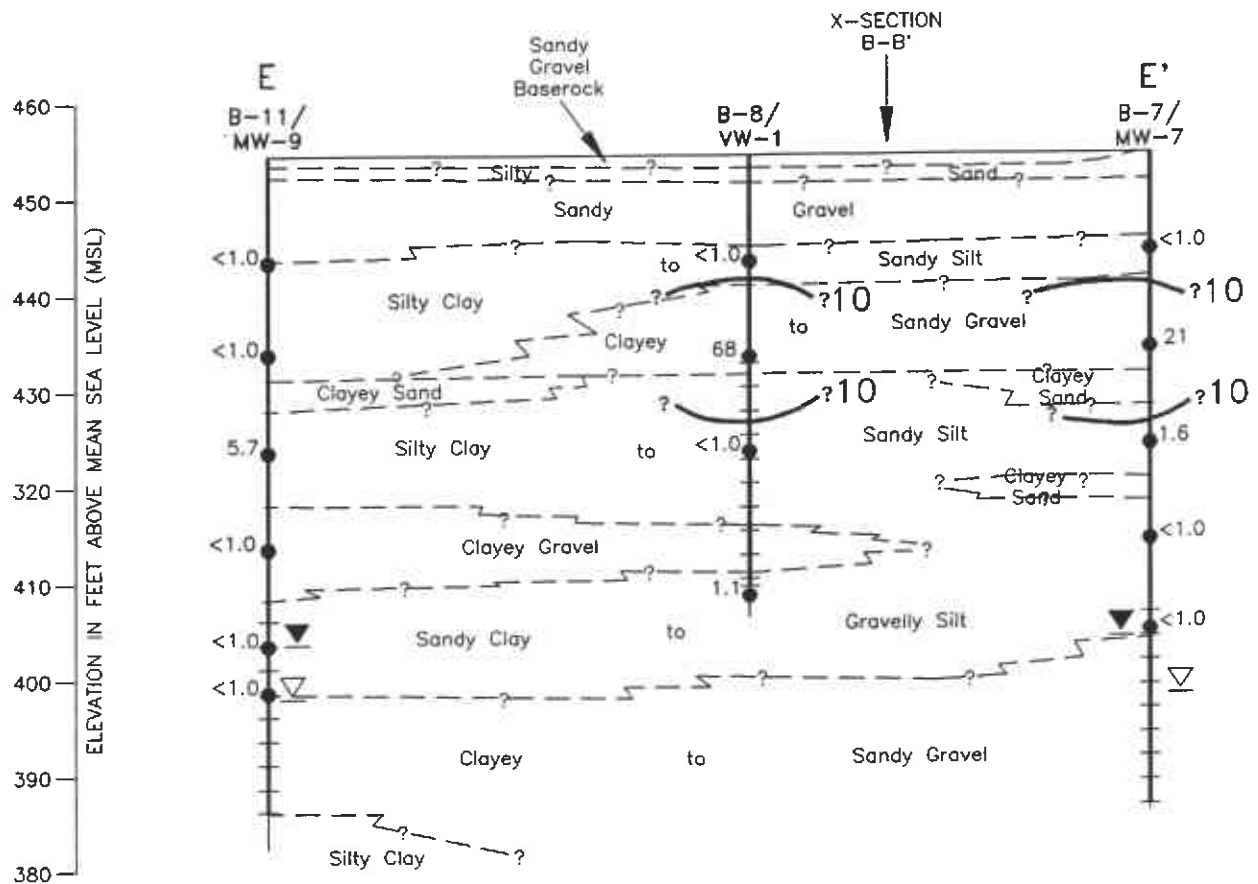
- = Line of equal concentration of TOG in soil in parts per million (ppm)
- = Laboratory analyzed soil sample showing concentration of TPHg (red), TPHd (green), and TOG (black) in ppm
- = Well casing
- = Well screen
- = Boring
- = Initial water level in boring
- = Not Detected
- = Laboratory analyzed tank pit soil sample showing concentration of TOG in ppm



GEOLOGIC CROSS SECTION D-D'
ARCO Service Station 6113
785 East Stanley Boulevard
Livermore, California

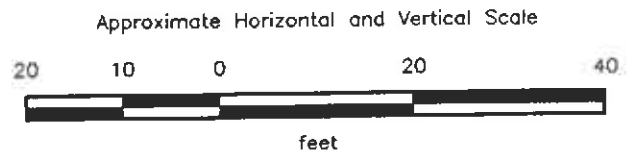
PLATE
29

PROJECT 69028.07



EXPLANATION

- = Line of equal concentration of TPHg in soil in parts per million (ppm)
- 68 = Laboratory analyzed soil sample showing concentration of TPHg in ppm
- = Well casing
- = Well screen
- = Boring
- = Initial water level in boring
- = Static water level in well (06/29/92)



RESNA
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PROJECT 69028.07

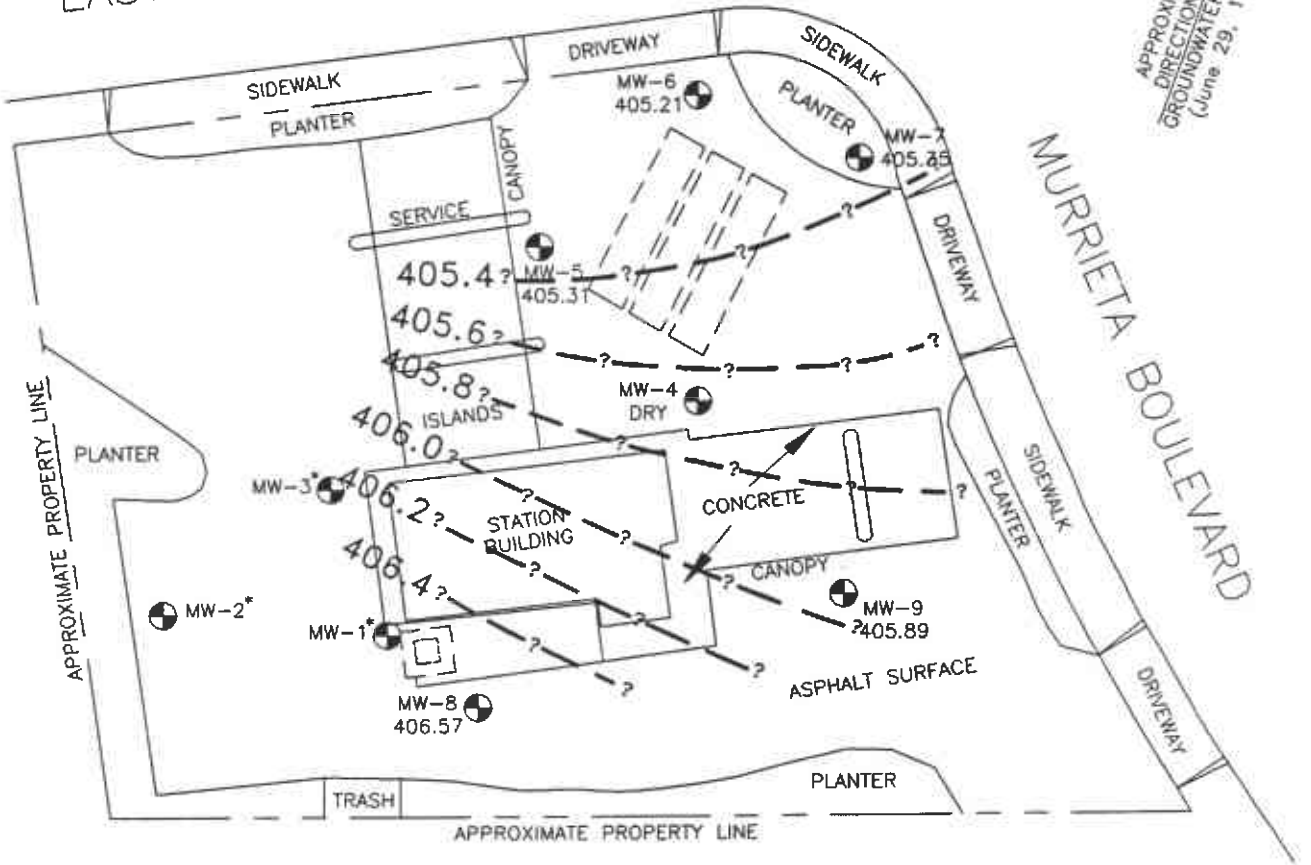
GEOLOGIC CROSS SECTION E-E'
ARCO Service Station 6113
785 East Stanley Boulevard
Livermore, California

PLATE



30

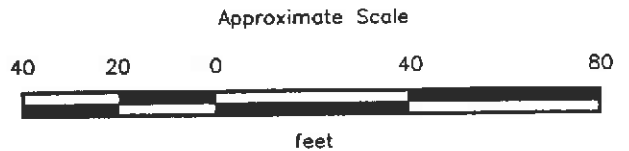
EAST STANLEY BOULEVARD

APPROXIMATE
DIRECTION OF
GROUNDWATER FLOW
(June 29, 1992)



EXPLANATION

- 406.4 = Line of equal elevation of groundwater in feet above mean sea level (MSL) in lower water-bearing zone
- 406.57 = Elevation of groundwater in feet above MSL, June 29, 1992
- MW-9  = Monitoring well (RESNA, 09/89, 02/91, and 06/92)
- * = Well contained residual water only
-  = Existing gasoline-storage tanks



Source: Modified from plan supplied by Ron Archer, Civil Engineer Inc., February 1991

RESNA
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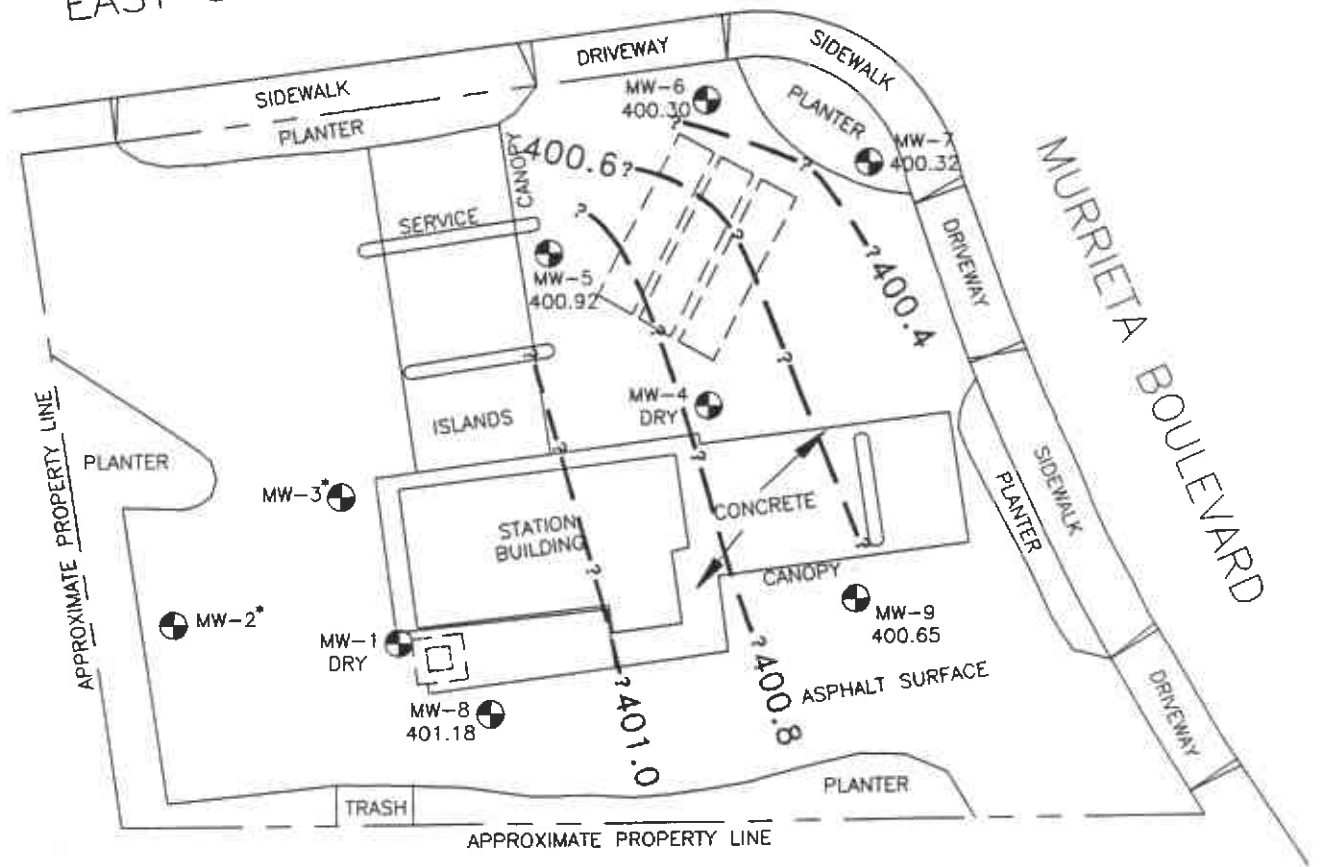
GROUNDWATER GRADIENT MAP
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California

PLATE

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PROJECT: 69028.07

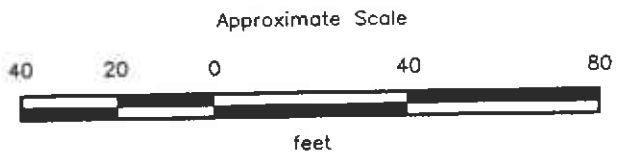
EAST STANLEY BOULEVARD



APPROXIMATE DIRECTION OF GROUNDWATER FLOW (July 28, 1992)

EXPLANATION

- 401.1 = Line of equal elevation of groundwater in feet above mean sea level (MSL) lower water-bearing zone
- 401.18 = Elevation of groundwater in feet above MSL, July 28, 1992
- MW-9 = Monitoring well (RESNA, 09/89, 02/91, and 06/92)
- * = Well contained residual water only
- = Existing gasoline-storage tanks



Source: Modified from plan supplied by Ron Archer, Civil Engineer Inc., February 1991

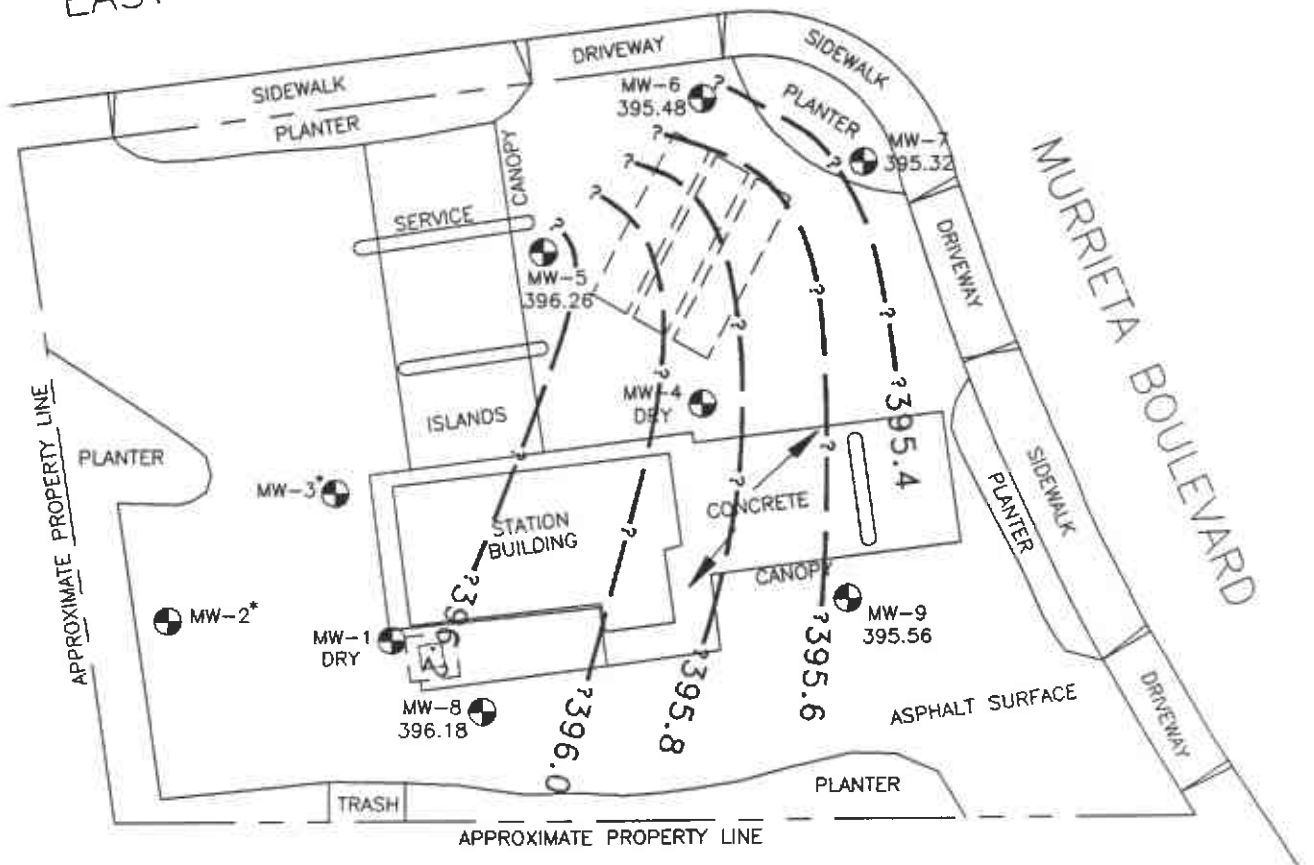
RESNA
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GROUNDWATER GRADIENT MAP
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California

PLATE
32

PROJECT: 69028.07

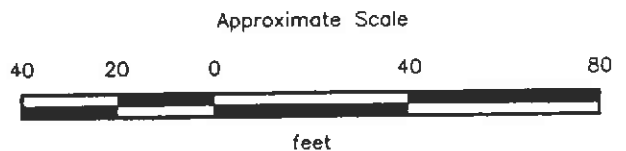
EAST STANLEY BOULEVARD



APPROXIMATE
DIRECTION OF
GROUNDWATER FLOW
(August 26, 1992)

EXPLANATION

- 396.2 = Line of equal elevation of groundwater in feet above mean sea level (MSL) in lower water-bearing zone
- 396.26 = Elevation of groundwater in feet above MSL, August 26, 1992
- MW-9 = Monitoring well (RESNA, 09/89, 02/91, and 06/92)
- * = Well contained residual water only
- = Existing gasoline-storage tanks



Source: Modified from plan supplied by Ron Archer, Civil Engineer Inc., February 1991

RESNA
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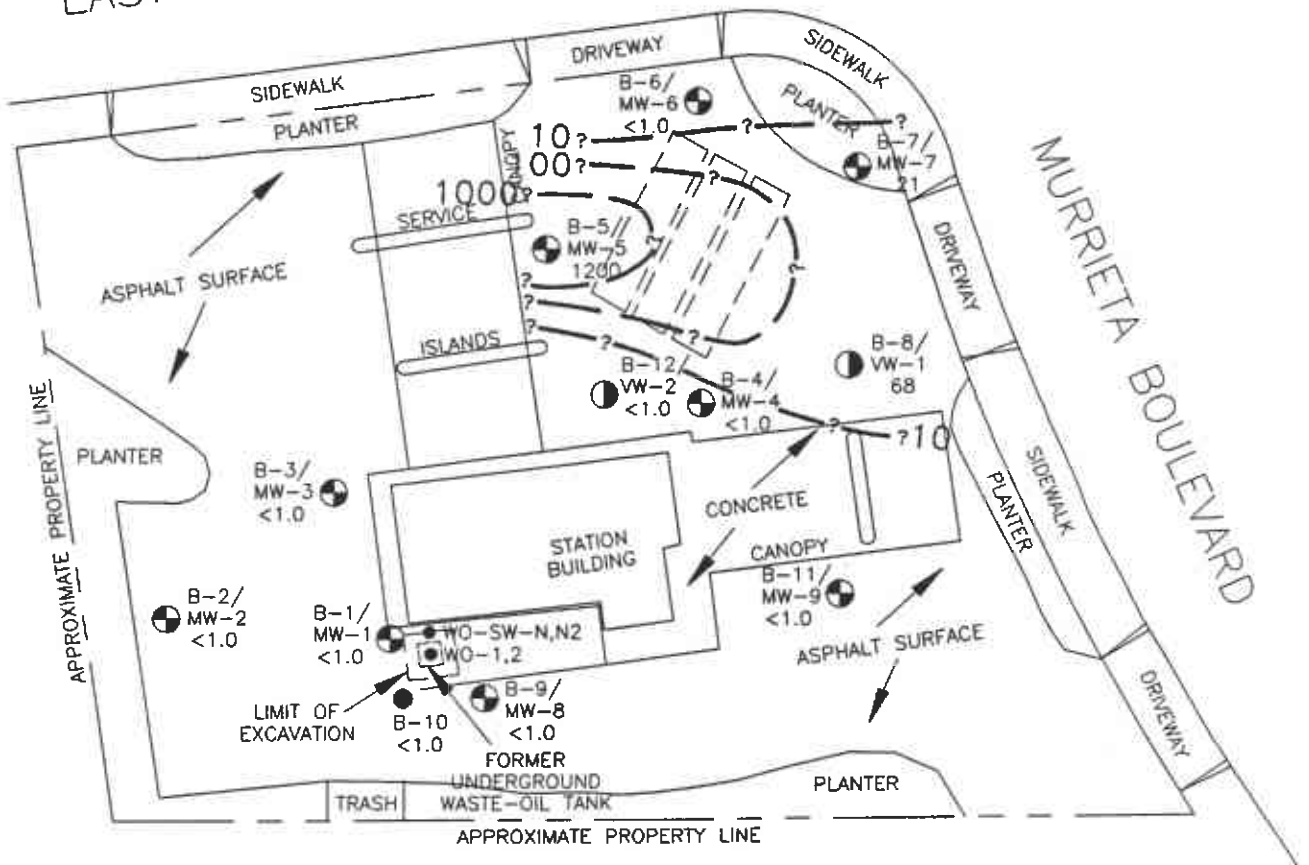
GROUNDWATER GRADIENT MAP
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California

PLATE

33

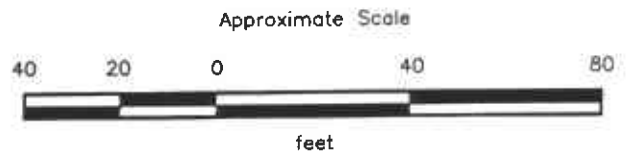
PROJECT: 69028.07

EAST STANLEY BOULEVARD



EXPLANATION

- 1000 = Line of equal concentration of TPHg in soil in parts per million (ppm)
- 1200 = Concentration of TPHg in soil at depths between 14 and 20-1/2 feet, in ppm
- B-11/
MW-9 ● = Boring/monitoring well (RESNA, 09/89, 02/91, and 06/92)
- B-12/
VW-2 ● = Boring/vapor extraction well (RESNA, 06/92 and 08/92)
- B-10 ● = Boring (RESNA, 06/92)
- WO-SW-N,N2 ● = Soil sample collected by Pacific (1989)
- [- -] = Existing underground gasoline storage tank



Source: Modified from plan supplied by Ron Archer, Civil Engineer Inc., October 1988.

RESNA
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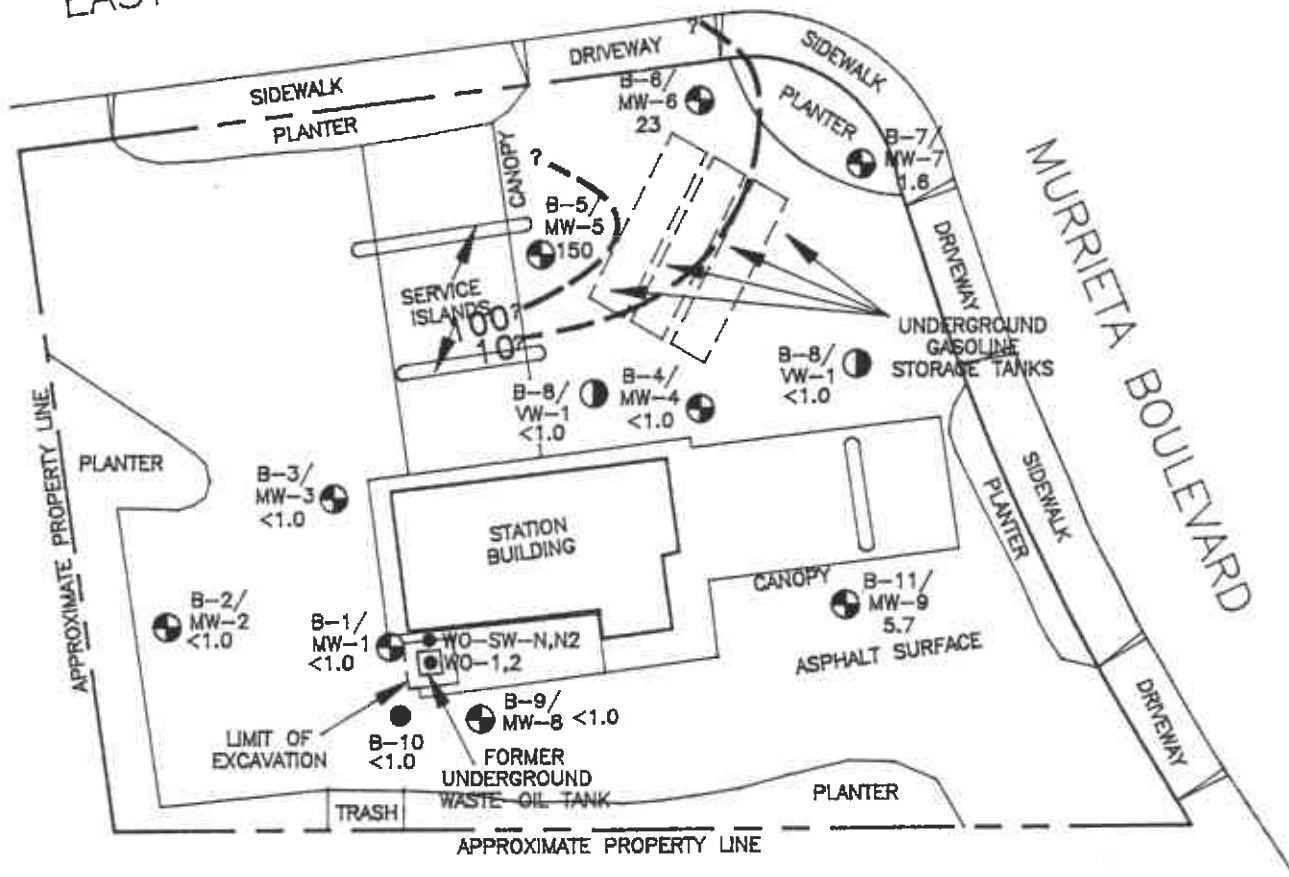
TPHg CONCENTRATIONS IN SOIL
BETWEEN 14 AND 20-1/2 FEET
ARCO Service Station 6113
785 East Stanley Boulevard
Livermore, California

PLATE

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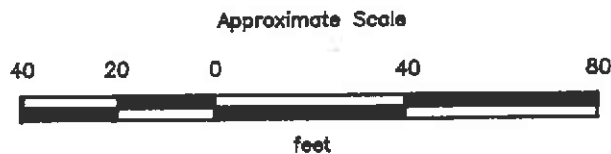
PROJECT: 69028.07

EAST STANLEY BOULEVARD



EXPLANATION

- 100 = Line of equal concentration of TPHg in soil in parts per million (ppm)
- 150 = Concentration of TPHg in groundwater in parts per billion, June 29, 1992
- B-11/MW-9 = Boring/monitoring well (RESNA, 09/89, 02/91, and 06/92)
- B-8/VW-2 = Boring/vapor extraction well (RESNA, 06/92 and 08/92)
- B-10 = Boring (RESNA, 06/92)
- WO-SW-N,N2 = Soil sample collected by Pacific (1989)
- = Underground gasoline storage tanks



Source: Modified from plan supplied by Ron Archer, Civil Engineer Inc., February 1991

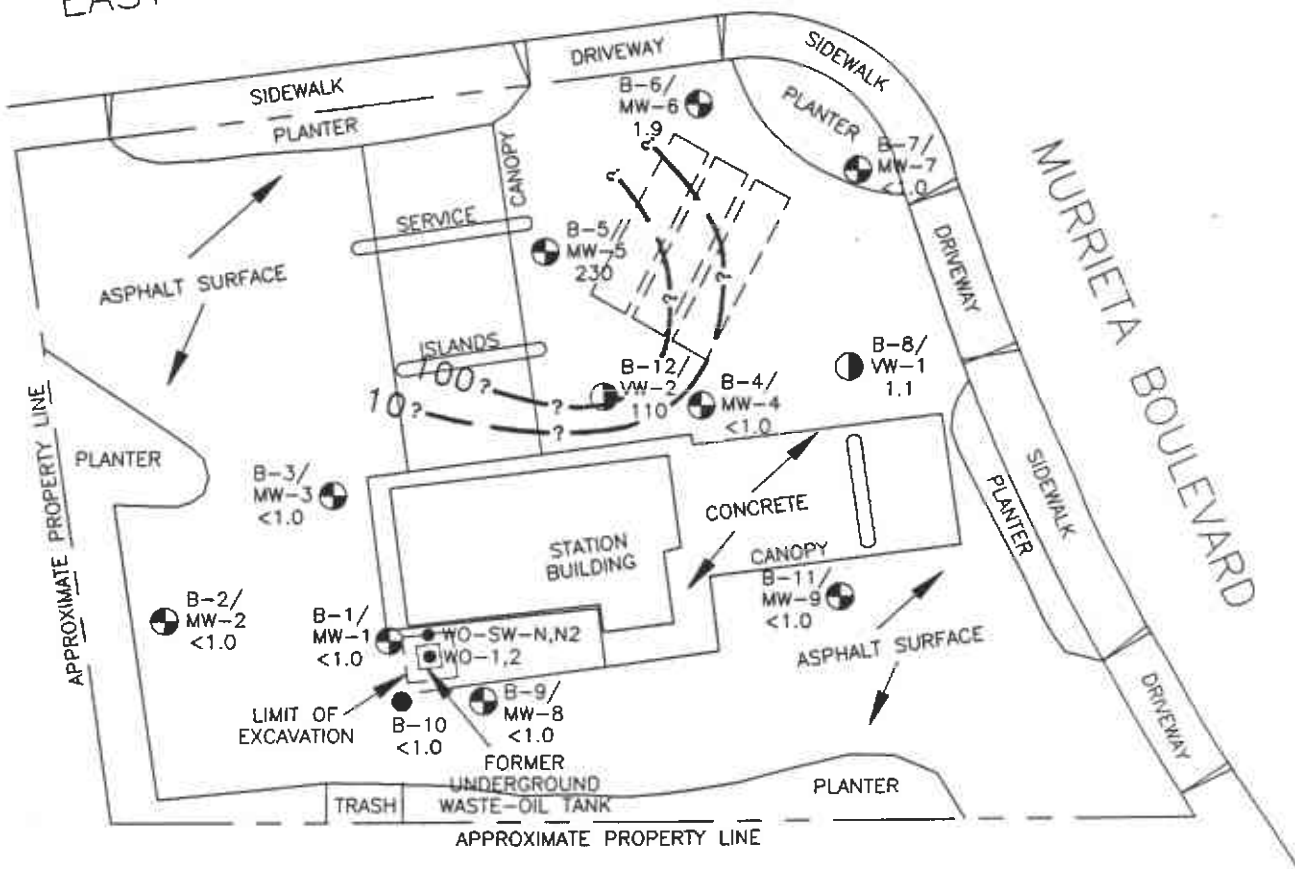
RESNA
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TPHg CONCENTRATIONS IN SOIL
BETWEEN 29 AND 34-1/2 FEET
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California

PLATE
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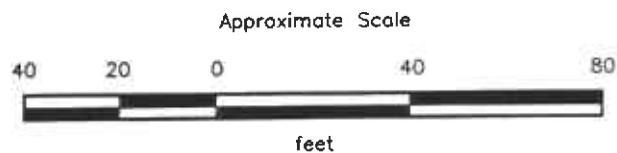
PROJECT 69028.07

EAST STANLEY BOULEVARD



EXPLANATION

- 100 = Line of equal concentration of TPHg in soil in parts per million (ppm)
- 230 = Concentration of TPHg in soil at depths between 37-1/2 and 45-1/2 feet, in ppm
- B-11/MW-9 = Boring/monitoring well (RESNA, 09/89, 02/91, and 06/92)
- B-12/VW-2 = Boring/vapor extraction well (RESNA, 06/92 and 08/92)
- B-10 = Boring (RESNA, 06/92)
- WO-SW-N,N2 = Soil sample collected by Pacific (1989)
- = Existing underground gasoline storage tank



Source: Modified from plan supplied by Ron Archer, Civil Engineer Inc., October 1988.

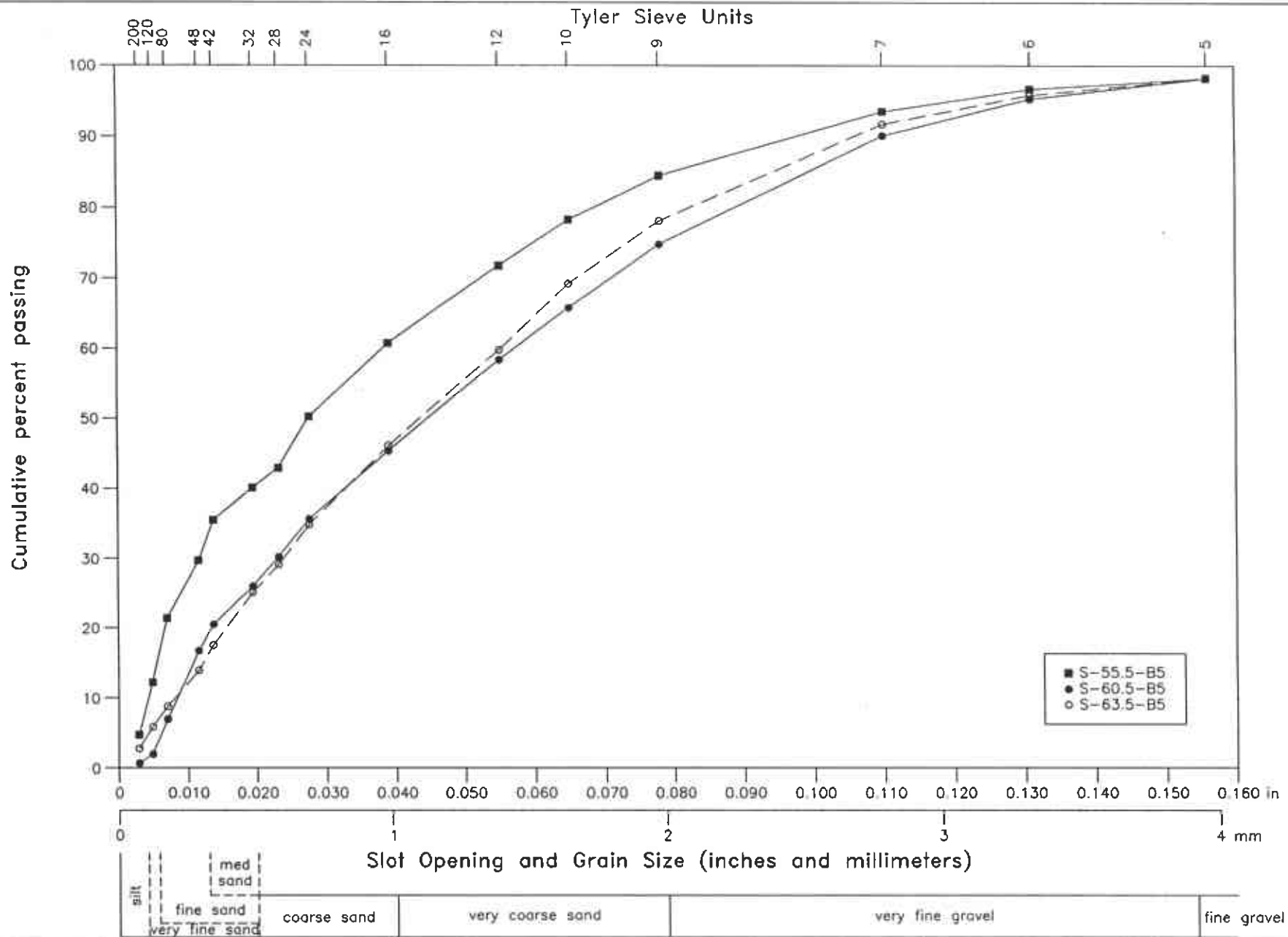
RESNA
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TPHg CONCENTRATIONS IN SOIL
BETWEEN 37-1/2 AND 45-1/2 FEET
ARCO Service Station 6113
785 East Stanley Boulevard
Livermore, California

PLATE

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PROJECT: 69028.07



PLATE

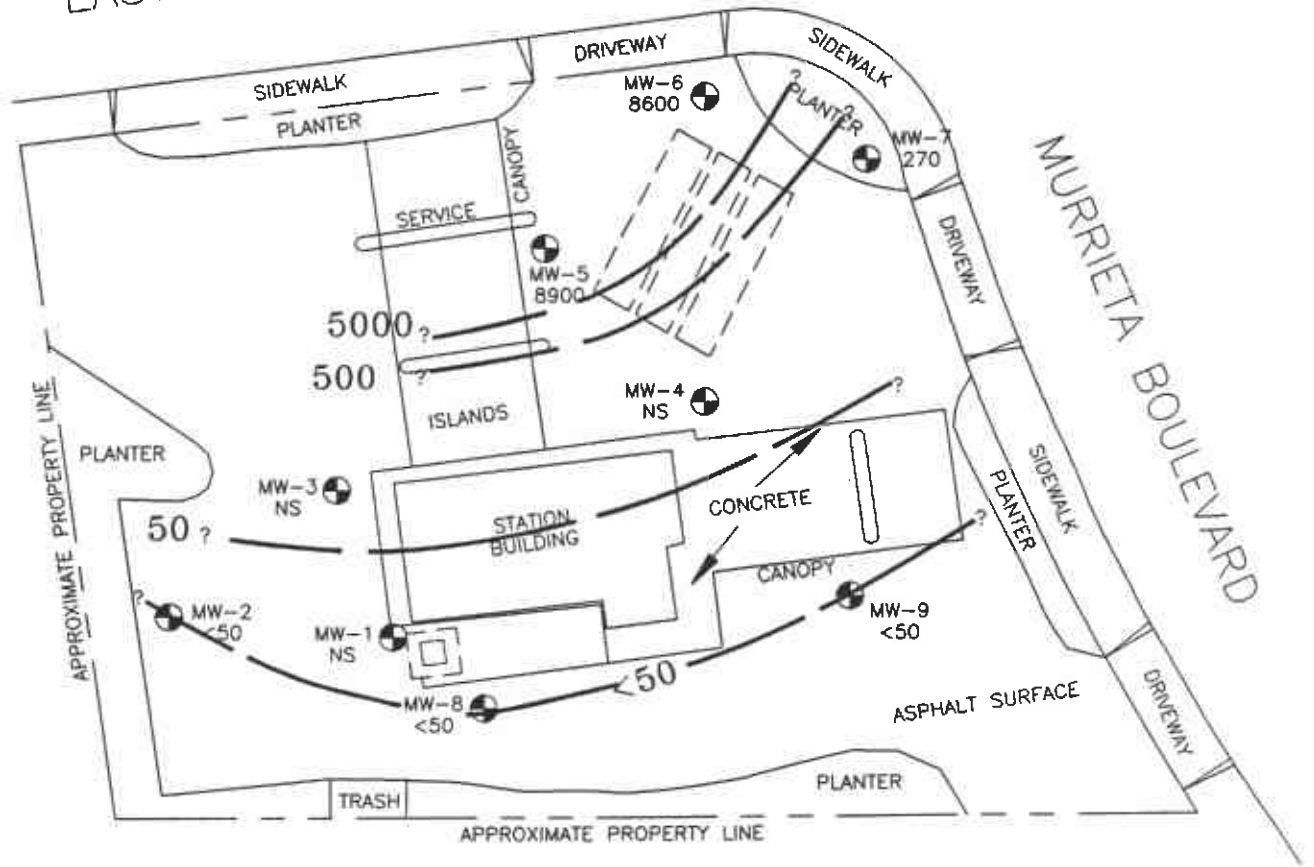
37

PARTICLE SIZE DISTRIBUTION GRAPH
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California

PROJECT

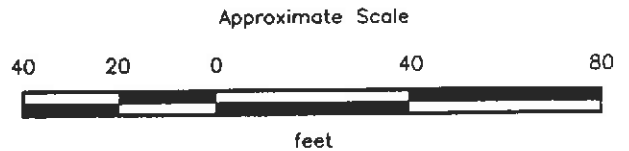
69028.07

EAST STANLEY BOULEVARD



EXPLANATION

- 5000 — = Line of equal concentration of TPHg in groundwater in ppb
- 8900 = Concentration of TPHg in groundwater in parts per billion, June 29, 1992
- MW-9 ⊕ = Monitoring well (RESNA, 09/89, 02/91, and 06/92)
- NS = Not sampled--well dry or residual water only
- = Existing gasoline-storage tanks



Source: Modified from plan supplied by Ron Archer, Civil Engineer Inc., February 1991

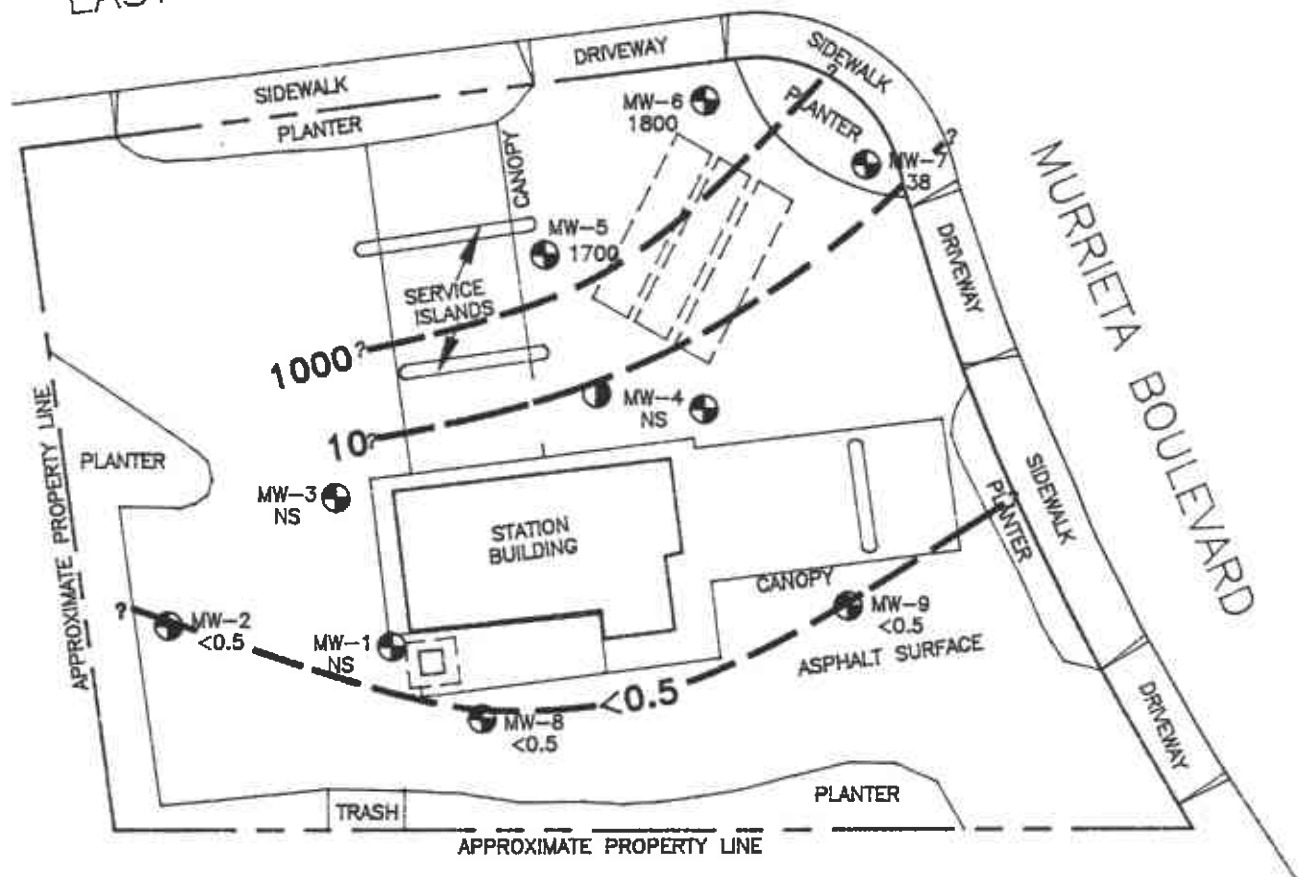
RESNA
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PROJECT: 69028.07

TPHg CONCENTRATIONS
IN GROUNDWATER
ARCO Station 613
785 East Stanley Boulevard
Livermore, California

PLATE
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EAST STANLEY BOULEVARD



EXPLANATION

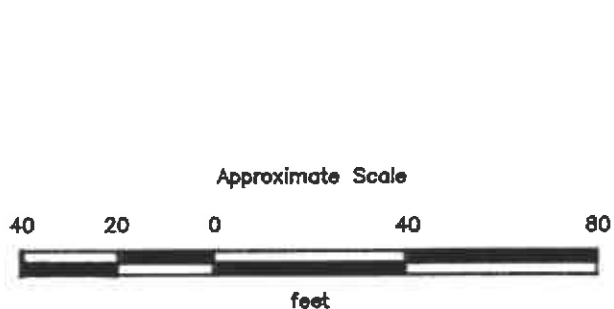
MW-9 = Boring/monitoring well (RESNA, 09/89, 02/91, and 06/92)

1000- = Line of equal concentration of benzene in groundwater in ppb

1800 = Concentration of benzene in groundwater in parts per billion, June 29, 1992

NS = Not sampled---well dry or residual water only

= Underground gasoline storage tanks



Source: Modified from plan supplied by Ron Archer, Civil Engineer Inc., February 1991

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PROJECT 69028.07

BENZENE CONCENTRATIONS
IN GROUNDWATER
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California

PLATE
39

Additional Subsurface Investigation and VET
ARCO Station 6113, Livermore, California

December 21, 1992
69028.07

TABLE 1
CUMULATIVE GROUNDWATER MONITORING DATA
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California
(Page 1 of 3)

Well Date	Elevation of Wellhead	Depth to Water	Elevation of Groundwater	Floating Product
<u>MW-1</u>				
09/20/89	457.04	21.03	436.01	None
10/12/89		19.64	437.40	None
06/21/90		21.72	435.32	None
09/20/90		19.79	437.25	None
12/18/90		19.28	437.76	None
02/21/91		22.45	434.59	None
03/20/91		19.87	437.17	None
04/10/91		19.42	437.62	None
05/20/91		25.95	431.09	None
06/20/91		32.55	424.49	None
07/25/91		38.22	418.82	None
08/13/91		40.74	416.30	None
09/12/91		43.16	413.88	None
10/22/91		Dry	Dry	None
11/13/91		Dry	Dry	None
12/21/91		Dry	Dry	None
01/18/92		Dry	Dry	None
02/21/92		Dry	Dry	None
03/19/92		36.16	420.88	None
04/24/92		38.14	418.90	None
05/20/92		40.74	416.30	None
06/29/92		43.80*	-	None
07/28/92		Dry	Dry	None
08/26/92		Dry	Dry	None
<u>MW-2</u>				
09/20/89	457.74	20.67	437.07	None
10/12/89		18.98	438.76	None
06/21/90		21.88	435.86	None
09/20/90		19.90	437.84	None
12/18/90		19.32	438.42	None
02/21/91		23.02	434.72	None
03/20/91		20.01	437.73	None
04/10/91		19.81	437.93	None
05/20/91		26.62	431.12	None
06/20/91		33.15	424.59	None
07/25/91		37.10	420.64	None
08/13/91		37.20	420.54	None
09/12/91		37.44*	-	None
10/22/91		37.38*	-	None
11/13/91		37.39*	-	None
12/21/91		Dry	Dry	None
01/18/92		37.65*	-	None

See notes on Page 3 of 3.

Additional Subsurface Investigation and VET
ARCO Station 6113, Livermore, California

December 21, 1992
69028.07

TABLE 1
CUMULATIVE GROUNDWATER MONITORING DATA
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California
(Page 2 of 3)

Well Date	Elevation of Wellhead	Depth to Water	Elevation of Groundwater	Floating Product
<u>MW-2cont.</u>				
02/21/92		37.75*	—	None
03/19/92		35.82	421.92	None
04/24/92		36.64	421.10	None
05/20/92		37.23	420.51	None
06/29/92		37.67*	—	None
07/28/92		38.36*	—	None
08/26/92		38.26*	—	None
<u>MW-3</u>				
09/20/89	456.97	20.98	435.99	None
10/12/89		19.66	437.31	None
06/21/90		21.72	435.25	None
09/20/90		19.72	437.25	None
12/18/90		19.21	437.76	None
02/21/91		22.36	434.61	None
03/20/91		19.79	437.18	None
04/10/91		19.35	437.62	None
05/20/91		25.86	431.11	None
06/20/91		32.45	424.52	None
07/25/91		38.06	418.91	None
08/13/91		38.40	418.57	None
09/12/91		Dry	Dry	None
10/22/91		Dry	Dry	None
11/13/91		Dry	Dry	None
12/21/92		Dry	Dry	None
01/18/92		38.90*	—	None
02/21/92		38.88*	—	None
03/19/92		36.03	420.94	None
04/24/92		37.92	419.05	None
05/20/92		38.57*	—	None
06/29/92		38.70*	—	None
07/28/92		39.05*	—	None
08/26/92		39.03*	—	None
<u>MW-4</u>				
02/21/91	456.97	22.01	434.96	None
03/20/91		20.31	436.66	None
04/10/91		19.55	437.42	None
05/20/91		25.24	431.73	None
06/20/91		Dry	Dry	None
07/25/91		Dry	Dry	None
08/13/91		Dry	Dry	None
09/12/91		Dry	Dry	None

See notes on Page 3 of 3.

Additional Subsurface Investigation and VET
ARCO Station 6113, Livermore, California

December 21, 1992
69028.07

TABLE 1
CUMULATIVE GROUNDWATER MONITORING DATA
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California
(Page 3 of 3)

Well Date	Elevation of Wellhead	Depth to Water	Elevation of Groundwater	Floating Product
<u>MW-4cont.</u>				
10/22/91		Dry	Dry	None
11/13/91		Dry	Dry	None
12/21/92		Dry	Dry	None
01/18/92		Dry	Dry	None
02/21/92		Dry	Dry	None
03/19/92		Dry	Dry	None
04/24/92		Dry	Dry	None
05/20/92		Dry	Dry	None
06/29/92	456.55	Dry	Dry	None
07/28/91		Dry	Dry	None
08/26/92		Dry	Dry	None
<u>MW-5</u>				
06/29/92	455.84	50.53	405.31	Odor
07/28/92		54.92	400.92	None
08/26/92		59.58	396.26	None
<u>MW-6</u>				
06/29/92	454.93	49.72	405.21	None
07/28/92		54.63	400.30	None
08/26/92		59.45	395.48	None
<u>MW-7</u>				
06/29/92	454.92	49.57	405.35	None
07/28/92		54.60	400.32	None
08/26/92		59.60	395.32	None
<u>MW-8</u>				
06/29/92	456.97	50.40	406.57	None
07/28/92		55.79	401.18	None
08/28/92		60.79	396.18	None
<u>MW-9</u>				
06/29/92	456.18	50.29	405.89	None
07/28/92		55.53	400.65	None
08/26/92		60.62	395.56	None

For MW-1 through MW-3 (surveyed by Ron Archer in October 1988) and MW-4 (surveyed by Ron Archer in February 1991) wellhead elevation based on benchmark: Top of pin set in concrete in the most westerly monument at the intersection of East Stanley Boulevard and Fenton Avenue. Elevation taken as 455.896 mean sea level. City of Livermore Datum.

For MW-4 through MW-9 (surveyed by John Koch in June 1992) wellhead elevation based on benchmark: Top of pin in standard monument, at intersection of El Rancho Drive and Albatross Ave. Elevation taken as 448.218'. City of Livermore Datum.

Depth-to-water measurements in feet below the top of the well casing.

* Residual water.

Additional Subsurface Investigation and VET
ARCO Station 6113, Livermore, California

December 21, 1992
69028.07

TABLE 2
VAPOR EXTRACTION TEST FIELD MONITORING DATA
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California
(Page 1 of 2)

Influent Air Stream from VW-1					Observation Wells					
Flow	% LEL	Applied Vacuum	% O ₂	Elapsed Time (min)	VW-2 Induced Vacuum	MW-4 Induced Vacuum	MW-5 Induced Vacuum	MW-6 Induced Vacuum	MW-7 Induced Vacuum	MW-9 Induced Vacuum
10.9	NM	5	NM	0	NM	NM	NM	NM	NM	NM
21.3	NM	10	NM	10	0	0.04	0	0	0	0
29.4	NM	15	NM	15	NM	NM	NM	NM	NM	NM
40.9	NM	25	NM	20	NM	NM	NM	NM	NM	NM
43.8	24	35	3.5	25	0	0.04	0.01	0.01	0	0.01
46.0	54	50	5	35	0	0.05	0.01	0.01	0.01	0.01
49.6	54	51	5	40	0.01	0.05	0.01	0.01	0.01	0.02
50.2	NM	60	NM	50	NM	NM	NM	NM	NM	NM
Distance from well VW-1 (feet):					54.5	37.11	74.9	65.7	38.7	48
Screen Interval (feet):					28-49.5	21-27	43-63	48-68	48-68	48-68
Depth to Water (DTW, feet):					Dry	Dry	57.2	56.9	56.9	57.8
Vapor extraction well VW-1 screened from 26 to 45 feet. DTW - Dry										

Influent Air Stream from MW-5					Observation Wells					
Flow	% LEL	Applied Vacuum	% O ₂	Elapsed Time (min)	VW-1 Induced Vacuum	VW-2 Induced Vacuum	MW-4 Induced Vacuum	MW-6 Induced Vacuum	MW-7 Induced Vacuum	MW-9 Induced Vacuum
10.9	NM	5	NM	0	NM	NM	NM	NM	NM	NM
21.3	NM	10	NM	5	NM	NM	NM	NM	NM	NM
24.9	84	20	15	20	0.05	0.04	0.015	0.50	0.44	0.015
* 34.5	72	28	12	30	0.04	0.04	0.015	0.90	0.90	0.02
* 34.5	72	28	12	35	0.04	0.06	0.01	1.2	1.2	0.015
* 30.7	12	24	2.5	40	0.04	0.06	0.01	1.2	1.25	0.015
* 34.5	90	28	17	50	0.04	0.06	0.01	1.4	1.3	0.015
* 38.3	24	30	5	60	0.04	0.06	0.01	1.6	1.4	0.015
28.5	24	20	4	75	0.04	0.06	0.01	1.2	1.15	0.015
28.5	78	20	10.5	90	0.04	0.06	0.01	1.25	1.15	0.015
28.5	78	20	10	110	0.04	0.06	0.01	1.25	1.15	0.015
Distance from well MW-5 (feet):					74.9	31.5	45	47.1	74	88
Screen Interval (feet):					26-45	28-49.5	21-27	48-68	48-68	48-68
Depth to Water (DTW, feet):					Dry	Dry	Dry	56.9	56.9	57.8
Vapor extraction well MW-5 screened from 43 to 63 feet. DTW - 57.21 feet										
*The I.C. engine operation sputtered at applied vacuums higher than 20" W.C. on MW-5 due to the low oxygen content in extracted vapor.										

Notes: Flow measured in cubic feet per minute (CFM).
Concentration measured as percent Lower Explosive Limit (%LEL) by volume on Combustible Gas Meter.
Vacuum measured in inches of water column.
NM = Not Measured.

Additional Subsurface Investigation and VET
ARCO Station 6113, Livermore, California

December 21, 1992
69028.07

TABLE 2
VAPOR EXTRACTION TEST FIELD MONITORING DATA
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California
(Page 2 of 2)

Influent Air Stream from VW-2					Observation Wells					
Flow	% LEL	Applied Vacuum	%O ₂	Elapsed Time (min)	VW-1 Induced Vacuum	MW-3 Induced Vacuum	MW-4 Induced Vacuum	MW-5 Induced Vacuum	MW-6 Induced Vacuum	MW-7 Induced Vacuum
22.9	NM	9	NM	0	NM	NM	NM	NM	NM	NM
37.4	NM	20	NM	2	NM	NM	NM	NM	NM	NM
44.4	NM	30	NM	4	NM	NM	NM	NM	NM	NM
46.1	NM	48	NM	6	NM	NM	NM	NM	NM	NM
* 43.5	NM	54	NM	8	NM	NM	NM	NM	NM	NM
* 48.5	NM	60	NM	10	NM	NM	NM	NM	NM	NM
47.8	36	50	17	15	0.07	0.05	0.09	0.07	0	0
53.5	48	50	16	30	0.08	0.04	0.1	0.08	0	0
49.7	42	50	12	45	0.07	0.05	0.09	0.07	0	0
47.8	36	50	17	60	0.09	0.04	0.1	0.07	0	0
47.8	54	50	7	75	0.09	0.04	0.105	0.06	0	0
47.8	72	48	11	90	0.095	0.04	0.12	0.06	0	0
53.6	60	49	13	110	0.095	0.04	0.12	0.06	0	0
48.4	48	49	15	120	0.095	0.04	0.12	0.06	0	0
45.2	NM	40	NM	130	0.08	0.04	0.1	0.06	0	0
36.4	NM	30	NM	140	0.06	0.04	0.075	0.04	0	0
27.0	NM	20	NM	150	0.06	0.02	0.06	0.04	0	0
10.7	NM	10	NM	170	0.04	0.02	0.04	0.03	0	0

Distance from well VW-2 (feet): 54.5 59.4 18.11 31.5 58.5 66.7
 Screen Interval (feet): 26-45 25-40 21-27 43-63 48-68 48-68
 Depth to Water (DTW, feet): Dry Dry Dry 57.2 56.9 56.9
 Vapor extraction well VW-2 screened from 28 to 49.5 feet. DTW - Dry
 *The I.C. engine operation sputtered at applied vacuums higher than 50" W.C. on VW-2.

Flow measured in cubic feet per minute (CFM).
 Concentration measured as percent Lower Explosive Limit (%LEL) by volume on Combustible Gas Meter.
 Vacuum measured in inches of water column.
 NM = Not Measured.

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TABLE 3
CUMULATIVE RESULTS OF LABORATORY ANALYSES OF SOIL SAMPLES
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California
(Page 1 of 3)

Sample	B	T	E	X	TPHg	TPHd	TOG
<u>September 1989</u>							
S-14½-B1	<0.005	<0.005	<0.005	<0.005	<1.0	<10	<30
S-34½-B1	<0.005	<0.005	<0.005	<0.005	<1.0	<10	<30
S-44½-B1	<0.005	<0.005	<0.005	<0.005	<1.0	<10	<30
S-19-B2	<0.005	<0.005	<0.005	<0.005	<1.0	<10	<50
S-34-B2	<0.005	<0.005	<0.005	<0.005	<1.0	<10	<50
S-41-B2	<0.005	<0.005	<0.005	<0.005	<1.0	<10	<50
S-14-B3	<0.005	<0.005	<0.005	<0.005	<1.0	<10	<50
S-34-B3	<0.005	<0.005	<0.005	<0.005	<1.0	<10	<50
S-37½-B3	<0.005	<0.005	<0.005	<0.005	<1.0	<10	<50
<u>February 1991</u>							
S-14½-B4	<0.005	<0.005	<0.005	<0.005	<1.0	<10	<50
S-19½-B4	<0.005	<0.005	<0.005	<0.005	<1.0	<10	<50
S-29-B4	0.008	<0.005	<0.005	<0.005	<1.0	<10	<50
S-0221-SP(A-D)	<0.005	<0.005	<0.005	<0.005	<1.0	<10	NA
<u>June 1992</u>							
S-10½-B5	<0.005	<0.005	<0.005	<0.005	<1.0	NA	NA
S-20½-B5	1.4	2.0	13	67	1,200	NA	NA
S-30½-B5	1.1	0.30	1.1	6.0	150	NA	NA
S-40½-B5	17	32	14	150	230	NA	NA
S-50½-B5	0.012	<0.005	<0.005	<0.005	<1.0	NA	NA
S-10½-B6	<0.005	<0.005	<0.005	<0.005	<1.0	NA	NA
S-20½-B6	<0.005	<0.005	<0.005	<0.005	<1.0	NA	NA
S-30½-B6	0.45	0.079	0.035	0.15	23	NA	NA
S-45½-B6	0.70	0.021	<0.005	<0.005	1.9	NA	NA
S-50½-B6	0.056	<0.005	<0.005	0.006	<1.0	NA	NA
S-10½-B7	<0.005	<0.005	<0.005	<0.005	<1.0	NA	NA
S-20½-B7	0.43	1.3	0.35	2.5	21	NA	NA
S-30½-B7	0.094	0.20	<0.005	0.023	1.6	NA	NA
S-40½-B7	0.009	<0.005	<0.005	<0.005	<1.0	NA	NA
S-50½-B7	<0.005	<0.005	<0.005	<0.005	<1.0	NA	NA
S-10½-B8	<0.005	<0.005	<0.005	<0.005	<1.0	NA	NA
S-20½-B8	<0.005	0.22	0.42	2.1	68	NA	NA
S-30½-B8	0.043	<0.005	<0.005	<0.005	<1.0	NA	NA
S-45½-B8	0.022	<0.005	<0.005	<0.005	1.1	NA	NA

See notes on Page 3 of 3.

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TABLE 3
CUMULATIVE RESULTS OF LABORATORY ANALYSES OF SOIL SAMPLES
ARCO Station 6113
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Sample	B	T	E	X	TPHg	TPHd	TOG
S-8½-B9	<0.005	<0.005	<0.005	<0.005	<1.0	<1.0	<30
S-20½-B9	<0.005	<0.005	<0.005	<0.005	<1.0	<1.0	74
S-30½-B9	<0.005	<0.005	<0.005	<0.005	<1.0	<1.0	<30
S-40½-B9	<0.005	<0.005	<0.005	<0.005	<1.0	<1.0	<30
S-50½-B9	<0.005	<0.005	<0.005	<0.005	<1.0	<1.0	<30
S-10-B10	<0.005	<0.005	<0.005	<0.005	<1.0	<1.0	<30
S-20-B10	<0.005	<0.005	<0.005	<0.005	<1.0	<1.0	<30
S-30-B10	<0.005	<0.005	<0.005	<0.005	<1.0	<1.0	<30
S-45-B10	<0.005	<0.005	<0.005	<0.005	<1.0	<1.0	77
S-55-B10	<0.005	<0.005	<0.005	<0.005	<1.0	<1.0	<30
S-10½-B11	<0.005	<0.005	<0.005	<0.005	<1.0	NA	NA
S-20½-B11	<0.005	<0.005	<0.005	<0.005	<1.0	NA	NA
S-30½-B11	<0.005	<0.005	<0.005	<0.005	5.7	NA	NA
S-40½-B11	<0.005	<0.005	<0.005	<0.005	<1.0	NA	NA
S-50½-B11	<0.005	<0.005	<0.005	<0.005	<1.0	NA	NA
S-55½-B11	<0.005	<0.005	<0.005	<0.005	<1.0	NA	NA
S-0615-SP1(A-D)	<0.005	<0.005	<0.005	<0.005	<1.0	NA	NA
S-0615-SP2(A-D)	0.014	0.037	0.054	0.45	24	NA	NA
<u>August 1992</u>							
S-10-B12	<0.005	<0.005	<0.005	<0.005	<1.0	NA	NA
S-20-B12	<0.005	<0.005	<0.005	<0.005	<1.0	NA	NA
S-30-B12	<0.005	<0.005	<0.005	<0.005	<1.0	NA	NA
S-40-B12	0.59	0.60	1.3	2.0	110	NA	NA
S-50-B12	<0.005	<0.005	<0.005	<0.005	<1.0	NA	NA
S-0804-SP(A-D)	<0.005	0.011	0.030	0.066	2.6	NA	NA

See notes on Page 3 of 3.

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TABLE 3
CUMULATIVE RESULTS OF LABORATORY ANALYSES OF SOIL SAMPLES
ARCO Station 6113
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Sample	Cadmium	Chromium	Lead	Nickel	Zinc	VOC
<u>June 1992</u>						
S-8½-B9	<0.010	<0.010	<0.0050	0.051	0.47	ND*
S-50½-B9	<0.010	<0.010	<0.0050	0.098	0.57	ND*
S-10-B10	<0.010	<0.010	<0.0050	0.13	0.44	ND*
S-55-B10	<0.010	<0.010	<0.0050	0.063	0.75	ND*
Background average concentrations in soil (ppm) ^{1,2}						
	0.06	100	11.5	74	50	-

Results in parts per million (ppm).

<: Results reported as less than the detection limit.

NA: Not Analyzed

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

TPHd: Total petroleum hydrocarbons as diesel by EPA method 3550/8015.

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

BTEX: Analyzed by EPA method 5030/8015/8020.

TOG: Total Oil and Grease by Standard Method 5520 E&F.

VOCs = Halogenated volatile organics.

NA = Compound not analyzed for.

ND = Compound not detected.

* = 37 compounds were tested

¹Lindsay, W.L. 1979. Chemical Equilibria in Soil. John Wiley & Sons.

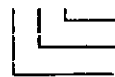
²Scot, L.M. December 1991. Background Metal Concentrations in Soils in Northern Santa Clara County, California". M.S.

Thesis, University of San Francisco.

Composite soil sample S-0615-SP2(A-D) consists of four soil samples taken from stockpiled soil.

Sample designation:

S-55-B11



Boring number

Sample depth in feet below ground surface

Soil sample

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TABLE 4
 CUMULATIVE RESULTS OF GROUNDWATER LABORATORY ANALYSES - TPHg and BTEX
 ARCO Station 6113
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 Livermore, California
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Well Date	TPHg	Benzene	Toluene	Ethyl- benzene	Total Xylenes
<u>MW-1</u>					
09/20/89	80	3.0	1.0	0.7	1
06/21/90	<20	<0.50	0.66	<0.50	<0.50
09/20/90	<50	<0.5	1.0	<0.5	1.8
12/18/90	<50	<0.5	1.8	<0.5	1.7
02/21/91	<50	1.2	2.3	<0.5	2.2
05/20/91	<30	<0.30	<0.30	<0.30	<0.30
08/13/91		Not sampled—dry			
11/13/91		Not sampled—dry			
03/19/92	400	<3.5*	<1.2*	<0.8*	<1.0*
06/29/92		Not sampled—residual water only			
<u>MW-2</u>					
09/20/89	<50	<0.5	<0.5	<0.5	<1
06/21/90	<20	<0.50	<0.50	<0.50	<0.50
09/20/90	<50	<0.5	0.7	<0.5	1.4
12/18/90	<50	0.6	1.5	<0.5	1.9
02/21/91	<50	<0.5	<0.5	<0.5	<0.5
05/20/91	<30	<0.30	<0.30	<0.30	<0.30
08/13/91		Not sampled—dry			
11/13/91		Not sampled—dry			
03/19/92	<50	<0.5	<0.5	<0.5	<0.5
06/29/92	<50	<0.5	<0.5	<0.5	<0.5
<u>MW-3</u>					
09/20/89	170	8.9	0.6	1.1	<1
06/21/90	<20	<0.50	1.0	<0.50	<0.50
09/20/90	<50	<0.5	1.0	<0.5	1.9
12/18/90	<50	<0.5	1.7	<0.5	2.0
02/21/91	<50	<0.5	<0.5	<0.5	<0.5
05/20/91	97	1.3	1.1	6.2	8.4
08/13/91		Not sampled—dry			
11/13/91		Not sampled—dry			
03/19/92	220	<1.1*	<1.9	<0.6*	<0.8*
06/29/92		Not sampled—residual water only			
<u>MW-4</u>					
02/21/91	3,500	410	7.6	30	47
05/20/91	1,400	150	6.0	4.4	3.1
08/13/91		Not sampled—dry			
11/13/91		Not sampled—dry			
03/19/92		Not sampled—dry			
06/29/92		Not sampled—dry			

See notes on Page 2 of 2.

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TABLE 4
CUMULATIVE RESULTS OF GROUNDWATER LABORATORY ANALYSES - TPHg and BTEX
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California
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<u>Well</u> <u>Date</u>	TPHg	Benzene	Toluene	Ethyl- benzene	Total Xylenes
<u>MW-5</u> 06/29/92	8,900	1,700	640	310	1,100
<u>MW-6</u> 06/29/92	8,600	1,800	460	52	450
<u>MW-7</u> 06/29/92	270	38	3.7	1.1	4.4
<u>MW-8</u> 06/29/92	<50	<0.5	<0.5	<0.5	<0.5
<u>MW-9</u> 06/29/92	<50	<0.5	<0.5	<0.5	<0.5
<u>October 1990</u> MCLs	None	1.0	None	680	1,750
Als	None	None	100	None	None

Results in parts per billion (ppb).

TPHg = Total petroleum hydrocarbons as gasoline

BTEX = Benzene, toluene, ethylbenzene and total xylenes

< = Less than the detection limits shown.

NA = Not analyzed

NS = Not sampled

MCLs = Adopted Maximum Contaminant Levels in Drinking Water, DHS (October 1990)

Als = Recommended Drinking Water Action Levels, DHS (October 1990)

* = Laboratory reportedly raised detection limit due to matrix interference.

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TABLE 5
CUMULATIVE RESULTS OF GROUNDWATER LABORATORY ANALYSES -- VOC, TPHd, TOG, and Metals
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California
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Well Date	VOC	TPHd	TOG	Cd	Cr	Pb	Zn	Ni
<u>MW-1</u>								
09/20/89	NA	<50	<5,000	NA	NA	NA	NA	NA
06/21/90	NA	<100	13,000	NA	NA	NA	NA	NA
09/20/90	NA	<50	<5,000	NA	NA	NA	NA	NA
12/18/90	NA	NA	<5,000	NA	NA	NA	NA	NA
02/21/91	NA	NA	<5,000	NA	NA	NA	NA	NA
05/20/91	NA	NA	<75,000	NA	NA	NA	NA	NA
08/13/91	NS	NS	NS	NS	NS	NS	NS	NS
11/13/91	NS	NS	NS	NS	NS	NS	NS	NS
03/19/92	NA	NA	NA	NA	NA	NA	NA	NA
<u>MW-2</u>								
09/20/89	NA	<50	<5,000	NA	NA	NA	NA	NA
06/21/90	NA	<100	<5,000	NA	NA	NA	NA	NA
09/20/90	NA	<50	<5,000	NA	NA	NA	NA	NA
12/18/90	NA	NA	<5,000	NA	NA	NA	NA	NA
02/21/91	NA	NA	<5,000	NA	NA	NA	NA	NA
05/20/91	NA	NA	<75,000	NA	NA	NA	NA	NA
08/13/91	NS	NS	NS	NS	NS	NS	NS	NS
11/13/91	NS	NS	NS	NS	NS	NS	NS	NS
03/19/92	NA	NA	NA	NA	NA	NA	NA	NA
<u>MW-3</u>								
09/20/89	NA	<50	<5,000	NA	NA	NA	NA	NA
06/21/90	NA	<100	10,000	NA	NA	NA	NA	NA
09/20/90	NA	<50	<5,000	NA	NA	NA	NA	NA
12/18/90	NA	NA	<5,000	NA	NA	NA	NA	NA
02/21/91	NA	NA	<5,000	NA	NA	NA	NA	NA
05/20/91	NA	NA	<75,000	NA	NA	NA	NA	NA
08/13/91	NS	NS	NS	NS	NS	NS	NS	NS
11/13/91	NS	NS	NS	NS	NS	NS	NS	NS
03/19/92	NA	<50	<5,000	NA	NA	NA	NA	NA

See notes on Page 2 of 2.

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TABLE 5
CUMULATIVE RESULTS OF GROUNDWATER LABORATORY ANALYSES – VOC, TPHd, TOG, and Metals
ARCO Station 6113
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Well Date	VOC	TPHd	TOG	Cd	Cr	Pb	Zn	Ni
<u>MW-4</u>								
02/21/91	NA	NA	<5,000	NA	NA	NA	NA	NA
05/20/91	NA	NA	<75,000	NA	NA	NA	NA	NA
08/13/91	NS	NS	NS	NS	NS	NS	NS	NS
11/13/91	NS	NS	NS	NS	NS	NS	NS	NS
03/19/92	NS	NS	NS	NS	NS	NS	NS	NS
<u>MW-8</u>								
06/29/92	ND*	<50	<500	<3	1,780	143	1,310	5,100
MCL:	Varies	—	—	10	50	50	5,000	—

Results for VOC, TPHd and TOG in micrograms per liter (ug/L) = parts per billion (ppb).

Results for Cd, Cr, Pb, Zn and Ni in micrograms per liter (ug/L) = parts per billion (ppb).

VOC: Halogenated Volatile Organic Compounds by EPA Method 5030/601.

TPHd: Total petroleum hydrocarbons as diesel by EPA Methods 3510/California DHS LUFT Method.

TOG: Total oil and grease measured by EPA Method 5520C&F.

NA: Not analyzed.

<: Results reported as less than the detection limit.

NS: Not sampled.

ND: Not detected.

*: 31 compounds tested were nondetectable.

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TABLE 6
LABORATORY ANALYSES OF AIR SAMPLES
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California

Sample ID	Sample Location	Elapsed Time of Sample	TPHg	B	T	E	X
AS-VW1-35	VW-1	35	45,000	900	89	27	68
AS-VW2-30	VW-2	30	52,000	510	58	15	35
AS-VW2-EFF	VW-2	35	630	33	5	2	6
AS-VW2-120	VW-2	120	37,000	350	34	10	21
AS-MW5-90	MW-5	90	130,000	530	120	17	39

Concentrations reported in milligrams per cubic meter (mg/m³).
Effluent sample collected from stack of internal combustion engine.

TPHg: Total petroleum hydrocarbons as gasoline (analyzed by EPA Methods 8015 and 8020).
B: Benzene
T: Toluene
E: Ethylbenzene
X: Total Xylene Isomers
BTEX: Analyzed by EPA Methods 8015 and 8020

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TABLE 7
ESTIMATED RADIUS OF INFLUENCE AND
PROJECTED INITIAL HYDROCARBON EXTRACTION RATES
DURING VAPOR EXTRACTION TEST
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California

Vapor Well	Elapsed Time	Applied Vacuum	Air Flowrate	Initial TPHg Vapor Concentration	Projected TPHg Removal Rate	Estimated ROI
VW-1	35 min	50	46 scfm	45,000 mg/m ³	186.0 lb/day	15 to 20
VW-2	30 min	50	48 scfm	52,000 mg/m ³	220 lb/day	15 to 20
VW-2	120 min	50	48 scfm	37,000 mg/m ³	160.0 lb/day	15 to 20
MW-5	90 min	20	28 scfm	130,000 mg/m ³	330 lb/day	10 to 75

Applied vacuum measured in inches of water column.

min = Elapsed time in minutes.

scfm = Air flowrate measured in standard cubic feet per minute.

mg/m³ = Milligrams per cubic meter

TPHg = Total petroleum hydrocarbons as gasoline (analyzed by EPA Method 8015/8020).

ROI = Effective radius of influence in feet.

lb/day = Removal rate measured in pounds per hour.

$$\text{TPHg removal rate} = \text{air flowrate (ft}^3/\text{min)} \times \text{Air concentration (mg/m}^3\text{)} \times \frac{[1440 \text{ min/day}] \times [0.02832 \text{ m}^3/\text{ft}^3]}{454,000 \text{ mg/lb}}$$

APPENDIX A
PREVIOUS WORK

Additional Subsurface Investigation and VET
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PREVIOUS WORK

January and February 1989

Previous Work performed at the site in January and February 1989 by Pacific Environmental Group (Pacific), included soil excavation, removal of the 280-gallon waste-oil tank, and collection of soil samples for laboratory analyses (Pacific Environmental Group, April 25, 1989). The waste-oil tank pit was excavated and the tank removed from the pit by Crosby and Overton, Inc. on January 26, 1989. During removal of the waste-oil tank, Pacific noted that the tank displayed no sign of leakage from either the fill pipe or the tank, and reported no detectable product odor in the soil beneath the tank. Pacific reported that soil removed from the northern wall of the tank excavation was slightly darker than soil from other areas of the excavation. The tank pit was excavated to a depth of 7-1/2 feet below grade. Pacific collected a soil sample (WO-1) at this depth (two feet below the bottom of the former waste-oil tank) in the central portion of the excavation. Pacific also collected a soil sample (WOSW-N) from the discolored area at a depth of 5 feet in the northern wall of the tank excavation, as requested by Mr. Gil Wistar of ACHCSA. The soil samples were analyzed for total oil and grease (TOG), high boiling hydrocarbons (HBHC, calculated as oil and diesel), semi-volatile organic compounds (VOC), and cadmium, chromium, lead, and zinc at International Technology Corporation (Hazardous Waste Testing Laboratory No. 137) in San Jose, California. Pacific reported that concentrations of chromium, lead, and VOCs were below the levels set by the California Regional Water Quality Control Board for these compounds in soil. Because elevated concentrations of TOG (660 to 1700 parts per million [ppm] and HBHC (60 to 790 ppm) were detected in both samples, the pit was excavated further two feet laterally and one foot vertically on February 3, 1989. According to Pacific's report, further excavation would have threatened the stability of the station building. Two additional samples (WO-2 at a depth of 8-1/2 feet from the center of the excavation, and WOSW-N2, at a depth of 7 feet from the northern end of the excavation) were collected and analyzed for TOG and HBHC. Soil sample locations are shown on Plate 2. The results of Pacific's soil laboratory testing are shown in Table 1A, Results of Laboratory Analyses of Soil Samples for Petroleum Hydrocarbons and Metals from Waste-Oil Tank Pit. The excavation was backfilled with clean fill.

September 1989 - January 1991

RESNA drilled and sampled three soil borings (B-1, B-2, and B-3), and installed and sampled three groundwater monitoring wells (MW-1, MW-2, and MW-3, respectively) in the borings (AGS, December 6, 1989). The locations of these borings are shown on Plate 2. The results of laboratory analyses of soil samples are presented in Table 3, Cumulative Results of Laboratory Analyses of Soil Samples in the main body of this report. Laboratory

Additional Subsurface Investigation and VET
ARCO Station 6113, Livermore, California

December 21, 1992
69028.07

analyses of soil samples obtained from each of the borings reported nondetectable (less than 1 ppm) levels of total petroleum hydrocarbons as gasoline (TPHg), nondetectable (less than 10 ppm) levels of total petroleum hydrocarbons as diesel (TPHd), and nondetectable (less than 30 ppm) levels of TOG.

Laboratory analyses of water samples obtained from wells MW-1, MW-2, and MW-3 during quarterly monitoring by RESNA reported nondetectable levels of TPHd (less than 100 parts per billion [ppb]) and TOG (less than 5,000 ppb) in the wells, with the exception of two samples collected on June 21, 1990, from the monitoring wells MW-1 and MW-2 which contained 13,000 ppb and 10,000 ppb of TOG respectively (see Table 4, Cumulative Results of Groundwater Laboratory Analyses - TPHg and BTEX, and Table 5, Cumulative Results of Groundwater Laboratory Analyses - VOC, TPHd, TOG, and Metals, in the main body of this report). Between September 1989 and January 1991, the gasoline constituents benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) in water samples obtained from wells MW-1 through MW-3 have been below the California State Department of Health Services (DHS) maximum contaminant levels (MCLs) for drinking water.

The groundwater gradient evaluated from the groundwater elevation data (Table 1, Cumulative Groundwater Monitoring Data in the main body of this report) remained consistent since September 1989 through January 1991, and ranged from 0.028 to 0.009 to the northeast.

The results of quarterly monitoring are summarized in the reports listed in the References section of this report.

February and March 1991

RESNA performed a limited subsurface environmental investigation (RESNA, April 16, 1991) to evaluate the lateral and vertical extent of waste-oil related hydrocarbons in the soil, and the potential impact of these hydrocarbons on groundwater downgradient of the former underground waste-oil tank. This work involved drilling one soil boring (B-4) collecting and describing soil samples from the boring, installing and developing a 4-inch-diameter groundwater monitoring well (MW-4) in the boring, sampling groundwater from the monitoring wells at the site, surveying wellhead elevations, measuring depths-to-water in the wells, laboratory analyses of selected soil and groundwater samples, and preparing a report. The location of the boring/monitoring well is shown on Plate 2.

Groundwater was first encountered at a depth of approximately 24 feet below the ground surface. Results of laboratory analyses of soil samples indicated nondetectable concentrations of TPHg, TPHd, TOG, and BTEX in all soil samples, with the exception of

Additional Subsurface Investigation and VET
ARCO Station 6113, Livermore, California

December 21, 1992
69028.07

one sample collected at 29 feet in a damp silty clay layer, which contained a very low concentration of benzene at 0.008 ppm (slightly above the laboratory detection limit [<0.005]). The results of laboratory analyses of soil samples are presented in Table 3.

Water samples collected from MW-1 through MW-4 for subjective analyses showed no evidence of measurable floating product or product sheen. Laboratory analyses of groundwater samples collected on February 21, 1991 from monitoring wells MW-1 through MW-4 reported concentrations of BTEX in the wells below the MCLs and recommended action levels for drinking water, with the exception of benzene in wells MW-1 (1.2 ppb) and MW-4 (410 ppb). Concentrations of TPHg and TOG continued to remain nondetectable in wells MW-1 through MW-3, which are generally upgradient of the former waste-oil tank; however, 3,500 ppb TPHg and nondetectable concentrations of TOG were reported in the water sample obtained from MW-4 in February 1991, downgradient of the former waste-oil tank (Tables 4 and 5).

April 1991 through May 1992

The groundwater elevations in groundwater monitoring wells MW-1 through MW-4 have decreased 10 to 18 feet since April 1991, and the wells has been dry or contained only residual water most of the time since the second half of 1991. During this period quarterly groundwater sampling of wells MW-1 through MW-4 was performed at the site on May 20, 1991, and of wells MW-1 through MW-3 on March 19, 1992. During the third and fourth quarters of 1991 the wells could not be sampled because they were dry. The DTW measurements, wellhead elevations, and groundwater elevations are presented in Table 1, and the results of groundwater analyses are presented in Tables 4 and 5 in the main body of this report.

Gradient interpretations from the monitoring episodes incorporating data from the second quarter of 1991 and March 1992 from wells MW-1 through MW-3 indicated a fluctuated groundwater gradient direction (west-southwest to east-northeast).

Additional Subsurface Investigation and VET
ARCO Station 6113, Livermore, California

December 21, 1992
69028.07

TABLE 1A
RESULTS OF LABORATORY ANALYSES OF SOIL SAMPLES
FOR PETROLEUM HYDROCARBONS AND METALS FROM WASTE-OIL TANK PIT
ARCO Station 6113
785 East Stanley Boulevard
Livermore, California

Sample Identifier	TOG	HBHC DIESEL	HBHC OIL	ZN	PB	CD	CR
<u>01/26/89</u>							
W0-1	660	160	60	36	18	ND	35
W0SW-N	1700	490	790	43	16	ND	61
<u>02/03/89</u>							
W0-2	ND	ND	ND	NM	NM	NM	NM
W0SW-N2	1100	30	800	NM	NM	NM	NM

Results in parts per million (ppm).

Results from work performed by Pacific Environmental Group, April 25, 1989

TOG: Total oil and grease

HBHC: High boiling hydrocarbons

ZN: zinc PB: lead CD: cadmium CR: chromium

ND: Not detected NM: Not measured

APPENDIX B

WELL CONSTRUCTION PERMITS



ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

5997 PARKSIDE DRIVE PLEASANTON, CALIFORNIA 94588 (415) 484-2600

DRILLING PERMIT APPLICATION

FOR APPLICANT TO COMPLETE

FOR OFFICE USE

LOCATION OF PROJECT ARCO 6113
185 East Stanley Boulevard
Livermore CA

PERMIT NUMBER 92376

LOCATION NUMBER

CLIENT
Name ARCO
Address P.O. Box 9811 Phone 415 571-2434
City San Mateo Zip 94402

PERMIT CONDITIONS

Circled Permit Requirements Apply

APPLICANT
Name RESNA Industries
Address 235 Alameda Exp Bldg Phone 408 264-7723
City San Jose Zip 95118

A. GENERAL

- 1. A permit application should be submitted so as to arrive at the Zone 7 office five days prior to proposed starting date.
2. Submit to Zone 7 within 60 days after completion of permitted work the original Department of Water Resources Water Well Drillers Report or equivalent for well projects, or drilling logs and location sketch for geotechnical projects.
3. Permit is void if project not begun within 90 days of approval date.

B. WATER WELLS, INCLUDING PIEZOMETERS

- 1. Minimum surface seal thickness is two inches of cement grout placed by tremie.
2. Minimum seal depth is 50 feet for municipal and industrial wells or 20 feet for domestic and irrigation wells unless a lesser depth is specially approved. Minimum seal depth for monitoring wells is the maximum depth practicable or 20 feet.

C. GEOTECHNICAL. Backfill bore hole with compacted cuttings or heavy bentonite and upper two feet with compacted material. In areas of known or suspected contamination, tremied cement grout shall be used in place of compacted cuttings.

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

E. WELL DESTRUCTION. See attached.

TYPE OF PROJECT
Well Construction Geotechnical Investigation
Cathodic Protection General
Water Supply Contamination
Monitoring Well Destruction
Super Extraction well

PROPOSED WATER SUPPLY WELL USE
Domestic Industrial Other
Municipal Irrigation

DRILLING METHOD:
Air Rotary Air Rotary Auger Mollar Stem
Other

DRILLER'S LICENSE NO. 484288 (C-57)

PROJECTS
Drill Hole Diameter 12 In. Maximum
Casing Diameter 4 In. Depth 50 ft.
Surface Seal Depth 17 ft. Number 1

GEOTECHNICAL PROJECTS
Number of Borings Maximum
Hole Diameter In. Depth ft.

ESTIMATED STARTING DATE 8/01/92
ESTIMATED COMPLETION DATE 9/01/92

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

Approved Wyman Hong Date 30 Jul 92

Wyman Hong

APPLICANT'S SIGNATURE Barbara M... Date 7/27/92



ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

5997 PARKSIDE DRIVE PLEASANTON, CALIFORNIA 94588 (510) 484-2600

DRILLING PERMIT APPLICATION

FOR APPLICANT TO COMPLETE

FOR OFFICE USE

LOCATION OF PROJECT ARCO 6113
285 EAST STANLEY BOULEVARD
LIVERMORE, CA

PERMIT NUMBER 92131
LOCATION NUMBER

CLIENT
Name ARCO ENR
Address P.O. BOX 5811 Phone (415) 571-2434
City SAN MATEO Zip 94402

PERMIT CONDITIONS

Circled Permit Requirements Apply

APPLICANT
Name RESNA - JOEL COFFMAN
Address SUITE 34 3315 ALMADEN EXPWAY Phone (408) 264-7723
City SAN JOSE Zip 95118

TYPE OF PROJECT
Well Construction Geotechnical Investigation
Cathodic Protection General
Water Supply Contamination
Monitoring Well Destruction

PROPOSED WATER SUPPLY WELL USE
Domestic Industrial Other MONITORING
Municipal Irrigation

DRILLING METHOD:
Mud Rotary Air Rotary Auger Hollow-STEM
Cable Other

DRILLER'S LICENSE NO. 484288(C-57)

WELL PROJECTS
Drill Hole Diameter 10 in. Maximum
Casing Diameter 4 in. Depth 45 ft.
Surface Seal Depth 25 ft. Number 5

GEOTECHNICAL PROJECTS
Number of Borings 1 Maximum
Hole Diameter 8 in. Depth 45 ft.

ESTIMATED STARTING DATE April 1, 1992 8 JUN 92
ESTIMATED COMPLETION DATE April 18, 1992

- A. GENERAL
1. A permit application should be submitted so as to arrive at the Zone 7 office five days prior to proposed starting date.
2. Submit to Zone 7 within 60 days after completion of permitted work the original Department of Water Resources Water Well Drillers Report or equivalent for well projects, or drilling logs and location sketch for geotechnical projects.
3. Permit is void if project not begun within 90 days of approval date.
B. WATER WELLS, INCLUDING PIEZOMETERS
1. Minimum surface seal thickness is two inches of cement grout placed by tremie.
2. Minimum seal depth is 50 feet for municipal and industrial wells or 20 feet for domestic and irrigation wells unless a lesser depth is specially approved. Minimum seal depth for monitoring wells is the maximum depth practicable or 20 feet.
C. GEOTECHNICAL. Backfill bore hole with compacted cuttings or heavy bentonite and upper two feet with compacted material. In areas of known or suspected contamination, tremied cement grout shall be used in place of compacted cuttings.
D. CATHODIC. Fill hole above anode zone with concrete placed by tremie.
E. WELL DESTRUCTION. See attached.

Approved Wyman Hong Date 20 Mar 92

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

APPLICANT'S SIGNATURE Joel Coffman Date 3-18-92

FIELD PROTOCOL

Site Safety Plan

The Site Safety Plan (RESNA, May 29, 1992) describes the safety requirements for the evaluation of gasoline hydrocarbons in soil and groundwater at the site. The site Safety Plan is applicable to personnel of RESNA and its subcontractors. RESNA personnel and subcontractors of RESNA scheduled to perform the work at the site were briefed on the contents of the Site Safety Plan before work began. A copy of the Site Safety Plan was available for reference by appropriate parties during the work. The Staff Geologist of RESNA was Site Safety Officer for 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 aluminized duct tape; labeled; and promptly placed in iced storage for transport to the laboratory, where compositing will be performed.

Soil Borings

Prior to the drilling of borings and construction of monitoring wells, permits were acquired from the appropriate regulatory agency. Copies of the permits are included in Appendix B of this report. Prior to drilling, Underground Services Alert was notified of our intent to drill, and known underground utility lines and structures were marked. The borings were drilled by a truck-mounted drill rig equipped with 10- or 12-inch-diameter, hollow-stem augers. The augers were steam-cleaned prior to drilling each boring to minimize the possibility of cross-contamination. After the borings were drilled, wells were constructed in the borings, or the borings were backfilled to the ground surface with neat-cement grout and bentonite.

Borings for groundwater monitoring wells were drilled to a depth of no more than 20 feet below the depth at which a saturated zone was first encountered, or a short distance into

a stratum beneath the saturated zone which was of moisture content and consistency to be judged as a perching layer by the field geologist, whichever was shallower.

Drill Cuttings

Drill cuttings subjectively evaluated for hydrocarbons at levels greater than 100 parts per million (ppm) were separated from those subjectively evaluated for hydrocarbons at levels less than 100 ppm. Evaluation was based either on subjective evidence of soil discoloration, or on measurements made using a field calibrated organic vapor meter (OVM). Readings were taken by placing a soil sample into a ziplock-type plastic bag and allowing volatilization to occur. The intake probe of the OVM was then inserted into the headspace created in the plastic bag immediately after opening it. The drill cuttings from the borings were placed on plastic at the site, and covered with plastic. The cuttings were removed to a Sanitary Landfill by ARCO.

Soil Sampling in Borings

Soil samples were collected at no greater than 5-foot intervals from the ground surface to the total depth of the borings. The soil samples were 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. The sampler and brass sleeves were laboratory-cleaned, steam-cleaned, or washed thoroughly with Alconox® and water, prior to each use. The sampler was driven with a standard 140-pound hammer repeatedly dropped 30 inches. The number of blows to drive the sampler each successive six inches was counted and recorded to evaluate the relative consistency of the soil.

The samples selected for laboratory analyses were removed from the sampler and quickly sealed in their brass sleeves with aluminum foil, plastic caps, and aluminized duct tape. The samples were 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 analyses at each sampling interval was tested in the field using an OVM that was field calibrated at the beginning of each day it was used. This testing was performed by inserting the intake probe of the OVM into the headspace created 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 report.

Logging of Borings

A geologist was present to log the soil cuttings and samples using the Unified Soil Classification System. Samples not selected for chemical analyses, and the soil in the sampler shoe, were 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 hydrocarbons, such as soil staining, noticeable or obvious product odor, and OVM readings.

Well Construction

Monitoring wells were constructed in selected borings using clean 4-inch-diameter, thread-jointed, Schedule 40 PVC casing. No chemical cements, glues, or solvents were used in well construction. Each casing bottom was sealed with a threaded end-plug, and each casing top with a locking plug. The screened portions of the wells were constructed of machine-slotted PVC casing with 0.020-inch-wide slots for initial site wells. The screened sections in groundwater monitoring wells were placed to allow monitoring during seasonal fluctuations of groundwater levels. Vapor extraction wells were constructed using the same protocol for monitoring wells mentioned above, however the screened portion of the wells were constructed with much-slotted PVC casing with 0.100-inch-wide slots. This is to allow greater air-flow communication between the stratigraphic units and the well.

The annular space of each well was backfilled with No. 3 sand (groundwater monitoring wells), or pea gravel (vapor extraction wells) to approximately two feet above the top of the screened casing. The sand pack grain size for subsequent wells will be based on sieve analyses and/or well development data. A 1- to 2-foot-thick bentonite plug was placed above the sand as a seal against cement entering the filter pack. The remaining annulus was then backfilled with a slurry of water, neat cement, and bentonite to approximately one foot below the ground surface.

An utility box was 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 were developed by over-pumping and surge-block techniques. The wells were pumped, allowed to recharge, and bailed or pumped again until the water removed from the wells was subjectively evaluated to be clear by the field geologist. The

RECEIVED

JUL 23 1992

RESNA
SAN JOSE

JOHN E. KOCH
Land Surveyor
CA State Lic. No. LS4811
5427 Telegraph Ave., Suite A
Oakland, CA 94609
(510) 655-9956
FAX (510) 655-9745

TRANSMITTAL LETTER

TO: Barbara Sieminski

FROM: John Koch _____

Job No.: 92056 _____

COMPANY: RESNA / San Jose

Re: RESNA Proj. #69028.07 _____

FAX NO: (408) 264-2435 _____

SUBJECT: Arco Station 6113

PER: Your request.

Our telephone conversation of: _____

Other: _____

FIND ENCLOSED:

1. Report of monitor well data table. _____

2. Plan showing location of wells.

NO. OF PAGES (including transmittal): 4

MESSAGE:

***Your attention is brought to Note 3 on the MONITOR WELL DATA TABLE regarding the elevation of MW-4.

JOHN E. KOCH
Land Surveyor
CA. State Lic. No. LS4811
5427 Telegraph Ave., Suite A
Oakland, CA 94609
(510)655-9956
FAX(510)655-9745



RESNA / San Jose
3315 Almaden Expressway, Suite 34
San Jose, CA 95118
(408)264-7723
FAX(408)264-2435

07/02/92

Tabulation of Elevations as of
04:00 p.m. 06/22/92

Job #92056
RESNA Project 69028.07
Project Geologist:Joel Coffman
Site: Arco Station 6113
785 East Stanley Blvd.
@ Murrieta Blvd.
Livermore, CA

BENCHMARK: B.M. #B 2-3a. Top of pin in standard monument, at the intersection of El Rancho Drive and Albatross Ave. Elevation taken as 448.218'. City of Livermore Datum.

MONITOR WELL DATA TABLE

Well Designation	Elevation	Description
MW-4	456.55 456.85	Top of PVC Casing Top of Box
MW-5	455.84 456.25	Top of PVC Casing Top of Box
MW-6	454.93 455.43	Top of PVC Casing Top of Box
MW-7	454.92 455.34	Top of PVC Casing Top of Box
MW-8	456.97 457.48	Top of PVC Casing Top of Box

JOHN E. KOCH, P.L.S.

RESNA PROJ.#69028.07

JEK JOB #92056

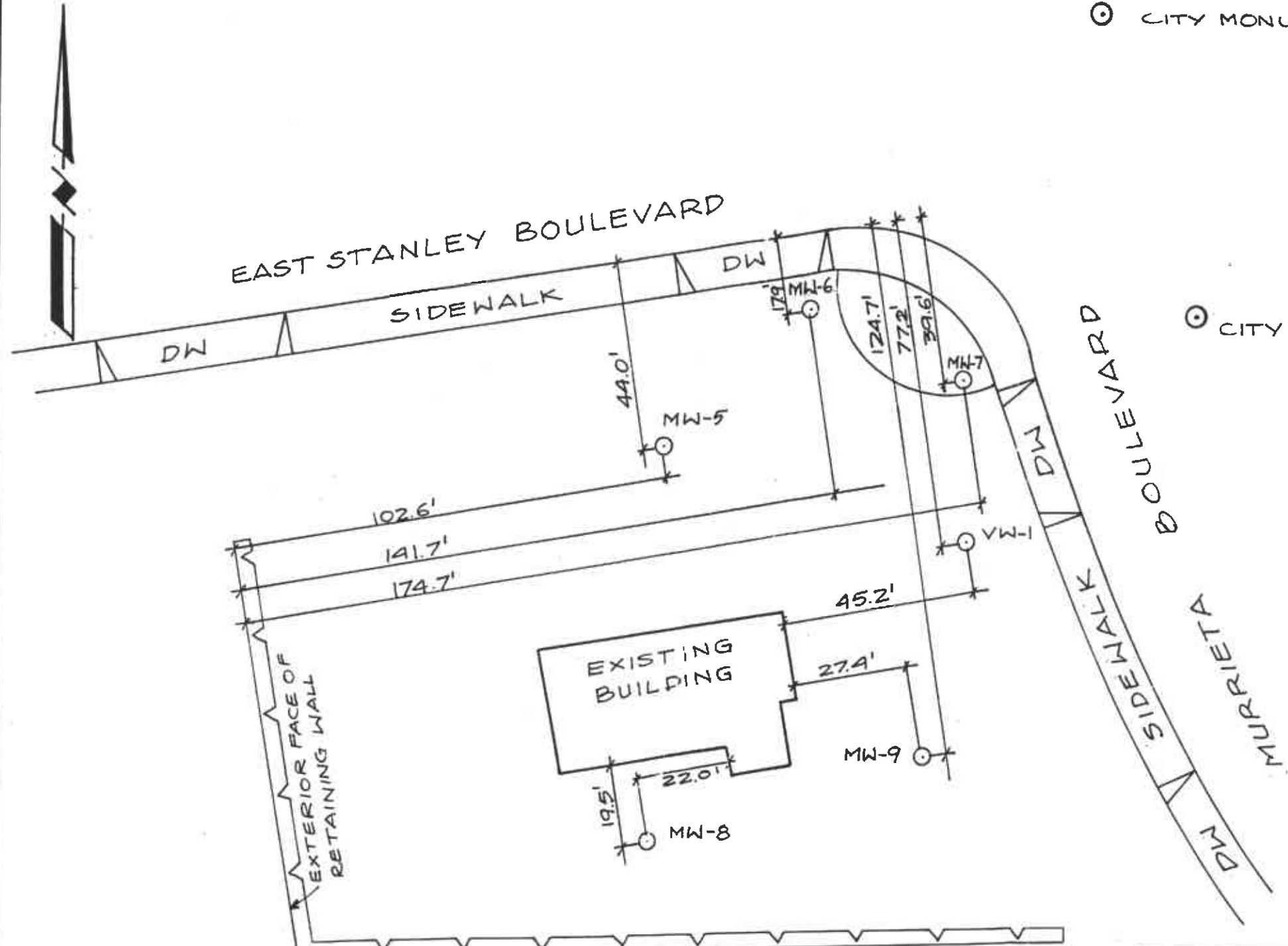
Well Designation	Elevation	Description
MW-9	456.18	Top of PVC Casing
	456.50	Top of Box
VW-1	455.16	Top of PVC Casing
	455.52	Top of Box

NOTES:

1. Datum is City of Livermore= USGS
2. Top of PVC Casing elevation taken at mark at top of PVC for all wells.
3. On 07/15/92 a level circuit was run from City of Livermore BM #A 5 ((top of pin in standard monument, at the intersection of Stanley Blvd. and Fenton Street (West monument set for Fenton Street), elevation taken as 455.896')). Based on this circuit the top of casing elevation of MW-4 was found to be 0.03' lower than the elevation given above for top of casing of MW-4 based on BM #B 2-3a.

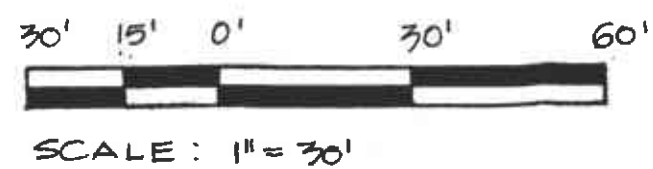


⊙ CITY MONUMENT



ELEVATIONS

WELL NUMBER	TOPOF CASING	TOP OF BOX
MW-5	456.84'	456.25'
MW-6	454.93'	455.43'
MW-7	454.92'	455.34'
MW-8	456.97'	457.48'
MW-9	456.18'	456.50'
VW-1	455.16'	455.52'



LEGEND:
DW = DRIVEWAY

SITE:
ARCO STATION 6113
785 EAST STANLEY BLVD.
@ MURRIETA BLVD.
LIVERMORE, CA.
RESNA PROJECT 6902807

CLIENT:
RESNA
3315 ALMADEN EXPRESSWAY,
SUITE 34
SAN JOSE, CA. 95118

JOHN E. KOCH
LAND SURVEYOR
CA. STATE LIC. NO. LS4811
5427 TELEGRAPH AVE., SUITE A
OAKLAND, CA. 94609
(510) 655-9956
FAX (510) 655-9745

JOB #	DRAWN BY	DATE
92056	T. ROSU	07.16.92

APPENDIX E

**EMCON'S SUMMARY OF GROUNDWATER MONITORING
DATA, CHAIN OF CUSTODY FORMS
and LABORATORY ANALYTICAL REPORTS
OF GROUNDWATER SAMPLES**



EMCON
ASSOCIATES

Consultants in Wastes
Management and
Environmental Control

RECEIVED

JUL 15 1992
RESNA
SAN JOSE

Date July 15, 1992
Project G70-38.01

To:
Mr. Joel Coffman
RESNA/ Applied Geosystems
3315 Almaden Expressway, Suite 34
San Jose, California 95050

We are enclosing:

Copies	Description
<u>1</u>	<u>Depth To Water / Floating Product Survey Results</u>
<u>1</u>	<u>Summary of Groundwater Monitoring Data</u>
<u>2</u>	<u>Certified Analytical Reports with Chain-of-Custody</u>
<u>9</u>	<u>Water Sample Field Data Sheets</u>

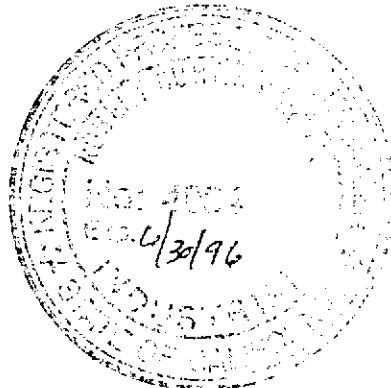
For your: X Information Sent by: X Mail

Comments:

Enclosed are the data from the second quarter 1992 monitoring event at ARCO service station 6113, 785 East Stanley Boulevard, Livermore, CA. Groundwater monitoring is conducted consistent with applicable regulatory guidelines. Please call if you have any questions: (408) 453-2266.

Jim Butera *JB*

Reviewed by:



Robert Porter
Robert Porter, Senior Project
Engineer.



FIELD REPORT
DEPTH TO WATER / FLOATING PRODUCT SURVEY

PROJECT # : G70-38.01

STATION ADDRESS : 785 East Stanley Blvd. Livermore

DATE : 6-29-12

ARCO STATION # : 6113

FIELD TECHNICIAN : L. RATH

DAY : Monday

DTW Order	WELL ID	Well Box Seal	Well Lid Secure	Gasket	Lock	Locking Well Cap	FIRST DEPTH TO WATER (feet)	SECOND DEPTH TO WATER (feet)	DEPTH TO FLOATING PRODUCT (feet)	FLOATING PRODUCT THICKNESS (feet)	WELL TOTAL DEPTH (feet)	COMMENTS
1	MW-2	OK	YES	OK	3259	OK	37.67	37.66	ND	NA	38.60	Survey points are top of casing
2	MW-3	OK	YES	OK	3259	OK	38.70	38.70	ND	NA	39.10	-
3	MW-8	OK	YES	OK	3259	OK	50.40	50.41	ND	NA	66.60	-
4	MW-1	Good	YES	OK	3259	OK	43.80	43.80	ND	NA	44.80	-
5	MW-9	OK	YES	OK	3259	OK	50.29	50.29	ND	NA	68.00	-
6	MW-7	OK	YES	OK	3259	OK	49.57	49.58	ND	NA	67.70	-
7	MW-6	OK	YES	OK	3259	OK	49.72	49.72	ND	NA	67.40	-
8	MW-5	OK	YES	OK	3259	OK	50.53	50.53	ND	NA	62.60	-
9	MW-4	OK	YES	OK	3259	OK	DRY	DRY	NA	-	26.10	-

Summary of Groundwater Monitoring Data
 Second Quarter 1992
 ARCO Service Station 6113
 785 East Stanley Boulevard, Livermore, California
 micrograms per liter ($\mu\text{g/l}$) and milligrams per liter (mg/l)

Well ID and Sample Depth	Sampling Date	Depth To Water (feet)	Floating Product Thickness (feet)	TPH ¹ as Gasoline ($\mu\text{g/l}$)	Benzene ($\mu\text{g/l}$)	Toluene ($\mu\text{g/l}$)	Ethyl-benzene ($\mu\text{g/l}$)	Total Xylenes ($\mu\text{g/l}$)	TPH as Diesel (mg/l)	Total Oil and Grease, 5520C (mg/l)	Hydrocarbons 5520F IR (mg/l)
MW-1	NS. ²	43.80	ND. ³	NS	NS	NS	NS	NS	NR. ⁴	NR.	NR
MW-2(38)	06/29/92	37.67	ND	<50	<0.5	<0.5	<0.5	<0.5	NR	NR	NR
MW-3	NS	38.70	ND	NS	NS	NS	NS	NS	NS	NS	NS
MW-4	NS	Dry	NA. ⁵	NS	NS	NS	NS	NS	NS	NS	NS
MW-5(61)	06/30/92	50.53	ND	8,900.	1,700.	640.	310.	1,100.	NR	NR	NR
MW-6(66)	06/30/92	49.72	ND	8,600.	1,800.	460.	52.	450.	NR	NR	NR
MW-7(66)	06/30/92	49.57	ND	270.	38.	3.7	1.1	4.4	NR	NR	NR
MW-8(65)	06/29/92	50.40	ND	<50	<0.5	<0.5	<0.5	<0.5	<50	<0.5	<0.5
MW-9(67)	06/29/92	50.29	ND	<50	<0.5	<0.5	<0.5	<0.5	NR	NR	NR
FB-1. ⁶	06/29/92	NA.	NA.	<50	<0.5	<0.5	<0.5	<0.5	NR.	NR.	NR.

1. TPH. = Total petroleum hydrocarbons

2. NS. = Not sampled; dry well

3. ND. = Not detected

4. NR. = Not reported; sample was not scheduled for analysis of the selected parameter

5. NA. = Not applicable

6. FB. = Field Blank

Summary of Groundwater Monitoring Data
Second Quarter 1992
ARCO Service Station 6113
785 East Stanley Boulevard, Livermore, California
micrograms per liter ($\mu\text{g/l}$) and milligrams per liter (mg/l)

Well ID and Sample Depth	Sampling Date	Depth To Water (feet)	Floating Product Thickness (feet)	Cadmium ($\mu\text{g/l}$) (ppb)	Chromium ($\mu\text{g/l}$) (ppb)	Lead ($\mu\text{g/l}$) (ppb)	Nickel ($\mu\text{g/l}$) (ppb)	Zinc ($\mu\text{g/l}$) (ppb)
MW-8(65)	06/29/92	50.40	ND	<3	1,780.	143.	5,100.	1,310.

**Columbia
Analytical
Services^{inc.}**

July 13, 1992

Jim Butera
EMCON Associates
1921 Ringwood Avenue
San Jose, CA 95131

Re: EMCON Project No. G70-38.01
Arco Facility No. 6113

Dear Mr. Butera:

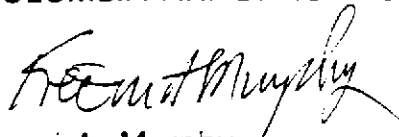
Enclosed are the results of the water samples submitted to our lab on June 30, 1992.
For your reference, our service request number for this work is SJ92-0788.

All analyses were performed in accordance with the laboratory's quality assurance program.

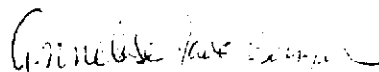
Please call if you have any questions.

Respectfully submitted:

COLUMBIA ANALYTICAL SERVICES, INC.



Keoni A. Murphy
Laboratory Manager



Annelise J. Bazar
Regional QA Coordinator

le/KAM

Analytical Report

Client: EMCON Associates
 Project: EMCON Project No. G70-38.01
 Arco Facility No. 6113

Date Received: 06/30/92
 Work Order #: SJ92-0788
 Sample Matrix: Water

Inorganic Parameters¹
 mg/L (ppm)

Sample Name: MW-8 (65) Method Blank
 Date Sampled: 06/29/92

<u>Analyte</u>	<u>Method</u>	<u>MRL</u>		
Total Oil and Grease	5520C	0.5	ND	ND
Hydrocarbons, IR	5520F	0.5	ND	ND

MRL Method Reporting Limit

ND None Detected at or above the method reporting limit

¹ Unless otherwise noted, all analyses were performed within EPA recommended maximum holding times specified in *Test Methods for Evaluating Solid Waste*, (SW-846, 3rd Edition) and *Methods for Chemical Analysis of Water and Waste* (EPA-600/4-79-020, Revised March 1983).

Approved by

Kevin Murphy

Date

July 13, 1992

Analytical Report

Client: EMCON Associates
 Project: EMCON Project No. G70-38.01
 Arco Facility No. 6113
 Sample Matrix: Water

Date Received: 06/30/92
 Date Extracted: 07/07/92
 Date Analyzed: 07/08/92
 Work Order #: SJ92-0788

Total Petroleum Hydrocarbons as Diesel
 EPA Method 3510/California DHS LUFT Method
 $\mu\text{g/L}$ (ppb)

<u>Sample Name</u>	<u>MRL</u>	<u>TPH as Diesel</u>
MW-8 (65)	50.	ND
Method Blank	50.	ND

MRL Method Reporting Limit
 TPH Total Petroleum Hydrocarbons
 ND None Detected at or above the method reporting limit

Approved by

Karen Atkinson

Date

July 13, 1992

Analytical Report

Client: EMCON Associates
 Project: EMCON Project No. G70-38.01
 Arco Facility No. 5113

Date Received: 06/30/92
 Work Order #: SJ92-0788
 Sample Matrix: Water

BTEX and TPH as Gasoline
 EPA Methods 5030/8020/DHS LUFT Method
 $\mu\text{g/L}$ (ppb)

Sample Name:	<u>MW-2 (38)</u>	<u>MW-5 (61)</u>	<u>MW-6 (66)</u>
Date Analyzed:	07/01/92	07/07/92	07/08/92

<u>Analyte</u>	<u>MRL</u>			
Benzene	0.5	ND	1,700.	1,800.
Toluene	0.5	ND	640.	460.
Ethylbenzene	0.5	ND	310.	52.
Total Xylenes	0.5	ND	1,100.	450.
TPH as Gasoline	50	ND	8,900.	8,600.

TPH Total Petroleum Hydrocarbons
 MRL Method Reporting Limit
 ND None Detected at or above the method reporting limit

Approved by

Kenneth Murphy

Date

July 13, 1992

Analytical Report

Client: EMCON Associates
 Project: EMCON Project No. G70-38.01
 Arco Facility No. 6113

Date Received: 06/30/92
 Work Order #: SJ92-0788
 Sample Matrix: Water

BTEX and TPH as Gasoline
 EPA Methods 5030/8020/DHS LUFT Method
 $\mu\text{g/L}$ (ppb)

Sample Name:	<u>MW-7 (66)</u>	<u>MW-8 (65)</u>	<u>MW-9 (67)</u>
Date Analyzed:	07/07/92	07/02/92	07/02/92

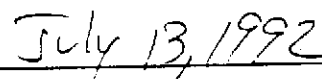
<u>Analyte</u>	<u>MRL</u>			
Benzene	0.5	38.	ND	ND
Toluene	0.5	3.7	ND	ND
Ethylbenzene	0.5	1.1	ND	ND
Total Xylenes	0.5	4.4	ND	ND
TPH as Gasoline	50	270.	ND	ND

TPH Total Petroleum Hydrocarbons
 MRL Method Reporting Limit
 ND None Detected at or above the method reporting limit

Approved by



Date



Analytical Report

Client: EMCON Associates
 Project: EMCON Project No. G70-38.01
 Arco Facility No. 6113

Date Received: 06/30/92
 Work Order #: SJ92-0788
 Sample Matrix: Water

BTEX and TPH as Gasoline
 EPA Methods 5030/8020/DHS LUFT Method
 µg/L (ppb)

Sample Name: FB-1 Method Blank Method Blank
 Date Analyzed: 07/01/92 07/01/92 07/02/92

<u>Analyte</u>	<u>MRL</u>			
Benzene	0.5	ND	ND	ND
Toluene	0.5	ND	ND	ND
Ethylbenzene	0.5	ND	ND	ND
Total Xylenes	0.5	ND	ND	ND
TPH as Gasoline	50	ND	ND	ND

TPH Total Petroleum Hydrocarbons
 MRL Method Reporting Limit
 ND None Detected at or above the method reporting limit

Approved by Kenneth Murphy Date July 13, 1992

Analytical Report

Client: EMCON Associates
 Project: EMCON Project No. G70-38.01
 Arco Facility No. 6113

Date Received: 06/30/92
 Work Order #: SJ92-0788
 Sample Matrix: Water

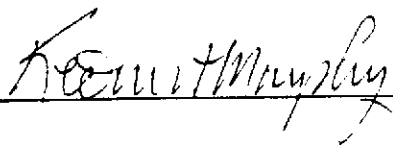
BTEX and TPH as Gasoline
 EPA Methods 5030/8020/DHS LUFT Method
 $\mu\text{g/L}$ (ppb)

Sample Name: Method Blank Method Blank
 Date Analyzed: 07/07/92 07/08/92

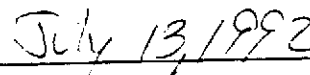
<u>Analyte</u>	<u>MRL</u>		
Benzene	0.5	ND	ND
Toluene	0.5	ND	ND
Ethylbenzene	0.5	ND	ND
Total Xylenes	0.5	ND	ND
TPH as Gasoline	50	ND	ND

TPH Total Petroleum Hydrocarbons
 MRL Method Reporting Limit
 ND None Detected at or above the method reporting limit

Approved by



Date



Analytical Report

Client: EMCON Associates
 Project: EMCON Project No. G70-38.01
 Arco Facility No. 6113

Date Received: 06/30/92
 Work Order #: SJ92-0788
 Sample Matrix: Water

Halogenated Volatile Organic Compounds
 EPA Methods 5030/601
 $\mu\text{g/L}$ (ppb)

Sample Name: MW-8 (65) Method Blank
 Date Analyzed: 07/01/92 07/01/92

Analyte	MRL		
Dichlorodifluoromethane (Freon 12)	1	ND	ND
Chloromethane	1	ND	ND
Vinyl Chloride	0.5	ND	ND
Bromomethane	0.5	ND	ND
Chloroethane	0.5	ND	ND
Trichlorofluoromethane (Freon 11)	0.5	ND	ND
1,1-Dichloroethene	0.5	ND	ND
Trichlorotrifluoroethane (Freon 113)	0.5	ND	ND
Methylene Chloride	0.5	ND	ND
<i>trans</i> -1,2-Dichloroethene	0.5	ND	ND
<i>cis</i> -1,2-Dichloroethene	0.5	ND	ND
1,1-Dichloroethane	0.5	ND	ND
Chloroform	0.5	ND	ND
1,1,1-Trichloroethane (TCA)	0.5	ND	ND
Carbon Tetrachloride	0.5	ND	ND
1,2-Dichloroethane	0.5	ND	ND
Trichloroethene (TCE)	0.5	ND	ND
1,2-Dichloropropane	0.5	ND	ND
Bromodichloromethane	0.5	ND	ND
2-Chloroethyl Vinyl Ether	5	ND	ND
<i>trans</i> -1,3-Dichloropropene	0.5	ND	ND
<i>cis</i> -1,3-Dichloropropene	0.5	ND	ND
1,1,2-Trichloroethane	0.5	ND	ND
Tetrachloroethene (PCE)	0.5	ND	ND
Dibromochloromethane	0.5	ND	ND
Chlorobenzene	0.5	ND	ND
Bromoform	0.5	ND	ND
1,1,2,2-Tetrachloroethane	0.5	ND	ND
1,3-Dichlorobenzene	1	ND	ND
1,4-Dichlorobenzene	1	ND	ND
1,2-Dichlorobenzene	1	ND	ND

MRL Method Reporting Limit

ND None Detected at or above the method reporting limit

Approved by

Kenneth Murphy

Date

July 13, 1992

Client: EMCON Associates
Project: EMCON Project No. G70-38.01
Arco Facility No. 6113

Date Received: 06/30/92
Work Order #: SJ92-0788
Sample Matrix: Water

QA/QC Report
Continuing Calibration Summary
Inorganics
mg/L (ppm)

<u>Analyte</u>	<u>True Value</u>	<u>Result</u>	<u>Percent Recovery</u>	<u>CAS Percent Recovery Acceptance Criteria</u>
Total Oil and Grease	100.	105.	105.	80-120

Approved by Kenneth Murphy Date July 13, 1992

Client: EMCON Associates
 Project: EMCON Project No. G70-38.01
 Arco Facility No. 6113

Date Received: 06/30/92
 Work Order #: SJ92-0788
 Sample Matrix: Water

QA/QC Report
 Matrix Spike Summary
 Inorganic Parameters
 mg/L (ppm)

<u>Parameter</u>	<u>Spike Level</u>	<u>Sample Result</u>	<u>Spike Result</u>		<u>Percent</u>		<u>Recovery Acceptance Criteria</u>
			<u>MS</u>	<u>DMS</u>	<u>MS</u>	<u>DMS</u>	
Total Oil and Grease	4.0	ND	3.5	3.7	88.	93.	53-149

ND None Detected at or above the method reporting limit

Approved by *Kenneth Murphy* Date July 13, 1992

Client: EMCON Associates
Project: EMCON Project No. G70-38.01
Arco Facility No. 6113

Date Received: 06/30/92
Work Order #: SJ92-0788
Sample Matrix: Water

QA/QC Report
Continuing Calibration Summary
Total Petroleum Hydrocarbons as Diesel
EPA Method 3510/DHS LUFT Method
mg/L (ppm)

Date Analyzed: 07/08/92

<u>Analyte</u>	<u>True Value</u>	<u>Result</u>	<u>Percent Recovery</u>	<u>CAS Percent Recovery Acceptance Criteria</u>
TPH as Diesel	1,000.	907.	91.	90-110

TPH Total Petroleum Hydrocarbons

Approved by *Kevin Murphy* Date *July 13, 1992*

Client: EMCON Associates
 Project: EMCON Project No. G70-38.01
 Arco Facility No. 6113

Date Received: 06/30/92
 Work Order #: SJ92-0788
 Sample Matrix: Water

QA/QC Report
 Surrogate Recovery Summary
 Total Petroleum Hydrocarbons as Diesel
 EPA Method 3510/DHS LUFT Method

<u>Sample Name</u>	<u>Date Analyzed</u>	<u>Percent Recovery</u> P-Terphenyl
MW-8 (65)	07/08/92	77.
MS	07/08/92	90.
DMS	07/08/92	96.
Method Blank	07/08/92	86.
	CAS Acceptance Criteria	55-145

Approved by *Kenneth Murphy* Date July 13, 1992

Client: EMCON Associates
 Project: EMCON Project No. G70-38.01
 Arco Facility No. 6113

Date Received: 06/30/92
 Work Order #: SJ92-0788
 Sample Matrix: Water

QA/QC Report
 Matrix Spike/Duplicate Matrix Spike Summary
 Total Petroleum Hydrocarbons as Diesel
 DHS LUFT Method
 $\mu\text{g/L}$ (ppb)

Date Analyzed: 07/08/92

<u>Parameter</u>	<u>Spike Level</u>	<u>Sample Result</u>	<u>Spike Result</u>		<u>Percent Recovery</u>		<u>Acceptance Criteria</u>
			<u>MS</u>	<u>DMS</u>	<u>MS</u>	<u>DMS</u>	
TPH as Diesel	4,440.	ND	4,200.	4,290.	95.	97.	55-145

ND None Detected at or above the method reporting limit
 TPH Total Petroleum Hydrocarbons

Approved by

Steven M. Murphy

Date

July 13, 1992

Client: EMCON Associates
 Project: EMCON Project No. G70-38.01
 Arco Facility No. 6113

Date Received: 06/30/92
 Work Order #: SJ92-0788
 Sample Matrix: Water

QA/QC Report
 Continuing Calibration Summary
 BTEX and TPH as Gasoline
 EPA Methods 5030/8020/DHS LUFT Method
 Nanograms

Date Analyzed: 07/01/92

<u>Analyte</u>	<u>True Value</u>	<u>Result</u>	<u>Percent Recovery</u>	<u>CAS Percent Recovery Acceptance Criteria</u>
Benzene	250.	239.	96.	85-115
Toluene	250.	254.	102.	85-115
Ethylbenzene	250.	253.	101.	85-115
Total Xylenes	750.	698.	93.	85-115
TPH as Gasoline	2,500.	2,482.	99.	90-110

Date Analyzed: 07/02/92

<u>Analyte</u>	<u>True Value</u>	<u>Result</u>	<u>Percent Recovery</u>	<u>CAS Percent Recovery Acceptance Criteria</u>
Benzene	250.	263.	105.	85-115
Toluene	250.	280.	112.	85-115
Ethylbenzene	250.	280.	112.	85-115
Total Xylenes	750.	776.	103.	85-115
TPH as Gasoline	2,500.	2,511.	100.	90-110

TPH Total Petroleum Hydrocarbons

Approved by Kamath Myslin Date July 13, 1992

Client: EMCON Associates
 Project: EMCON Project No. G70-38.01
 Arco Facility No. 6113

Date Received: 06/30/92
 Work Order #: SJ92-0788
 Sample Matrix: Water

QA/QC Report
 Continuing Calibration Summary
 BTEX and TPH as Gasoline
 EPA Methods 5030/8020/DHS LUFT Method
 Nanograms

Date Analyzed: 07/07/92

<u>Analyte</u>	<u>True Value</u>	<u>Result</u>	<u>Percent Recovery</u>	<u>CAS Percent Recovery Acceptance Criteria</u>
Benzene	250.	248.	99.	85-115
Toluene	250.	262.	105.	85-115
Ethylbenzene	250.	260.	104.	85-115
Total Xylenes	750.	710.	95.	85-115
TPH as Gasoline	2,500.	2,331.	93.	90-110

Date Analyzed: 07/08/92

<u>Analyte</u>	<u>True Value</u>	<u>Result</u>	<u>Percent Recovery</u>	<u>CAS Percent Recovery Acceptance Criteria</u>
Benzene	250.	266.	106.	85-115
Toluene	250.	286.	114.	85-115
Ethylbenzene	250.	285.	114.	85-115
Total Xylenes	750.	798.	106.	85-115
TPH as Gasoline	2,500.	2,325.	93.	90-110

TPH Total Petroleum Hydrocarbons

Approved by Kenneth Murphy Date July 13, 1992

Client: EMCON Associates
 Project: EMCON Project No. G70-38.01
 Arco Facility No. 6113

Date Received: 06/30/92
 Work Order #: SJ92-0788
 Sample Matrix: Water

QA/QC Report
 Surrogate Recovery Summary
 BTEX and TPH as Gasoline
 EPA Methods 5030/8020/DHS LUFT Method

<u>Sample Name</u>	<u>Date Analyzed</u>	<u>Percent Recovery</u> <i>a,a,a</i> -Trifluorotoluene
MW-2 (38)	07/01/92	105.
MW-5 (61)	07/07/92	106.
MW-6 (66)	07/08/92	105.
MW-7 (66)	07/07/92	113.*
MW-8 (65)	07/02/92	112.
MW-9 (67)	07/02/92	108.
FB-1	07/01/92	113.
MS	07/01/92	112.
DMS	07/01/92	112.
Method Blank	07/01/92	111.
Method Blank	07/02/92	103.
Method Blank	07/07/92	98.
Method Blank	07/08/92	106.

CAS Acceptance Criteria 70-130

TPH Total Petroleum Hydrocarbons
 * The surrogate used on this sample was 4-Bromofluorobenzene.

Approved by

Kevin A. Murphy

Date

July 13, 1992

Client: EMCCN Associates
Project: EMCCN Project No. G70-38.01
Arco Facility No. 6113

Date Received: 06/30/92
Work Order #: SJ92-0788
Sample Matrix: Water

QA/QC Report
Matrix Spike/Duplicate Matrix Spike Summary
BTE
EPA Methods 5030/8020
 $\mu\text{g/L}$ (ppb)

Date Analyzed: 07/01/92

Percent Recovery

Analytes	Spike Level	Sample Result	Spike Result		Percent Recovery		Acceptance Criteria
			MS	DMS	MS	DMS	
Benzene	25.	ND	26.2	25.9	105.	104.	39-150
Toluene	25.	ND	27.4	27.1	110.	108.	46-148
Ethylbenzene	25.	ND	28.6	28.2	114.	113.	32-160

ND None Detected at or above the method reporting limit

Approved by Kenneth Murphy Date July 13, 1992

QA/QC Report

Client: EMCON Associates
 Project: EMCON Project No. G70-38.01
 Arco Facility No. 6113

Date Received: 06/30/92
 Work Order #: SJ92-0788
 Sample Matrix: Water

Continuing Calibration Summary
 Halogenated Volatile Organic Compounds
 EPA Methods 5030.601
 Nanograms

Date Analyzed: 07/01/92

Analyte	True Value	Result	Percent Recovery	EPA Percent Recovery Acceptance Criteria
Chloromethane	50	60.	120.	D-193
Vinyl Chloride	50	65.	130.	28-163
Bromomethane	50	56.	112.	D-144
Chloroethane	50	55.	110.	46-137
Trichlorofluoromethane (Freon 11)	50	46.	92.	21-156
1,1-Dichloroethene	50	44.	88.	28-167
Methylene Chloride	50	48.	96.	25-162
<i>trans</i> -1,2-Dichloroethene	50	50.	100.	38-155
1,1-Dichloroethane	50	49.	98.	47-132
Chloroform	50	46.	92.	49-133
1,1,1-Trichloroethane (TCA)	50	50.	100.	41-138
Carbon Tetrachloride	50	52.	104.	43-143
1,2-Dichloroethane	50	53.	106.	51-147
Trichloroethene (TCE)	50	50.	100.	35-146
1,2-Dichloropropane	50	51.	102.	44-156
Bromodichloromethane	50	50.	100.	42-172
<i>trans</i> -1,3-Dichloropropene	50	57.	114.	22-178
<i>cis</i> -1,3-Dichloropropene	50	50.	100.	22-178
1,1,2-Trichloroethane	50	50.	100.	39-136
Tetrachloroethene (PCE)	50	53.	106.	26-162
Dibromochloromethane	50	49.	98.	24-191
Chlorobenzene	50	52.	104.	38-150
Bromoform	50	44.	88.	13-159
1,1,2,2-Tetrachloroethane	50	48.	96.	8-184
1,3-Dichlorobenzene	50	49.	98.	7-187
1,4-Dichlorobenzene	50	53.	106.	42-143
1,2-Dichlorobenzene	50	52.	104.	D-208

D Detected

Approved by

Kenneth Mayhew

Date

July 13, 1992

Client: EMCON Associates
Project: EMCON Project No. G70-38.01
Arco Facility No. 6113

Date Received: 06/30/92
Work Order #: SJ92-0788
Sample Matrix: Water

QA/QC Report
Surrogate Recovery Summary
Halogenated Volatile Organic Compounds
EPA Methods 5030/601

<u>Sample Name</u>	<u>Date Analyzed</u>	<u>Percent Recovery</u> 4-Bromofluorobenzene
MW-8 (65)	07/01/92	99.
MW-8 (65) MS	07/01/92	119.
MW-8 (65) DMS	07/01/92	123.
Method Blank	07/01/92	96.
	CAS Acceptance Criteria	70-130

Approved by *Kenneth M. ...* Date July 13, 1992

Client: EMCON Associates
Project: EMCON Project No. G70-38.01
Arco Facility No. 6113

Date Received: 06/30/92
Work Order #: SJ92-0788
Sample Matrix: Water

QA/QC Report
Matrix Spike/Duplicate Matrix Spike Summary
Halogenated Volatile Organic Compounds
EPA Methods 5030/601
µg/L (ppb)

Sample Name: MW-8 (65)
Date Analyzed: 07/01/92

Percent Recovery

Analyte	Spike Level	Sample Result	Spike Result		Percent Recovery		EPA Acceptance Criteria
			MS	DMS	MS	DMS	
1,1-Dichloroethene	10.	ND	10.6	10.3	106.	103.	28-167
Trichloroethene	10.	ND	10.1	10.2	101.	102.	35-146
Tetrachloroethene	10.	ND	10.0	10.3	100.	103.	26-162

ND None Detected at or above the method reporting limit

Approved by *Kenneth Murphy* Date July 13, 1992

ARCO engineer **Kyle Christie** Telephone no. (ARCO) **(915) 571-2444** Project manager (Consultant) **Jim Bulera** Telephone no. (Consultant) **(408) 453-0719** Fax no. (Consultant) **(408) 453-0452**
 Consultant name **EMCON ASSOCIATES** Address (Consultant)

Laboratory name **CAS**
 Contract number **07077**

Sample I.D.	Lab no.	Container no.	Matrix			Preservation		Sampling date	Sampling time	BTEX EPA 8020	BTEX/TPH EPA 8020/8015	TPH Modified 8015 Gas <input type="checkbox"/> Diesel <input type="checkbox"/>	Oil and Grease 413.1 <input type="checkbox"/> 413.2 <input type="checkbox"/>	TPH EPA 418.1/SM503E	EPA 8010	EPA 8240	EPA 8270	TCMP Metals <input type="checkbox"/> VOA <input type="checkbox"/>	SEM VOA <input type="checkbox"/>	CAM Metals EPA 6010/7000 TLC <input type="checkbox"/> STLC <input type="checkbox"/>	Lead Org./DHS Lead EPA 7420/7421 <input checked="" type="checkbox"/>	TOTAL METALS Cd, Cr, Ni, Zn by method	EPA 200.7	
			Soil	Water	Other	Ice	Acid																	
107 ()		206	X			X	HEIX	NO Sample		X		X		X										
108 (38) 1-2	2							6-29-92 1130		X														
109 ()	2							NO Sample		X														
110 ()	2							NO Sample		X														
111 (G1) 3-4	2							6-30-92 1140		X														
112 (G4) 5-6	2							6-30-92 1045		X														
113 (G6) 7-9	2							6-30-92 1000		X														
114 (G3) 1-14	2	6						6-29-92 1240		X		X		X										
115 (G2) 15-14	2							6-29-92 1435		X														
116-1 14-20	2							6-29-92 1300		X														
117 ()	2							NP				X												
118 (G5) 17-18	2							NP 6-29-92 1240				X												
119 ()	1							HNO ₃												X	X			
120 (G4)	1							HNO ₃ 6-29-92 1240												X	X			

Method of shipment
Sampler will deliver

Special detection Limit/reporting
Lowest possible

Special QA/QC
AS Normal

Remarks **2**
40 ml VOA's
mul and mu-8
Add:
2-40 ml VOA's
2-liter glass NH
2-liter glass HCl
1-HNO₃ 500 LPE
GTO-3001

Lab number
5792-0788

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

Condition of sample: **OK** Temperature received: **cool**
 Relinquished by sampler **Lois Parker** Date **6-30-92** Time **1424** Received by **[Signature]** Date **6-30-92** Time **1424**
 Relinquished by _____ Date _____ Time _____ Received by _____ Date _____ Time _____
 Relinquished by _____ Date _____ Time _____ Received by laboratory _____ Date _____ Time _____

RECEIVED

JUL 14 1992

CAS SJ



July 13, 1992

Jim Butera
EMCON Associates
1921 Ringwood Avenue
San Jose, CA 95131

Re: ARCO #6113 - Livermore/Project #G70-38.01/SJ920788

Dear Jim:

Enclosed are the results of the sample submitted to our lab on June 30, 1992. For your reference, these analyses have been assigned our work order number K924102C.

All analyses were performed in accordance with our laboratory's quality assurance program. Reproduction of reports is allowed only in whole, not in part. Results apply only to the samples analyzed.

Please call if you have any questions.

Respectfully submitted,

Columbia Analytical Services, Inc.

A handwritten signature in cursive script that reads "Colin B. Elliott".

Colin B. Elliott
Senior Project Chemist

CBE/das

Columbia Analytical Services, Inc.

A handwritten signature in cursive script that reads "Lawrence J. Jacoby".

Lawrence J. Jacoby, Ph.D.
Quality Assurance Coordinator

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: EMCON Associates
Project: ARCO #6113 - Livermore
Sample Matrix: Water

Date Received: 06/30/92
Work Order No.: K924102C

Total Metals
µg/L (ppb)

Sample Name:
Lab Code:

MW-8
K4102-1

Method Blank
K4102-MB

Analyte	EPA Method	MRL		
Cadmium	6010	3	ND	ND
Chromium	6010	5	1,780	ND
Lead	7421	2	143	ND
Nickel	6010	20	5,100	ND
Zinc	6010	10	1,310	ND

MRL Method Reporting Limit
ND None Detected at or above the method reporting limit

Approved by Alan Elliott Date 7/13/92

00001

APPENDIX A
LABORATORY QC RESULTS

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EMCON Associates
 Project: ARCO #6113 - Livermore
 Sample Matrix: Water

Date Received: 06/30/92
 Work Order No.: K924102C

Matrix Spike/Duplicate Matrix Spike Summary
 Total Metals
 µg/L (ppb)

Sample Name: MW-8
 Lab Code: K4102-1

Percent Recovery

Analyte	MRL	Spike Level	Sample Result	Spiked Sample Result	Duplicate Spiked Sample Result	Spiked Sample	Duplicate Spiked Sample	CAS Acceptance Criteria	Relative Percent Difference
Cadmium	3	50	ND	54	56	108	112	75-125	4
Chromium	5	200	1,780	2,050	1,980	NA	NA	75-125	3
Lead	2	20	143	170	170	NA	NA	75-125	<1
Nickel	20	500	5,100	5,720	5,850	NA	NA	75-125	2
Zinc	10	500	1,310	1,790	1,810	96	100	75-125	1

MRL Method Reporting Limit

ND None Detected at or above the method reporting limit

NA Not Applicable because of the sample matrix. Accuracy of the spike recovery value is reduced, since the sample concentration was greater than four times the amount spiked.

Approved by

Alan Elliott

Date

7/13/92

40003

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EMCON Associates
Project: ARCO #6113 - Livermore

Date Analyzed: 07/08/92
Work Order No.: K924102C

Initial Calibration Verification (ICV) Summary
 $\mu\text{g/L}$ (ppb)

Analyte	EPA Method	True Value	Result	Percent Recovery
Cadmium	6010	1,250	1,260	101
Chromium	6010	500	523	105
Lead	7421	98.4	104	105
Nickel	6010	1,250	1,260	101Z
Zinc	6010	1,250	1,280	102

ICV Source: EPA ICV

Approved by Colin Elliott Date 7/13/92

90004

ARCO Facility no. 6113	City (Facility) LIVERMORE	Project manager (Consultant) Jim Bulera
ARCO engineer Kyle Christie	Telephone no (ARCO) (915) 571-2444	Telephone no (Consultant) (415) 453-0719
Consultant name EMCON ASSOCIATES	Address (Consultant)	Fax no. (Consultant) (415) 453-0452

Laboratory name **CAS**

Contract number **07077**

Method of shipment **Sampler will deliver**

Sample I.D.	Lab no.	Container no.	Matrix			Preservation		Sampling date	Sampling time	BTEX RC2/EPA 8020	BTEX/TPH CAS EPA 8082/8020/8015	TPH Measured 8015 Gas <input type="checkbox"/> Liquid <input type="checkbox"/>	Oil and Grease 413.1 <input type="checkbox"/> 413.2 <input type="checkbox"/>	TPH EPA 418.1/SM500E	EPA 8210/8010	EPA 8212/8240	EPA 825/827	TCLP Metals <input type="checkbox"/> VOC <input type="checkbox"/> VOA <input type="checkbox"/>	CAMP Metals EPA 8010/7000 TLIC <input type="checkbox"/> STLC <input type="checkbox"/>					
			Soil	Water	Other	Ice	Acid																	
MW 1 ()		206	X			X	HC1x	No Sample		X	X			X										
MW 2 (38)	1-2	2						6-29-92 1130		X														
MW 9 ()		2						No Sample		X														
MW 4 ()		2						No Sample		X														
MW 5 (61)	3-4	2						6-30-92 1140		X														
MW 6 (66)	5-6	2						6-30-92 1045		X														
MW 7 (66)	7-9	2						6-30-92 1000		X														
MW 8 (65)	11-14	2						6-29-92 1240		X		X		X										
MW 9 (67)	15-14	2						6-29-92 1435		X														
FB-1	14-20	2						6-29-92 1300		X														
MW 1 ()		2						NP			X													
MW 2 (65)	17-18	2						NP 6-29-92 1240			X													
MW 7 ()		1						HNO3																
MW 8 ()		1						HNO3 6-29-92 1240																

Special detection Limit/reporting **Lowest possible**

Special QA/QC **AC Normal**

Remarks **2**
40ml VOA MW 1 and MW 8
 Add:
 2-40 ml VOA's
 2-liter glass h
 2-liter glass HCl
 1-HNO₃ 500 ml
GT-3001

Lab number **K72-402**
G592-078

Condition of sample: OK	Temperature received: COOL
Relinquished by sampler Steve Patey	Date 6-30-92 1424
Relinquished by	Date
Relinquished by	Date
Received by laboratory Sam Kelly	Date 7/1/92 Time 0930

Turnaround time

Priority Rush **1 Business Day**

Rush **2 Business Days**

Expedited **5 Business Days**

Standard **10 Business Days**

WATER SAMPLE FIELD DATA SHEET



EMCON
ASSOCIATES

PROJECT NO: G70 33 01

SAMPLE ID: MW-1

PURGED BY: L.R.H

CLIENT NAME: AZCO Gilg

SAMPLED BY: -

LOCATION: 785 E Stanley Bl
Livermore, CA

TYPE: Ground Water Surface Water Treatment Effluent Other

CASING DIAMETER (inches): 2 3 4 4.5 6 Other

CASING ELEVATION (feet/MSL): <u>NIL</u>	VOLUME IN CASING (gal.): <u>0.15</u>
DEPTH TO WATER (feet): <u>43.85</u>	CALCULATED PURGE (gal.): <u>0.77</u>
DEPTH OF WELL (feet): <u>44.80</u>	ACTUAL PURGE VOL (gal.): <u>250 ml</u>

DATE PURGED: 6-29-92 Start (2400 Hr) 1306 End (2400 Hr) 1307

DATE SAMPLED: NA Start (2400 Hr) NA End (2400 Hr) NA

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1307</u>	<u>250 ml</u>	<u>6.14</u>	<u>815</u>	<u>68.3</u>	<u>Brown</u>	<u>Heavily</u>

D. O. (ppm): NIL ODOR: NIL (COBALT 0 - 100) NIL (NTU 0 - 200) NIL

FIELD QC SAMPLES COLLECTED AT THIS WELL (i.e. FB-1, XDUP-1): FB-1

PURGING EQUIPMENT

SAMPLING EQUIPMENT

- | | | | |
|---|--|--|---|
| <input type="checkbox"/> 2" Bladder Pump | <input checked="" type="checkbox"/> Bailer (Teflon®) | <input type="checkbox"/> 2" Bladder Pump | <input type="checkbox"/> Bailer (Teflon®) |
| <input type="checkbox"/> Centrifugal Pump | <input type="checkbox"/> Bailer (PVC) | <input type="checkbox"/> DDL Sampler | <input type="checkbox"/> Bailer (Stainless Steel) |
| <input type="checkbox"/> Submersible Pump | <input type="checkbox"/> Bailer (Stainless Steel) | <input type="checkbox"/> Dipper | <input type="checkbox"/> Submersible Pump |
| <input type="checkbox"/> Well Wizard™ | <input type="checkbox"/> Dedicated | <input type="checkbox"/> Well Wizard™ | <input type="checkbox"/> Dedicated |
- Other: _____ Other: NA

WELL INTEGRITY: good LOCK #: 3259

REMARKS: well dried on first bailer
Came back to well at 1345 NO Recharge
Came back to well on 6-30-92 1200 HRS
NO Recharge NO Sample taken

Meter Calibration: Date: 6-29-92 Time: _____ Meter Serial #: C111 Temperature °F: _____

(EC 1000 _____ / _____) (DI _____) (pH 7 _____ / _____) (pH 10 _____ / _____) (pH 4 _____ / _____)

Location of previous calibration: MW-2

Signature: [Signature] Reviewed By: JL Page 1 of 0



EMCON ASSOCIATES

WATER SAMPLE FIELD DATA SHEET

PROJECT NO: 670 38-01
PURGED BY: L RATH
SAMPLED BY: L. Rath

SAMPLE ID: MW-2 (38)
CLIENT NAME: ARCO 613
LOCATION: 785 E Stanley Plv
Livermore CA

TYPE: Ground Water Surface Water _____ Treatment Effluent _____ Other _____

CASING DIAMETER (inches): 2 3 _____ 4 _____ 4.5 _____ 6 _____ Other _____

CASING ELEVATION (feet/MSL): AIR VOLUME IN CASING (gal.): 0.15
DEPTH TO WATER (feet): 37.67 CALCULATED PURGE (gal.): 0.76
DEPTH OF WELL (feet): 38.60 ACTUAL PURGE VOL. (gal.): approx 15gal

DATE PURGED: 6-29-92 Start (2400 Hr) 1101 End (2400 Hr) 1103
DATE SAMPLED: 6-29-92 Start (2400 Hr) 1130 End (2400 Hr) _____

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	EC. (umhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1103</u>	<u>0.15</u>	<u>6.41</u>	<u>1605</u>	<u>75.1</u>	<u>Brown</u>	<u>Heavy</u>
<u>1130</u>	<u>Recharge</u>	<u>6.50</u>	<u>1621</u>	<u>74.8</u>	<u>Brown</u>	<u>Heavy</u>
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____

D. O. (ppm): NI ODOR: NI _____
(COBALT 0-100) (NTU 0-200)

FIELD QC SAMPLES COLLECTED AT THIS WELL (i.e. FB-1, XDUP-1): AIR

PURGING EQUIPMENT

SAMPLING EQUIPMENT

- 2" Bladder Pump
- Centrifugal Pump
- Submersible Pump
- Well Wizard™
- Other: _____
- Bailor (Teflon®)
- Bailor (PVC)
- Bailor (Stainless Steel)
- Dedicated
- Other: _____
- 2" Bladder Pump
- Bailor (Teflon®)
- DDL Sampler
- Dipper
- Well Wizard™
- Bailor (Stainless Steel)
- Submersible Pump
- Dedicated
- Other: _____

WELL INTEGRITY: good LOCK #: 3259

REMARKS: well dried after one Bailor 1103 HRS
approx 0.15 gal Purge

Meter Calibration: Date: 6-29-92 Time: 1049 Meter Serial #: 9111 Temperature °F: 74.1
(EC 1000 1020/1000) (DI 0.04) (pH 7 6.97/7.00) (pH 10 9.99/10.00) (pH 4 3.95/)

Location of previous calibration: _____

Signature: [Signature] Reviewed By: JL Page 1 of 9



EMCON ASSOCIATES

WATER SAMPLE FIELD DATA SHEET

Rev. 2, 5/91

PROJECT NO: 670 38-01
PURGED BY: L. RATH
SAMPLED BY: —

SAMPLE ID: MW-3
CLIENT NAME: ARCO 6113
LOCATION: 785 E Stanley Bl
Livermore CA

TYPE: Ground Water Surface Water Treatment Effluent Other

CASING DIAMETER (inches): 2 3 4 4.5 6 Other

CASING ELEVATION (feet/MSL): NR VOLUME IN CASING (gal.): 0.065
DEPTH TO WATER (feet): 38.70 CALCULATED PURGE (gal.): 0.32
DEPTH OF WELL (feet): 39.10 ACTUAL PURGE VOL (gal.): 0.06/NA

DATE PURGED: 6-29-92 Start (2400 Hr) 1139 End (2400 Hr) 1140
DATE SAMPLED: — Start (2400 Hr) — End (2400 Hr) —

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm. @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>NO ENOUGH VOLUME FOR SAMPLE OR READINGS</u>						

D. O. (ppm): NR ODOR: — NR NR
(COBALT 0 - 100) (NTU 0 - 200)

FIELD QC SAMPLES COLLECTED AT THIS WELL (i.e. FB-1, XDUP-1): NR

PURGING EQUIPMENT

SAMPLING EQUIPMENT

- | | | | |
|---|--|--|---|
| <input type="checkbox"/> 2" Bladder Pump | <input checked="" type="checkbox"/> Bailer (Teflon®) | <input type="checkbox"/> 2" Bladder Pump | <input type="checkbox"/> Bailer (Teflon®) |
| <input type="checkbox"/> Centrifugal Pump | <input checked="" type="checkbox"/> Bailer (PVC) | <input type="checkbox"/> DDL Sampler | <input type="checkbox"/> Bailer (Stainless Steel) |
| <input type="checkbox"/> Submersible Pump | <input type="checkbox"/> Bailer (Stainless Steel) | <input type="checkbox"/> Dipper | <input type="checkbox"/> Submersible Pump |
| <input type="checkbox"/> Well Wizard™ | <input type="checkbox"/> Dedicated | <input type="checkbox"/> Well Wizard™ | <input type="checkbox"/> Dedicated |
| Other: <u>—</u> | | Other: <u>NA</u> | |

WELL INTEGRITY: good LOCK #: 3257

REMARKS: well dried on first Bailer 1140 HRS at approx 75 ml
came back to well at 1330 HRS NO Recharge
came back to well on 6-30-92 at 1215 HRS
NO Recharge NO sample taken

Meter Calibration: Date: 6-29-92 Time: — Meter Serial #: 011 Temperature °F: —
(EC 1000 — / —) (DI —) (pH 7 — / —) (pH 10 — / —) (pH 4 — / —)

Location of previous calibration: MW-2

Signature: [Signature] Reviewed By: JB Page 3 of 9



EMCON ASSOCIATES

WATER SAMPLE FIELD DATA SHEET

Rev. 2, 5/91

PROJECT NO: G70-38-01

SAMPLE ID: MW-4

PURGED BY: L. RATH

CLIENT NAME: ARCO 6113

SAMPLED BY: _____

LOCATION: 785 E Stanley Bl
Livermore CA

TYPE: Ground Water Surface Water _____ Treatment Effluent _____ Other _____

CASING DIAMETER (inches): 2 3 _____ 4 _____ 4.5 _____ 6 _____ Other _____

CASING ELEVATION (feet/MSL):	<u>NR</u>	VOLUME IN CASING (gal.):	<u>NA</u>
DEPTH TO WATER (feet):	<u>DRY</u>	CALCULATED PURGE (gal.):	<u>/</u>
DEPTH OF WELL (feet):	<u>26.70</u>	ACTUAL PURGE VOL (gal.):	<u>/</u>

DATE PURGED:	<u>6-29-92</u>	Start (2400 Hr)	<u>NA</u>	End (2400 Hr)	<u>NA</u>
DATE SAMPLED:	<u>NA</u>	Start (2400 Hr)	<u>/</u>	End (2400 Hr)	<u>/</u>

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	EC. (umhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
		<u>WELL</u>	<u>DRY</u>			
		<u>NO</u>	<u>SAMPLE</u>			
D. O. (ppm):	<u>NA</u>	ODOR:	<u>NR</u>		<u>NA</u>	<u>NR</u>
					(COBALT 0-100)	(NTU 0-200)

FIELD QC SAMPLES COLLECTED AT THIS WELL (i.e. FB-1, XDUP-1): NA

PURGING EQUIPMENT

SAMPLING EQUIPMENT

- | | | | |
|---|---|--|---|
| <input type="checkbox"/> 2" Bladder Pump | <input type="checkbox"/> Bailer (Teflon®) | <input type="checkbox"/> 2" Bladder Pump | <input type="checkbox"/> Bailer (Teflon®) |
| <input type="checkbox"/> Centrifugal Pump | <input type="checkbox"/> Bailer (PVC) | <input type="checkbox"/> DDL Sampler | <input type="checkbox"/> Bailer (Stainless Steel) |
| <input type="checkbox"/> Submersible Pump | <input type="checkbox"/> Bailer (Stainless Steel) | <input type="checkbox"/> Dipper | <input type="checkbox"/> Submersible Pump |
| <input type="checkbox"/> Well Wizard™ | <input type="checkbox"/> Dedicated | <input type="checkbox"/> Well Wizard™ | <input type="checkbox"/> Dedicated |
| Other: _____ | | Other: _____ | |

WELL INTEGRITY: File LOCK #: 3259

REMARKS: _____

Meter Calibration: Date: _____ Time: _____ Meter Serial #: _____ Temperature °F: _____
 (EC 1000 _____ / _____) (DI _____) (pH 7 _____ / _____) (pH 10 _____ / _____) (pH 4 _____ / _____)
 Location of previous calibration: _____



EMCON ASSOCIATES

WATER SAMPLE FIELD DATA SHEET

Rev. 2, 5/91

PROJECT NO: G70 3801
PURGED BY: L. RATH
SAMPLED BY: L. RATH

SAMPLE ID: MW-5 (61)
CLIENT NAME: ARCO GIB
LOCATION: 785 E Stankov Bl
Livermore CA

TYPE: Ground Water Surface Water _____ Treatment Effluent _____ Other _____
CASING DIAMETER (inches): 2 _____ 3 _____ 4 4.5 _____ 6 _____ Other _____

CASING ELEVATION (feet/MSL): Nil VOLUME IN CASING (gal.): 7.90
DEPTH TO WATER (feet): 50.55 CALCULATED PURGE (gal.): 39.52
DEPTH OF WELL (feet): 62.60 ACTUAL PURGE VOL (gal.): 20.00

DATE PURGED: 6-30-92 Start (2400 Hr) 1105 End (2400 Hr) 1137
DATE SAMPLED: 6-30-92 Start (2400 Hr) 1140 End (2400 Hr) _____

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	EC. (umhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1115</u>	<u>8</u>	<u>6.44</u>	<u>1025</u>	<u>69.9</u>	<u>Brown</u>	<u>Heavy</u>
<u>1122</u>	<u>16</u>	<u>6.55</u>	<u>967</u>	<u>70.1</u>	<u>Brown</u>	<u>Heavy</u>
<u>1129</u>	<u>24</u>	<u>6.50</u>	<u>964</u>	<u>69.6</u>	<u>Brown</u>	<u>Heavy</u>
<u>1132</u>	32	<u>well dried at 30 gal</u>		<u>69.5</u>	<u>Brown</u>	<u>Heavy</u>
<u>1140</u>	40	<u>6.55</u>	<u>966</u>	<u>69.5</u>	<u>Brown</u>	<u>Heavy</u>

D. O. (ppm): NR ODOR: Strong
(COBALT 0 - 100) NR (NTU 0 - 200) NR

FIELD QC SAMPLES COLLECTED AT THIS WELL (i.e. FB-1, XDUP-1): NR

PURGING EQUIPMENT

SAMPLING EQUIPMENT

- | | | | |
|--|---|--|--|
| <input type="checkbox"/> 2" Bladder Pump | <input type="checkbox"/> Bailer (Teflon®) | <input type="checkbox"/> 2" Bladder Pump | <input checked="" type="checkbox"/> Bailer (Teflon®) |
| <input type="checkbox"/> Centrifugal Pump | <input type="checkbox"/> Bailer (PVC) | <input type="checkbox"/> DDL Sampler | <input type="checkbox"/> Bailer (Stainless Steel) |
| <input checked="" type="checkbox"/> Submersible Pump | <input type="checkbox"/> Bailer (Stainless Steel) | <input type="checkbox"/> Dipper | <input type="checkbox"/> Submersible Pump |
| <input type="checkbox"/> Well Wizard™ | <input type="checkbox"/> Dedicated | <input type="checkbox"/> Well Wizard™ | <input type="checkbox"/> Dedicated |
| Other: _____ | | Other: _____ | |

WELL INTEGRITY: good LOCK #: 3259

REMARKS: well dried at 30 gal at 1132 HRS

Meter Calibration: Date: 6-30-92 Time: _____ Meter Serial #: 911 Temperature °F: _____
(EC 1000 _____ / _____) (DI _____) (pH 7 _____ / _____) (pH 10 _____ / _____) (pH 4 _____ / _____)

Location of previous calibration: MW-7

Signature: [Signature] Reviewed By: JH Page 5 of 9



WATER SAMPLE FIELD DATA SHEET

EMCON
ASSOCIATES

PROJECT NO: G7038C1
 PURGED BY: L. RATH
 SAMPLED BY: L. RATH

SAMPLE ID: MW-6(66)
 CLIENT NAME: ARCO 6112
 LOCATION: 785 E Stanley Bl
Livermore CA

TYPE: Ground Water Surface Water _____ Treatment Effluent _____ Other _____

CASING DIAMETER (inches): 2 _____ 3 _____ 4 4.5 _____ 6 _____ Other _____

CASING ELEVATION (feet/MSL): NR VOLUME IN CASING (gal.): 11.58
 DEPTH TO WATER (feet): 49.74 CALCULATED PURGE (gal.): 57.92
 DEPTH OF WELL (feet): 67.40 ACTUAL PURGE VOL (gal.): 58.00

DATE PURGED: 6-30-92 Start (2400 Hr) 1012 End (2400 Hr) 1042
 DATE SAMPLED: 6-30-92 Start (2400 Hr) 1045 End (2400 Hr) 1045

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	EC. (µmhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1017</u>	<u>11.75</u>	<u>6.24</u>	<u>799</u>	<u>67.2</u>	<u>Brown</u>	<u>Heavy</u>
<u>1023</u>	<u>23.50</u>	<u>6.50</u>	<u>793</u>	<u>66.5</u>	<u>Brown</u>	<u>Heavy</u>
<u>1030</u>	<u>35.25</u>	<u>6.61</u>	<u>806</u>	<u>66.9</u>	<u>Brown</u>	<u>Heavy</u>
<u>1036</u>	<u>47.00</u>	<u>6.63</u>	<u>795</u>	<u>66.2</u>	<u>Brown</u>	<u>Heavy</u>
<u>1042</u>	<u>58.00</u>	<u>6.62</u>	<u>790</u>	<u>65.9</u>	<u>Brown</u>	<u>Heavy</u>

D. O. (ppm): NR ODOR: NONE NR NR
 (COBALT 0-100) (NTU 0-200)

FIELD QC SAMPLES COLLECTED AT THIS WELL (i.e. FB-1, XDUP-1): NR

PURGING EQUIPMENT

SAMPLING EQUIPMENT

- | | | | |
|--|---|--|--|
| <input type="checkbox"/> 2" Bladder Pump | <input type="checkbox"/> Bailor (Teflon®) | <input type="checkbox"/> 2" Bladder Pump | <input checked="" type="checkbox"/> Bailor (Teflon®) |
| <input type="checkbox"/> Centrifugal Pump | <input type="checkbox"/> Bailor (PVC) | <input type="checkbox"/> DDL Sampler | <input type="checkbox"/> Bailor (Stainless Steel) |
| <input checked="" type="checkbox"/> Submersible Pump | <input type="checkbox"/> Bailor (Stainless Steel) | <input type="checkbox"/> Dipper | <input type="checkbox"/> Submersible Pump |
| <input type="checkbox"/> Well Wizard™ | <input type="checkbox"/> Dedicated | <input type="checkbox"/> Well Wizard™ | <input type="checkbox"/> Dedicated |
| Other: _____ | | Other: _____ | |

WELL INTEGRITY: good LOCK #: 3259

REMARKS: _____

Meter Calibration: Date: 6-30-92 Time: _____ Meter Serial #: 9111 Temperature °F: _____
 (EC 1000 _____ / _____) (DI _____) (pH 7 _____ / _____) (pH 10 _____ / _____) (pH 4 _____ / _____)

Location of previous calibration: MW-7
 Signature: L. RATH Reviewed By: J.D. Page 6 of 9



EMCON
ASSOCIATES

WATER SAMPLE FIELD DATA SHEET

PROJECT NO: 6703801
 PURGED BY: L. RATH
 SAMPLED BY: L. RATH

SAMPLE ID: MW-7 (66)
 CLIENT NAME: ARCO 6113
 LOCATION: 755 E Stanley Bl
Livermore CA

TYPE: Ground Water Surface Water _____ Treatment Effluent _____ Other _____
 CASING DIAMETER (inches): 2 _____ 3 _____ 4 4.5 _____ 6 _____ Other _____

CASING ELEVATION (feet/MSL): NR VOLUME IN CASING (gal.): 11.88
 DEPTH TO WATER (feet): 49.58 CALCULATED PURGE (gal.): 59.43
 DEPTH OF WELL (feet): 67.70 ACTUAL PURGE VOL (gal.): 45.00

DATE PURGED: 6-30-92 Start (2400 Hr) 0925 End (2400 Hr) 0953
 DATE SAMPLED: 6-30-92 Start (2400 Hr) 1000 End (2400 Hr) _____

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	E.C. (µmhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>0930</u>	<u>12.00</u>	<u>6.04</u>	<u>900</u>	<u>70.1</u>	<u>Brown</u>	<u>Heavily</u>
<u>0935</u>	<u>24.00</u>	<u>6.29</u>	<u>862</u>	<u>69.4</u>	<u>Brown</u>	<u>Heavily</u>
<u>0947</u>	<u>36.00</u>	<u>6.47</u>	<u>858</u>	<u>68.2</u>	<u>Brown</u>	<u>Heavily</u>
<u>0953</u>	<u>48.00</u>	<u>well dried out 45 gal</u>				
<u>1000</u>	<u>66.00</u>	<u>6.49</u>	<u>849</u>	<u>68.4</u>	<u>Brown</u>	<u>Heavily</u>
D. O. (ppm):	<u>NR</u>	ODOR:	<u>NONE</u>		<u>NR</u>	<u>NR</u>
					(COBALT 0-100)	(NTU 0-200)

FIELD QC SAMPLES COLLECTED AT THIS WELL (i.e. FB-1, XDUP-1): NR

PURGING EQUIPMENT		SAMPLING EQUIPMENT	
<input type="checkbox"/> 2" Bladder Pump	<input type="checkbox"/> Bailer (Teflon®)	<input type="checkbox"/> 2" Bladder Pump	<input checked="" type="checkbox"/> Bailer (Teflon®)
<input type="checkbox"/> Centrifugal Pump	<input type="checkbox"/> Bailer (PVC)	<input type="checkbox"/> DDL Sampler	<input type="checkbox"/> Bailer (Stainless Steel)
<input checked="" type="checkbox"/> Submersible Pump	<input type="checkbox"/> Bailer (Stainless Steel)	<input type="checkbox"/> Dipper	<input type="checkbox"/> Submersible Pump
<input type="checkbox"/> Well Wizard™	<input type="checkbox"/> Dedicated	<input type="checkbox"/> Well Wizard™	<input type="checkbox"/> Dedicated
Other: _____		Other: _____	

WELL INTEGRITY: good LOCK #: 3259

REMARKS: well dried out 45 gal at 0953 HRS

Meter Calibration: Date: 6-30-92 Time: 0910 Meter Serial #: 911 Temperature °F: 70.8
 (EC 1000 940/1000) (DI 7.03) (pH 7 6.90/7.00) (pH 10 1006/1000) (pH 4 4.06/)
 Location of previous calibration: _____

Signature: L. RATH Reviewed By: JTB Page 7 of 9



EMCON ASSOCIATES

WATER SAMPLE FIELD DATA SHEET

Rev. 2, 5/91

PROJECT NO: G70 38 01

SAMPLE ID: mw-8 (65)

PURGED BY: L. RATH

CLIENT NAME: ARCO G113

SAMPLED BY: L. RATH

LOCATION: 785 E Stanley Bl
Livermore cit

TYPE: Ground Water Surface Water _____ Treatment Effluent _____ Other _____

CASING DIAMETER (inches): 2 _____ 3 _____ 4 _____ 4.5 _____ 6 _____ Other _____

CASING ELEVATION (feet/MSL): <u>AIR</u>	VOLUME IN CASING (gal.): <u>10.61</u>
DEPTH TO WATER (feet): <u>50.42</u>	CALCULATED PURGE (gal.): <u>53.07</u>
DEPTH OF WELL (feet): <u>66.60</u>	ACTUAL PURGE VOL (gal.): <u>30.00</u>

DATE PURGED: <u>6-29-92</u>	Start (2400 Hr) <u>1155</u>	End (2400 Hr) <u>1220</u>
DATE SAMPLED: <u>6-29-92</u>	Start (2400 Hr) <u>1240</u>	End (2400 Hr) <u>—</u>

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	EC. (µmhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
1205	<u>10.75</u>	<u>6.17</u>	<u>850</u>	<u>67.7</u>	<u>Brown</u>	<u>Heavy</u>
1212	21.20 32.25	<u>6.22</u>	<u>834</u>	<u>66.0</u>	<u>Brown</u>	<u>Heavy</u>
1220	33.50 53.75	<u>well Dried at 30 gal</u>				
1240	<u>Recharge</u>	<u>6.25</u>	<u>828</u>	<u>66.3</u>	<u>Brown</u>	<u>Heavy</u>

D. O. (ppm): AIR ODOR: Slight AIR (COBALT 0 - 100) AIR (NTU 0 - 200)

FIELD QC SAMPLES COLLECTED AT THIS WELL (i.e. FB-1, XDUP-1): AIR

PURGING EQUIPMENT

SAMPLING EQUIPMENT

- | | | | |
|--|---|--|--|
| <input type="checkbox"/> 2" Bladder Pump | <input type="checkbox"/> Bailer (Teflon®) | <input type="checkbox"/> 2" Bladder Pump | <input checked="" type="checkbox"/> Bailer (Teflon®) |
| <input type="checkbox"/> Centrifugal Pump | <input type="checkbox"/> Bailer (PVC) | <input type="checkbox"/> DDL Sampler | <input type="checkbox"/> Bailer (Stainless Steel) |
| <input checked="" type="checkbox"/> Submersible Pump | <input type="checkbox"/> Bailer (Stainless Steel) | <input type="checkbox"/> Dipper | <input type="checkbox"/> Submersible Pump |
| <input type="checkbox"/> Well Wizard™ | <input type="checkbox"/> Dedicated | <input type="checkbox"/> Well Wizard™ | <input type="checkbox"/> Dedicated |
| Other: _____ | | Other: _____ | |

WELL INTEGRITY: good LOCK #: 3259

REMARKS: well Dried at 30 gal at 1220 HRS
Water is very silty. 2" gravel silted up and stopped running.
cleaned out side (L.R.)

Meter Calibration: Date: 6-29-92 Time: _____ Meter Serial #: 911 Temperature °F: _____
 (EC 1000 _____ / _____) (DI _____) (pH 7 _____ / _____) (pH 10 _____ / _____) (pH 4 _____ / _____)
 Location of previous calibration: mw-2

Signature: [Signature] Reviewed By: [Signature] Page 8 of 9



WATER SAMPLE FIELD DATA SHEET

Rev. 2, 5/91

EMCON
ASSOCIATES

PROJECT NO: 670 38 01

SAMPLE ID: mw-9 (67)

PURGED BY: L. RATH

CLIENT NAME: IRCO 6113

SAMPLED BY: L. RATH

LOCATION: 795 E Stanley Bl
Livermore CA

TYPE: Ground Water Surface Water _____ Treatment Effluent _____ Other _____

CASING DIAMETER (inches): 2 _____ 3 _____ 4 4.5 _____ 6 _____ Other _____

CASING ELEVATION (feet/MSL):	<u>NR</u>	VOLUME IN CASING (gal.):	<u>11.61</u>
DEPTH TO WATER (feet):	<u>50.30</u>	CALCULATED PURGE (gal.):	<u>58.05</u>
DEPTH OF WELL (feet):	<u>68.00</u>	ACTUAL PURGE VOL (gal.):	<u>50.0</u>

DATE PURGED: 6-29-92 Start (2400 Hr) 1348 End (2400 Hr) 1425

DATE SAMPLED: 6-29-92 Start (2400 Hr) 1435 End (2400 Hr) _____

TIME (2400 Hr)	VOLUME (gal.)	pH (units)	E.C. (umhos/cm @ 25° C)	TEMPERATURE (°F)	COLOR (visual)	TURBIDITY (visual)
<u>1355</u>	<u>11.75</u>	<u>6.15</u>	<u>820</u>	<u>63.9</u>	<u>Brown</u>	<u>Heavily</u>
<u>1404</u>	<u>23.50</u>	<u>6.39</u>	<u>856</u>	<u>65.5</u>	<u>Brown</u>	<u>Heavily</u>
<u>1411</u>	<u>35.25</u>	<u>6.47</u>	<u>844</u>	<u>65.7</u>	<u>Brown</u>	<u>Heavily</u>
<u>1421</u>	<u>47.00</u>	<u>6.46</u>	<u>836</u>	<u>65.9</u>	<u>Brown</u>	<u>Heavily</u>
<u>1425</u>	58.05	<u>well dried at 50 gal at 1425 HRS</u>				

D. O. (ppm): NR ODOR: NONE _____ NR NR
(COBALT 0-100) (NTU 0-200)

FIELD QC SAMPLES COLLECTED AT THIS WELL (i.e. FB-1, XDUP-1): NR

PURGING EQUIPMENT

SAMPLING EQUIPMENT

- | | | | |
|--|---|--|--|
| <input type="checkbox"/> 2" Bladder Pump | <input type="checkbox"/> Bailor (Teflon®) | <input type="checkbox"/> 2" Bladder Pump | <input checked="" type="checkbox"/> Bailor (Teflon®) |
| <input type="checkbox"/> Centrifugal Pump | <input type="checkbox"/> Bailor (PVC) | <input type="checkbox"/> DDL Sampler | <input type="checkbox"/> Bailor (Stainless Steel) |
| <input checked="" type="checkbox"/> Submersible Pump | <input type="checkbox"/> Bailor (Stainless Steel) | <input type="checkbox"/> Dipper | <input type="checkbox"/> Submersible Pump |
| <input type="checkbox"/> Well Wizard™ | <input type="checkbox"/> Dedicated | <input type="checkbox"/> Well Wizard™ | <input type="checkbox"/> Dedicated |
- Other: _____ Other: _____

WELL INTEGRITY: good LOCK #: 3259

REMARKS: well dried at 50 gal at 1425 HRS.

time	vol.	pH	E.C.	Temp	color	turbidity
<u>Recharge 1425</u>	<u>Recharge</u>	<u>6.41</u>	<u>837</u>	<u>65.8</u>	<u>Brown</u>	<u>Heavily</u>

Meter Calibration: Date: 6-29-92 Time: _____ Meter Serial #: 9111 Temperature °F: _____

(EC 1000 _____ / _____) (DI _____) (pH 7 _____ / _____) (pH 10 _____ / _____) (pH 4 _____ / _____)

Location of previous calibration: mw-2

Signature: L. RATH Reviewed By: JR Page 9 of 9



EMCON
ASSOCIATES

Consultants in Wastes
Management and
Environmental Control

Date July 30, 1992
Project G70-38.01

To:
Mr. Joel Coffman
RESNA/ Applied Geosystems
3315 Almaden Expressway, Suite 34
San Jose, California 95118

We are enclosing:

Copies	Description
<u>1</u>	<u>Depth To Water/Floating Product Survey Results</u>
<u> </u>	<u>July 1992 monthly water level survey, ARCO</u>
<u> </u>	<u>station 6113, 785 East Stanley Blvd., Livermore, CA</u>

For your: X Information Sent by: X Mail

Comments:

Monthly water level data for the above mentioned site are attached. Please call if you have any questions: (408) 453-2266.

Reviewed by:



Jim Butera JB

Robert Porter
Robert Porter, Senior Project
Engineer.



**FIELD REPORT
DEPTH TO WATER / FLOATING PRODUCT SURVEY**

PROJECT # : G70-38.01

STATION ADDRESS : 785 East Stanley Blvd. Livermore

DATE : 7-28-92

ARCO STATION # : 6113

FIELD TECHNICIAN : Rich Schaeffer

DAY : TUESDAY

DTW Order	WELL ID	Well Box Seal	Well Lid Secure	Gasket	Lock	Locking Well Cap	FIRST DEPTH TO WATER (feet)	SECOND DEPTH TO WATER (feet)	DEPTH TO FLOATING PRODUCT (feet)	FLOATING PRODUCT THICKNESS (feet)	WELL TOTAL DEPTH (feet)	COMMENTS
1	MW-2	FINE	Yes	Yes	3259	FINE	38.36	38.36	N.D	N.D	38.6	-
2	MW-3	FINE	Yes	Yes	3259	FINE	39.05	39.05	N.D	N.D	39.1	-
3	MW-8	FINE	Yes	Yes	3259	FINE	55.79	55.79	N.D	N.D	66.6	-
4	MW-1	FINE	Yes	Yes	3259	FINE	DRY	DRY	N.D	N.D	41.8 41.8	-
5	MW-9	FINE	Yes	Yes	3259	FINE	55.53	55.53	N.D	N.D	68.0	-
6	MW-7	FINE	Yes	Yes	3259	FINE	54.60	54.60	N.D	N.D	67.7	-
7	MW-6	FINE	Yes	Yes	3259	FINE	54.63	54.63	N.D	N.D	67.4	-
8	MW-5	FINE	Yes	Yes	3259	FINE	54.92	54.92	N.D	N.D	62.6	-
9	MW-4	FINE	Yes	Yes	3259	FINE	Dry	Dry	N.D	N.D	26.7	-

SURVEY POINTS ARE TOP OF WELL CASINGS



EMCON
ASSOCIATES

Consultants in Wastes
Management and
Environmental Control

Date Sept 01, 1992
Project G70-38.01

To:
Mr. Joel Coffman
RESNA/ Applied Geosystems
3315 Almaden Expressway, Suite 34
San Jose, California 95118

We are enclosing:

Copies	Description
<u>1</u>	<u>Depth To Water/Floating Product Survey Results</u>
	<u>August 1992 monthly water level survey, ARCO</u>
	<u>station 6113, 785 East Stanley Blvd., Livermore, CA</u>

For your: X Information Sent by: X Mail

Comments:

Monthly water level data for the above mentioned site are attached. Please call if you have any questions: (408) 453-2266.

Reviewed by:



Jim Butera JB

Robert Porter
Robert Porter, Senior Project
Engineer.



**FIELD REPORT
DEPTH TO WATER/FLOATING PRODUCT SURVEY**

PROJECT # : G70-38.01

STATION ADDRESS : 785 East Stanley Blvd. Livermore

DATE : 8-26-92

ARCO STATION # : 6113

FIELD TECHNICIAN : Rich Schaeffer

DAY : WED

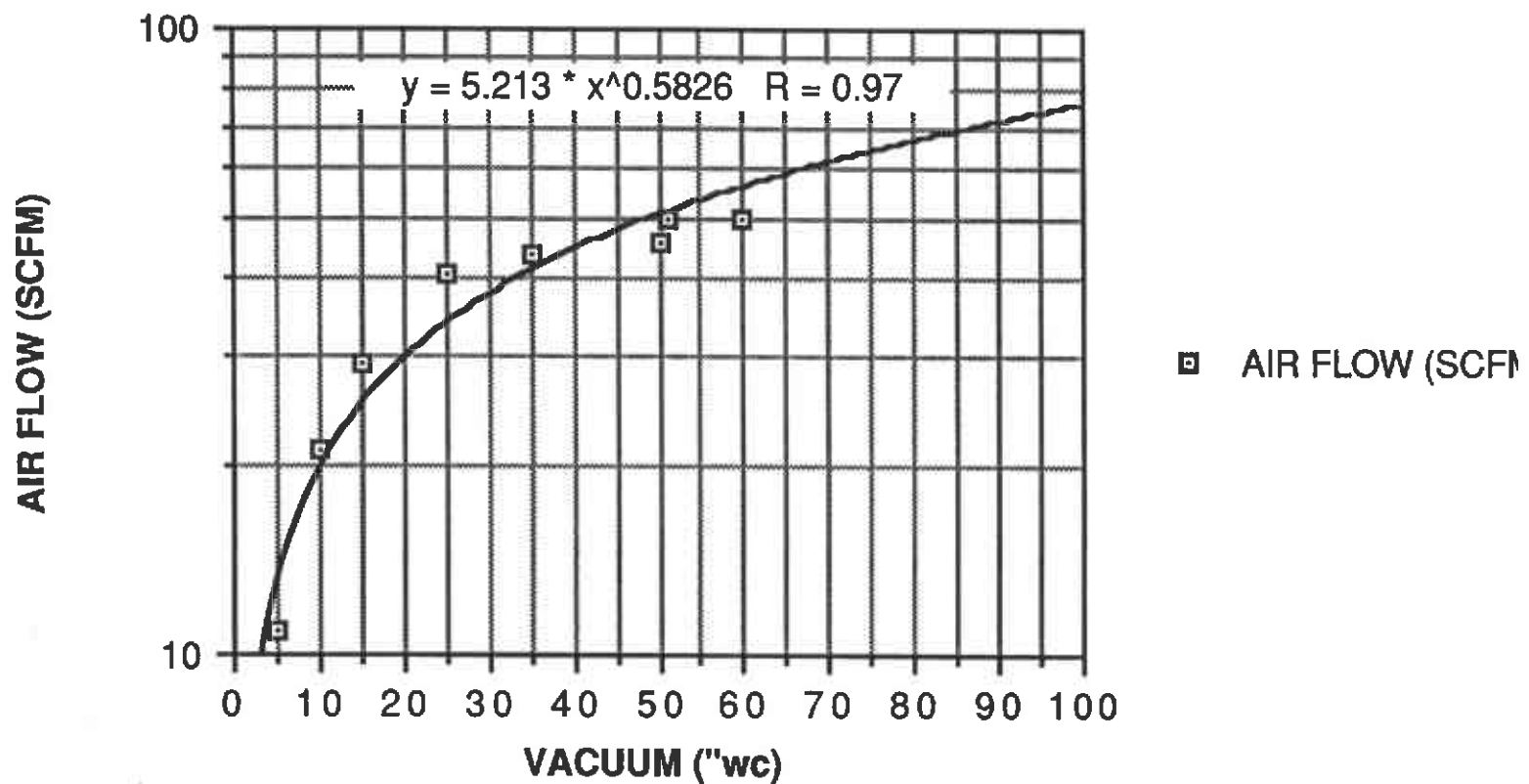
DTW Order	WELL ID	Well Box Seal	Well Lid Secure	Gasket	Lock	Locking Well Cap	FIRST DEPTH TO WATER (feet)	SECOND DEPTH TO WATER (feet)	DEPTH TO FLOATING PRODUCT (feet)	FLOATING PRODUCT THICKNESS (feet)	WELL TOTAL DEPTH (feet)	COMMENTS
1	MW-2	FINE	YES	NONE	3259	YES	38.26	38.26	N.D	N.D	38.6	-
2	MW-3	FINE	YES	NONE	3259	YES	39.03	39.03	N.D	N.D	39.1	-
3	MW-8	FINE	YES	FINE	3259	YES	60.79	60.79	N.D	N.D	66.6	-
4	MW-1	FINE	YES	NONE	3259	YES	DRY		N.D	N.D	44.8	-
5	MW-9	FINE	YES	FINE	3259	YES	60.62	60.62	N.D	N.D	68.0	-
6	MW-7	FINE	YES	FINE	3259	YES	59.60	59.60	N.D	N.D	67.7	-
7	MW-6	FINE	YES	FINE	3259	YES	59.45	59.45	N.D	N.D	67.4	-
8	MW-5	FINE	YES	FINE	3259	YES	59.58	59.58	N.D	N.D	62.6	-
9	MW-4	FINE	YES	FINE	3259	YES	DRY		N.D	N.D	26.7	-

SURVEY POINTS ARE TOP OF WELL CASINGS

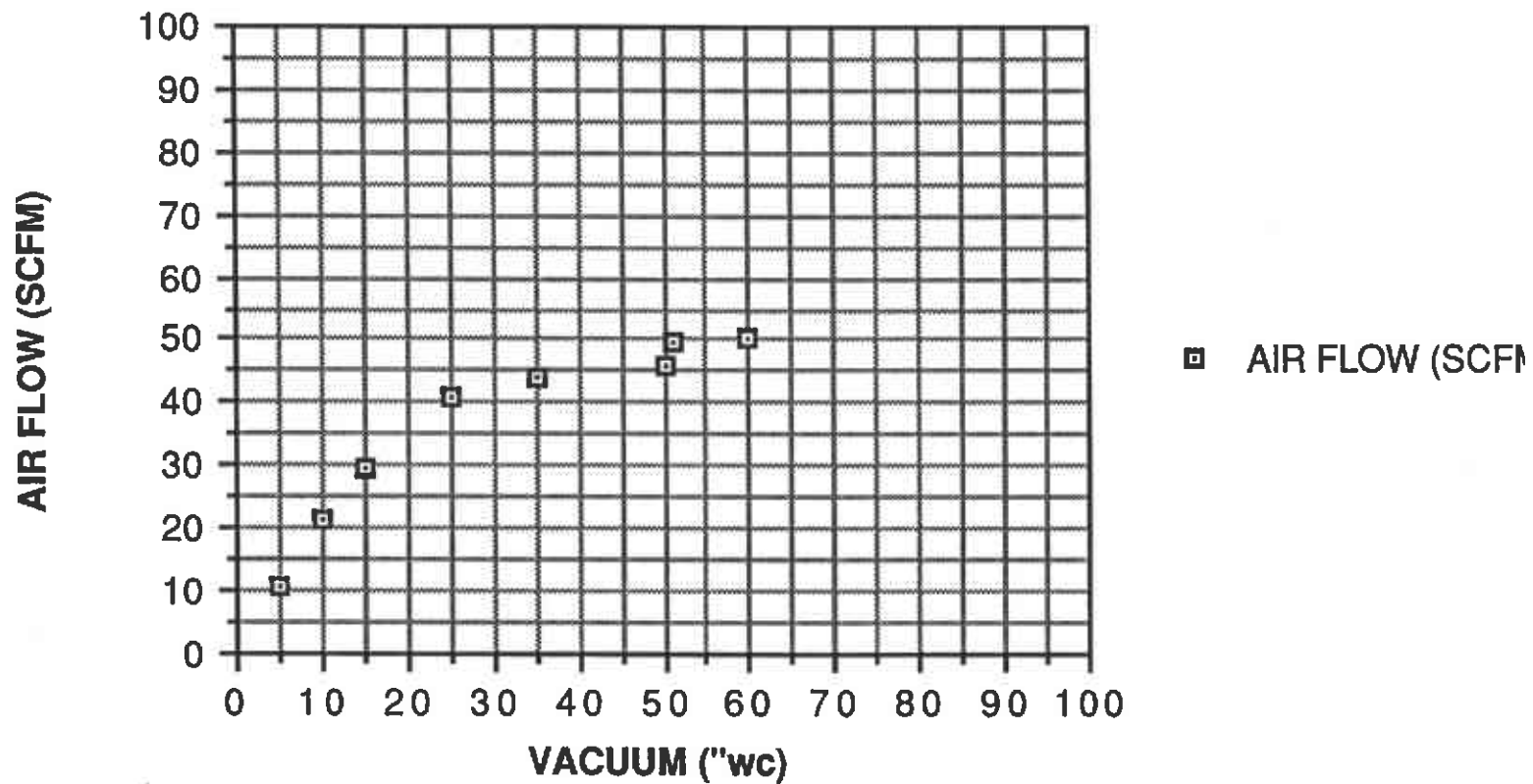
APPENDIX F

WELLHEAD AIR FLOW CHARACTERISTICS

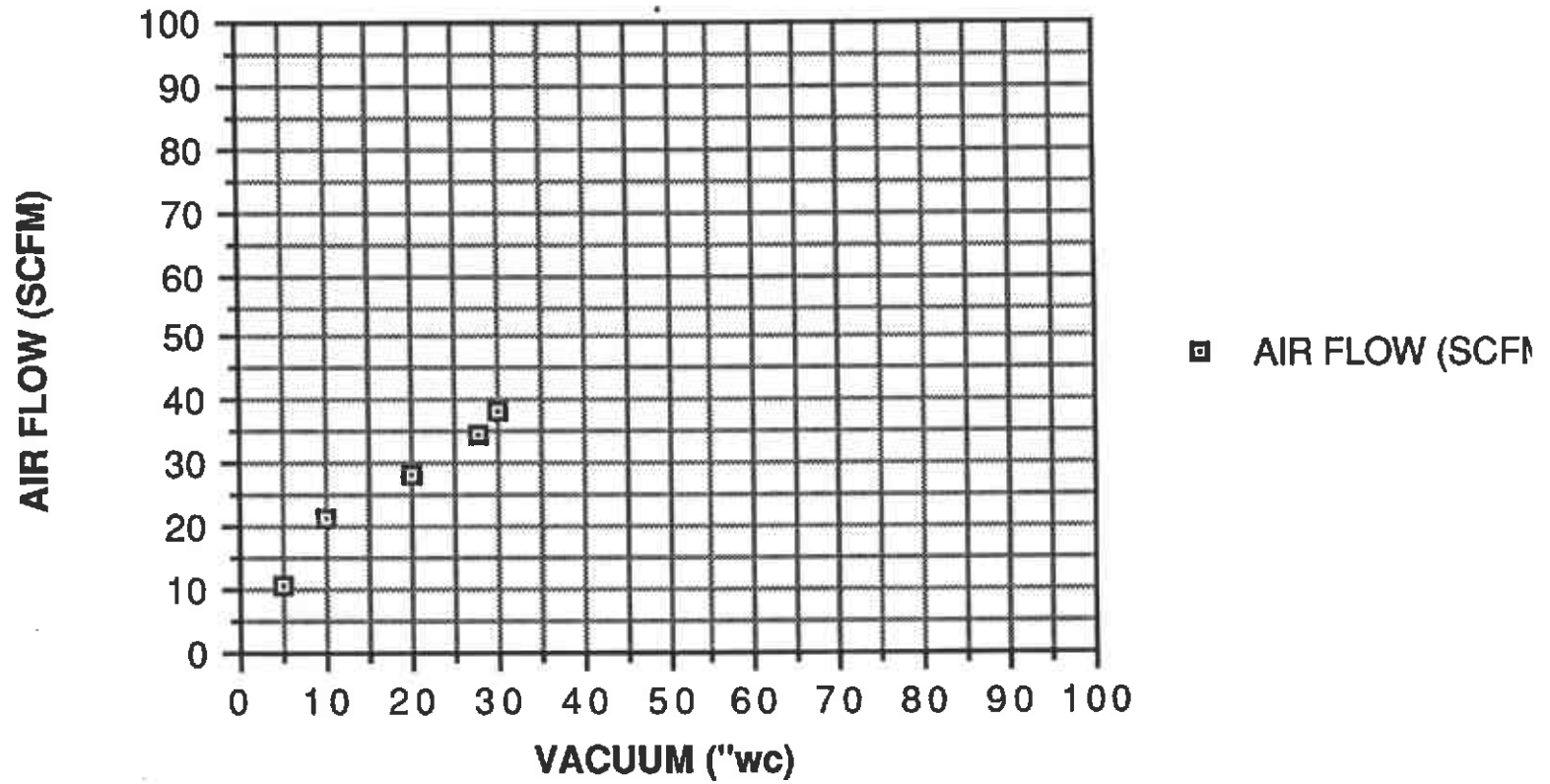
Data from "VAPOR WELL VW-1"



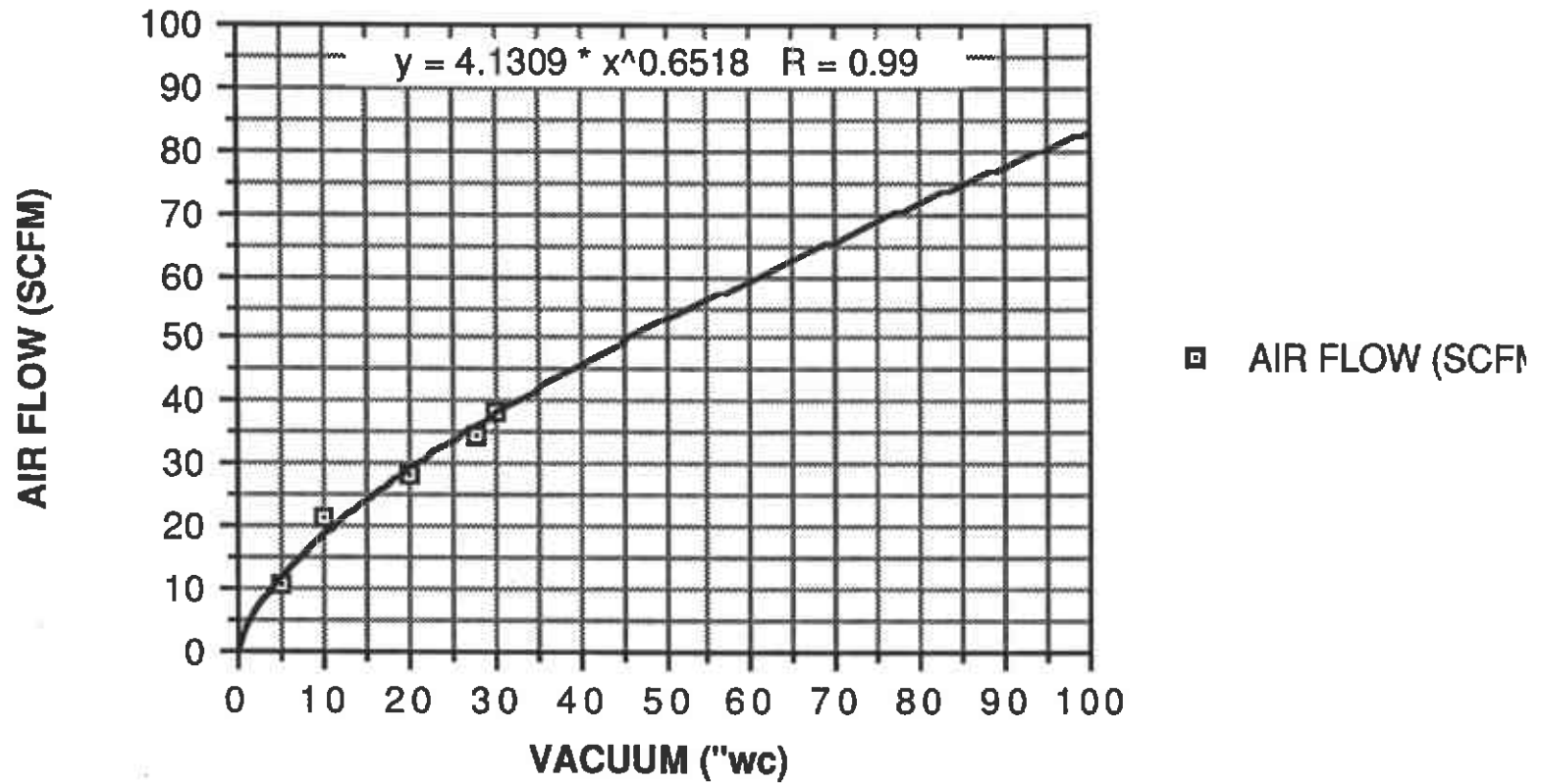
Data from "VAPOR WELL VW-1"



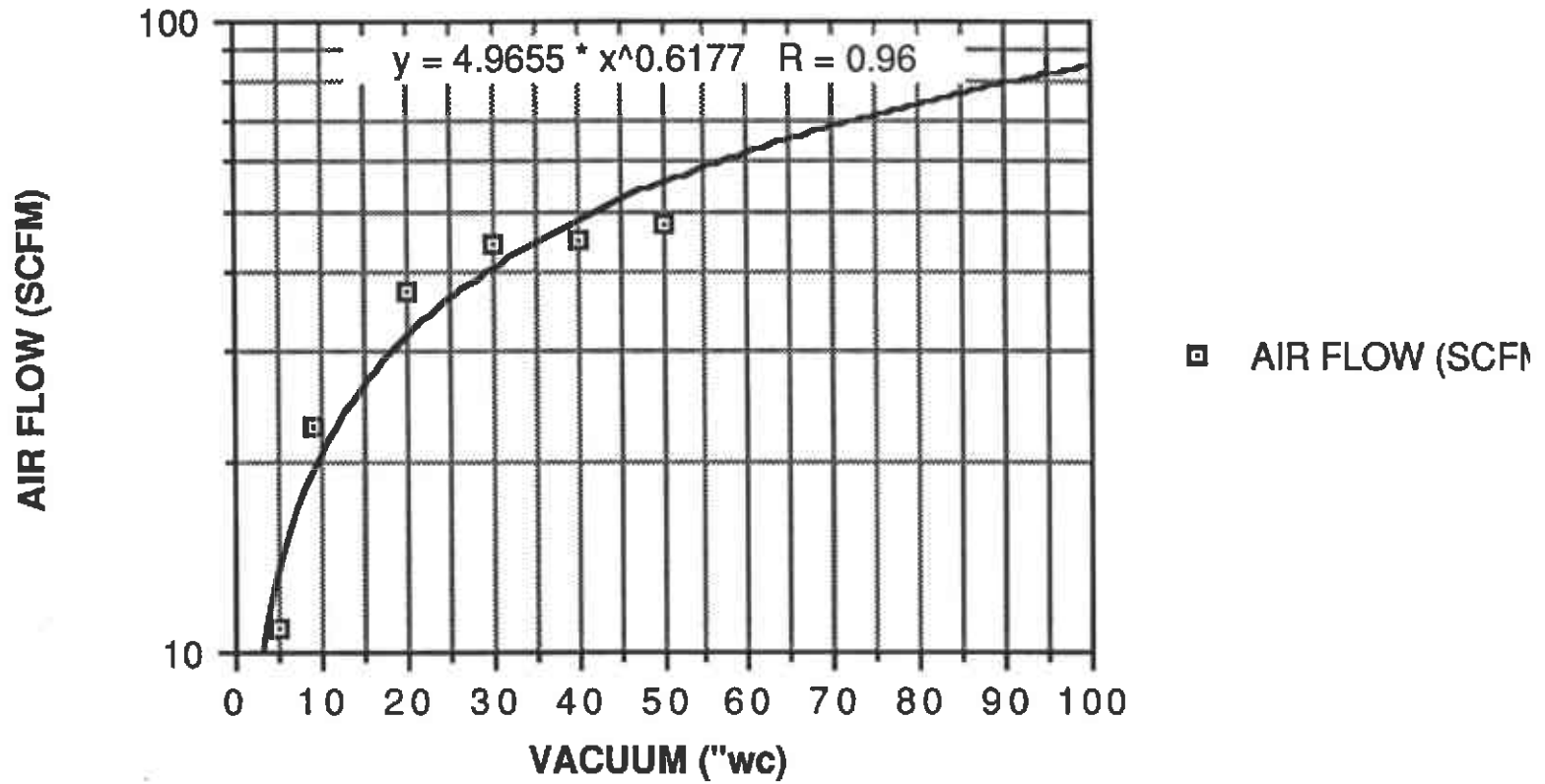
Data from "VAPOR WELL MW-5"



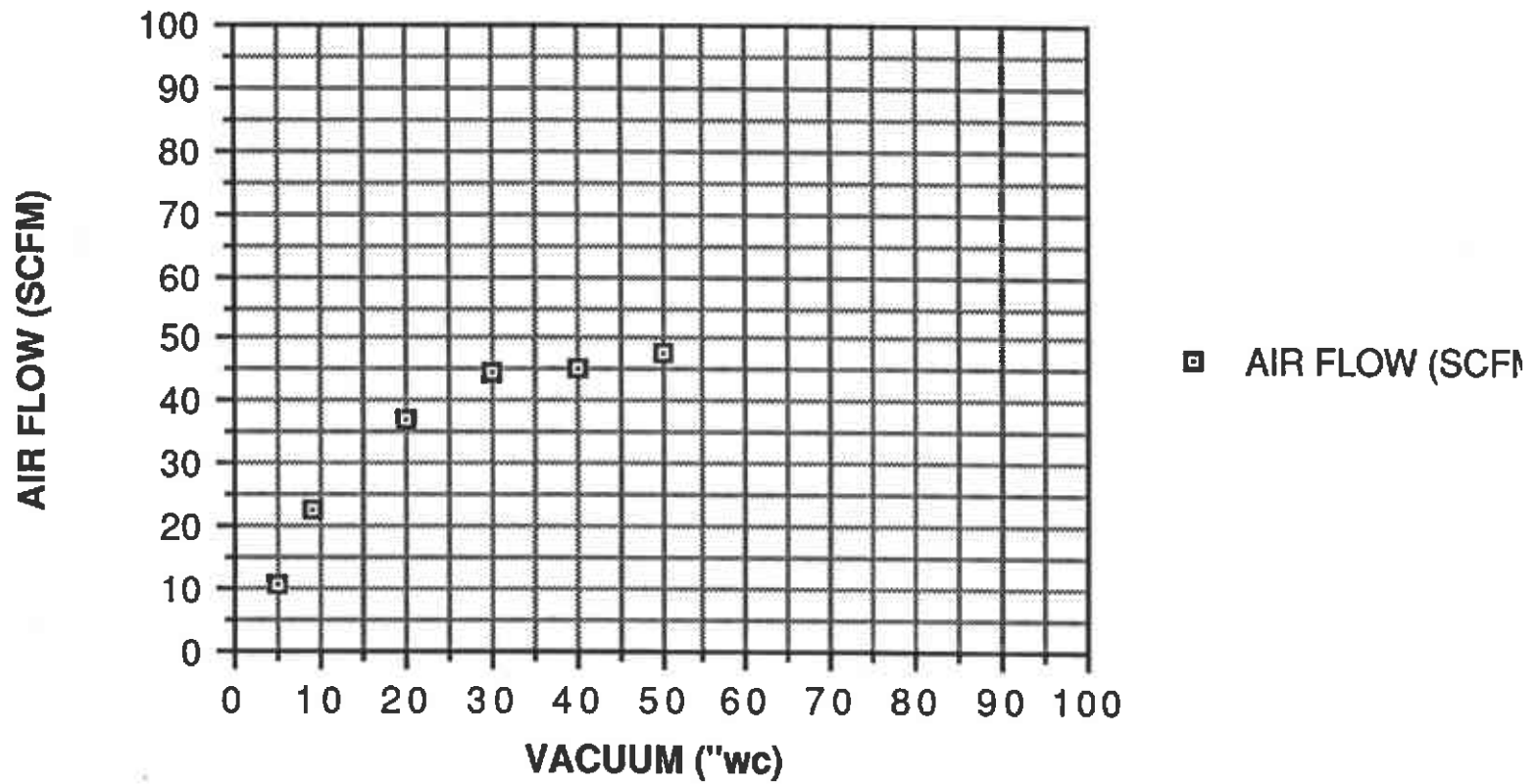
Data from "VAPOR WELL MW-5"



Data from "VAPOR WELL VW-2"



Data from "VAPOR WELL VW-2"



APPENDIX G

**CHAIN OF CUSTODY FORMS
and LABORATORY ANALYTICAL REPORTS
OF SOIL AND AIR SAMPLES**



SEQUOIA ANALYTICAL

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

RECEIVED

JUN 1 1992

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: Joel Coffman

RESNA
SAN JOSE

Project: ARCO 6113, Livermore

Enclosed are the results from 13 soil samples received at Sequoia Analytical on June 9, 1992.
The requested analyses are listed below:

SAMPLE #	SAMPLE DESCRIPTION	DATE OF COLLECTION	TEST METHOD
2062796	Soil, S-10.5-B5	6/8/92	EPA 5030/8015/8020
2062797	Soil, S-20.5-B5	6/8/92	EPA 5030/8015/8020
2062798	Soil, S-30.5-B5	6/8/92	EPA 5030/8015/8020
2062799	Soil, S-40.5-B5	6/8/92	EPA 5030/8015/8020
2062800	Soil, S-50.5-B5	6/8/92	EPA 5030/8015/8020
2062801	TCLP Extract of Soil, SB-10-B10	6/8/92	Cd, Cr, Pb, Ni, Zn EPA 3550/8015 EPA 5030/8015/8020 EPA 8240 SM 5520 E&F (Gravimetric)
2062802	Soil, S-20-B10	6/8/92	EPA 3550/8015 EPA 5030/8015/8020 SM 5520 E&F (Gravimetric)
2062803	Soil, S-30-B10	6/8/92	EPA 3550/8015 EPA 5030/8015/8020 SM 5520 E&F (Gravimetric)
2062804	Soil, S-45-B10	6/8/92	EPA 3550/8015 EPA 5030/8015/8020 SM 5520 E&F (Gravimetric)
2062805	TCLP Extract of Soil, SB-55-B10	6/8/92	Cd, Cr, Pb, Ni, Zn EPA 3550/8015 EPA 5030/8015/8020 EPA 8240 SM 5520 E&F (Gravimetric)



SEQUOIA ANALYTICAL

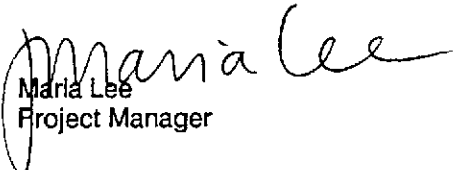
680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

2063361	Soil, S-55.5-B5	6/8/92	Particle Size Distribution by Weight
2063362	Soil, S-60.5-B5	6/8/92	Particle Size Distribution by Weight
2063363	Soil, S-63.5-B5	6/8/92	Particle Size Distribution by Weight

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


Maria Lee
Project Manager



SEQUOIA ANALYTICAL

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

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: Joel Coffman

Client Project ID: ARCO 6113, Livermore
Matrix Descript: Soil
Analysis Method: EPA 5030/8015/8020
First Sample #: 206-2796

Sampled: Jun 8, 1992
Received: Jun 9, 1992
Analyzed: Jun 17, 1992
Reported: Jun 26, 1992

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons mg/kg (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethyl Benzene mg/kg (ppm)	Xylenes mg/kg (ppm)
206-2796	S-10.5-B5	N.D.	N.D.	N.D.	N.D.	N.D.
206-2800	S-50.5-B5	N.D.	0.012	N.D.	N.D.	N.D.
206-2801	S-10-B10	N.D.	N.D.	N.D.	N.D.	N.D.
206-2802	S-20-B10	N.D.	N.D.	N.D.	N.D.	N.D.
206-2803	S-30-B10	N.D.	N.D.	N.D.	N.D.	N.D.
206-2804	S-45-B10	N.D.	N.D.	N.D.	N.D.	N.D.
206-2805	S-55-B10	N.D.	N.D.	N.D.	N.D.	N.D.

Detection Limits:	1.0	0.0050	0.0050	0.0050	0.0050
-------------------	-----	--------	--------	--------	--------

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Maria Lee
Maria Lee
Project Manager



SEQUOIA ANALYTICAL

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

RESNA	Client Project ID: ARCO 6113, Livermore	Sampled: Jun 8, 1992
3315 Almaden Expwy., Suite 34	Matrix Descript: Soil	Received: Jun 9, 1992
San Jose, CA 95118	Analysis Method: EPA 5030/8015/8020	Analyzed: Jun 22, 1992
Attention: Joel Coffman	First Sample #: 206-2797	Reported: Jun 26, 1992

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons mg/kg (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethyl Benzene mg/kg (ppm)	Xylenes mg/kg (ppm)
206-2797	S-20.5-B5	1,200	1.4	2.0	13	67
206-2799	S-40.5-B5	230	17	32	14	150

Detection Limits:	100	0.50	0.50	0.50	0.50
-------------------	-----	------	------	------	------

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard. Analytes reported as N.D. were not present above the stated limit of detection. Because matrix effects and/or other factors required additional sample dilution, detection limits for this sample have been raised.

SEQUOIA ANALYTICAL

Maria Lee
Maria Lee
Project Manager

2062796.RES <2>



SEQUOIA ANALYTICAL

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

RESNA	Client Project ID: ARCO 6113, Livermore	Sampled: Jun 8, 1992
3315 Almaden Expwy., Suite 34	Matrix Descript: Soil	Received: Jun 9, 1992
San Jose, CA 95118	Analysis Method: EPA 5030/8015/8020	Analyzed: Jun 22, 1992
Attention: Joel Coffman	First Sample #: 206-2798	Reported: Jun 26, 1992

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons mg/kg (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethyl Benzene mg/kg (ppm)	Xylenes mg/kg (ppm)
206-2798	S-30.5-B5	150	1.1	0.30	1.1	6.0

Detection Limits:	20	0.10	0.10	0.10	0.10
-------------------	----	------	------	------	------

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard. Analytes reported as N.D. were not present above the stated limit of detection. Because matrix effects and/or other factors required additional sample dilution, detection limits for this sample have been raised.

SEQUOIA ANALYTICAL

Mania Lee
Mania Lee
Project Manager

2062796.RES <3>



SEQUOIA ANALYTICAL

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

RESNA	Client Project ID: ARCO 6113, Livermore	Sampled: Jun 8, 1992
3315 Almaden Expwy., Suite 34	Matrix Descript: Soil	Received: Jun 9, 1992
San Jose, CA 95118	Analysis Method: EPA 3550/8015	Extracted: Jun 22, 1992
Attention: Joel Coffman	First Sample #: 206-2801	Analyzed: Jun 22, 1992
		Reported: Jun 26, 1992


TOTAL PETROLEUM FUEL HYDROCARBONS (EPA 8015)

Sample Number	Sample Description	High B.P. Hydrocarbons mg/kg (ppm)
206-2801	S-10-B10	N.D.
206-2802	S-20-B10	N.D.
206-2803	S-30-B10	N.D.
206-2804	S-45-B10	N.D.
206-2805	S-55-B10	N.D.

Detection Limits: 1.0

High Boiling Point Hydrocarbons are quantitated against a diesel fuel standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL


Maria Lee
Project Manager

2062796.RES <4>



SEQUOIA ANALYTICAL

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

RESNA	Client Project ID: ARCO 6113, Livermore	Sampled: Jun 8, 1992
3315 Almaden Expwy., Suite 34	Matrix Descript: Soil	Received: Jun 9, 1992
San Jose, CA 95118	Analysis Method: SM 5520 E&F (Gravimetric)	Extracted: Jun 23, 1992
Attention: Joel Coffman	First Sample #: 206-2801	Analyzed: Jun 25, 1992
		Reported: Jun 26, 1992

TOTAL RECOVERABLE PETROLEUM OIL


Sample Number	Sample Description	Oil & Grease mg/kg (ppm)
206-2801	S-10-B10	N.D.
206-2802	S-20-B10	N.D.
206-2803	S-30-B10	N.D.
206-2804	S-45-B10	77
206-2805	S-55-B10	N.D.

Detection Limits:

30

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

SEQUOIA ANALYTICAL


Maria Lee
Project Manager

2062796.RES <5>



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: Joel Coffman

Client Project ID: ARCO 6113, Livermore
Sample Descript: Soil, S-10-B10
Analysis Method: EPA 8240
Lab Number: 206-2801

Sampled: Jun 8, 1992
Received: Jun 9, 1992
Analyzed: Jun 22, 1992
Reported: Jun 26, 1992

VOLATILE ORGANICS by GC/MS (EPA 8240)

Analyte	Detection Limit µg/kg	Sample Results µg/kg
Acetone.....	500	N.D.
Benzene.....	100	N.D.
Bromodichloromethane.....	100	N.D.
Bromoform.....	100	N.D.
Bromomethane.....	100	N.D.
2-Butanone.....	500	N.D.
Carbon disulfide.....	100	N.D.
Carbon tetrachloride.....	100	N.D.
Chlorobenzene.....	100	N.D.
Chloroethane.....	100	N.D.
2-Chloroethyl vinyl ether.....	500	N.D.
Chloroform.....	100	N.D.
Chloromethane.....	100	N.D.
Dibromochloromethane.....	100	N.D.
1,1-Dichloroethane.....	100	N.D.
1,2-Dichloroethane.....	100	N.D.
1,1-Dichloroethene.....	100	N.D.
cis-1,2-Dichloroethene.....	100	N.D.
trans-1,2-Dichloroethene.....	100	N.D.
1,2-Dichloropropane.....	100	N.D.
cis-1,3-Dichloropropene.....	100	N.D.
trans-1,3-Dichloropropene.....	100	N.D.
Ethylbenzene.....	100	N.D.
2-Hexanone.....	500	N.D.
Methylene chloride.....	250	N.D.
4-Methyl-2-pentanone.....	500	N.D.
Styrene.....	100	N.D.
1,1,2,2-Tetrachloroethane.....	100	N.D.
Tetrachloroethene.....	100	N.D.
Toluene.....	100	N.D.
1,1,1-Trichloroethane.....	100	N.D.
1,1,2-Trichloroethane.....	100	N.D.
Trichloroethene.....	100	N.D.
Trichlorofluoromethane.....	100	N.D.
Vinyl acetate.....	100	N.D.
Vinyl chloride.....	100	N.D.
Total Xylenes.....	100	N.D.

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

SEQUOIA ANALYTICAL

Maria Lee
Maria Lee
Project Manager



SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063

(415) 364-9600 • FAX (415) 364-9233

RESNA	Client Project ID: ARCO 6113, Livermore	Sampled: Jun 8, 1992
3315 Almaden Expwy., Suite 34	Sample Descript: Soil, S-55-B10	Received: Jun 9, 1992
San Jose, CA 95118	Analysis Method: EPA 8240	Analyzed: Jun 22, 1992
Attention: Joel Coffman	Lab Number: 206-2805	Reported: Jun 26, 1992

VOLATILE ORGANICS by GC/MS (EPA 8240)

Analyte	Detection Limit µg/kg	Sample Results µg/kg
Acetone.....	500	N.D.
Benzene.....	100	N.D.
Bromodichloromethane.....	100	N.D.
Bromoform.....	100	N.D.
Bromomethane.....	100	N.D.
2-Butanone.....	500	N.D.
Carbon disulfide.....	100	N.D.
Carbon tetrachloride.....	100	N.D.
Chlorobenzene.....	100	N.D.
Chloroethane.....	100	N.D.
2-Chloroethyl vinyl ether.....	500	N.D.
Chloroform.....	100	N.D.
Chloromethane.....	100	N.D.
Dibromochloromethane.....	100	N.D.
1,1-Dichloroethane.....	100	N.D.
1,2-Dichloroethane.....	100	N.D.
1,1-Dichloroethene.....	100	N.D.
cis-1,2-Dichloroethene.....	100	N.D.
trans-1,2-Dichloroethene.....	100	N.D.
1,2-Dichloropropane.....	100	N.D.
cis-1,3-Dichloropropene.....	100	N.D.
trans-1,3-Dichloropropene.....	100	N.D.
Ethylbenzene.....	100	N.D.
2-Hexanone.....	500	N.D.
Methylene chloride.....	250	N.D.
4-Methyl-2-pentanone.....	500	N.D.
Styrene.....	100	N.D.
1,1,2,2-Tetrachloroethane.....	100	N.D.
Tetrachloroethene.....	100	N.D.
Toluene.....	100	N.D.
1,1,1-Trichloroethane.....	100	N.D.
1,1,2-Trichloroethane.....	100	N.D.
Trichloroethene.....	100	N.D.
Trichlorofluoromethane.....	100	N.D.
Vinyl acetate.....	100	N.D.
Vinyl chloride.....	100	N.D.
Total Xylenes.....	100	N.D.

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

SEQUOIA ANALYTICAL

Maria Lee
 Maria Lee
 Project Manager



SEQUOIA ANALYTICAL

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RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: Joel Coffman

Client Project ID: ARCO 6113, Livermore
Sample Descript: TCLP Extract of Soil, SB-10-B10
Lab Number: 206-2801

Sampled: Jun 8, 1992
Received: Jun 9, 1992
Extracted: Jun 17, 1992
Analyzed: 6/19-24/92
Reported: Jun 26, 1992

LABORATORY ANALYSIS by TCLP

Analyte	Detection Limit mg/L	Sample Results mg/L
Cadmium.....	0.010	N.D.
Chromium.....	0.010	N.D.
Lead.....	0.0050	N.D.
Nickel.....	0.050	0.13
Zinc.....	0.010	0.44

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

SEQUOIA ANALYTICAL

Maria Lee
Maria Lee
Project Manager



SEQUOIA ANALYTICAL

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

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: Joel Coffman

Client Project ID: ARCO 6113, Livermore
Sample Descript: TCLP Extract of Soil, SB-55-B10
Lab Number: 206-2805

Sampled: Jun 8, 1992
Received: Jun 9, 1992
Extracted: Jun 17, 1992
Analyzed: 6/19-24/92
Reported: Jun 26, 1992

LABORATORY ANALYSIS by TCLP

Analyte	Detection Limit mg/L	Sample Results mg/L
Cadmium.....	0.010	N.D.
Chromium.....	0.010	N.D.
Lead.....	0.0050	N.D.
Nickel.....	0.050	0.063
Zinc.....	0.010	0.75

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

SEQUOIA ANALYTICAL

Maria Lee
Maria Lee
Project Manager



SEQUOIA ANALYTICAL

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

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: Joel Coffman

Client Project ID: ARCO 6113, Livermore
Sample Descript: Soil, S-55.5-B5
Lab Number: 206-3361

Sampled: Jun 8, 1992
Received: Jun 9, 1992
Analyzed: Jun 22, 1992
Reported: Jun 26, 1992

PARTICLE SIZE DISTRIBUTION BY WEIGHT

Sieve # Tyler Sieve Units	Weight grams	Percent Distribution
5	1.8	1.96
6	1.5	1.61
7	2.9	3.2
9	8.3	9.0
10	5.8	6.2
12	6.0	6.5
16	10	11
24	9.6	10.5
28	6.8	7.3
32	2.6	2.8
42	4.2	4.5
48	5.3	5.8
80	7.6	8.3
120	8.5	9.2
200	6.9	7.4
Pan	4.4	4.8

SEQUOIA ANALYTICAL

Maria Lee
Maria Lee
Project Manager



SEQUOIA ANALYTICAL

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

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: Joel Coffman

Client Project ID: ARCO 6113, Livermore
Sample Descript: Soil, S-60.5-B5
Lab Number: 206-3362

Sampled: Jun 8, 1992
Received: Jun 9, 1992
Analyzed: Jun 22, 1992
Reported: Jun 26, 1992

PARTICLE SIZE DISTRIBUTION BY WEIGHT

Seive # Tyler Sieve Units	Weight grams	Percent Distribution
5	1.8	1.9
6	2.9	2.9
7	5.0	5.2
9	15	15.3
10	8.80	9.0
12	7.2	7.4
16	13	13
24	9.4	9.7
28	5.3	5.4
32	4.1	4.2
42	5.4	5.5
48	3.7	3.8
80	9.4	9.7
120	4.9	5.0
200	1.3	1.3
Pan	0.72	0.70

SEQUOIA ANALYTICAL

Maria Lee
Maria Lee
Project Manager



SEQUOIA ANALYTICAL

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

RESNA	Client Project ID: ARCO 6113, Livermore	Sampled: Jun 8, 1992
3315 Almaden Expwy., Suite 34	Sample Descript: Soil, S-63.5-B5	Received: Jun 9, 1992
San Jose, CA 95118		Analyzed: Jun 22, 1992
Attention: Joel Coffman	Lab Number: 206-3363	Reported: Jun 26, 1992

PARTICLE SIZE DISTRIBUTION BY WEIGHT

Seive # Tyler Sieve Units	Weight grams	Percent Distribution
5	2.0	2.0
6	2.6	2.4
7	4.2	4.1
9	14	13.6
10	9.4	8.9
12	9.8	9.4
16	14	13.7
24	12	11.2
28	6.0	5.7
32	4.2	4.0
42	8.0	7.6
48	3.8	3.6
80	5.3	5.1
120	3.0	2.9
200	3.3	3.1
Pan	2.9	2.8

SEQUOIA ANALYTICAL

Maria Lee
 Maria Lee
 Project Manager



SEQUOIA ANALYTICAL

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

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: Joel Coffman

Client Project ID: ARCO 6113, Livermore

QC Sample Group: 2062796-2805

Reported: Jun 26, 1992

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl- benzene	Xylenes
---------	---------	---------	-------------------	---------

Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	B. Ali	B. Ali	B. Ali	B. Ali
Reporting Units:	mg/kg	mg/kg	mg/kg	mg/kg
Date Analyzed:	Jun 17, 1992	Jun 17, 1992	Jun 17, 1992	Jun 17, 1992
QC Sample #:	GBLK061792	GBLK061792	GBLK061792	GBLK061792

Sample Conc.: N.D. N.D. N.D. N.D.

Spike Conc. Added: 0.20 0.20 0.20 0.60

Conc. Matrix Spike: 0.18 0.18 0.18 0.54

Matrix Spike % Recovery: 90 90 90 90

Conc. Matrix Spike Dup.: 0.18 0.18 0.18 0.54

Matrix Spike Duplicate % Recovery: 90 90 90 90

Relative % Difference: 0.0 0.0 0.0 0.0

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

SEQUOIA ANALYTICAL

Maria Lee
Maria Lee
Project Manager

% Recovery:	$\frac{\text{Conc. of M.S.} - \text{Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$
Relative % Difference:	$\frac{\text{Conc. of M.S.} - \text{Conc. of M.S.D.}}{(\text{Conc. of M.S.} + \text{Conc. of M.S.D.}) / 2} \times 100$



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: Joel Coffman

Client Project ID: ARCO 6113, Livermore

QC Sample Group: 2062796-2805

Reported: Jun 26, 1992

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl- benzene	Xylenes
---------	---------	---------	-------------------	---------

Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	B. Ali	B. Ali	B. Ali	B. Ali
Reporting Units:	mg/kg	mg/kg	mg/kg	mg/kg
Date Analyzed:	Jun 22, 1992	Jun 22, 1992	Jun 22, 1992	Jun 22, 1992
QC Sample #:	GBLK062292 MS/MSD	GBLK062292 MS/MSD	GBLK062292 MS/MSD	GBLK062292 MS/MSD
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	0.20	0.20	0.20	0.60
Conc. Matrix Spike:	0.14	0.15	0.15	0.44
Matrix Spike % Recovery:	70	75	75	73
Conc. Matrix Spike Dup.:	0.14	0.14	0.15	0.43
Matrix Spike Duplicate % Recovery:	70	70	75	72
Relative % Difference:	0.0	6.9	0.0	2.3

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

SEQUOIA ANALYTICAL

Maria Lee
Maria Lee
Project Manager

% Recovery:	$\frac{\text{Conc. of M.S.} - \text{Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$
Relative % Difference:	$\frac{\text{Conc. of M.S.} - \text{Conc. of M.S.D.}}{(\text{Conc. of M.S.} + \text{Conc. of M.S.D.}) / 2} \times 100$

2062796.RES <14>



SEQUOIA ANALYTICAL

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RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: Joel Coffman

Client Project ID: ARCO 6113, Livermore

QC Sample Group: 2062801-5

Reported: Jun 26, 1992

QUALITY CONTROL DATA REPORT

ANALYTE	Total Recoverable	
	Diesel	Petroleum Oil

Method:	EPA 8015	SM 5520 E & F
Analyst:	R. Lee	M. Shkidt
Reporting Units:	mg/kg	mg/kg
Date Analyzed:	Jun 22, 1992	Jun 23, 1992
QC Sample #:	DBLK062292	BLK062392

Sample Conc.:	N.D.	N.D.
Spike Conc. Added:	15	1000
Conc. Matrix Spike:	14	910
Matrix Spike % Recovery:	93	91
Conc. Matrix Spike Dup.:	13	920
Matrix Spike Duplicate % Recovery:	87	92
Relative % Difference:	7.4	1.1

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

SEQUOIA ANALYTICAL

Maria Lee
Maria Lee
Project Manager

% Recovery:	$\frac{\text{Conc. of M.S.} - \text{Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$
Relative % Difference:	$\frac{\text{Conc. of M.S.} - \text{Conc. of M.S.D.}}{(\text{Conc. of M.S.} + \text{Conc. of M.S.D.}) / 2} \times 100$



SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
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RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: Joel Coffman

Client Project ID: ARCO 6113, Livermore
Method (units): EPA 8240 (µg/L purged)
Analyst(s): S. Scott
QC Sample #: BLK062292

Q.C. Sample Dates

Analyzed: Jun 22, 1992
Reported: Jun 26, 1992

QUALITY CONTROL DATA REPORT

Analyte	Sample Conc.	Spike Conc. Added	Conc. Matrix Spike	Matrix Spike % Recovery	Conc. Matrix Spike Duplicate	Matrix Spike Duplicate % Recovery	Relative % Difference
1,1-Dichloroethene	N.D.	50	48	96	48	96	0.0
Trichloroethene	N.D.	50	51	102	51	102	0.0
Benzene	N.D.	50	55	110	54	108	1.8
Toluene	N.D.	50	54	108	54	108	0.0
Chlorobenzene	N.D.	50	54	108	54	108	0.0

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

SEQUOIA ANALYTICAL

Maria Lee
Maria Lee
Project Manager

% Recovery:	$\frac{\text{Conc. of M.S.} - \text{Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$
Relative % Difference:	$\frac{\text{Conc. of M.S.} - \text{Conc. of M.S.D.}}{(\text{Conc. of M.S.} + \text{Conc. of M.S.D.}) / 2} \times 100$



SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
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RESNA

Client Project ID: ARCO 6113, Livermore

3315 Almaden Expwy., Suite 34
San Jose, CA 95118

Attention: Joel Coffman

QC Sample Group: 2062801, 05

Reported: Jun 26, 1992

QUALITY CONTROL DATA REPORT - TCLP

ANALYTE

	Lead	Cadmium	Chromium	Nickel	Zinc
Method:	EPA 239.2	EPA 200.7	EPA 200.7	EPA 200.7	EPA 200.7
Analyst:	S. Chin	R. Sharma	R. Sharma	R. Sharma	R. Sharma
Reporting Units:	mg/L	mg/L	mg/L	mg/L	mg/L
Date Analyzed:	Jun 19, 1992	Jun 24, 1992	Jun 24, 1992	Jun 24, 1992	Jun 24, 1992
QC Sample #:	206-2805	206-2848	206-2848	206-2848	206-2848
Sample Conc.:	N.D.	N.D.	N.D.	N.D.	0.47
Spike Conc. Added:	1.0	1.0	1.0	1.0	1.0
Conc. Matrix Spike:	0.90	0.99	0.97	1.0	1.5
Matrix Spike % Recovery:	90	99	97	95	103
Conc. Matrix Spike Dup.:	0.86	0.99	0.98	1.0	1.5
Matrix Spike Duplicate % Recovery:	86	99	98	95	103
Relative % Difference:	4.5	0.0	1.0	0.0	0.0

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

SEQUOIA ANALYTICAL

Maria Lee
Maria Lee
Project Manager

% Recovery:	$\frac{\text{Conc. of M.S.} - \text{Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$
Relative % Difference:	$\frac{\text{Conc. of M.S.} - \text{Conc. of M.S.D.}}{(\text{Conc. of M.S.} + \text{Conc. of M.S.D.}) / 2} \times 100$

ARCO Products Company

Division of AtlanticRichfieldCompany

Task Order No. **6113-91-2B**

Chain of Custody

ARCO Facility no. **6113** City (Facility) **Livermore**

Project manager (Consultant) **Joel Coffman**

Laboratory name
Sequoia

ARCO engineer **Michael Whelan**

Telephone no. (ARCO) **(415) 571-2474**

Telephone no. (Consultant) **(408) 264-7723**

Fax no. (Consultant) **(408) 264-2435**

Contract number
07-073

Consultant name **RESNA**

Address (Consultant) **3315 Almaden Exp. Suite 34, San Jose, CA 95118**

Sample I.D.	Lab no.	Container no.	Matrix			Preservation		Sampling date	Sampling time	BTEX EPA 802	BTEX/TPH EPA 816/802/8015	TPH Modified 8015 Gas Diesel	Oil and Grease 413.1 413.2	TPH EPA 418.1/SMS503E	EPA 801/8010	EPA 824/8240	EPA 825/8270	TCPL Metals VOA VOA	Semi Metals VOA VOA	CAM Metals EPA 821/8210	ITLC STLC	Lead Org./DHS EPA 7420/7421	Particle size	Hold			
			Soil	Water	Other	Ice	Acid																				
S-5.5-B5		1	✓			✓		06/08/92																		✓	
S-10.5-B5		1	✓			✓		06/08/92		×																	✓
S-15.5-B5		1	✓			✓		06/08/92																			✓
S-20.5-B5		1	✓			✓		06/08/92		×																	✓
S-25.5-B5		1	✓			✓		06/08/92																			✓
S-30.5-B5		1	✓			✓		06/08/92		×																	✓
S-35.5-B5		1	✓			✓		06/08/92																			✓
S-37-B5		1	✓			✓		06/08/92																			✓
S-37.5-B5		1	✓			✓		06/08/92																			✓
S-40.5-B5		1	✓			✓		06/08/92		×																	✓
S-45.5-B5		1	✓			✓		06/08/92																			✓
S-50.5-B5		1	✓			✓		06/08/92		×																	✓
S-55.5-B5		1	✓			✓		06/09/92																			✓
S-60.5-B5		1	✓			✓		06/09/92																			✓
S-63.5-B5		1	✓			✓		06/09/92																			✓

Method of shipment
Sequoia Courier

Special detection Limit/reporting

Special QA/QC

Remarks
RESNA will call regarding samples to be analyzed

Lab number

Turnaround time

Priority Rush 1 Business Day

Rush 2 Business Days

Expedited 5 Business Days

Standard 10 Business Days

Condition of sample: **good**

Temperature received: **cool**

Relinquished by sampler **Barbara Nieminski** Date **06/09/92** Time **2:30 pm**

Received by **Mark V. Elley** Date **6-9-92** Time **2:50 pm**

Relinquished by **Mark V. Elley** Date **6-9-92** Time **4:00**

Received by laboratory **Joel Coffman** Date **6-9** Time **1600**

ARCO Products Company
Division of AtlanticRichfieldCompany

Task Order No.

Chain of Custody

ARCO Facility no. **6113** City (Facility) **Livermore** Project manager (Consultant) **Joel Coffman**
 ARCO engineer **Michael Whelan** Telephone no. (ARCO) **(415) 571-2434** Telephone no. (Consultant) **(408) 264-7723** Fax no. (Consultant) **(408) 264-2435**
 Consultant name **RESNA** Address (Consultant) **3315 Almaden Exp. Suite 34, San Jose, CA 95118**

Laboratory name **Sequoia**
 Contract number **07-073**

Sample I.D.	Lab no.	Container no.	Matrix			Preservation		Sampling date	Sampling time	BTEX EPA 802/EPA 8020	BTEX/TPH EPA M602/8020/8015	TPH Modified 8015 Gas <input type="checkbox"/> Diesel <input checked="" type="checkbox"/>	Oil and Grease 413.1 <input checked="" type="checkbox"/> 413.2 <input type="checkbox"/> EF	TPH EPA 418.1/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	Other Metals TCLP <input type="checkbox"/> VOA <input type="checkbox"/> VOA <input type="checkbox"/>	SAM Metals EPA 6010/7000 TTL <input type="checkbox"/> STL <input type="checkbox"/>	Lead Org./DHS Lead EPA 7420/7421 <input type="checkbox"/>	Hold		
			Soil	Water	Other	Ice	Acid																
S-5-810		1	✓			✓		06/08/92														X	
S-10-810		1	✓			✓		06/08/92		X	X	X						X					
S-15-810		1	✓			✓		06/08/92															X
S-20-810		1	✓			✓		06/08/92		X	X	X											
S-25-810		1	✓			✓		06/08/92															X
S-30-810		1	✓			✓		06/08/92		X	X	X											
S-35-810		1	✓			✓		06/08/92															X
S-40-810		1	✓			✓		06/08/92															X
S-45-810		1	✓			✓		06/08/92		X	X	X											X
S-50-810		1	✓			✓		06/08/92															X
S-55-810		1	✓			✓		06/08/92		X	X	X											X
S-60-810		1	✓			✓		06/08/92															X

Method of shipment **Sequoia Courier**

Special detection Limit/reporting

Special QA/QC

Remarks
RESNA will call regarding samples to be analyzed

Lab number

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

Condition of sample: **good** Temperature received: **cool**
 Relinquished by sampler **Barbara Sieminski** Date **06/09/92** Time **2:50 PM** Received by **Mark V. Elley** Date **6-9-92** Time **2:50 pm**
 Relinquished by **Mark V. Elley** Date **6-9-92** Time **4:00** Received by laboratory **jslufam** Date **6-9** Time **1600**



SEQUOIA ANALYTICAL

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

RECEIVED

JUN 26 1992

RESNA
SAN JOSE

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: Joel Coffman

Project: ARCO 6113, Livermore

Enclosed are the results from 4 soil samples received at Sequoia Analytical on June 15, 1992. The requested analyses are listed below:

SAMPLE #	SAMPLE DESCRIPTION	DATE OF COLLECTION	TEST METHOD
2063231	Soil, S-10.5-B8	6/15/92	EPA 5030/8015/8020
2063232	Soil, S 20.5-B8	6/15/92	EPA 5030/8015/8020
2063233	Soil, S-30.5--B8	6/15/92	EPA 5030/8015/8020
2063234	Soil, S-45.5-B8	6/15/92	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


Maria Lee
Project Manager



SEQUOIA ANALYTICAL

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

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: Joel Coffman

Client Project ID: ARCO 6113, Livermore
Matrix Descript: Soil
Analysis Method: EPA 5030/8015/8020
First Sample #: 206-3231

Sampled: Jun 15, 1992
Received: Jun 15, 1992
Analyzed: Jun 19, 1992
Reported: Jun 24, 1992

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons		Toluene mg/kg (ppm)	Ethyl Benzene	Xylenes mg/kg (ppm)
		mg/kg (ppm)	Benzene mg/kg (ppm)		mg/kg (ppm)	
206-3231	S-10.5-B8	N.D.	N.D.	N.D.	N.D.	N.D.
206-3233	S-30.5-B8	N.D.	0.043	N.D.	N.D.	N.D.
206-3234	S-45.5-B8	1.1	0.022	N.D.	N.D.	N.D.

Detection Limits:	1.0	0.0050	0.0050	0.0050	0.0050
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Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection.

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Project Manager

2063231.RES <1>



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RESNA	Client Project ID: ARCO 6113, Livermore	Sampled: Jun 15, 1992
3315 Almaden Expwy., Suite 34	Matrix Descript: Soil	Received: Jun 15, 1992
San Jose, CA 95118	Analysis Method: EPA 5030/8015/8020	Analyzed: Jun 19, 1992
Attention: Joel Coffman	First Sample #: 206-3232	Reported: Jun 24, 1992

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons mg/kg (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethyl Benzene mg/kg (ppm)	Xylenes mg/kg (ppm)
206-3232	S 20.5-B8	68	N.D.	0.22	0.42	2.1

Detection Limits:	10	0.050	0.050	0.050	0.050
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Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection. Because matrix effects and/or other factors required additional sample dilution, detection limits for this sample have been raised.

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Project Manager

2063231.RES <2>



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RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: Joel Coffman

Client Project ID: ARCO 6113, Livermore

QC Sample Group: 2063231-4

Reported: Jun 24, 1992

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl- benzene	Xylenes
	Method:	EPA 8020	EPA 8020	EPA 8020
Analyst:	B. Ali	B. Ali	B. Ali	B. Ali
Reporting Units:	mg/L	mg/L	mg/L	mg/L
Date Analyzed:	Jun 19, 1992	Jun 19, 1992	Jun 19, 1992	Jun 19, 1992
QC Sample #:	GBLK061992 MS/MSD-A	GBLK061992 MS/MSD-A	GBLK061992 MS/MSD-A	GBLK061992 MS/MSD-A
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	0.20	0.20	0.20	0.60
Conc. Matrix Spike:	0.17	0.17	0.17	0.50
Matrix Spike % Recovery:	85	85	85	83
Conc. Matrix Spike Dup.:	0.18	0.18	0.18	0.52
Matrix Spike Duplicate % Recovery:	90	90	90	87
Relative % Difference:	5.7	5.7	5.7	3.9

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

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Project Manager

% Recovery:	$\frac{\text{Conc. of M.S.} - \text{Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$
Relative % Difference:	$\frac{\text{Conc. of M.S.} - \text{Conc. of M.S.D.}}{(\text{Conc. of M.S.} + \text{Conc. of M.S.D.}) / 2} \times 100$

ARCO Facility no. 6117 City (Facility) Livermore Project manager (Consultant) Joel Coffman
 ARCO engineer Michael Whelan Telephone no. (ARCO) 571-2434 Telephone no. (Consultant) (408) 264-7723 Fax no. (Consultant) (408) 264-2435
 Consultant name RESNA Address (Consultant) 3315 Almaden Exp. Suite 34, San Jose, CA 95118

Laboratory name Sequosia
 Contract number 07-073

Sample I.D.	Lab no.	Container no.	Matrix			Preservation		Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH EPA 1602/8020/8015	TPH Modified 8015 Gas <input type="checkbox"/> Diesel <input type="checkbox"/>	Oil and Grease 413.1 <input type="checkbox"/> 413.2 <input type="checkbox"/>	TPH EPA 418.1/SM603E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals <input type="checkbox"/> VOA <input type="checkbox"/> VOA <input type="checkbox"/>	Semi Metals <input type="checkbox"/> VOA <input type="checkbox"/> VOA <input type="checkbox"/>	CAN Metals EPA 8010/7000 TLC <input type="checkbox"/> STLC <input type="checkbox"/>	Lead Org./DHS <input type="checkbox"/> Lead EPA 7420/7421 <input type="checkbox"/>	Hold	
			Soil	Water	Other	Ice	Acid																
S-5.5-88		1	✓			✓		06/15/92															X
S-10.5-88		1	✓			✓	2063231	06/15/92		X													X
S-15.5-88		1	✓			✓		06/15/92															X
S-20.5-88		1	✓			✓	2063232	06/15/92		X													X
S-25.5-88		1	✓			✓		06/15/92															X
S-30.5-88		1	✓			✓	2063233	06/15/92		X													X
S-35.5-88		1	✓			✓		06/15/92															X
S-40.5-88		1	✓			✓		06/15/92															X
S-45.5-88		1	✓			✓	2063234	06/15/92		X													X

Method of shipment Sequosia Courier

Special detection Limit/reporting

Special QA/QC

Remarks
RESNA will call regarding samples to be analyzed

Lab number cel 3231-34

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

Condition of sample: good Temperature received: cool

Relinquished by sampler Barbara Aieminski Date 06/15/92 Time 6:00 PM Received by Resna 357

Relinquished by [Signature] Date 6/15 Time 4:50 Received by

Relinquished by Date Time Received by laboratory [Signature] Date 6/15 Time 7:30 PM



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RECEIVED

JUN 1 1992

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: Joel Coffman

RESNA
SAN JOSE

Project: ARCO 6113, Livermore

Enclosed are the results from 15 soil samples received at Sequoia Analytical on June 11, 1992.
The requested analyses are listed below:

SAMPLE #	SAMPLE DESCRIPTION	DATE OF COLLECTION	TEST METHOD
2062838	Soil, S-10.5-B6	6/9-10/92	EPA 5030/8015/8020
2062839	Soil, S-20.5-B6	6/9-10/92	EPA 5030/8015/8020
2062840	Soil, S-30.5-B6	6/9-10/92	EPA 5030/8015/8020
2062841	Soil, S-45.5-B6	6/9-10/92	EPA 5030/8015/8020
2062842	Soil, S-50.5-B6	6/9-10/92	EPA 5030/8015/8020
2062843	Soil, S-10.5-B7	6/9-10/92	EPA 5030/8015/8020
2062844	Soil, S-20.5-B7	6/10/92	EPA 5030/8015/8020
2062845	Soil, S-30.5-B7	6/9-10/92	EPA 5030/8015/8020
2062846	Soil, S-40.5-B7	6/9-10/92	EPA 5030/8015/8020
2062847	Soil, S-50.5-B7	6/9-10/92	EPA 5030/8015/8020
2062848	TCLP Extract of Soil, S-8.5-B9	6/11/92	Cd, Cr, Pb, Ni, Zn EPA 3550/8015 EPA 5030/8015/8020 EPA 8240 SM 5520 E&F (Gravimetric)
2062849	Soil, S-20.5-B9	6/11/92	EPA 3550/8015 EPA 5030/8015/8020 SM 5520 E&F (Gravimetric)
2062850	Soil, S-30.5-B9	6/11/92	EPA 3550/8015 EPA 5030/8015/8020 SM 5520 E&F (Gravimetric)



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2062851	Soil, S-40.5-B9	6/11/92	EPA 3550/8015 EPA 5030/8015/8020 SM 5520 E&F (Gravimetric)
2062852	TCLP Extract of Soil, S-50.5-B9	6/11/92	Cd, Cr, Pb, Ni, Zn

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


Maria Lee
Project Manager



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RESNA	Client Project ID: ARCO 6113, Livermore	Sampled: 6/9-10/92
3315 Almaden Expwy., Suite 34	Matrix Descript: Soil	Received: Jun 11, 1992
San Jose, CA 95118	Analysis Method: EPA 5030/8015/8020	Analyzed: 6/17, 18/92
Attention: Joel Coffman	First Sample #: 206-2838	Reported: Jun 26, 1992

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons mg/kg (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethyl Benzene mg/kg (ppm)	Xylenes mg/kg (ppm)
206-2838	S-10.5-B6	N.D.	N.D.	N.D.	N.D.	N.D.
206-2839	S-20.5-B6	N.D.	N.D.	N.D.	N.D.	N.D.
206-2840	S-30.5-B6	23	0.45	0.079	0.035	0.15
206-2841	S-45.5-B6	1.9	0.70	0.021	N.D.	N.D.
206-2842	S-50.5-B6	N.D.	0.056	N.D.	N.D.	0.0060
206-2843	S-10.5-B7	N.D.	N.D.	N.D.	N.D.	N.D.
206-2845	S-30.5-B7	1.6	0.094	0.020	N.D.	0.023
206-2846	S-40.5-B7	N.D.	0.0090	N.D.	N.D.	N.D.
206-2847	S-50.5-B7	N.D.	N.D.	N.D.	N.D.	N.D.
206-2848	S-8.5-B9	N.D.	N.D.	N.D.	N.D.	N.D.

Detection Limits:	1.0	0.0050	0.0050	0.0050	0.0050
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Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL


Maria Lee
Project Manager

2062838.RES <1>



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RESNA	Client Project ID: ARCO 6113, Livermore	Sampled: Jun 10, 1992
3315 Almaden Expwy., Suite 34	Matrix Descript: Soil	Received: Jun 11, 1992
San Jose, CA 95118	Analysis Method: EPA 5030/8015/8020	Analyzed: Jun 18, 1992
Attention: Joel Coffman	First Sample #: 206-2844	Reported: Jun 26, 1992

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons mg/kg (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethyl Benzene mg/kg (ppm)	Xylenes mg/kg (ppm)
206-2844	S-20.5-B7	21	0.43	1.3	0.35	2.5

Detection Limits:	2.0	0.010	0.010	0.010	0.010
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Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard. Analytes reported as N.D. were not present above the stated limit of detection. Because matrix effects and/or other factors required additional sample dilution, detection limits for this sample have been raised.

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Project Manager



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RESNA	Client Project ID: ARCO 6113, Livermore	Sampled: Jun 11, 1992
3315 Almaden Expwy., Suite 34	Matrix Descript: Soil	Received: Jun 11, 1992
San Jose, CA 95118	Analysis Method: EPA 5030/8015/8020	Analyzed: Jun 17, 1992
Attention: Joel Coffman	First Sample #: 206-2849	Reported: Jun 26, 1992

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons mg/kg (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethyl Benzene mg/kg (ppm)	Xylenes mg/kg (ppm)
206-2849	S-20.5-B9	N.D.	N.D.	N.D.	N.D.	N.D.
206-2850	S-30.5-B9	N.D.	N.D.	N.D.	N.D.	N.D.
206-2851	S-40.5-B9	N.D.	N.D.	N.D.	N.D.	N.D.
206-2852	S-50.5-B9	N.D.	N.D.	N.D.	N.D.	N.D.

Detection Limits:	1.0	0.0050	0.0050	0.0050	0.0050
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Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection.

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Maria Lee
Project Manager

2062838.RES <3>



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RESNA	Client Project ID: ARCO 6113, Livermore	Sampled: 6/9-10-92
3315 Almaden Expwy., Suite 34	Matrix Descript: Soil	Received: Jun 11, 1992
San Jose, CA 95118	Analysis Method: EPA 3550/8015	Extracted: Jun 22, 1992
Attention: Joel Coffman	First Sample #: 206-2848	Analyzed: Jun 22, 1992
		Reported: Jun 26, 1992

TOTAL PETROLEUM FUEL HYDROCARBONS (EPA 8015)

Sample Number	Sample Description	High B.P. Hydrocarbons mg/kg (ppm)
206-2848	S-8.5-B9	N.D.
206-2849	S-20.5-B9	N.D.
206-2850	S-30.5-B9	N.D.
206-2851	S-40.5-B9	N.D.
206-2852	S-50.5-B9	N.D.

Detection Limits: 1.0

High Boiling Point Hydrocarbons are quantitated against a diesel fuel standard.
Analytes reported as N.D. were not present above the stated limit of detection.

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Maria Lee
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Project Manager

2062838.RES <4>



SEQUOIA ANALYTICAL

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RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: Joel Coffman

Client Project ID: ARCO 6113, Livermore
Matrix Descript: Soil
Analysis Method: SM 5520 E&F (Gravimetric)
First Sample #: 206-2848

Sampled: 6/9-10/92
Received: Jun 11, 1992
Extracted: Jun 24, 1992
Analyzed: Jun 25, 1992
Reported: Jun 26, 1992

TOTAL RECOVERABLE PETROLEUM OIL

Sample Number	Sample Description	Oil & Grease mg/kg (ppm)
206-2848	S-8.5-B9	N.D.
206-2849	S-20.5-B9	74
206-2850	S-30.5-B9	N.D.
206-2851	S-40.5-B9	N.D.
206-2852	S-50.5-B9	N.D.

Detection Limits:

30

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

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Project Manager

2062838.RES <5>



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RESNA	Client Project ID: ARCO 6113, Livermore	Sampled: Jun 11, 1992
3315 Almaden Expwy., Suite 34	Sample Descript: Soil, S-8.5-B9	Received: Jun 11, 1992
San Jose, CA 95118	Analysis Method: EPA 8240	Analyzed: Jun 22, 1992
Attention: Joel Coffman	Lab Number: 206-2848	Reported: Jun 26, 1992

VOLATILE ORGANICS by GC/MS (EPA 8240)

Analyte	Detection Limit µg/kg	Sample Results µg/kg
Acetone.....	500	N.D.
Benzene.....	100	N.D.
Bromodichloromethane.....	100	N.D.
Bromoform.....	100	N.D.
Bromomethane.....	100	N.D.
2-Butanone.....	500	N.D.
Carbon disulfide.....	100	N.D.
Carbon tetrachloride.....	100	N.D.
Chlorobenzene.....	100	N.D.
Chloroethane.....	100	N.D.
2-Chloroethyl vinyl ether.....	500	N.D.
Chloroform.....	100	N.D.
Chloromethane.....	100	N.D.
Dibromochloromethane.....	100	N.D.
1,1-Dichloroethane.....	100	N.D.
1,2-Dichloroethane.....	100	N.D.
1,1-Dichloroethene.....	100	N.D.
cis-1,2-Dichloroethene.....	100	N.D.
trans-1,2-Dichloroethene.....	100	N.D.
1,2-Dichloropropane.....	100	N.D.
cis-1,3-Dichloropropene.....	100	N.D.
trans-1,3-Dichloropropene.....	100	N.D.
Ethylbenzene.....	100	N.D.
2-Hexanone.....	500	N.D.
Methylene chloride.....	250	N.D.
4-Methyl-2-pentanone.....	500	N.D.
Styrene.....	100	N.D.
1,1,2,2-Tetrachloroethane.....	100	N.D.
Tetrachloroethene.....	100	N.D.
Toluene.....	100	N.D.
1,1,1-Trichloroethane.....	100	N.D.
1,1,2-Trichloroethane.....	100	N.D.
Trichloroethene.....	100	N.D.
Trichlorofluoromethane.....	100	N.D.
Vinyl acetate.....	100	N.D.
Vinyl chloride.....	100	N.D.
Total Xylenes.....	100	N.D.

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

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 Project Manager



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RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: Joel Coffman

Client Project ID: ARCO 6113, Livermore
Sample Descript: Soil, S-50.5-B9
Analysis Method: EPA 8240
Lab Number: 206-2852

Sampled: Jun 11, 1992
Received: Jun 11, 1992
Analyzed: Jun 22, 1992
Reported: Jun 26, 1992

VOLATILE ORGANICS by GC/MS (EPA 8240)

Analyte	Detection Limit µg/kg	Sample Results µg/kg
Acetone.....	500	N.D.
Benzene.....	100	N.D.
Bromodichloromethane.....	100	N.D.
Bromoform.....	100	N.D.
Bromomethane.....	100	N.D.
2-Butanone.....	500	N.D.
Carbon disulfide.....	100	N.D.
Carbon tetrachloride.....	100	N.D.
Chlorobenzene.....	100	N.D.
Chloroethane.....	100	N.D.
2-Chloroethyl vinyl ether.....	500	N.D.
Chloroform.....	100	N.D.
Chloromethane.....	100	N.D.
Dibromochloromethane.....	100	N.D.
1,1-Dichloroethane.....	100	N.D.
1,2-Dichloroethane.....	100	N.D.
1,1-Dichloroethene.....	100	N.D.
cis-1,2-Dichloroethene.....	100	N.D.
trans-1,2-Dichloroethene.....	100	N.D.
1,2-Dichloropropane.....	100	N.D.
cis-1,3-Dichloropropene.....	100	N.D.
trans-1,3-Dichloropropene.....	100	N.D.
Ethylbenzene.....	100	N.D.
2-Hexanone.....	500	N.D.
Methylene chloride.....	250	N.D.
4-Methyl-2-pentanone.....	500	N.D.
Styrene.....	100	N.D.
1,1,2,2-Tetrachloroethane.....	100	N.D.
Tetrachloroethene.....	100	N.D.
Toluene.....	100	N.D.
1,1,1-Trichloroethane.....	100	N.D.
1,1,2-Trichloroethane.....	100	N.D.
Trichloroethene.....	100	N.D.
Trichlorofluoromethane.....	100	N.D.
Vinyl acetate.....	100	N.D.
Vinyl chloride.....	100	N.D.
Total Xylenes.....	100	N.D.

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

SEQUOIA ANALYTICAL

Maria Lee
Maria Lee
Project Manager



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(415) 364-9600 • FAX (415) 364-9233

RESNA	Client Project ID: ARCO 6113, Livermore	Sampled: Jun 11, 1992
3315 Almaden Expwy., Suite 34	Sample Descript: TCLP Extract of Soil, S-8.5-B9	Received: Jun 11, 1992
San Jose, CA 95118		Extracted: Jun 18, 1992
Attention: Joel Coffman	Lab Number: 206-2848	Analyzed: 6/22-24/92
		Reported: Jun 26, 1992

LABORATORY ANALYSIS by TCLP

Analyte	Detection Limit mg/L	Sample Results mg/L
Cadmium.....	0.010	N.D.
Chromium.....	0.010	N.D.
Lead.....	0.0050	N.D.
Nickel.....	0.050	0.051
Zinc.....	0.010	0.47

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

SEQUOIA ANALYTICAL

Maria Lee
Maria Lee
Project Manager



SEQUOIA ANALYTICAL

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

RESNA	Client Project ID: ARCO 6113, Livermore	Sampled: Jun 11, 1992
3315 Almaden Expwy., Suite 34	Sample Descript: TCLP Extract of Soil, S-50.5-B9	Received: Jun 11, 1992
San Jose, CA 95118		Extracted: Jun 18, 1992
Attention: Joel Coffman	Lab Number: 206-2852	Analyzed: 6/22-24/92
		Reported: Jun 26, 1992

LABORATORY ANALYSIS by TCLP

Analyte	Detection Limit mg/L	Sample Results mg/L
Cadmium.....	0.010	N.D.
Chromium.....	0.010	N.D.
Lead.....	0.0050	N.D.
Nickel.....	0.050	0.098
Zinc.....	0.010	0.57

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

SEQUOIA ANALYTICAL

Maria Lee
 Maria Lee
 Project Manager



SEQUOIA ANALYTICAL

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

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: Joel Coffman

Client Project ID: ARCO 6113, Livermore

QC Sample Group: 2062838-52

Reported: Jun 26, 1992

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
Reporting Units:	mg/kg	mg/kg	mg/kg	mg/kg
Date Analyzed:	Jun 18, 1992	Jun 18, 1992	Jun 18, 1992	Jun 18, 1992
QC Sample #:	GBLK061892 MS/MSD	GBLK061892 MS/MSD	GBLK061892 MS/MSD	GBLK061892 MS/MSD
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	0.20	0.20	0.20	0.60
Conc. Matrix Spike:	0.20	0.20	0.20	0.58
Matrix Spike % Recovery:	100	100	100	97
Conc. Matrix Spike Dup.:	0.19	0.19	0.19	0.57
Matrix Spike Duplicate % Recovery:	95	95	95	95
Relative % Difference:	5.1	5.1	5.1	1.7

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

SEQUOIA ANALYTICAL

Maria Lee
Maria Lee
Project Manager

% Recovery:	$\frac{\text{Conc. of M.S.} - \text{Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$
Relative % Difference:	$\frac{\text{Conc. of M.S.} - \text{Conc. of M.S.D.}}{(\text{Conc. of M.S.} + \text{Conc. of M.S.D.}) / 2} \times 100$



SEQUOIA ANALYTICAL

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RESNA

Client Project ID: ARCO 6113, Livermore

3315 Almaden Expwy., Suite 34
San Jose, CA 95118

Attention: Joel Coffman

QC Sample Group: 2062838-52

Reported: Jun 26, 1992

QUALITY CONTROL DATA REPORT

ANALYTE

Benzene

Toluene

Ethyl-
benzene

Xylenes

Method: EPA 8020

EPA 8020

EPA 8020

EPA 8020

Analyst: B. Ali

B. Ali

B. Ali

B. Ali

Reporting Units: mg/kg

mg/kg

mg/kg

mg/kg

Date Analyzed: Jun 17, 1992

Jun 17, 1992

Jun 17, 1992

Jun 17, 1992

QC Sample #: GBLK061792

GBLK061792

GBLK061792

GBLK061792

Sample Conc.:

N.D.

N.D.

N.D.

N.D.

Spike Conc.
Added:

0.20

0.20

0.20

0.60

Conc. Matrix
Spike:

0.18

0.18

0.18

0.54

Matrix Spike
% Recovery:

90

90

90

90

Conc. Matrix
Spike Dup.:

0.18

0.18

0.18

0.54

Matrix Spike
Duplicate
% Recovery:

90

90

90

90

Relative
% Difference:

0.0

0.0

0.0

0.0

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

SEQUOIA ANALYTICAL

Maria Lee
Maria Lee
Project Manager

% Recovery: $\frac{\text{Conc. of M.S.} - \text{Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$

Relative % Difference: $\frac{\text{Conc. of M.S.} - \text{Conc. of M.S.D.}}{(\text{Conc. of M.S.} + \text{Conc. of M.S.D.}) / 2} \times 100$

2062838.RES <11>



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: Joel Coffman

Client Project ID: ARCO 6113, Livermore

QC Sample Group: 2062838-52

Reported: Jun 26, 1992

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
Reporting Units:	mg/kg	mg/kg	mg/kg	mg/kg
Date Analyzed:	Jun 17, 1992	Jun 17, 1992	Jun 17, 1992	Jun 17, 1992
QC Sample #:	GBLK061792 MS/MSD	GBLK061792 MS/MSD	GBLK061792 MS/MSD	GBLK061792 MS/MSD
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	0.20	0.20	0.20	0.60
Conc. Matrix Spike:	0.18	0.18	0.19	0.56
Matrix Spike % Recovery:	90	90	95	93
Conc. Matrix Spike Dup.:	0.19	0.18	0.19	0.56
Matrix Spike Duplicate % Recovery:	95	90	95	93
Relative % Difference:	5.4	0.0	0.0	00

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

SEQUOIA ANALYTICAL

Maria Lee
Maria Lee
Project Manager

% Recovery:	$\frac{\text{Conc. of M.S.} - \text{Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$
Relative % Difference:	$\frac{\text{Conc. of M.S.} - \text{Conc. of M.S.D.}}{(\text{Conc. of M.S.} + \text{Conc. of M.S.D.}) / 2} \times 100$



SEQUOIA ANALYTICAL

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RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: Joel Coffman

Client Project ID: ARCO 6113, Livermore

QC Sample Group: 2062848-52

Reported: Jun 26, 1992

QUALITY CONTROL DATA REPORT

ANALYTE	Total Recoverable	
	Diesel	Petroleum Oil

Method:	EPA 8015	SM 5520 E & F
Analyst:	R. Lee	M. Shkidt
Reporting Units:	mg/kg	mg/kg
Date Analyzed:	Jun 22, 1992	Jun 24, 1992
QC Sample #:	DBLK062292	BLK062492

Sample Conc.:	N.D.	N.D.
Spike Conc. Added:	15	1000
Conc. Matrix Spike:	14	770
Matrix Spike % Recovery:	93	77
Conc. Matrix Spike Dup.:	13	700
Matrix Spike Duplicate % Recovery:	87	70
Relative % Difference:	7.4	9.5

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

SEQUOIA ANALYTICAL

Maria Lee
Maria Lee
Project Manager

% Recovery:	$\frac{\text{Conc. of M.S.} - \text{Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$
Relative % Difference:	$\frac{\text{Conc. of M.S.} - \text{Conc. of M.S.D.}}{(\text{Conc. of M.S.} + \text{Conc. of M.S.D.}) / 2} \times 100$



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(415) 364-9600 • FAX (415) 364-9233

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: Joel Coffman

Client Project ID: ARCO 6113, Livermore
Method (units): EPA 8240 (µg/L purged)
Analyst(s): S. Scott
QC Sample #: BLK062292

Q.C. Sample Dates
Analyzed: Jun 22, 1992
Reported: Jun 26, 1992

QUALITY CONTROL DATA REPORT

Analyte	Sample Conc.	Spike Conc. Added	Conc. Matrix Spike	Matrix Spike % Recovery	Conc. Matrix Spike Duplicate	Matrix Spike % Recovery	Relative % Difference
1,1-Dichloroethene	N.D.	50	48	96	48	96	0.0
Trichloroethene	N.D.	50	51	102	51	102	0.0
Benzene	N.D.	50	55	110	54	108	1.8
Toluene	N.D.	50	54	108	54	108	0.0
Chlorobenzene	N.D.	50	54	108	54	108	0.0

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

SEQUOIA ANALYTICAL

Maria Lee
Maria Lee
Project Manager

% Recovery:	$\frac{\text{Conc. of M.S.} - \text{Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$
Relative % Difference:	$\frac{\text{Conc. of M.S.} - \text{Conc. of M.S.D.}}{(\text{Conc. of M.S.} + \text{Conc. of M.S.D.}) / 2} \times 100$



SEQUOIA ANALYTICAL

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

RESNA

Client Project ID: ARCO 6113, Livermore

3315 Almaden Expwy., Suite 34

San Jose, CA 95118

Attention: Joel Coffman

QC Sample Group: 2062848, 52

Reported: Jun 26, 1992

QUALITY CONTROL DATA REPORT - TCLP

ANALYTE

	Lead	Cadmium	Chromium	Nickel	Zinc
Method:	EPA 239.2	EPA 200.7	EPA 200.7	EPA 200.7	EPA 200.7
Analyst:	S. Chin	R. Sharma	R. Sharma	R. Sharma	R. Sharma
Reporting Units:	mg/L	mg/L	mg/L	mg/L	mg/L
Date Analyzed:	Jun 22, 1992	Jun 24, 1992	Jun 24, 1992	Jun 24, 1992	Jun 24, 1992
QC Sample #:	206-2957	206-2848	206-2848	206-2848	206-2848
Sample Conc.:	N.D.	N.D.	N.D.	0.051	0.47
Spike Conc. Added:	0.10	1.0	1.0	1.0	1.0
Conc. Matrix Spike:	0.90	0.99	0.97	1.0	1.5
Matrix Spike % Recovery:	90	99	97	95	103
Conc. Matrix Spike Dup.:	0.90	0.99	0.98	1.0	1.5
Matrix Spike Duplicate % Recovery:	90	99	98	95	103
Relative % Difference:	0.0	0.0	1.0	0.0	0.0

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

SEQUOIA ANALYTICAL

Mayia Lee
Mayia Lee
Project Manager

% Recovery:	$\frac{\text{Conc. of M.S.} - \text{Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$
Relative % Difference:	$\frac{\text{Conc. of M.S.} - \text{Conc. of M.S.D.}}{(\text{Conc. of M.S.} + \text{Conc. of M.S.D.}) / 2} \times 100$

ARCO Facility no. 6113	City (Facility) Livermore	Project manager (Consultant) Joel Coffman	Laboratory name Sequoia
ARCO engineer Michael Whelan	Telephone no. (ARCO) (415) 571-2434	Telephone no. (Consultant) (408) 264-7723	Contract number OT-073
Consultant name RESNA	Address (Consultant) 3315 Almaden Exp. Suite 34, San Jose, CA 95118		

Sample I.D.	Lab no.	Container no.	Matrix			Preservation		Sampling date	Sampling time	BTEX EPA 801	BTEX/TPH EPA 1602/802/8015	TPH Modified 8015 Gas <input type="checkbox"/> Diesel <input checked="" type="checkbox"/>	Oil and Grease 413.1 <input type="checkbox"/> 413.2 <input type="checkbox"/>	TPH EPA 418.1/SM503E	EPA-601/8010	EPA 624/8240	EPA 625/8270	Lead Org./DHS EPA 7420/7421 <input type="checkbox"/>	Lead EPA 7420/7421 <input type="checkbox"/>	Method of shipment Sequoia Courier	
			Soil	Water	Other	Ice	Acid														
S-405-89		1	✓			✓		06/10/92		X											
S-455-89		1	✓			✓		06/10/92													
S-505-89		1	✓			✓		06/10/92		X											
S-60-89		1	✓			✓		06/11/92													
S-85-89		1	✓			✓		06/11/92		X	X	X			X						
S-10-89		1	✓			✓		06/11/92													
S-155-89		1	✓			✓		06/11/92													
S-205-89		1	✓			✓		06/11/92		X	X	X									
S-255-89		1	✓			✓		06/11/92													
S-305-89		1	✓			✓		06/11/92		X	X	X									
S-355-89		1	✓			✓		06/11/92													
S-405-89		1	✓			✓		06/11/92		X	X	X									
S-455-89		1	✓			✓		06/11/92													
S-505-89		1	✓			✓		06/11/92		X	X	X			X						
S-555-89		1	✓			✓		06/11/92													

Condition of sample:	Temperature received:	Priority Rush 1 Business Day <input type="checkbox"/>
Relinquished by sampler Barbara Nieminski Date 06/11/92 Time 5:40 PM	Received by Tom Jane	Rush 2 Business Days <input type="checkbox"/>
Relinquished by Tom Jane Date 6-11-92	Received by	Expedited 5 Business Days <input type="checkbox"/>
Relinquished by	Received by laboratory AN Date	Standard 10 Business Days <input checked="" type="checkbox"/>

ARCO Products Company
Division of AtlanticRichfieldCompany

Task Order No. **6113-91-2B**

Chain of Custody

ARCO Facility no. 6113	City (Facility) Livermore	Project manager (Consultant) Joel Coffman	Laboratory name Sequoia
ARCO engineer Michael Whelan	Telephone no. (ARCO) (415) 571-2434	Telephone no. (Consultant) (408) 264-7723	Contract number 07-073
Consultant name RESNA	Address (Consultant) 3315 Almaden Exp. Suite 34, San Jose, CA 95118		
		Fax no. (Consultant) (408) 264-2435	Method of shipment Sequoia Courier

Sample I.D.	Lab no.	Container no.	Matrix			Preservation		Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH EPA 8622/8020/8015	TPH Modified 8015 Gas <input type="checkbox"/> Diesel <input type="checkbox"/>	Oil and Grease 413.1 <input type="checkbox"/> 413.2 <input type="checkbox"/>	TPH EPA 418.1/ISM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCCLP Metals <input type="checkbox"/> VOA <input type="checkbox"/> VOA <input type="checkbox"/> VOA <input type="checkbox"/>	Semi Metals EPA 6010/7000 TTL <input type="checkbox"/> STL <input type="checkbox"/> STL <input type="checkbox"/>	Lead Org/DHS Lead EPA 7420/7421 <input type="checkbox"/>	Held		
			Soil	Water	Other	Ice	Acid																
S-55-B6		1	✓			✓		06/09/92														X	
S-105-B6		1	✓			✓		06/09/92		X													X
S-155-B6		1	✓			✓		06/09/92															X
S-205-B6		1	✓			✓		06/09/92		X													X
S-255-B6		1	✓			✓		06/09/92															X
S-305-B6		1	✓			✓		06/09/92		X													X
S-405-B6		1	✓			✓		06/09/92															X
S-455-B6		1	✓			✓		06/10/92		X													X
S-505-B6		1	✓			✓		06/10/92		X													X
S-555-B6		1	✓			✓		06/10/92															X
S-555-B7		1	✓			✓		06/10/92															X
S-105-B7		1	✓			✓		06/10/92		X													X
S-155-B7		1	✓			✓		06/10/92															X
S-205-B7		1	✓			✓		06/10/92		X													X
S-305-B7		1	✓			✓		06/10/92		X													X
S-355-B7		N.	✓			✓		06/10/92															X

Special detection Limit/reporting	
Special QA/QC	
Remarks	RESNA will call regarding samples to be analyzed
Lab number	
Turnaround time	
Priority Rush 1 Business Day	<input type="checkbox"/>
Rush 2 Business Days	<input type="checkbox"/>
Expedited 5 Business Days	<input type="checkbox"/>
Standard 10 Business Days	<input checked="" type="checkbox"/>

Condition of sample: EN	Temperature received:
Relinquished by sampler Barbara Nieminski	Date 06/11/92 Time 5:45 PM
Relinquished by Tom Lane	Date 6-11-92 Time 7
Relinquished by Pb	Date 6-11-92 Time 7
Received by Tom Lane	Date 6-11-92 Time 6:11
Received by A. Nigra	Date 6-11-92 Time 7



SEQUOIA ANALYTICAL

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JUN 26 1992

RESNA
SAN JOSE

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: Joel Coffman

Project: ARCO 6113, Livermore


Enclosed are the results from 6 soil samples received at Sequoia Analytical on June 12, 1992. The requested analyses are listed below:

SAMPLE #	SAMPLE DESCRIPTION	DATE OF COLLECTION	TEST METHOD
2062832	Soil, S-10.5-B11	6/12/92	EPA 5030/8015/8020
2062833	Soil, S-20.5-B11	6/12/92	EPA 5030/8015/8020
2062834	Soil, S-30.5-B11	6/12/92	EPA 5030/8015/8020
2062835	Soil, S-40.5-B11	6/12/92	EPA 5030/8015/8020
2062836	Soil, S-50.5-B11	6/12/92	EPA 5030/8015/8020
2062837	Soil, S-55.5-B11	6/12/92	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


Maria Lee
Project Manager



SEQUOIA ANALYTICAL

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

RESNA	Client Project ID: ARCO 6113, Livermore	Sampled: Jun 12, 1992
3315 Almaden Expwy., Suite 34	Matrix Descript: Soil	Received: Jun 12, 1992
San Jose, CA 95118	Analysis Method: EPA 5030/8015/8020	Analyzed: Jun 17, 1992
Attention: Joel Coffman	First Sample #: 206-2832	Reported: Jun 24, 1992

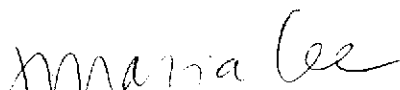
TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons mg/kg (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethyl Benzene mg/kg (ppm)	Xylenes mg/kg (ppm)
206-2832	S-10.5-B11	N.D.	N.D.	N.D.	N.D.	N.D.
206-2833	S-20.5-B11	N.D.	N.D.	N.D.	N.D.	N.D.
206-2834	S-30.5-B11	5.7	N.D.	N.D.	N.D.	N.D.
206-2835	S-40.5-B11	N.D.	N.D.	N.D.	N.D.	N.D.
206-2836	S-50.5-B11	N.D.	N.D.	N.D.	N.D.	N.D.
206-2837	S-55.5-B11	N.D.	N.D.	N.D.	N.D.	N.D.

Detection Limits:	1.0	0.0050	0.0050	0.0050	0.0050
-------------------	-----	--------	--------	--------	--------

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL


Maria Lee
Project Manager



SEQUOIA ANALYTICAL

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

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: Joel Coffman

Client Project ID: ARCO 6113, Livermore

QC Sample Group: 2062832-7

Reported: Jun 24, 1992

QUALITY CONTROL DATA REPORT

ANALYTE	Ethyl-			
	Benzene	Toluene	benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	C. Donohue	C. Donohue	C. Donohue	C. Donohue
Reporting Units:	mg/kg	mg/kg	mg/kg	mg/kg
Date Analyzed:	Jun 17, 1992	Jun 17, 1992	Jun 17, 1992	Jun 17, 1992
QC Sample #:	GBLK061792	GBLK061792	GBLK061792	GBLK061792
	MS/MSD	MS/MSD	MS/MSD	MS/MSD
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	0.20	0.20	0.20	0.60
Conc. Matrix Spike:	0.18	0.18	0.19	0.56
Matrix Spike % Recovery:	90	90	95	93
Conc. Matrix Spike Dup.:	0.19	0.18	0.19	0.56
Matrix Spike Duplicate % Recovery:	95	90	95	93
Relative % Difference:	5.4	0.0	0.0	0.0

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

SEQUOIA ANALYTICAL

Maria Lee
Maria Lee
Project Manager

% Recovery:	$\frac{\text{Conc. of M.S.} - \text{Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$
Relative % Difference:	$\frac{\text{Conc. of M.S.} - \text{Conc. of M.S.D.}}{(\text{Conc. of M.S.} + \text{Conc. of M.S.D.}) / 2} \times 100$

ARCO Products Company

Division Atlantic Richfield Company

Task Order No. **6113-91-2B**

Chain of Custody

ARCO Facility No. 6113	City (Facility) Livermore	Project manager (Consultant) Joel Cuffman	Laboratory name Sequoie
ARCO Engineer Michael Whelan	Telephone no. (ARCO) (415) 571-2434	Telephone no. (Consultant) (408) 264-7723	Contract number 07-073
Consultant name RESNA	Address (Consultant) 3315 Almaden Exp. Suite 34, San Jose, CA 95118		Method of shipment Sequoie Courier
		Fax no. (Consultant) (408) 264-2435	Special detection Limit/reporting

Sample I.D.	Lab no.	Container no.	Matrix			Preservation		Sampling date	Sampling time	BTEX EPA 802	BTEX/TPH EPA 1602/802/8015	TPH Modified 8015 Gas Diesel	Oil and Grease 413.1 413.2	TPH EPA 418.1/SM603E EPA 801/8010	EPA 824/8240	EPA 825/8270	TCLP Metals VOA VOA	CMM Metals EPA 8010/7000 TTLC STLC	Lead Org./DHS Lead EPA 7420/7421	Hold	
			Soil	Water	Other	Ice	Acid														
S-55-B11		1	✓			✓		06/12/92													X
S-105-B11		1	✓			✓		06/12/92		X					2062832						
S-155-B11		1	✓			✓		06/12/92													X
S-205-B11		1	✓			✓		06/12/92		X						33					X
S-255-B11		1	✓			✓		06/12/92													X
S-305-B11		1	✓			✓		06/12/92		X						34					X
S-355-B11		1	✓			✓		06/12/92													X
S-405-B11		1	✓			✓		06/12/92		X						35					X
S-455-B11		1	✓			✓		06/12/92													X
S-505-B11		1	✓			✓		06/12/92		X						36					X
S-555-B11		1	✓			✓		06/12/92		X						37					X
S-605-B11		1	✓			✓		06/12/92													X
S-655-B11		1	✓			✓		06/12/92													X
S-710-B11		1	✓			✓		06/12/92													X

Special detection Limit/reporting	
Special QA/QC	
Remarks	RESNA will call regarding samples to be analyzed
Lab number	
Turnaround time	

Condition of sample:				Temperature received:			
Relinquished by sampler Barbara Aiemmolis	Date 06/12/92	Time 2:37 PM	Received by Phil Nicholas - Prime Courier				
Relinquished by Phil Nicholas	Date 6/12/92	Time 3:39 PM	Received by Sophia Fatigi	Date 6-12	Time 2:39		
Relinquished by	Date	Time	Received by laboratory	Date	Time		



SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
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AUG 18 1992

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: Joel Coffman

RESNA
SAN JOSE

Project: ARCO 6113, Livermore

Enclosed are the results from 5 soil samples received at Sequoia Analytical on August 5, 1992. The requested analyses are listed below:

SAMPLE #	SAMPLE DESCRIPTION	DATE OF COLLECTION	TEST METHOD
2080758	Soil, S-10-B12	8/4/92	EPA 5030/8015/8020
2080759	Soil, S-20-B12	8/4/92	EPA 5030/8015/8020
2080760	Soil, S-30-B12	8/4/92	EPA 5030/8015/8020
2080761	Soil, S-40-B12	8/4/92	EPA 5030/8015/8020
2080762	Soil, S-50-B12	8/4/92	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


Maria Lee
Project Manager



SEQUOIA ANALYTICAL

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

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: Joel Coffman

Client Project ID: ARCO 6113, Livermore
Sample Matrix: Soil
Analysis Method: EPA 5030/8015/8020
First Sample #: 208-0758

Sampled: Aug 4, 1992
Received: Aug 5, 1992
Reported: Aug 17, 1992

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit mg/kg	Sample I.D. 208-0758 S-10-B12	Sample I.D. 208-0759 S-20-B12	Sample I.D. 208-0760 S-30-B12	Sample I.D. 208-0761 S-40-B12	Sample I.D. 208-0762 S-50-B12
Purgeable Hydrocarbons	1.0	N.D.	N.D.	N.D.	110	N.D.
Benzene	0.0050	N.D.	N.D.	N.D.	0.59	N.D.
Toluene	0.0050	N.D.	N.D.	N.D.	0.60	N.D.
Ethyl Benzene	0.0050	N.D.	N.D.	N.D.	1.3	N.D.
Total Xylenes	0.0050	N.D.	N.D.	N.D.	2.0	N.D.
Chromatogram Pattern:		--	--	--	Gas	--

Quality Control Data

Report Limit Multiplication Factor:	1.0	1.0	1.0	50	1.0
Date Analyzed:	8/7/92	8/7/92	8/7/92	8/7/92	8/7/92
Instrument Identification:	GCHP-1	GCHP-1	GCHP-1	GCHP-1	GCHP-1
Surrogate Recovery, %: (QC Limits = 70-130%)	109	109	109	120	101

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

SEQUOIA ANALYTICAL

Maria Lee
Maria Lee
Project Manager



SEQUOIA ANALYTICAL

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

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: Joel Coffman

Client Project ID: ARCO 6113, Livermore

QC Sample Group: 2080758-62

Reported: Aug 17, 1992

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl- benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	R. Lee	R. Lee	R. Lee	R. Lee
Reporting Units:	mg/kg	mg/kg	mg/kg	mg/kg
Date Analyzed:	Aug 7, 1992	Aug 7, 1992	Aug 7, 1992	Aug 7, 1992
QC Sample #:	GBLK080792 MS/MSD	GBLK080792 MS/MSD	GBLK080792 MS/MSD	GBLK080792 MS/MSD
Sample Conc.:	0.0060	N.D.	N.D.	N.D.
Spike Conc. Added:	0.20	0.20	0.20	0.60
Conc. Matrix Spike:	0.21	0.21	0.21	0.63
Matrix Spike % Recovery:	102	102	102	105
Conc. Matrix Spike Dup.:	0.23	0.23	0.23	0.70
Matrix Spike Duplicate % Recovery:	112	112	112	117
Relative % Difference:	9.1	9.1	9.1	11

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

SEQUOIA ANALYTICAL

Maria Lee
Maria Lee
Project Manager

% Recovery:	$\frac{\text{Conc. of M.S.} - \text{Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$
Relative % Difference:	$\frac{\text{Conc. of M.S.} - \text{Conc. of M.S.D.}}{(\text{Conc. of M.S.} + \text{Conc. of M.S.D.}) / 2} \times 100$

2080758.RES <2>

ARCO Products Company

Division of AtlanticRichfield Company

Task Order No.

6113-91-2B

Chain of Custody

ARCO Facility no. 6113	City (Facility) Livermore	Project manager (Consultant) Joel Coffman	Laboratory name Sequoia
ARCO engineer Michael Whelan	Telephone no. (ARCO) (415) 571-2434	Telephone no. (Consultant) (408) 264-7223	Contract number 07-073
Consultant name RESNA	Address (Consultant) 3315 Almaden Exp. Suite 34, San Jose, CA 95118		Method of shipment Sequoia Courier
Fax no. (Consultant) (408) 264-2435	Special detection Limit/reporting	Special QA/QC	Remarks

Sample I.D.	Lab no.	Container no.	Matrix			Preservation		Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH EPA 1602/8020/8015	TPH Modified 8015 Gas <input type="checkbox"/> Diesel <input type="checkbox"/>	Oil and Grease 413.1 <input type="checkbox"/> 413.2 <input type="checkbox"/>	TPH EPA 418.1/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TC/LP Metals <input type="checkbox"/> VOA <input type="checkbox"/>	Semi VOA <input type="checkbox"/>	CAM Metals EPA 8010/7000 TTL <input type="checkbox"/> STLC <input type="checkbox"/>	Lead Org./DHS <input type="checkbox"/> Lead EPA 7420/7421 <input type="checkbox"/>				
			Soil	Water	Other	ice	Acid																		
5-10-B12		1	✓			✓		8/4/92		X															
5-20-B12		1	✓			✓		8/4/92		X															
5-30-B12		1	✓			✓		8/4/92		X															
5-40-B12		1	✓			✓		8/4/92		X															
5-50-B12		1	✓			✓		8/4/92		X															

Condition of sample: good				Temperature received: cool			
Relinquished by sampler		Date	Time	Received by			Priority Rush
Barbare Sieminski		8/5/92	1:15	Arny McDonald			1 Business Day <input type="checkbox"/>
Relinquished by		Date	Time	Received by			Rush
Arny McDonald		8/5/92	5:20	Joel Coffman			2 Business Days <input type="checkbox"/>
Relinquished by		Date	Time	Received by laboratory		Date	Time
Joel Coffman		8-5-92	15:25	Joel Coffman		8-5-92	15:25
							Expedited 5 Business Days <input type="checkbox"/>
							Standard 10 Business Days <input checked="" type="checkbox"/>



SEQUOIA ANALYTICAL

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JUN 1 1992
RESNA
SAN JOSE, CA

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: Joel Coffman

Project: ARCO 6113, Livermore

Enclosed are the results from 2 soil samples received at Sequoia Analytical on June 15, 1992. The requested analyses are listed below:

SAMPLE #	SAMPLE DESCRIPTION	DATE OF COLLECTION	TEST METHOD
2062628	Soil, S-0615-SP 1A-D Composite	6/15/92	EPA 5030/8015/8020
2062629	Soil, S-0615-SP 2A-D Composite	6/15/92	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


Maria Lee
Project Manager



SEQUOIA ANALYTICAL

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

RESNA	Client Project ID: ARCO 6113, Livermore	Sampled: Jun 15, 1992
3315 Almaden Expwy., Suite 34	Matrix Descript: Soil	Received: Jun 15, 1992
San Jose, CA 95118	Analysis Method: EPA 5030/8015/8020	Analyzed: Jun 16, 1992
Attention: Joel Coffman	First Sample #: 206-2628	Reported: Jun 17, 1992

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons mg/kg (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethyl Benzene mg/kg (ppm)	Xylenes mg/kg (ppm)
206-2628	S-0615-SP1 A-D Composite	N.D.	N.D.	N.D.	N.D.	N.D.

Detection Limits:	1.0	0.0050	0.0050	0.0050	0.0050
--------------------------	------------	---------------	---------------	---------------	---------------

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Maria Lee
Maria Lee
Project Manager

2062628.RES <1>



SEQUOIA ANALYTICAL

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

RESNA	Client Project ID: ARCO 6113, Livermore	Sampled: Jun 15, 1992
3315 Almaden Expwy., Suite 34	Matrix Descript: Soil	Received: Jun 15, 1992
San Jose, CA 95118	Analysis Method: EPA 5030/8015/8020	Analyzed: Jun 16, 1992
Attention: Joel Coffman	First Sample #: 206-2629	Reported: Jun 17, 1992

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons mg/kg (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethyl Benzene mg/kg (ppm)	Xylenes mg/kg (ppm)
206-2629	S-0615-SP2 A-D Composite	24	0.014	0.037	0.054	0.45

Detection Limits:	2.0	0.010	0.010	0.010	0.010
-------------------	-----	-------	-------	-------	-------

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard. Analytes reported as N.D. were not present above the stated limit of detection. Because matrix effects and/or other factors required additional sample dilution, detection limits for this sample have been raised.

SEQUOIA ANALYTICAL


Maria Lee
Project Manager



SEQUOIA ANALYTICAL

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

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: Joel Coffman

Client Project ID: ARCO 6113, Livermore

QC Sample Group: 2062628-9

Reported: Jun 17, 1992

QUALITY CONTROL DATA REPORT

ANALYTE	Ethyl-			
	Benzene	Toluene	benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	A. MirafTAB	A. MirafTAB	A. MirafTAB	A. MirafTAB
Reporting Units:	mg/kg	mg/kg	mg/kg	mg/kg
Date Analyzed:	Jun 16, 1992	Jun 16, 1992	Jun 16, 1992	Jun 16, 1992
QC Sample #:	GBLK061592	GBLK061592	GBLK061592	GBLK061592
	MS/MSD	MS/MSD	MS/MSD	MS/MSD
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	0.20	0.20	0.20	0.60
Conc. Matrix Spike:	0.18	0.17	0.17	0.47
Matrix Spike % Recovery:	90	85	85	78
Conc. Matrix Spike Dup.:	0.19	0.17	0.17	0.49
Matrix Spike Duplicate % Recovery:	95	85	85	82
Relative % Difference:	5.4	0.0	0.0	4.2

SEQUOIA ANALYTICAL

Maria Lee
Maria Lee
Project Manager

% Recovery:	$\frac{\text{Conc. of M.S.} - \text{Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$
Relative % Difference:	$\frac{\text{Conc. of M.S.} - \text{Conc. of M.S.D.}}{(\text{Conc. of M.S.} + \text{Conc. of M.S.D.}) / 2} \times 100$

ARCO Products Company
Division of AtlanticRichfieldCompany

Task Order No.

Chain of Custody

ARCO Facility no. **6113** City (Facility) **Livermore** Project manager (Consultant) **Joel Coffman**
 ARCO engineer **Michael Whelan** Telephone no. (ARCO) **(415) 511-2434** Telephone no. (Consultant) **(408) 264-7723** Fax no. (Consultant) **(408) 264-2439**
 Consultant name **RESNA** Address (Consultant) **3315 Almaden Exp. Suite 34, San Jose, CA 95118**

Laboratory name **Sequoia**
 Contract number **07-073**
 Method of shipment **Sequoia Courier**

Sample I.D.	Lab no.	Container no.	Matrix			Preservation		Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH EPA 1602/8020/8015	TPH Modified 8015 Gas <input type="checkbox"/> Diesel <input type="checkbox"/>	Oil and Grease 413.1 <input type="checkbox"/> 413.2 <input type="checkbox"/>	TPH EPA 418.1/SM603E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TC/PC Metals <input type="checkbox"/> VOA <input type="checkbox"/> VOA <input type="checkbox"/>	Semi Metals <input type="checkbox"/> VOA <input type="checkbox"/> VOA <input type="checkbox"/>	CAM Metals EPA 6010/7000 TLC <input type="checkbox"/> STLC <input type="checkbox"/>	Lead Org./DHS <input type="checkbox"/> Lead EPA 7420/7421 <input type="checkbox"/>	
			Soil	Water	Other	Ice	Acid															
S-0615-SP1A	1	1	✓			✓		06/15/92		✓												
S-0615-SP1B	1	1	✓			✓		06/15/92		✓												
S-0615-SP1C	1	1	✓			✓		06/15/92		✓												
S-0615-SP1D	1	1	✓			✓		06/15/92		✓												
S-0615-SP2A	1	1	✓			✓		06/15/92		✓												
S-0615-SP2B	1	1	✓			✓		06/15/92		✓												
S-0615-SP2C	1	1	✓			✓		06/15/92		✓												
S-0615-SP2D	1	1	U			✓		06/15/92		✓												

comparing with previous

7/1/92

Special detection Limit/reporting

Special QA/QC

Remarks
48 hour turnaround time!

Lab number

Turnaround time

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

Condition of sample: **good** Temperature received: **cool**

Relinquished by sampler **Barbara Sleming** Date **06/15/92** Time **6:00 PM** Received by **Corroche 337**

Relinquished by **[Signature]** Date **6/15/92** Time **7:30** Received by

Relinquished by **[Signature]** Date **6/15/92** Time **7:30** Received by laboratory **[Signature]** Date **6/15/92** Time **7:30 AM**



SEQUOIA ANALYTICAL

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AUG 11 1992

RESNA
SAN JOSE

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: Joel Coffman

Project: ARCO 6113, Livermore


Enclosed are the results from 1 soil sample received at Sequoia Analytical on August 5, 1992. The requested analyses are listed below:

SAMPLE #	SAMPLE DESCRIPTION	DATE OF COLLECTION	TEST METHOD
2080500	Soil, S-0804-SP A-D	8/4/92	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


Maria Lee
Project Manager



SEQUOIA ANALYTICAL

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

RESNA	Client Project ID: ARCO 6113, Livermore	Sampled: Aug 4, 1992
3315 Almaden Expwy., Suite 34	Sample Matrix: Soil	Received: Aug 5, 1992
San Jose, CA 95118	Analysis Method: EPA 5030/8015/8020	Reported: Aug 7, 1992
Attention: Joel Coffman	First Sample #: 208-0500	

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit mg/kg	Sample I.D. 208-0500 S-0804-SP A-D
Purgeable Hydrocarbons	1.0	2.6
Benzene	0.0050	N.D.
Toluene	0.0050	0.011
Ethyl Benzene	0.0050	0.030
Total Xylenes	0.0050	0.066
Chromatogram Pattern:		Gas & Non-Gas Mix. C8 - C12

Quality Control Data

Report Limit Multiplication Factor:	1.0
Date Analyzed:	8/6/92
Instrument Identification:	GCHP-7
Surrogate Recovery, %: (QC Limits = 70-130%)	89

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

SEQUOIA ANALYTICAL

Maria Lee
Maria Lee
Project Manager



SEQUOIA ANALYTICAL

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

RESNA
3315 Almaden Expwy., Suite 34
San Jose, CA 95118
Attention: Joel Coffman

Client Project ID: ARCO 6113, Livermore

QC Sample Group: 208-0500

Reported: Aug 7, 1992

QUALITY CONTROL DATA REPORT

ANALYTE	Ethyl-			
	Benzene	Toluene	benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	R. Geckler	R. Geckler	R. Geckler	R. Geckler
Reporting Units:	mg/kg	mg/kg	mg/kg	mg/kg
Date Analyzed:	Aug 6, 1992	Aug 6, 1992	Aug 6, 1992	Aug 6, 1992
QC Sample #:	GBLK080692	GBLK080692	GBLK080692	GBLK080692
	MS/MSD	MS/MSD	MS/MSD	MS/MSD
Sample Conc.:	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	0.20	0.20	0.20	0.60
Conc. Matrix Spike:	0.19	0.19	0.19	0.55
Matrix Spike % Recovery:	95	95	95	92
Conc. Matrix Spike Dup.:	0.19	0.19	0.19	0.57
Matrix Spike Duplicate % Recovery:	95	95	95	95
Relative % Difference:	0.0	0.0	0.0	3.6

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

SEQUOIA ANALYTICAL

Maria Lee
Maria Lee
Project Manager

% Recovery:	$\frac{\text{Conc. of M.S.} - \text{Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$
Relative % Difference:	$\frac{\text{Conc. of M.S.} - \text{Conc. of M.S.D.}}{(\text{Conc. of M.S.} + \text{Conc. of M.S.D.}) / 2} \times 100$

ARCO Facility no. 6113	City (Facility) Livermore	Project manager (Consultant) Joel Coffman	
ARCO engineer Michael Whelan	Telephone no. (ARCO) (415) 571-2434	Telephone no. (Consultant) (408) 264-7723	Fax no. (Consultant) (408) 264-2435
Consultant name RESNA		Address (Consultant) 3315 Almaden Exp. Suite 34, San Jose, CA 95118	

Laboratory name
Sequoia

Contract number
07-073

Method of shipment
Sequoia Courier

Special detection Limit/reporting

Special QA/QC

Remarks
**48 hrs turnaround time!
Composite Sample**

Lab number

Turnaround time

Priority Rush 1 Business Day

Rush 2 Business Days

Expedited 5 Business Days

Standard 10 Business Days

Sample I.D.	Lab no.	Container no.	Matrix			Preservation		Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH EPA 1602/820/8025	TPH Modified 8015 Gas <input type="checkbox"/> Diesel <input type="checkbox"/>	Oil and Grease 413.1 <input type="checkbox"/> 413.2 <input type="checkbox"/>	TPH EPA 418.1/SMS03E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCIP Metals VOA <input type="checkbox"/> VOA <input type="checkbox"/>	Semi Metals VOA <input type="checkbox"/> VOA <input type="checkbox"/>	CAM Metals EPA 6010/7000 TLC <input type="checkbox"/> STLC <input type="checkbox"/>	Lead Org./DHS Lead EPA 7420/7421 <input type="checkbox"/>	
			Soil	Water	Other	Ice	Acid															
S-0804-SP-A	1	1	✓			✓		8/4/92		X												
S-0804-SP-B	1	1	✓			✓		8/4/92		X												
S-0804-SP-C	1	1	✓			✓		8/4/92		X												
S-0804-SP-D	1	1	✓			✓		8/4/92		X												

Composite

2080500

Condition of sample: good				Temperature received: cool			
Relinquished by sampler Barbara Sieminski	Date 8/5/92	Time 1:15pm	Received by Amy M. D'Amico	Date	Time		
Relinquished by Amy M. D'Amico	Date 8/5/92	Time 2:05	Received by	Date	Time		
Relinquished by	Date	Time	Received by laboratory J. Shufan	Date 8-5-92	Time 1:25		



Northwest Region
4080-C Pike Lane
Concord, CA 94520
(510) 685-7852
(800) 544-3422 from inside California
(800) 423-7143 from outside California
(510) 825-0720 (FAX)

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AUG 21 1992

RESNA
SAN JOSE

Client Number: RSN04ARC01
Facility Number: 6113
Arco Representative: Michael Whelan
Work Order Number: C2-08-255

August 18, 1992

Valli Voruganti
RESNA Industries
3315 Almaden Expressway, Suite 34
San Jose, CA 95118

Enclosed please find the analytical results for samples received by GTEL Environmental Laboratories, Inc. on 08/12/92, under task order number 6113-91-2B.

A formal Quality Control/Quality Assurance (QA/QC) program is maintained by GTEL, which is designed to meet or exceed the EPA requirements. Analytical work for this project met QA/QC criteria, unless otherwise stated in the footnotes.

GTEL is certified by the California State Department of Health Services to perform analyses for drinking water, wastewater, and hazardous waste materials according to EPA protocols.

If you have any questions concerning this analysis or if we can be of further assistance, please call our Customer Service Representative.

Sincerely,
GTEL Environmental Laboratories, Inc.

Eileen F. Bullen
Laboratory Director

Client Number: RSN04ARC01
 Facility Number: 6113
 Arco Representative: Michael Whelan
 Work Order Number: C2-08-255

Table 1

ANALYTICAL RESULTS

Aromatic Volatile Organics and
 Total Petroleum Hydrocarbons as Gasoline in Air

Modified EPA Methods 8020 and 8015^a

GTEL Sample Number		01	02	03	04
Client Identification		AS-VW-1-35	AS-MW-5-90	AS-VW-2-30	AS-VW-2-EFFL
Date Sampled		08/11/92	08/11/92	08/11/92	08/11/92
Date Analyzed		08/13/92	08/13/92	08/13/92	08/13/92
Analyte	Detection Limit, mg/m ³	Concentration, mg/m ³			
Benzene	0.5	900	530	510	33
Toluene	0.5	89	120	58	5
Ethylbenzene	0.5	27	17	15	2
Xylene, total	0.5	68	39	35	6
BTEX, total	--	1100	710	620	46
Gasoline	10	45000	130000	52000	630
Detection Limit Multiplier		1	1	1	1

- a. Test Methods for Evaluating Solid Waste, SW-846, Third Edition, Revision 0, US EPA November 1986. Modification for TPH as gasoline as per California State Water Resources Control Board LUFT Manual protocols, May 1988 revision.

Table 1 (Continued)

ANALYTICAL RESULTS

**Aromatic Volatile Organics and
 Total Petroleum Hydrocarbons as Gasoline in Air**

Modified EPA Methods 8020 and 8015^a

GTEL Sample Number		05	06		
Client Identification		AS-VW-2-120	METHOD BLNK.		
Date Sampled		08/11/92	08/11/92		
Date Analyzed		08/13/92	08/13/92		
Analyte	Detection Limit, mg/m ³	Concentration, mg/m ³			
Benzene	0.5	350	<0.5		
Toluene	0.5	34	<0.5		
Ethylbenzene	0.5	10	<0.5		
Xylene, total	0.5	21	<0.5		
BTEX, total	--	420	--		
Gasoline	10	37000	<10		
Detection Limit Multiplier		1	1		

a. Test Methods for Evaluating Solid Waste, SW-846, Third Edition, Revision 0, US EPA November 1986. Modification for TPH as gasoline as per California State Water Resources Control Board LUFT Manual protocols, May 1988 revision.

ARCO Facility no. **6113** City (Facility) **785 E. STANLEY BLVD LIVERMORE** Project manager (Consultant) **VALLI VORUGANTI**
 ARCO engineer **MICHAEL WHELAN** Telephone no (ARCO) **(415) 571-2449** Telephone no (Consultant) **(408) 264-7723** Fax no (Consultant) **264-2435**
 Consultant name **RESNA INDUSTRIES** Address (Consultant) **3315 ALMADEN EXPRESSWAY, SUITE 34 SAN JOSE, CA 95118**

Laboratory name
GITEK

Contract number

Method of shipment
Courier

Special detection Limit/reporting
Reporting in mg/m³

Special QA/QC

Remarks
Conf. No. 20-20-6

Sample I.D.	Lab no.	Container no.	Matrix			Preservation		Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH EPA M602/8020/8015	TPH Modified 8015 Gas <input type="checkbox"/> Diesel <input type="checkbox"/>	Oil and Grease 413.1 <input type="checkbox"/> 413.2 <input type="checkbox"/>	TPH EPA 418.1/SM603E	EPA 601/801D	EPA 624/8240	EPA 625/8270	TCLP Metals <input type="checkbox"/> VOA <input type="checkbox"/> VOA <input type="checkbox"/>	Semi Metals <input type="checkbox"/> VOA <input type="checkbox"/> VOA <input type="checkbox"/>	CAMP Metals EPA 6010/7000 ITLC <input type="checkbox"/> STLC <input type="checkbox"/>	Lead Crd./DHS <input type="checkbox"/> Lead EPA 7420/7421 <input type="checkbox"/>		
			Soil	Water	Other	Ice	Acid																
AS-VW1-351					Air			08/11	10:35		X												
AS-MW5-90					}			}	12:50														
AS-VW330									27:30														
AS-VW-2-611									2:40														
AS-VW-2-120									3:45														

Condition of sample: _____ Temperature received: _____

Relinquished by sampler **Valli Voruganti** Date **08/11** Time **6:00pm** Received by **Susan Concord Courier** Date **9/12/92** Time **11:15**

Relinquished by **Susan Concord Courier** Date **8/12/92** Time **12:50** Received by _____ Date _____ Time _____

Relinquished by _____ Date _____ Time _____ Received by laboratory **Nataly Brava** Date **8/12/92** Time **12:50**

Lab number

Turnaround time

Priority Rush
1 Business Day

Rush
2 Business Days

Expedited
5 Business Days

Standard
10 Business Days