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DATE: December 14, 1993
PROJECT #: 792608-11
SUBJECT: Additional Investigation and RAP at ARCO 5387

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cc: **Ms. Juliet Shin, Alameda County Health Care Services Agency**
Mr. Richard Hiett, Regional Water Quality Control Board
Mr. Chris Winsor, ARCO Products Company

GeoStrategies Inc.

ADDITIONAL REMEDIAL INVESTIGATION AND INTERIM REMEDIAL ACTION PLAN

ARCO Station 5387
20200 Hesperian Boulevard
San Lorenzo, California

792608-11

December 13, 1993

GeoStrategies Inc.

December 13, 1993

Mr. Michael Whelan
ARCO Products Company
Post Office Box 5811
San Mateo, California 94402

Subject: **ADDITIONAL REMEDIAL INVESTIGATION AND INTERIM REMEDIAL ACTION PLAN** for ARCO Station 5387, 20200 Hesperian Boulevard, San Lorenzo, California.

Mr. Whelan:

As requested by ARCO Products Company (ARCO), GeoStrategies, Inc. (GSI) performed an additional remedial investigation at ARCO Station 5387 located at 20200 Hesperian Boulevard in San Lorenzo, California. This investigation was performed to evaluate the feasibility of vapor extraction/air sparging as a method for remediation of soil and groundwater at the subject site. This report presents the results of this investigation, as specified in the Work Plan (GSI, March 14, 1993). Additionally, this report presents the interim remedial action plan (RAP) for the interim remediation of onsite hydrocarbon-impacted soils and groundwater for the subject site. The work performed for this investigation included: drilling six soil borings; collecting and describing soil samples from the borings; constructing one groundwater recovery well (AR-2), one air-sparging well (AS-1), one dual completion air-sparging/vapor extraction well (AS-2) and three vapor extraction wells (AV-1 through AV-3) in the borings; surveying AR-2 for wellhead elevation; development and sampling of groundwater recovery well AR-2; submitting soil and groundwater samples for laboratory analyses; performing two vapor extraction tests and two air sparging/vapor extraction tests; and preparing this report presenting field procedures, results and conclusions of this investigation. Field work was performed to comply with current State of California Regional Water Quality Control Board - San Francisco Bay Region (CRWQCB) and Alameda County Health

Care Services Agency (ACHCSA) guidelines. GSI Field Methods and Procedures were presented in the GSI Work Plan dated April 26, 1991.

SITE BACKGROUND

General

ARCO Station 5387 is an operating service station located at the southeastern corner of the intersection of Hesperian Boulevard and West Sunset Drive in San Lorenzo, California, as shown on Plate 1, Vicinity Map. The site is located in an area of commercial and residential development, and is a relatively flat asphalt- and concrete-covered lot at an elevation of approximately 38 feet above mean sea level. Pertinent site features include four service islands, a station building, and four gasoline underground storage tanks (USTs) located in the southeastern portion of the site. Pertinent site features are shown on Plate 2, Site Plan.

Regional Geology and Hydrogeology

The site is located within the San Francisco Bay Plain approximately 2.5 miles east of San Francisco Bay and approximately 0.2 miles north of Sulpher Creek in San Lorenzo, California. The area is underlain by Holocene-age alluvial deposits consisting of unconsolidated, moderately sorted, fine grained sand and silt, with clayey silt and occasional thin beds of coarse sand (Helley, H.J. and others, 1979). Cross section A-A' (Plate 3) and cross section B-B' (Plate 4) show the local geology underlying the site generated during previous subsurface investigations.

PREVIOUS ENVIRONMENTAL WORK

Subsurface Environmental Investigation

In August 1986, Groundwater Technology Inc. (GTI) drilled four exploratory soil borings (SB-1 through SB-4) and installed three ground-water monitoring wells (MW-1 through MW-3). Concentrations of TPH-G in the 9-9.5 foot soil samples from borings SB-2, SB-3 and SB-4 were reported as 49, 42 and 20 parts per million (ppm), respectively, and reported as none detected (ND) in soil samples collected from borings

SB-1 and MW-1 through MW-3. Results from this phase of the investigation are presented in a GTI report dated August 21, 1986.

In October and December, 1991, GSI installed four additional groundwater monitoring wells (A-4 through A-7). Total Petroleum Hydrocarbons calculated as Gasoline (TPH-G) were detected in soil from boring A-4 at a depth of 10 fbg at a concentration of 24 ppm. The remainder of the soil samples were reported as none detected (ND) for TPH-G. Results from this investigation are presented in a GSI Monitoring Well Installation Report dated March 6, 1992.

In August 1992, GSI installed two offsite groundwater monitoring wells (A-8 and A-9) and one groundwater recovery well (AR-1) at the site. TPH-G was detected in the soil samples from boring AR-1 collected at depths of 10.0 and 14.5 fbg at concentrations of 1.0 ppm and 8.8 ppm, respectively. TPH-G was reported as ND for soil samples collected from offsite borings A-8 and A-9. Results of this investigation are presented in a GSI Continuing Site Assessment/Quarterly Monitoring Report dated December 21, 1992.

One offsite downgradient exploratory soil boring was drilled and completed as groundwater monitoring well A-10 on November 18, 1992. Two soil samples collected at 13.0 and 16.5 fbg were selected for chemical analysis. TPH-G and BTEX were reported as ND for each sample. Results of this investigation are presented in a GSI Quarterly Monitoring/Well Installation Report dated January 29, 1993.

GSI drilled six onsite exploratory soil borings and installed recovery well AR-2, vapor extraction/air sparging well AS-1, and air sparging well AS-2 in these borings on March 16 and 17, 1993. TPH-G was detected in 8 of the 12 samples analyzed at concentrations ranging between 1.0 ppm and 32 ppm. Benzene was identified in 9 of the 12 samples analyzed at concentrations ranging between 0.010 ppm and 0.12 ppm. Results from this investigation are presented in this report.

Monitoring well and soil boring locations are shown on Plate 2. Soil chemical analytical data are summarized in Table 1, Historical Soil Analyses Data.

Aquifer Pumping and Recovery Tests

The 4 hour step-drawdown and 24 hour constant rate aquifer tests were performed utilizing recovery well AR-1 on October 13 and 14, 1992. The tests were performed to assess the feasibility of utilizing recovery well AR-1 to achieve hydrodynamic control of groundwater for extraction of petroleum hydrocarbons from the first encountered water-bearing zone.

Water-level measurements were obtained from recovery well AR-1 and monitoring wells MW-1 through MW-3 and A-4 through A-9 prior to conducting the test to establish baseline data as shown on Plate 8, Water Level Map Prior To Pumping.

Step-Drawdown Test

Well AR-1 was pumped at incrementaly increased discharge rates to establish an optimum long term discharge rate. The step-drawdown test consisted of four steps: for durations of 60, 20, 86, and 46 minutes, respectively. Discharge rates (Q) for steps one, two, and three were 2.0, 4.0, and 3.0 gallons per minute (gpm), respectively. Step four was the recovery step. An evaluation of the step-drawdown test data from a time versus drawdown plot suggested that a pumping rate of 3 gpm would be the optimal discharge rate for the constant rate test.

Constant Rate Test

Recovery well AR-1 was pumped for a total of 1480 minutes at a constant rate of 3.0 gpm. **Maximum observed drawdown in the pumping well was 12.061 feet.** Maximum observed drawdowns in the pumping well and observation wells, and distances to the respective observation wells are summarized in Table 4, Constant Rate Test Results.

Calculated transmissivity values (T) from the field data plots using the Jacob Method (Jacob, 1950) ranged between 4147 gallons per day per foot (gpd/ft) to 11,000 gpd/ft. Storativity (s) ranged between 1.09×10^{-4} and 9.92×10^{-2}. **Storativity values appear to represent an aquifer that is unconfined to semi-confined.** These data results are summarized in Table 4.

To further evaluate aquifer test data, GSI utilized the Graphical Well Analysis Package (GWAP) software to analyze test data using the Theis Method (Hantush and Jacob, 1955). Transmissivity values for Wells MW-1 through MW-3 and A-4 through A-9 ranged between 3769 gpd/ft and 9261 gpd/ft. Storativity values for these wells ranged between 2.13×10^{-4} and 1.35×10^{-1}. These results appear to be relatively consistent with the Jacob method calculations performed using the field data plots.

Well Influence

Data collected from the pumping and observation wells at the end of the 1480 minute constant-rate aquifer test were used to construct a water-level drawdown map for the site as shown on Plate 9, Water Level Map After Pumping Well AR-1. Drawdown was measured in each observation well and ranged between 0.08 and 0.47 feet below initial water-levels.

The maximum extent of influence observed in Well A-7, approximately 80 feet from pumping well AR-1. The radius of influence most likely is greater in the downgradient direction as shown on Plate 9. The cone of depression created by pumping recovery well AR-1 appeared to equilibrate during the constant rate test, indicating that a longer pumping duration may not produce a greater area of well influence.

Well Efficiency

The well efficiency was calculated using step drawdown test data as described by Todd (1980). Well efficiency was calculated to be approximately 16.5% at a constant discharge rate of 3 gpm. Low well efficiency of Well AR-1 may be a function of the fine grained nature of the aquifer in the area around the well.

Quarterly Sampling

Quarterly groundwater monitoring and sampling of site wells began in December 1991. Cumulative depth to water (DTW) measurements, wellhead elevations, groundwater elevations, and subjective observations of floating product on the groundwater are summarized in Table 2, Historical Water-Level Data. Free product or product sheen has not been

observed in monitoring wells at the site since quarterly monitoring began in December 1991.

The local groundwater gradient has fluctuated from 0.002 to 0.005. Groundwater flow direction has varied from north to west. Plate 5, Potentiometric Map, is a graphic interpretation of groundwater elevations at the time of the third quarter 1993 sampling.

Concentrations of TPH-G and BTEX have remained nondetectable in monitoring wells A-6, A-8, and A-9 since the quarterly monitoring began. Concentrations of TPH-G for other wells ranged from nondetectable (less than 50 parts per billion [ppb]) to 44,000 ppb. Historical groundwater analysis data is presented in Table 3, Historical Water Quality Database.

Graphic interpretations of the extent of TPH-G and Benzene in groundwater on August 12, 1993 are shown on Plate 6 TPH-G Isoconcentration Map, and Plate 7, Benzene Isoconcentration Map.

ADDITIONAL REMEDIAL INVESTIGATION

Drilling

A well construction permit was acquired from the Alameda County Flood Control and Water Conservation District, Zone 7 (ACFCWCD) prior to drilling at the site. A copy of the permit is included in Appendix A. Six onsite exploratory soil borings (AR-2, AS-1, AS-2, A-A, A-B, and A-C) were drilled on March 16 and 17, 1993, using a truck-mounted drilling rig and hollow-stem augers. A GSI geologist observed the drilling, described the encountered soils using the Unified Soil Classification System (ASTM D 2488-84) and Munsell Color Chart, and prepared a lithologic log for each boring. Borings AR-2, AS-1 and AS-2 were drilled to the total depths of between 31½ and 35 fbg and recovery well AR-2, vapor extraction/air sparging well AS-1VE/AS-1, and air sparging well AS-2 were constructed in these borings, respectively. Borings A-A through A-C were drilled to the total depth of 15 fbg. Vapor extraction wells AV-1 through AV-3 were constructed in these borings.

The soils encountered beneath the site consisted primarily of clay, silt, silty sand, sand, and minor gravel to the total depth explored of 35.0 fbg. Groundwater was first encountered between 12.0 and 13.5 fbg within the layer of silt grading to silty sand toward the bottom of the layer. Locations of the borings/wells are shown on Plate 2. Exploratory boring logs are presented in Appendix B.

Soil Sampling

Soil samples were collected from the borings at five-foot intervals using a modified California split-spoon sampler fitted with stainless steel sample tube liners. Soil samples retained for chemical analyses were sealed on both ends with aluminum foil and plastic end caps. Samples were labeled, entered onto a Chain-of-Custody form, and transported in a cooler with blue ice to Sequoia Analytical (Sequoia), a State-certified environmental laboratory (Hazardous Waste Testing Laboratory #1210) located in Redwood City, California.

An Organic Vapor Monitor (OVM) photoionization detector was used to perform head-space analyses on soils from each sample interval, as a reconnaissance-level field test to evaluate the presence of hydrocarbons in the soil. OVM readings are presented on each boring log (Appendix B).

Well Construction

Recovery well AR-2 was constructed in a 12-inch-diameter boring using 6-inch-diameter Schedule 40 polyvinyl chloride (PVC) blank well casing and 6-inch-diameter 0.020-inch wide machine-slotted continuous wrap carbon and stainless steel well screen. **Well screen extends from 5 fbg to 35 fbg.** Lonestar #2/12 graded sand was placed across the entire screened interval and extends 1 foot above the top of the well screen. A ½-foot thick bentonite seal was placed above the sandpack and hydrated with clean water. A neat cement seal was placed from the top of the bentonite to approximately 1 foot below ground surface. An underground vault box, set in concrete, was installed over the top of the well. The screen length for this well was extended to 5.0 fbg to facilitate the wells' potential use as a dual groundwater/vapor extraction well.

Well AS-1 was completed as a dual air-sparging/vapor extraction well in a 12-inch diameter boring. The air-sparging well was constructed using 1-inch-diameter Schedule 40 PVC blank casing and 1-inch-diameter 0.020-inch machine-slotted PVC well screen. Well screen for the air-sparging well extends from 33 to 35 fbg. Lonestar #2/12 graded sand was placed across the entire screened interval of the well and extends ½ feet above the top well screen. Approximately one foot of bentonite was placed above the sandpack, followed by a 16½-foot seal. The vapor extraction well was constructed using 2-inch-diameter Schedule 40 PVC blank well casing and 2-inch-diameter 0.060-inch continuous wrap well screen. Well screen for the vapor extraction well extends from 5½ to 15 fbg . Lonestar Coarse Aquarium Sand was placed above the bentonite and extends ½ feet above the top of the vapor extraction well screen. A neat cement seal was placed from the top of the bentonite to approximately 1 foot below ground surface. An underground vault box, set in concrete, was placed over the top of the wells. A waterproof locking cap and lock was placed on each of the well casings.

Air-sparging well AS-2 was completed in an 8.0-inch-diameter boring using 1-inch diameter Schedule 40 PVC blank well casing and 0.020-inch wide machine-slotted PVC well screen. Well screen extends from 28 to 30 fbg. Lonestar #2/12 graded sand was placed across the entire screened interval and extends ½ feet above the top of the well screen. A 12½-foot bentonite seal was placed above the sandpack and hydrated with clean water. A neat cement seal was placed from the top of the bentonite to approximately 1 fbg. An underground vault box, set in concrete, was installed over the top of the well. A waterproof locking well cap and lock were placed on the well casing.

The vapor extraction wells AV-1 through AV-3 were constructed in 10-inch-diameter borings using 4-inch diameter Schedule 40 PVC blank casing and 4-inch-diameter 0.020-inch (AV-1 and AV-2) on 0.060-inch (AV-3) continuous wrap PVC well screen. Wells AV-1 and AV-3 were screened from 5 to 15 fbg, and well AV-2 was screened from 7 to 15 fbg. Lonestar Coarse Aquarium Sand was placed across the entire screened interval in each vapor extraction well and extends ½ feet above the top of the well screen. A ½-foot thick bentonite seal was placed above the sandpacks and hydrated with clean water. A neat cement seal

was placed from the top of the bentonite to approximately 1 foot below ground surface. An underground vault box, set in concrete, was placed over the top of each well. A waterproof locking cap and lock was placed on each well casing.

Well completion details are presented with the exploratory boring logs in Appendix B.

Recovery Well Development and Sampling

Recovery well AR-2 was developed on March 19, 1993, by Gettler-Ryan Inc. (G-R). G-R purged and sampled the well on March 30, 1993.

LABORATORY ANALYSES

Soil Samples

Soil samples were analyzed for TPH-G according to EPA Method 8015 (Modified), and BTEX according to EPA Method 8020.

Soil chemical analytical data are summarized in Table 1. Two soil samples collected from depths of 10.0 and 15.0 fbg from each boring were submitted for chemical analyses. TPH-G was detected in 8 of the 12 samples analyzed at concentrations ranging between 1.0 ppm and 32 ppm. Benzene was detected in 9 of the 12 samples analyzed at concentrations ranging between 0.010 ppm and 0.12 ppm. The soil chemical analytical report and Chain-of-Custody Form are presented in Appendix D.

Groundwater Samples

The groundwater samples collected from well AR-2 were analyzed for TPH-G and BTEX.

TPH-G was detected in the groundwater sample collected from well AR-2 at a concentration of 390 ppb. Benzene was detected in this sample at a concentration of 4.1 ppb. Chemical analytical results for Well AR-2 are presented in Table 2. The G-R Field Data Sheets and Sequoia

Groundwater Analytical Report and Chain-of-Custody are presented in Appendix E.

VAPOR EXTRACTION/AIR SPARGING TESTS

Field Procedures and Observations

GSI performed two vapor extraction tests (VET) and one vapor extraction/air sparging test (SVET) at the site on March 24, 1993. A fourth VET was performed on August 13, 1993 at the site. These tests were performed on four distinct groups of wells. **Pressures were monitored with a Remote Sensor Module (RSM) connected to the observation wells for Tests 1 through 3.** Dial manometers and magnahelic gauges were used to measure pressures during Test 4. Hydrocarbon concentrations in the effluent stream from the vapor extraction wells were monitored in the field using a Horiba Infrared Analyzer or OVM. Vacuum applied on the extraction wells during the tests was measured in inches of water column (in. H_2O). Tests 1 and 4 employed vapor extraction only; Tests 2 and 3 employed both vapor extraction and air sparging.

Test 1:

Vapor extraction was performed on well AV-3 while pressures were monitored on wells A-4 and AV-1. Pressure, flow rate and hydrocarbon concentration were recorded at 15 minute intervals during the test. Field data obtained during Test 1 are summarized in Table 4 and depicted on Plate 10.

Test 2:

Vapor extraction was performed on well AV-1, air sparging was performed on well AS-1 and pressures were monitored on wells AR-1, MW-1, MW-3 and the vapor extraction casing in well AS-1 (AS-1VE). Pressures, flow rates and hydrocarbon concentrations were recorded at 15 minute intervals during the test. Vapor extraction was conducted for the duration of the test. Air sparging was initiated after the vapor extraction flow had stabilized. After the flows and pressures stabilized again, the air sparging was discontinued and only vapor extraction was conducted for the

duration of the test. Field data obtained during Test 2 are summarized in Table 5 and depicted on Plates 11 and 12.

Test 3:

Vapor extraction was performed on well AR-1, air sparging was performed on well AS-2, and pressures were monitored in wells AR-2, AS-1 and MW-2. Pressures, flow rates, and hydrocarbon concentrations were recorded at 15 minute intervals. Field data obtained during Test 3 are summarized in Table 6 and depicted on Plates 13 and 14.

Upon initiation of Test 3, water was inadvertently extracted from well AR-1. Vapor extraction pressure was reduced to approximately 50 in. H_2O to eliminate water extraction. Vapor extraction was conducted for the duration of the test. Air sparging was then initiated after the vapor extraction flow had stabilized. After the flows and pressures stabilized again, the air sparging was discontinued and only vapor extraction was conducted for the duration of the test. Initially, the sparging flow was too low to be measured (below 1 cubic foot per minute [cfm]), and sparging flow gradually increased to 1.7 cfm near the end of the test.

Test 4:

Vapor extraction was performed on well AR-2 while response pressures were monitored on wells A-5, A-7, A-9, MW-2, AR-1 and AS-1. 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 in. H_2O. Pressure, flow rate and hydrocarbon concentration were recorded at 6 to 31 minute intervals during the test. The data collected for observation well AR-1 appeared to be incorrect due to a malfunctioning gauge. Field data obtained during Test 4 are summarized in Table 7 and depicted on Plates 15 and 16.

Laboratory Analyses of Air Samples

Air samples were collected from wells AV-3, AV-1, AR-1 at the end of Tests 1 through 3, respectively, and from well AR-2 at the beginning and end of Test 4. Samples were also collected for analyses for lead content from the vapor extraction flow during Test 1 through 3. The lead sampling procedure involved a small fraction of the vapor extraction flow (18 to 20 ft^3/hr) being directed through a Millipore filter for the duration of each test. A new filter was used for each test. The air samples and filter tubes were sent to Sequoia for analysis. The air samples were analyzed for TPH-G according to EPA Method 8015 (Modified) and BTEX according to EPA Method 8020. The filter tubes were analyzed for organic lead using California LUFT Manual (12/87) Method.

Laboratory reports and Chain-of-Custody Forms are included in Appendix F.

Discussion of Tests Results

During Test 1, field monitored hydrocarbon concentrations continually decreased in the vapor extraction influent flow from well AV-3. Observation well A-4 indicated vacuum response but there was no measurable vacuum response in observation well AV-1. This may be due to short-circuiting of air through the existing tank pit area between extraction well AV-3 and well AV-1.

During Test 2, observation wells AR-1, MW-1, MW-3 and AS-1VE appeared to be unaffected by vapor extraction. However, wells MW-3 and AS-1VE showed positive pressure changes after sparging was combined with vapor extraction. Wells AR-1 and MW-1 only began to become affected shortly after cessation of sparging, and, then showed effects until the end of the test.

Sparging increased the apparent hydrocarbons removal rate by approximately 75% during Test 2. Field measurements of hydrocarbon concentration rates without sparging (vapor extraction only) and with sparging for the four tests are presented in Table 8.

During Test 3, an initial field measurement of the vapor extraction flow showed hydrocarbon concentrations of approximately 2,690 parts per million by volume (ppmv). Water entered the extraction well during testing. Hydrocarbon concentrations were much lower, possibly due to the presence of water in the soils introduced into the vadose and capillary fringe zones. Hydrocarbon concentrations increased sharply just prior to initiating sparging. *This increase may* indicate that the soil in the vicinity of well AR-1 was drying (Plate 13). The decrease in measured hydrocarbon removal rates (from the vapor extraction flow) during the sparging portion of Test 3, which may indicate the short-circuiting of sparge air between sparging well AS-2 and the extraction well AR-1. The measured pressures in observation wells AS-1VE and AR-2 showed no effect. Well MW-2 showed positive pressure changes ranging from 0.3 to 1.3 in H_2O during Test 3 which may be a result of gauge malfunction.

Hydrocarbon removal rates during Test 3 are indeterminate because concentrations did not stabilize during the test. The increase in measured hydrocarbon concentrations at the end of the vapor extraction-only and after cessation of the sparging portions of Test 3 may indicate that the soils were drying.

During Test 4, field monitored hydrocarbon concentrations initially increased from 11600 ppmv to 13920 ppmv, and then continually decreased in the effluent from well AR-2. A vacuum response ranging from 0.12 to 0.25 in. H_2O was observed in well MW-2. Observation wells AS-1VE, A-7 and A-9 showed smaller amounts of vacuum response, ranging from 0.015 to 0.160 in. H_2O. Positive pressure changes (up to 2.80 in. H_2O) were observed in observation well A-5.

Discussion of Laboratory Analytical Results for Air Samples

Laboratory analytical results for air samples indicated TPH-G concentrations ranging from 790 parts per million per volume (ppmv) in the sample collected from well AR-1 at the end of Test 3 to 10,000 ppmv in the sample collected from well AR-2 at the beginning of Test 4. Lead was not detected (less than 1 microgram) in any sample.

Vapor Extraction Radius of Influence Estimate

Utilizing induced vacuum and distance measurements obtained during the VET, an effective radius of influence (ROI) was estimated for the vapor extraction test points at the site. The effective ROI has been defined as the radial distance from a vapor extraction well at which recorded vacuum levels suggest that subsurface air flow occurs and is presumed to be sufficient for remediation.

Vacuum readings decrease exponentially with distance given the following assumptions: steady state, radial flow; and homogeneous, isotropic flow media. Although no soils are truly homogeneous, these assumptions are allowed given that true 3 dimensional soil characteristics are not fully defined.

To calculate an effective radius of influence, monitoring well vacuum response is plotted versus distance from the extraction well on semi-log paper. Using statistical analysis techniques, a best fit exponential function is calculated to fit the observed data and appears on semi-log paper as a straight line. Where this function crosses a vacuum response threshold is presumed to be the effective ROI for the extraction well.

Based on past experience, GSI generally assumes that an induced vacuum of 0.2 inches of water column should be sufficient to induce subsurface airflow within the zone of influence. The radial distance corresponding to an induced vacuum of 0.2 is interpolated to be the effective ROI for the given extraction well at the applied vacuum.

VET number 4 was the only vapor extraction test performed at this site during which enough pressure response wells were monitored to give an accurate representation of induced vapor extraction vacuum respose. The induced vacuum response values for the response wells and their respective distances to the extraction well were plotted on semi-log paper (see Plate 17) and a best exponential function was calculated. The distance from the extraction well where 0.2 inches of water column is estimated to occur by the best fit exponential function is approximately 24 feet. **A conservative estimate for the effective ROI for this site is therefore approximately 20 feet.**

SUMMARY OF SOIL AND GROUNDWATER CONTAMINATION

Extent of Hydrocarbon Impacted Soil

The lateral extent of hydrocarbon impacted soil beneath the site is presented on the geologic cross sections, Plates 3 and 4. The majority of gasoline impacted soil appears to be in the southern and southwestern portion of the site, adjacent to and downgradient of the existing gasoline USTs. Hydrocarbon impacted soils are encountered between 9 to 17 fbg, with the highest concentrations encountered near the capillary fringe. The lateral extent of gasoline hydrocarbons in the soil at the subject site appears to be delineated to nondetectable levels except the southern and eastern vicinity of the site.

The presence of hydrocarbon impacted soil in the capillary fringe at the eastern corner of the site (upgradient to the existing USTs) might be due to an offsite source.

Extent of Hydrocarbon Impacted Groundwater

The lateral extent of gasoline hydrocarbons in the groundwater has been delineated to nondetectable concentrations of TPH-G (less than 50 ppb) in the northern and southern vicinity of the site. Plates 6 and 7, respectively, depict TPH-G and benzene concentrations in groundwater based on the August 12, 1993 sampling event (see Table 3). **The lateral extent of gasoline hydrocarbons in the groundwater is not delineated in the western (downgradient) and in the eastern (generally upgradient and crossgradient) vicinity of the site, as indicated by the presence of TPH-G in offsite wells A-10 and A-4.** The presence of hydrocarbons in well A-4 (located upgradient to the existing UST's) may indicate an offsite source.

The results of this investigation are presented below:

- Six exploratory borings (A-A, A-B, A-C, AS-1, AS-2, and AR-2) were drilled on-site on March 16 and 17, 1993, and completed as vapor extraction wells AV-1 through AV-3, vapor extraction/air sparging well AS-1, air sparging well AS-2, and recovery well AR-2.

- The lithology of the borings consisted primarily of silt, silty sand, sand and minor clay to the total depth explored of 35.0 feet below ground surface (fbg). Groundwater was first encountered in the borings at depths of between 12.0 and 13.5 fbg.

- Laboratory analytical results for soil samples collected from borings A-A, A-B, A-C, AS-1, AS-2, and AR-2 at depths of 10 and 15 feet reported the presence of TPH-G in 8 of the 12 samples analyzed at concentrations ranging between 1.0 ppm and 32 ppm. Benzene was identified in 9 of the 12 samples analyzed at concentrations ranging between 0.010 ppm and 0.12 ppm.

- Laboratory analytical results for groundwater samples collected from recovery well AR-2 reported 390 ppb TPH-G and 4.1 ppb of benzene.

- Air sparging/vapor extraction appears to be a viable remediation alternative for the remediation of gasoline hydrocarbons from onsite soils and groundwater. Air sparging appears to increase the hydrocarbons removal rate as indicated by Test 2 results. However, the radius of influence appears to be limited (estimated at approximately 20 feet) and more vapor extraction and air sparging wells may need to be installed to cover all hydrocarbon impacted areas.

DESCRIPTION OF PROPOSED INTERIM SOIL AND GROUNDWATER REMEDIATION SYSTEMS

The proposed vapor extraction system (VES) and groundwater remediation system will function as an interim remedial measure for onsite hydrocarbon-impacted soils and groundwater beneath the site. **The proposed interim soil and groundwater remediation systems will consist of a combined vapor extraction and air sparging system. Alternatively, in the event the air sparging is not effective, the interim soil and groundwater remediation systems will consist of a vapor extraction system and groundwater recovery system.**

Upon installation and operation of the systems, the effectiveness of the remedial systems will be reassessed. The installation of additional vapor extraction wells, air sparging wells, or groundwater recovery wells may be necessary.

Interim VES System

The VES will be installed and operated in two phases. The first phase will consist of an internal combustion engine (ICE) connected to wells AV-1 through AV-3, AS-1VE, and AV-4. The ICE will provide the vacuum source and will destroy the hydrocarbons extracted with the soil vapor. The second phase will consist of a vacuum blower connection to the same wells and to vapor phase activated carbon. The switch between the two systems will be made when the hydrocarbon concentrations being drawn from the wells drop enough to make activated carbon economically feasible. Due to the number of vapor extraction wells at the site, the VES may be operated using individual wells or sets of vapor wells in sequence, rather than operating all wells concurrently. This approach should minimize the size and inherent operating costs for the off-gas abatement unit, while still allowing the air flow from individual wells to be maximized. The design approach is also consistent with the relatively high vapor-phase TPH-G concentrations observed during the VET.

Vapor Wellheads

Wellhead piping will be equipped with a vacuum gauge, a sample port, and a shut-off valve so that flow through each well can be adjusted to maximize hydrocarbon extraction from the soil. To allow for future expansion of the VES, a limited number of additional vapor extraction pipe stub-out connections may be installed to facilitate the connection of future vapor extraction wells or air-sparging points, if needed.

VES Treatment Processes

Subsurface piping will direct extracted vapor from the wells to the remedial system. A condensate separator will remove entrained droplets of moisture from the airstream. The ICE will provide the necessary

bearing zone itself. By contrast, pump and treat systems require dissolved hydrocarbons to be hydraulically drawn toward the well for removal. The hydraulically-induced migration of groundwater toward the recovery well is often slow (depending on subsurface geology and hydrogeology), and compounded by the retardation of dissolved hydrocarbons as they flow through soil. In addition, extracted groundwater typically only contains dissolved hydrocarbons at the ppm or ppb level. Consequently, in pump and treat systems, the net mass removal of hydrocarbons is typically low relative to the volumes of water removed. An additional advantage of air sparging is that it can often enhance the removal of adsorbed-phase hydrocarbons in the saturated soil zone more effectively than groundwater pumping alone. Finally, since air sparging systems do not generally create a hydraulic capture zone, potential off-site contaminants from other sources are less likely to be drawn toward the site.

A general concern regarding air sparging systems is the potential for the migration of the dissolved contaminant plume. The presence of relatively impermeable soil zones above the water surface can restrict the vertical travel of sparge air, which could potentially drive the dissolved plume in a horizontal direction. These parameters will be monitored closely during the initial sparging period to gauge the effectiveness of the air sparging system.

Interim Groundwater Recovery System [optional]

If air sparging is not as effective as planned, the potential installation of a groundwater extraction system will be evaluated to begin migration control of the on-site dissolved hydrocarbon plume. Recovery Wells AR-1 and AR-2 will be utilized to control and extract dissolved hydrocarbons for treatment. The locations of Wells AR-1 and AR-2 were chosen because of their locations with respect to the dissolved hydrocarbon plume, the hydraulic gradient and the estimated radius of influent observed during the aquifer test. Based on aquifer test data, a combined flow rate from Recovery Wells AR-1 and AR-2 is estimated to be in the range of 3 to 6 gpm.

Interim Groundwater Recovery System Treatment Processes [optional]

If groundwater recovery is selected as an interim remediation method, subsurface piping will direct extracted groundwater from the wells to the remediation compound for above-ground treatment to reduce dissolved hydrocarbon constituents, prior to discharge to the sanitary sewer. At the remediation compound, extracted groundwater will be filtered through a bag filter unit to remove particulates. Groundwater will then pass though an oil-water separator to protect against the possibility of drawing free-phase hydrocarbon into the system from the off-site floating plume upgradient of the ARCO site. The extracted groundwater will then be treated using two or three 1000-pound liquid phase carbon canisters in series to meet discharge requirements of the Oro Loma Sanitary District (OLSD). As an option, an equalization (surge) tank with transfer pump may be used to promote more uniform flow through the carbon canisters and reduce the required pressure head of the submersible well pumps. If the OLSD does not accept the treated groundwater, a National Pollutant Discharge Elimination System (NPDES) permit will be obtained to discharge treated water to the storm drain.

Spill Prevention and Safety Plan

Spill prevention measures for the groundwater treatment system (if installed) will include pressure switches or pressure relief valves on the carbon canisters to prevent overpressuring; double containment for the liquid-phase carbon canisters, oil-water separator, and equalization tank; and a remote autodialer system to report alarm or shut-down condition. When any alarm conditions are triggered the remote monitoring system will notify GSI's field personnel so the condition can be rectified prior to system restart. A fire extinguisher and no smoking signs will also be installed in the remediation compound.

PROPOSED SCOPE OF WORK

Based on the results of previous subsurface investigations, GSI proposes the following project Tasks 1 through 3 listed below, for interim remedial measures for soil and groundwater. These tasks outlined below are described in detail in ensuing sections:

- Task 1. Construction and Construction Inspection
- Task 2. System Startup and Operation
- Task 3. System Performance Evaluation

Task 1. Construction and Construction Inspection

After having secured the Building, Fire and Planning Department Permits, BAAQMD air permit to construct, after selection of a general contractor, and after equipment procurement, system installation in accordance with the approved Plans and Specifications will be initiated. Construction will include: construction of utility trenches to contain all necessary gas and electrical lines; connection to the sanitary sewer (optional); installation of necessary underground pipes and electrical conduits to and from the proposed treatment compound; pressure testing of lines; construction of the remediation compound; electrical service and propane hookup; and installation and plumbing of all soil and groundwater remediation equipment. Construction of the remediation system compound will begin after design of the VES and groundwater remediation system is completed and city building permits have been obtained.

Task 2. System Startup and Operation

This section and the ensuing sections detail a monitoring plan to verify the effectiveness of the proposed interim VES at this site.

System Monitoring

After completion of system installation, operation of the proposed interim VES and air sparging groundwater remediation system will be initiated in compliance with all applicable regulatory agencies. Startup procedures will include system monitoring, maintenance and sampling within the first ten days of operation. Operation and maintenance of the VES as described above typically include: daily site inspections for the first five days of operation, and site visits once every week for the first month. After the first month of operation, site visits will be typically performed once every two weeks, or as needed over the operating life of the remediation systems. Modifications to this typical schedule will be made if additional requirements are specified by the guidelines set forth by the

BAAQMD in the Authority to Construct/Permit to Operate for this site, as necessary. Routine maintenance of the VES and groundwater system will be performed during these site visits and as needed.

Site inspections will typically include: monitoring and adjustment of system parameters to optimize VES and groundwater treatment system efficiency; periodic sampling and field monitoring of influent and effluent as required by the BAAQMD; and other periodic maintenance to promote continued operation of the remediation equipment. Parameters monitored and adjusted in the field will include: field measurement of vapor extraction flow rates, induced vacuum responses at onsite wells if applicable, and hydrocarbon vapor concentrations with an organic vapor monitor approved by the BAAQMD.

System Sampling

Typical BAAQMD guidelines require that during the startup phase of the off-gas abatement unit, influent and effluent air samples to the VES be collected to evaluate destruction efficiency of the unit. To demonstrate compliance with BAAQMD regulations, the VES will likely be sampled at least once during the first week of operation, and once per month for the life of the remediation system. With the exception of influent and effluent air samples collected and analyzed as detailed above, during the first two days of operation and later on a biweekly and monthly basis, all other sampling of the VES will be conducted using a field organic vapor monitoring instrument approved by the BAAQMD. If at any time the results of laboratory analyses or field monitoring readings show emission limits to be exceeded, a confirmation air sample will be taken immediately and analyzed on a 24 hour turnaround basis. If emission limits are still exceeded, the system will be shut down and any necessary corrective action will be performed before repeating the startup sequence. BAAQMD will be notified that emission limits were exceeded within 24 hours of such indication.

The off-gas treatment system will be modified to an activated carbon adsorption system (three, in-series 2000-pound vapor-phase activated carbon canisters) when the hydrocarbon concentrations of the vapor approach 200 ppmv, or when it becomes cost-effective. Typical

BAAQMD guidelines require that, extracted vapor influent and effluent from the carbon system will be monitored with a field instrument approved by the BAAQMD on a daily basis until the frequency of carbon changeout can be determined. System monitoring frequency will likely be changed to once every two weeks, or monthly, with a field instrument and monthly verification with bag samples upon receiving BAAQMD approval.

If groundwater extraction is implemented, influent and effluent water samples will be collected for laboratory analysis during the first week of startup. All water compliance sampling will be conducted in accordance with the OLSD or NPDES permit requirements if a groundwater extraction system is installed.

Task 3. System Performance Evaluation

Following continued operation of the interim VES and groundwater remediation system, a system performance evaluation will be conducted to monitor the effectiveness of the interim soil and groundwater remediation systems. This evaluation will be performed in conjunction with continued groundwater monitoring and sampling at the subject site, and will be submitted together with the regularly scheduled quarterly monitoring and sampling reports. This report may include the following: hours of operation; system influent and effluent field monitoring readings collected; laboratory results of influent and effluent air and water samples collected and analyzed; total and individual vapor extraction well and groundwater extraction well flow rates; induced vacuum responses recorded in observation wells; all other relevant field data collected; and results obtained such as observed radius of influence, system destruction efficiency, groundwater treatment system efficiency, etc.

Recommendations will then be made to further optimize system performance and to further enhance remediation of subsurface impacted soils and groundwater. Recommendations may include tie-in of additional vapor extraction wells, air sparging wells, or groundwater extraction wells (if applicable) to the remediation system, upgrading of the off-gas abatement unit, etc.

PRELIMINARY TIME SCHEDULE

A preliminary schedule for the completion of the proposed work in this RAP is included as Plate 18.

LIMITATIONS

This report was prepared in accordance with generally accepted standards of environmental geological and engineering practice in California at the time this investigation was performed. This assessment was conducted solely for the purpose of evaluating environmental conditions of the soil and groundwater with respect to gasoline and waste-oil related hydrocarbons at the site. No soil engineering or geotechnical references are implied or should be inferred. Groundwater monitoring procedures and acquisition of groundwater field data were performed under the direction of EMCON; evaluation and warrant of their field data and field protocols is beyond GSI's scope of work. Evaluation of the geologic conditions at the site for the purpose of this assessment is made from a limited number of observation points. Subsurface conditions may vary away from the data points available.

DISTRIBUTION

GSI recommends that copies of this report be sent to the following regulatory agencies:

Ms. Juliet Shin
Alameda County Health Care Services Agency
80 Swan Way, Room 200
Oakland, California 94621

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

ARCO Station 5387 December 13, 1993
Additional Investigation and Interim Remedial Action Plan
792608-11

If you have any questions or comments regarding this report, please call us at (510) 551-8777.

Sincerely,
GeoStrategies Inc.

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MED/JC/SJC/rt

Attachments

Table 1.	Soil Boring Analyses Data
Table 2.	Historical Water Level Data
Table 3.	Historical Groundwater Quality Database
Table 4.	Vapor Extraction Test Data, Test 1
Table 5.	Vapor Extraction/Air Sparging Test Data, Test 2
Table 6.	Vapor Extraction/Air Sparging Test Data, Test 3
Table 7.	Vapor Extraction Test Data, Test 4
Table 8.	Hydrocarbon Removal Rate

Attachments (Continued)

Plate 1.	Vicinity Map
Plate 2.	Site Plan
Plate 3.	Cross Section A-A'
Plate 4.	Cross Section B-B'
Plate 5.	Potentiometric Map (8/12/93)
Plate 6.	TPH-G Isoconcentration Map (8/12/93)
Plate 7.	Benzene Isoconcentration Map (8/12/93)
Plate 8.	Water Level Map Prior to Pumping
Plate 9.	Water Level Map After Pumping
Plate 10.	Test 1
Plate 11.	Test 2 - Extraction Data
Plate 12.	Test 2 - Response Data
Plate 13.	Test 3 - Extraction Data
Plate 14.	Test 3 - Response Data
Plate 15.	Test 4 - Extraction Data
Plate 16.	Test 4 - Response Data
Plate 17.	Radius of Influence Map
Plate 18.	Preliminary Time Schedule

Appendix A:	Well Construction Permit
Appendix B:	Exploratory Boring Logs and Well Construction Details
Appendix C:	Wellhead Survey Report
Appendix D:	Analytical Report and Chain-of-Custody Form for Soil Samples
Appendix E:	Analytical Report and Chain-of-Custody Form for Groundwater Samples, and G-R's Well Sampling Data Sheet
Appendix F:	Analytical Report and Chain-of-Custody Form for Air Samples

QC Review: MC

REFERENCES

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GeoStrategies Inc. Continuing Site Assessment/Quarterly Monitoring Report dated December 21, 1992.

GeoStrategies Inc. Quarterly Monitoring/Well Installation Report dated January 29, 1993.

GeoStrategies Inc. Quarterly Monitoring Report - Third Quarter 1993 dated October 28, 1993.

GeoStrategies Inc. Well Installation/Vapor Extraction/Air Sparging Tests Report in draft form.

Groundwater Technology, 1986. Report describing the results of four soil borings and three groundwater monitoring wells dated August 21, 1986.

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

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TABLE 1

SOIL ANALYSES DATA

SAMPLE I.D.	SAMPLE DATE	ANALYZED DATE	TPH-G (PPM)	BENZENE (PPM)	TOLUENE (PPM)	ETHYLBENZENE (PPM)	XYLENES (PPM)
A-A-10.0	17-Mar-93	24-Mar-93	4.4	0.022	<0.0050	0.033	0.030
A-A-15.0	17-Mar-93	24-Mar-93	32	0.12	0.042	0.38	0.22
A-B-10.0	17-Mar-93	24-Mar-93	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
A-B-15.0	17-Mar-93	24-Mar-93	<1.0	<0.0050	<0.0050	<0.0050	<0.0050
A-C-10.0	17-Mar-93	24-Mar-93	1.0	0.010	0.0060	0.050	0.0080
A-C-15.0	17-Mar-93	24-Mar-93	1	0.027	0.081	0.11	0.52
AS-1-10.0	16-Mar-93	23-Mar-93	<1.0	<0.0050	<0.0050	<0.0050	0.0070
AS-1-15.0	16-Mar-93	23-Mar-93	17	0.027	0.012	0.090	0.16
AS-2-10.0	17-Mar-93	24-Mar-93	1.3	0.042	<0.0050	<0.0050	0.020
AS-2-15.0	17-Mar-93	24-Mar-93	26	0.085	0.012	0.26	0.22
AR-2-10.0	16-Mar-93	24-Mar-93	<1.0	0.11	<0.0050	<0.0050	0.022
AR-2-15.0	16-Mar-93	24-Mar-93	16	0.061	0.015	0.14	0.56

TPH-G = Total Petroleum Hydrocarbons calculated as Gasoline.
PPM = Parts Per Million.

Note: All data shown as <x are reported as ND (none detected).

TABLE 2

HISTORICAL WATER LEVEL DATA
ARCO Station 5367
San Lorenzo, California

MONITORING DATE	WELL NUMBER	DEPTH TO WATER (FT)	WELL ELEVATION (FT)	STATIC WATER ELEVATION (FT)	FLOATING PRODUCT THICKNESS (FT)
08-Aug-86	MW-1	11.25	38.36	27.11	0.00
24-Dec-91	MW-1	16.12	38.36	22.24	0.00
10-Mar-92	MW-1	13.34	38.36	25.02	0.00
09-Jun-92	MW-1	14.12	38.36	24.24	0.00
14-Sep-92	MW-1	15.34	38.36	23.02	0.00
12-Nov-92	MW-1	15.46	38.36	22.90	0.00
11-Feb-93	MW-1	11.95	38.36	26.41	0.00
14-Apr-93	MW-1	11.65	38.36	26.71	0.00
12-Aug-93	MW-1	12.93	38.36	25.43	0.00
08-Aug-86	MW-2	11.62	38.58	26.96	0.00
24-Dec-91	MW-2	16.50	38.58	22.08	0.00
10-Mar-92	MW-2	13.50	38.58	25.08	0.00
09-Jun-92	MW-2	14.52	38.58	24.06	0.00
14-Sep-92	MW-2	15.78	38.58	22.80	0.00
12-Nov-92	MW-2	15.98	38.58	22.60	0.00
11-Feb-93	MW-2	12.27	38.58	26.31	0.00
14-Apr-93	MW-2	12.01	38.58	26.57	0.00
12-Aug-93	MW-2	13.81	38.58	24.77	0.00
08-Aug-86	MW-3	10.61	37.77	27.16	0.00
24-Dec-91	MW-3	15.60	37.77	22.17	0.00
10-Mar-92	MW-3	12.90	37.77	24.87	0.00
09-Jun-92	MW-3	13.60	37.77	24.17	0.00
14-Sep-92	MW-3	14.78	37.77	22.99	0.00
12-Nov-92	MW-3	14.92	37.77	22.85	0.00
11-Feb-93	MW-3	11.65	37.77	26.12	0.00
14-Apr-93	MW-3	11.16	37.77	26.61	0.00
12-Aug-93	MW-3	12.82	37.77	24.95	0.00
24-Dec-91	A-4	17.60	39.86	22.26	0.00
10-Mar-92	A-4	14.76	39.86	25.10	0.00
09-Jun-92	A-4	15.63	39.86	24.23	0.00
14-Sep-92	A-4	16.83	39.86	23.03	0.00
12-Nov-92	A-4	16.97	39.86	22.89	0.00
11-Feb-93	A-4	13.43	39.86	26.43	0.00
14-Apr-93	A-4	13.06	39.86	26.80	0.00

TABLE 2

HISTORICAL WATER LEVEL DATA
ARCO Station 5387
San Lorenzo, California

MONITORING DATE	WELL NUMBER	DEPTH TO WATER (FT)	WELL ELEVATION (FT)	STATIC WATER ELEVATION (FT)	FLOATING PRODUCT THICKNESS (FT)
12-Aug-93	A-4	14.94	39.86	24.92	0.00
24-Dec-91	A-5	16.85	38.94	22.09	0.00
10-Mar-92	A-5	13.83	38.94	25.11	0.00
09-Jun-92	A-5	14.91	38.94	24.03	0.00
14-Sep-92	A-5	16.14	38.94	22.80	0.00
12-Nov-92	A-5	16.35	38.94	22.59	0.00
11-Feb-93	A-5	13.21	38.94	25.73	0.00
14-Apr-93	A-5	12.97	38.94	25.97	0.00
12-Aug-93	A-5	14.12	38.94	24.82	0.00
24-Dec-91	A-6	16.88	39.07	22.19	0.00
10-Mar-92	A-6	13.73	39.07	25.34	0.00
09-Jun-92	A-6	14.95	39.07	24.12	0.00
14-Sep-92	A-6	16.20	39.07	22.87	0.00
12-Nov-92	A-6	16.35	39.07	22.72	0.00
11-Feb-93	A-6	13.04	39.07	26.03	0.00
14-Apr-93	A-6	12.23	39.07	26.84	0.00
12-Aug-93	A-6	14.18	39.07	24.89	0.00
24-Dec-91	A-7	18.11	39.95	21.84	0.00
10-Mar-92	A-7	15.30	39.95	24.65	0.00
09-Jun-92	A-7	16.12	39.95	23.83	0.00
14-Sep-92	A-7	17.35	39.95	22.60	0.00
12-Nov-92	A-7	17.47	39.95	22.48	0.00
11-Feb-93	A-7	13.80	39.95	26.15	0.00
14-Apr-93	A-7	13.60	39.95	26.35	0.00
12-Aug-93	A-7	15.54	39.95	24.41	0.00
14-Sep-92	A-8	14.19	37.23	23.04	0.00
12-Nov-92	A-8	14.35	37.23	22.88	0.00
11-Feb-93	A-8	11.25	37.23	25.98	0.00
14-Apr-93	A-8	12.33	37.23	24.90	0.00
12-Aug-93	A-8	12.41	37.23	24.82	0.00
14-Sep-92	A-9	16.12	38.71	22.59	0.00
12-Nov-92	A-9	16.29	38.71	22.42	0.00
11-Feb-93	A-9	12.31	38.71	26.40	0.00
14-Apr-93	A-9	12.01	38.71	26.70	0.00

TABLE 2

HISTORICAL WATER LEVEL DATA
ARCO Station 5387
San Lorenzo, California

MONITORING DATE	WELL NUMBER	DEPTH TO WATER (FT)	WELL ELEVATION (FT)	STATIC WATER ELEVATION (FT)	FLOATING PRODUCT THICKNESS (FT)
12-Aug-93	A-9	13.90	38.71	24.81	0.00
07-Dec-92	A-10	16.81	38.94	22.13	0.00
11-Feb-93	A-10	13.15	38.94	25.79	0.00
14-Apr-93	A-10	12.93	38.94	26.01	0.00
12-Aug-93	A-10	14.87	38.94	24.07	0.00
14-Sep-92	AR-1	15.21	38.11	22.90	0.00
12-Nov-92	AR-1	15.36	38.11	22.75	0.00
11-Feb-93	AR-1	12.81	38.11	25.30	0.00
14-Apr-93	AR-1	11.77	38.11	26.34	0.00
12-Aug-93	AR-1	13.55	38.11	24.56	0.00
30-Mar-93	AR-2	11.53	38.39	26.86	0.00
14-Apr-93	AR-2	11.87	38.39	26.52	0.00
12-Aug-93	AR-2	13.59	38.39	24.80	0.00

Notes:
1. Static water elevations referenced to Mean Sea Level (MSL).
2. Well elevations and depth-to-water measurements are measured from the top of the well box.

TABLE 3

GROUNDWATER QUALITY DATABASE
ARCO Station 5387
San Lorenzo, California

SAMPLE DATE	SAMPLE POINT	TPH-G (PPB)	BENZENE (PPB)	TOLUENE (PPB)	ETHYLBENZENE (PPB)	XYLENES (PPB)
08-Aug-86	MW-1	7040	132	8.7	439	230
24-Dec-91	MW-1	2200	190	8.5	6.9	2.6
10-Mar-92	MW-1	2800	270	29	56	39
09-Jun-92	MW-1	2900	960	27	99	63
14-Sep-92	MW-1	2600	450	<5.0	45	21
12-Nov-92	MW-1	1600	310	7.2	22	8.9
11-Feb-93	MW-1	4000	510	47	200	91
14-Apr-93	MW-1	1700	260	20	100	70
12-Aug-93	MW-1	830	60	3.8	39	3.6
08-Aug-86	MW-2	1910	20.1	2.8	1.8	---
24-Dec-91	MW-2	23000	1500	1100	480	1400
10-Mar-92	MW-2	210000	44000	3900	1700	5800
09-Jun-92	MW-2	33000	2300	370	780	2600
14-Sep-92	MW-2	16000	3700	100	470	1000
12-Nov-92	MW-2	16000	3800	86	470	910
11-Feb-93	MW-2	27000	3500	720	1600	3800
14-Apr-93	MW-2	27000	3500	220	2200	5100
12-Aug-93	MW-2	16000	1600	27	1300	1200
08-Aug-86	MW-3	7450	510	549	409	1380
24-Dec-91	MW-3	6800	450	10	610	45
10-Mar-92	MW-3	11000	2500	75	400	560
09-Jun-92	MW-3	16000	2000	69	1300	2600
14-Sep-92	MW-3	14000	630	<50	1500	2400
12-Nov-92	MW-3	7400	400	<25	860	330
11-Feb-93	MW-3	8600	580	<20	710	300
14-Apr-93	MW-3	6900	300	8.8	580	99
12-Aug-93	MW-3	3400	56	<5	190	<5
24-Dec-91	A-4	1900	29	1.9	25	29
10-Mar-92	A-4	7400	37	<0.60	11	73
09-Jun-92	A-4	4500	3.2	1.5	37	16
14-Sep-92	A-4	1300	<2.5	2.5	61	6.8
12-Nov-92	A-4	610	7.2	0.98	34	0.97
11-Feb-93	A-4	740	2.4	<0.50	5.0	3.5
14-Apr-93	A-4	380	<0.50	<0.50	10	1.6

TABLE 3

HISTORICAL GROUNDWATER QUALITY DATABASE
ARCO Station 5387
San Lorenzo, California

SAMPLE DATE	SAMPLE POINT	TPH-G (PPB)	BENZENE (PPB)	TOLUENE (PPB)	ETHYLBENZENE (PPB)	XYLENES (PPB)
12-Aug-93	A-4	1200	0.93	<0.50	0.91	<0.50
24-Dec-91	A-5	1600	35	<0.30	32	52
10-Mar-92	A-5	1000	21	<1.5	43	100
09-Jun-92	A-5	680	1.6	<0.30	14	16
14-Sep-92	A-5	770	34	<2.5	51	65
12-Nov-92	A-5	520	12	0.96	29	36
11-Feb-93	A-5	150	3.0	<0.50	5.1	1.5
14-Apr-93	A-5	190	1.6	<0.50	1.5	0.97
12-Aug-93	A-5	230	5.4	<0.50	5.3	0.94
24-Dec-91	A-6	<30	<0.30	<0.30	<0.30	<0.30
10-Mar-92	A-6	<30	<0.30	<0.30	<0.30	<0.30
09-Jun-92	A-6	<30	<0.30	<0.30	<0.30	<0.30
14-Sep-92	A-6	<50	<0.50	<0.50	<0.50	<0.50
12-Nov-92	A-6	<50	<0.50	<0.50	<0.50	<0.50
11-Feb-93	A-6	<50	<0.50	<0.50	<0.50	<0.50
14-Apr-93	A-6	<50	<0.50	<0.50	<0.50	<0.50
12-Aug-93	A-6	<50	<0.50	<0.50	<0.50	<0.50
24-Dec-91	A-7	10000	88	16	170	610
10-Mar-92	A-7	320	9.3	0.54	8.8	34
09-Jun-92	A-7	340	11	1.1	8.9	26
14-Sep-92	A-7	510	12	<2.0	30	51
12-Nov-92	A-7	760	17	0.83	50	73
11-Feb-93	A-7	260	20	1.0	11	21
14-Apr-93	A-7	1300	89	2.1	48	87
12-Aug-93	A-7	360	9.0	<0.50	13	9.0
14-Sep-92	A-8	<50	<0.50	<0.50	<0.50	<0.50
12-Nov-92	A-8	<50	<0.50	<0.50	<0.50	<0.50
11-Feb-93	A-8	<50	<0.50	<0.50	<0.50	<0.50
14-Apr-93	A-8	<50	<0.50	<0.50	<0.50	<0.50
12-Aug-93	A-8	<50	<0.50	<0.50	<0.50	<0.50
14-Sep-92	A-9	<50	<0.50	<0.50	<0.50	<0.50
12-Nov-92	A-9	<50	<0.50	<0.50	<0.50	<0.50
11-Feb-93	A-9	<50	<0.50	<0.50	<0.50	<0.50
14-Apr-93	A-9	<50	<0.50	<0.50	<0.50	<0.50

TABLE 3

HISTORICAL GROUNDWATER QUALITY DATABASE
ARCO Station 5387
San Lorenzo, California

SAMPLE DATE	SAMPLE POINT	TPH-G (PPB)	BENZENE (PPB)	TOLUENE (PPB)	ETHYLBENZENE (PPB)	XYLENES (PPB)
12-Aug-93	A-9	<50	<0.50	<0.50	<0.50	<0.50
07-Dec-92	A-10	660	30	<2.5	<2.5	<2.5
11-Feb-93	A-10	210	<0.50	0.97	<0.50	<0.50
14-Apr-93	A-10	770	<0.50	3.0	0.76	1.9
12-Aug-93	A-10	390	<0.50	<0.50	<0.50	0.84
14-Sep-92	AR-1	820	67	<1.0	8.8	6.7
12-Nov-92	AR-1	140	66	<0.50	4.3	3.7
11-Feb-93	AR-1	360	190	<2.5	8.6	<2.5
14-Apr-93	AR-1	420	240	5.2	30	8.7
12-Aug-93	AR-1	370	150	<2	11	<2
30-Mar-93	AR-2	390	4.1	1.6	<0.50	47
14-Apr-93	AR-2	310	18	<0.50	0.67	36
12-Aug-93	AR-2	130	16	<0.50	1.7	0.57

TPH-G = Total Petroleum Hydrocarbons calculated as Gasoline.
PPB = Parts Per Billion.

Note: All data shown as <x are reported as ND (none detected).

Table 4

Vapor Extraction Test Data March 24, 1993

TEST 1

Elapsed Time (H:M)	Extraction Well AV-3			Response Well Pressure	
	Extraction Flow (CFM)	Extraction Pressure (in H2O)	Extraction Concentration (PPMV)	A-4 (in H2O)	AV-1 (in H2O)
0:00	9.7	-74.0	7140	-0.1	0.0
0:10	16.3	-95.4	5840	-0.2	0.0
0:15	18.4	-76.0	5580	-0.2	0.0
0:30	19.7	-74.6	4440	-0.2	0.0
0:45	19.3	-74.3	4010	-0.1	0.0
1:00	18.5	-73.4	3770	-0.1	0.0
1:15	18.7	-72.4	3740	-0.1	0.0
1:30	18.4	-73.0	3580	-0.1	0.0
1:45	18.0	-72.5	3510	-0.1	0.0
2:00	16.4	-74.0	3400	-0.1	0.0
2:15	20.3	-79.0	3240	-0.1	0.0

Notes:

H:M	Hours:Minutes
CFM	Cubic feet per minute
in H2O	Inches water column
PPMV	Parts per million by volume

Table 5

Vapor Extraction/Air Sparging Test Data March 24, 1993

Test 2

Elapsed Time (H:M)	Extraction Well AV-1			Sparge AS-1		Response Well Pressure			
	Extraction Flow (CFM)	Extraction Pressure (in H2O)	Extraction Concentration (PPMV)	Sparge Pressure (PSI)	Sparge Flow (CFM)	AR-1 (in H2O)	AS-1 VE (in H2O)	MW-1 (in H2O)	MW-3 (in H2O)
0:00	0.4	-127.2	24000	0.0	0.0	0.2	0.0	0.2	0.2
0:18	4.8	-127.5	21700	0.0	0.0	0.2	0.0	0.2	0.3
0:30	5.4	-134.0	20500	0.0	0.0	0.2	0.0	0.3	0.3
0:45	5.8	-131.0	20500	0.0	0.0	0.2	0.0	0.3	0.3
0:47	6.2	-131.1		8.4	0.0	0.3	0.0	0.3	0.3
1:00	6.4	-127.0	20500	13.3	1.8	7.5	4.0	1.4	0.4
1:15	5.8	-124.4	20500	12.4	2.0	14.5	4.5	2.2	0.0
1:30	6.3	-123.0	21000	12.4	2.3	14.3	5.1	3.0	0.2
1:45	7.1	-124.2	20500	13.0	2.5	11.4	5.2	3.2	1.0
2:00	7.1	-125.2	20000	13.1	2.6	9.1	5.1	3.0	1.3
2:15	7.8	-132.0	16800	8.1	0.0	-10.4	3.5	-1.1	6.4
2:30	7.4	-126.4	13200	0.0	0.0	-15.1	0.1	-1.5	9.3
2:45	7.9	-126.1	12000	0.3	0.0	-6.5	0.3	-2.0	13.4
3:00	7.5	-126.3	12000	0.1	0.0	-3.4	0.0	-1.4	15.3

Notes:

H:M	Hours:Minutes
CFM	Cubic feet per minute
in H2O	Inches water column
PPMV	Parts per million by volume
PSI	Pounds per square inch

Table 6

Vapor Extraction/Air Sparging Test Data, March 24, 1993

TEST 3

Elapsed Time (H:M)	Extraction Well AR-1			Sparge AS-2		Response Well Pressure		
	Extraction Flow (CFM)	Extraction Pressure (in H2O)	Extraction Concentration (PPMV)	Sparge Pressure (PSI)	Sparge Flow (CFM)	AR-2 (in H2O)	AS-1 VE (in H2O)	MW-2 (in H2O)
0:00	74.9	-113.6	2690	0.0	0.0	0.0	0.0	0.3
0:10	Extracted water from well							
0:25	18.1	-50.5	950	0.0	0.0	0.0	0.0	0.6
0:40	17.3	-56.1	1130	0.0	0.0	0.0	0.0	1.0
0:55	17.7	-57.0	1290	0.0	0.0	0.0	0.0	1.0
1:12	17.7	-56.1	1530	0.0	0.0	0.0	0.0	1.1
1:25	17.5	-55.5	1720	0.0	0.0	0.0	0.0	1.1
1:40	17.5	-55.5	1730	0.0	0.0	0.0	0.0	1.1
1:55	17.4	-54.4	2040	0.0	0.0	0.0	0.0	1.1
1:56		-55.6		13.5	0.0	0.0	0.0	1.1
2:10	17.4	-56.3	1780	13.4	1.3	0.0	0.0	1.3
2:25	17.4	-56.3	1560	13.5	1.6	0.0	0.0	1.3
2:40	17.3	-56.5	1400	13.3	1.7	0.0	0.0	1.3
2:55	17.5	-54.3	2380	4.0	0.0	0.0	0.0	1.2
3:10	17.5	-54.2	2220	1.0	0.0	0.0	0.0	1.1

Notes:

**	Gauge drift reading (Referenced to atmosphere)
H:M	Hours:Minutes
CFM	Cubic feet per minute
in H2O	Inches water column
PPMV	Parts per million by volume
PSI	Pounds per square inch

Table 7

Vapor Extraction Test Data August 13, 1993

TEST 4

	Extraction Well AR-2				Response Well Pressure					
Elapsed Time (H:M)	Extraction Flow (CFM)	Extraction Pressure (in H2O)	Extraction Concentration (PPMV)	Extraction Oxygen (%)	A-5 (in H2O)	MW-2 (in H2O)	AR-1 (in H2O)	AS-1 (in H2O)	A-7 (in H2O)	A-9 (in H2O)
0:00	36	-100			----	-0.12	----	-0.04	-0.04	
0:06					2.6	-0.21	0.03*	-0.05	-0.04	
0:18	44	-92	11600		2.8	-0.23	0.01*	-0.07	-0.02	
0:23	44	-90	13920		2.80	-0.24	0.02*	-0.08	-0.03	
0:29	44	-92	13740		2.75	-0.230	0.015*	-0.095	-0.030	
0:34	43	-94	13780		2.70	-0.230	0.020*	-0.115	-0.030	
0:58	43	-96	13200	13	2.58	-0.210	0.025*	-0.125	-0.025	-0.030
1:07	43	-97	13250	14	2.55	-0.205	0.018*	-0.125	-0.030	----
1:16	43	-97	13240	13	2.50	-0.220	0.005*	-0.135	-0.035	-0.015
1:30	44	-98	12910	12	2.45	-0.240	0.025*	-0.105	-0.035	-0.020
1:44	44	-97	11720	12	2.40	-0.225	0.025*	-0.090	-0.035	-0.030
1:56	44	-96	11730	12	2.35	-0.235	0.150*	-0.110	-0.040	-0.015
2:27	44	-95	11560	12	2.15	-0.250	0.150*	-0.160	-0.040	-0.020
2:35	0	0			2.05	-0.020	0.030*	-0.155	0.000	-0.010

Notes:

*	Gauge malfunction on well AR-1.
H:M	Hours:Minutes
CFM	Cubic feet per minute
in H2O	Inches water column
PPMV	Parts per million by volume

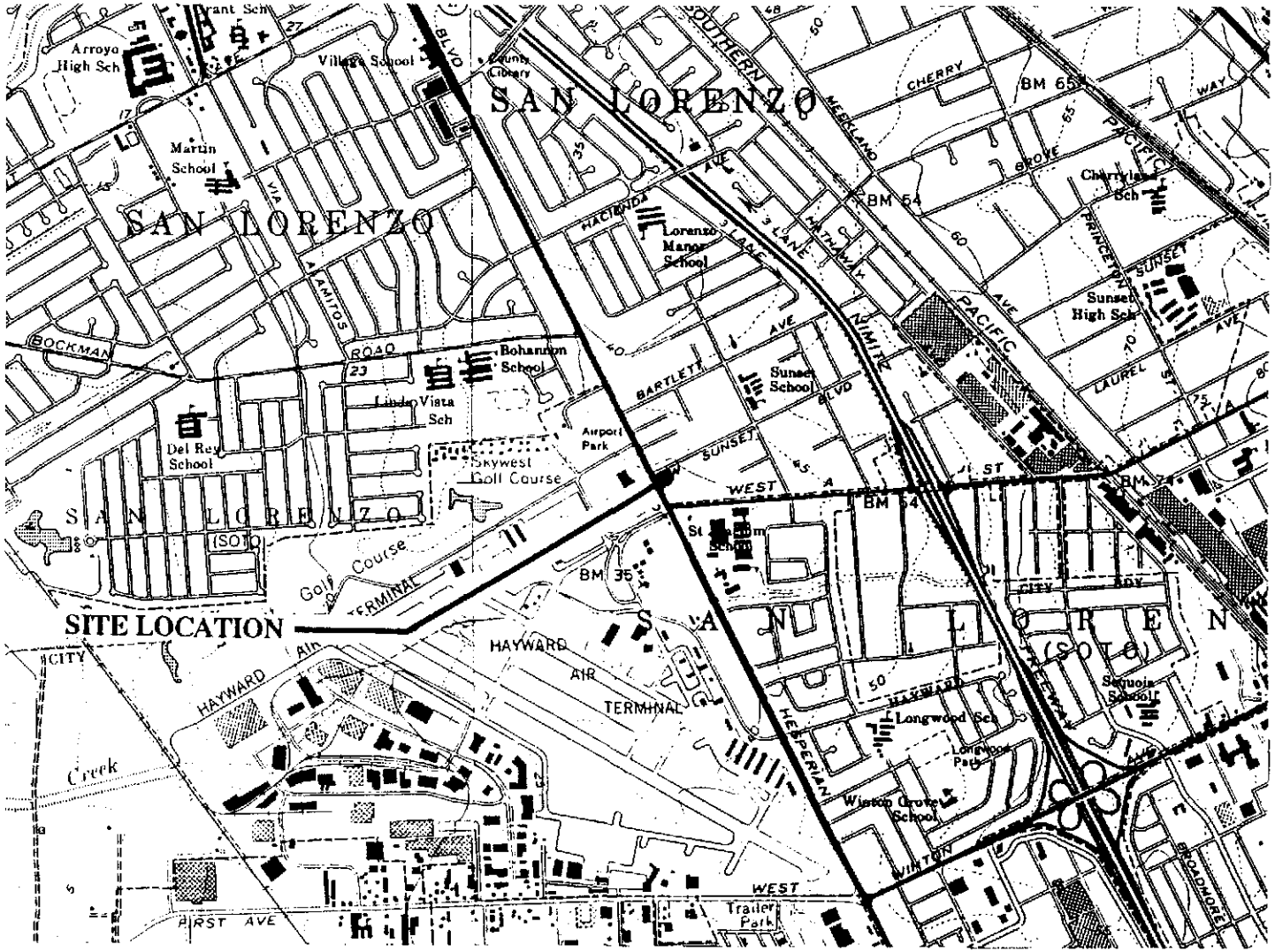
Table 8

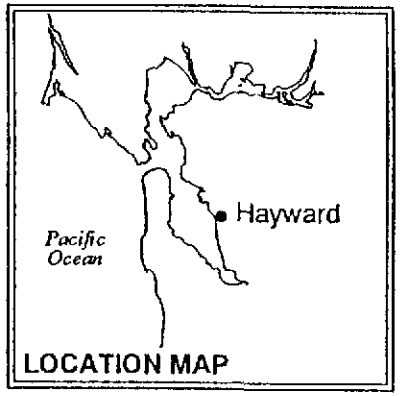
Hydrocarbon Removal Rates

Test	SVE Removal Rates (lb/day)	
	Without Sparging	With Sparging
1	11	NA
2	13.1	22.9
3	Indeterminate	Indeterminate
4	60.7	NA

Notes:

NA	Not applicable
Indeterminate	Concentrations did not stabilize





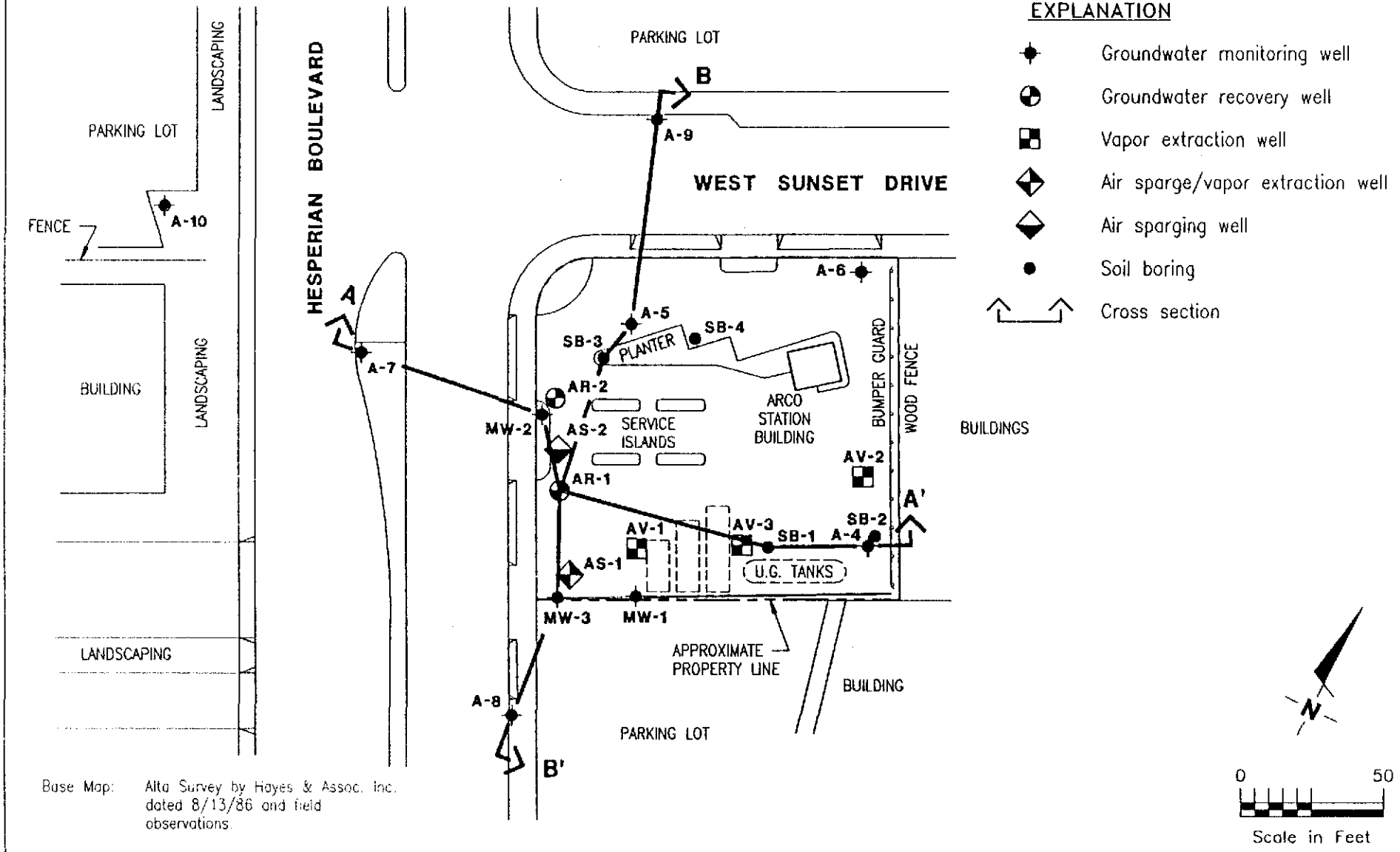
Base Map: USGS Topographic Map

GeoStrategies Inc.

VICINITY MAP
ARCO Service Station #5387
20200 Hesperian Boulevard
San Lorenzo, California

PLATE **1**

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
7926		11/91	



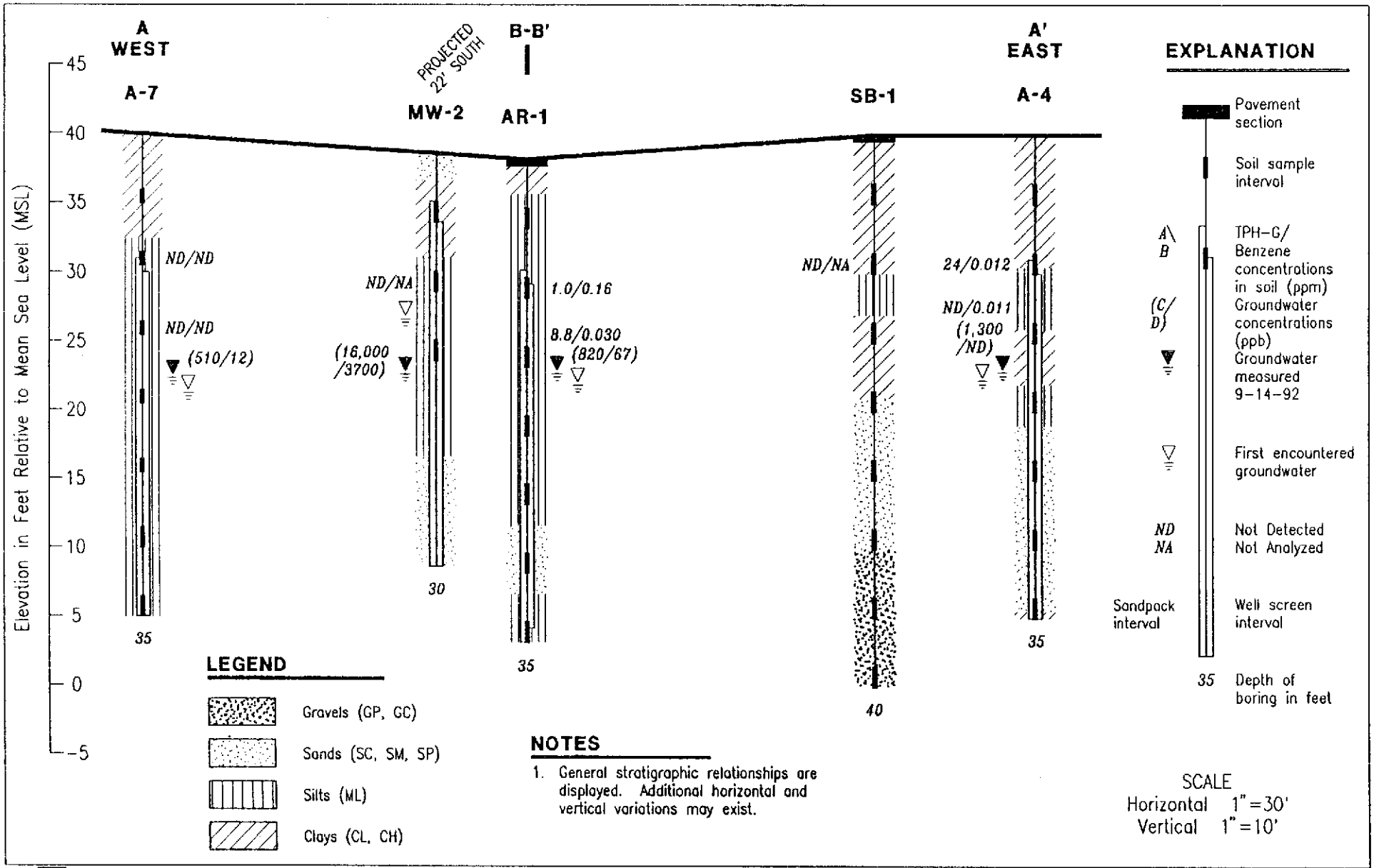
Base Map: Alta Survey by Hayes & Assoc. Inc. dated 8/13/86 and field observations.

GeoStrategies Inc.

SITE PLAN
ARCO Service Station #5387
20200 Hesperian Boulevard
San Lorenzo, California

PLATE 2

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
408-11		12/93	



GeoStrategies Inc.

CROSS SECTION A-A'
ARCO Service Station #5387
20200 Hesperian Boulevard
San Lorenzo, California

PLATE
3

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
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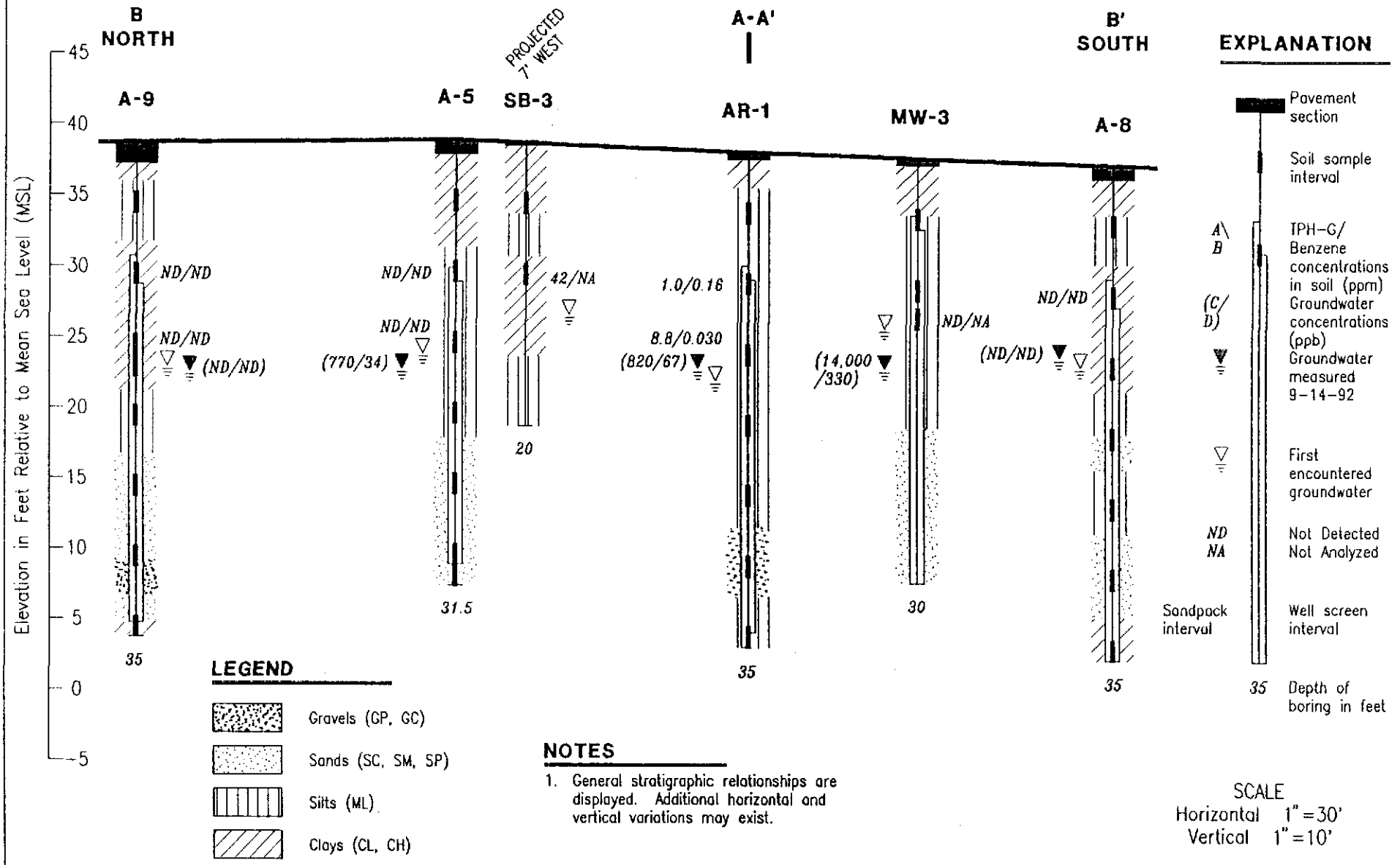
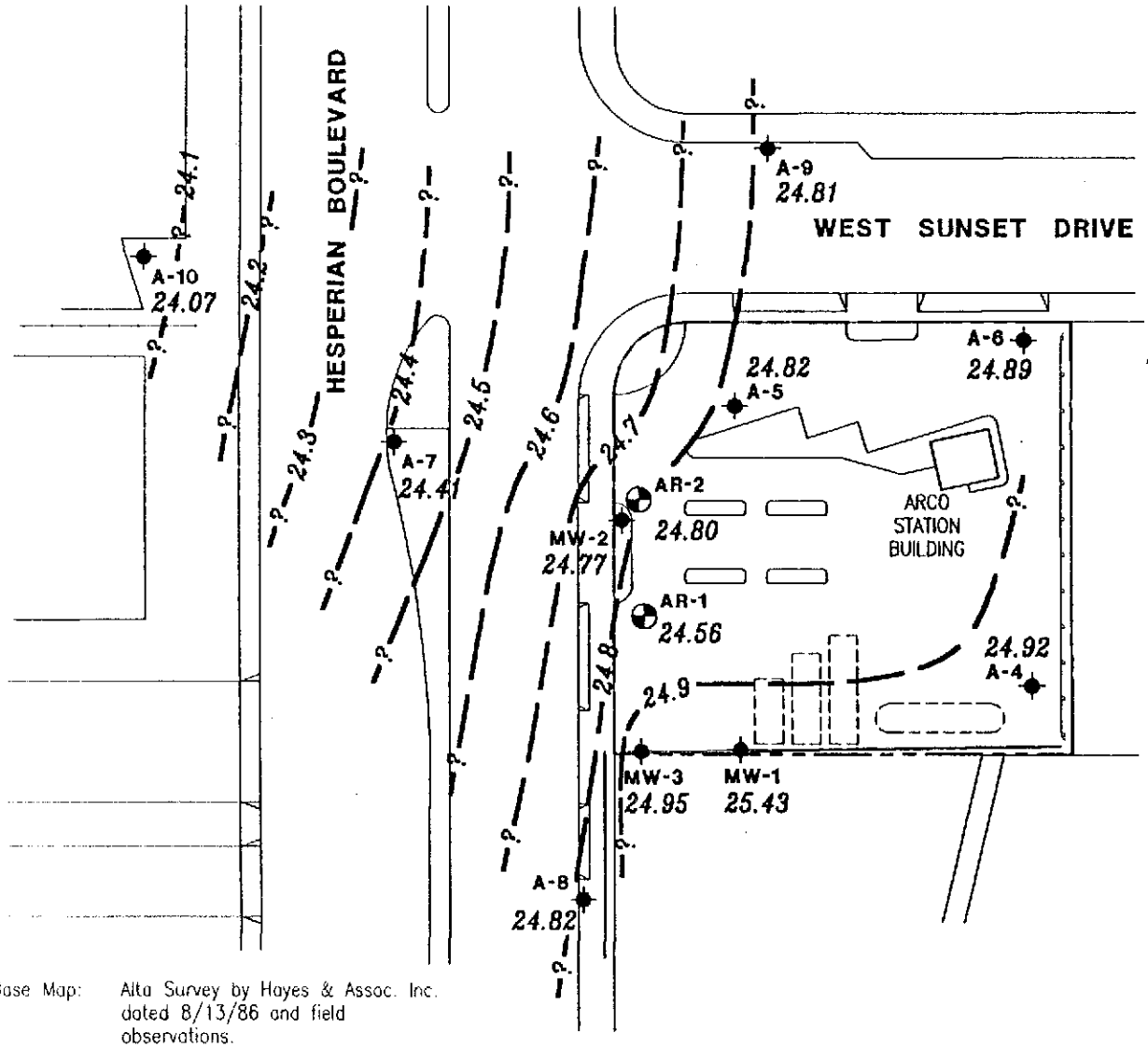


GeoStrategies Inc.

CROSS SECTION B-B'
ARCO Service Station #5387
20200 Hesperian Boulevard
San Lorenzo, California

PLATE 4

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
792608-11		12/93	



EXPLANATION

- Groundwater monitoring well
- Groundwater recovery well
- 99.99 Groundwater elevation in feet referenced to Mean Sea Level (MSL) measured on August 12, 1993
- Groundwater elevation contour. Approximate Gradient = 0.004

NOTES:
1. Contours may be influenced by irrigation practices and/or site construction activities.
2. Wells AR-1 and MW-1 appear to be anomalous and were not used in contouring.

Base Map: Alta Survey by Hayes & Assoc. Inc. dated 8/13/86 and field observations.

N

0 50

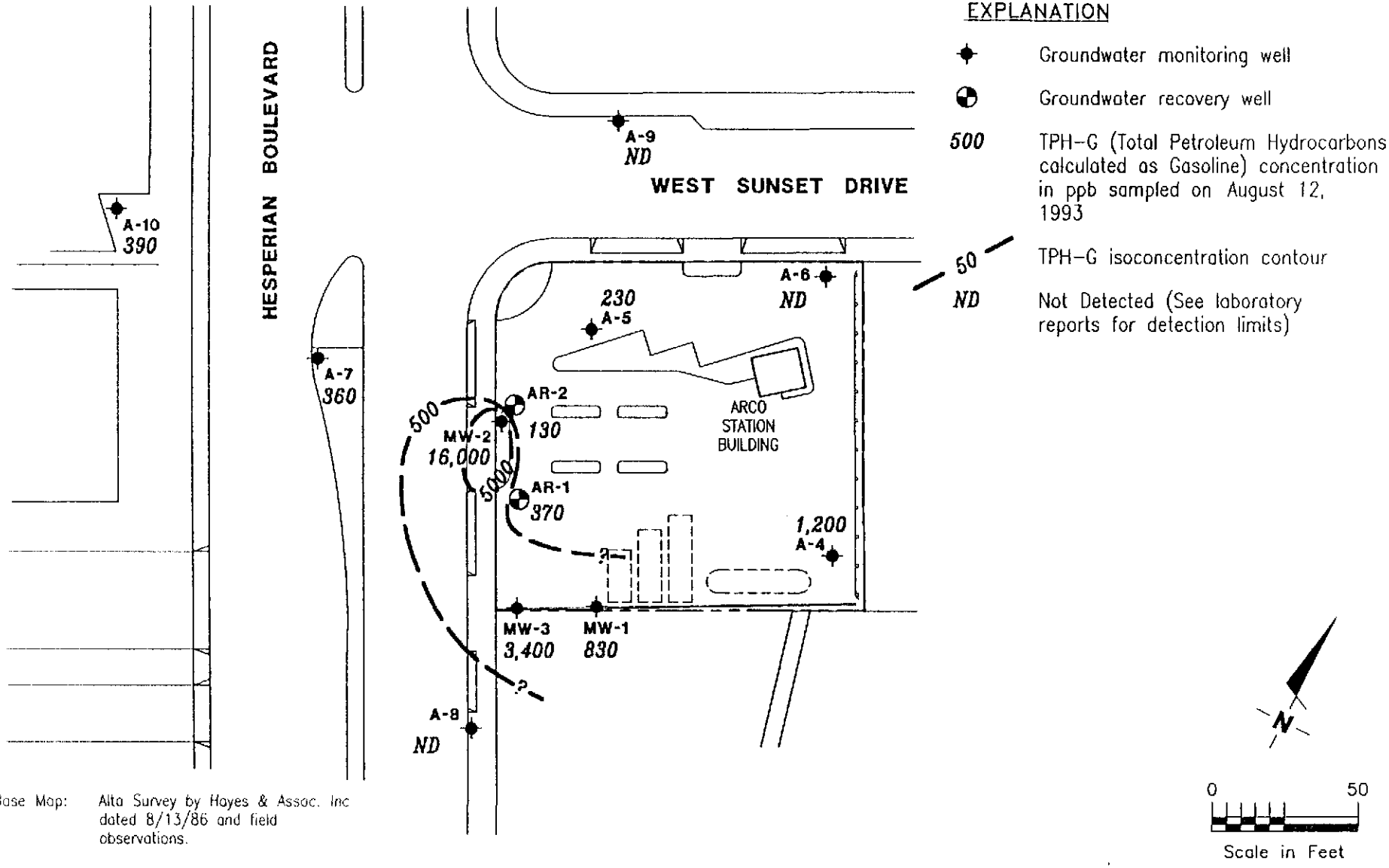
Scale in Feet

GeoStrategies Inc.

POTENTIOMETRIC MAP
ARCO Service Station #5387
20200 Hesperian Boulevard
San Lorenzo, California

PLATE **5**

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
792608-11		12/93	



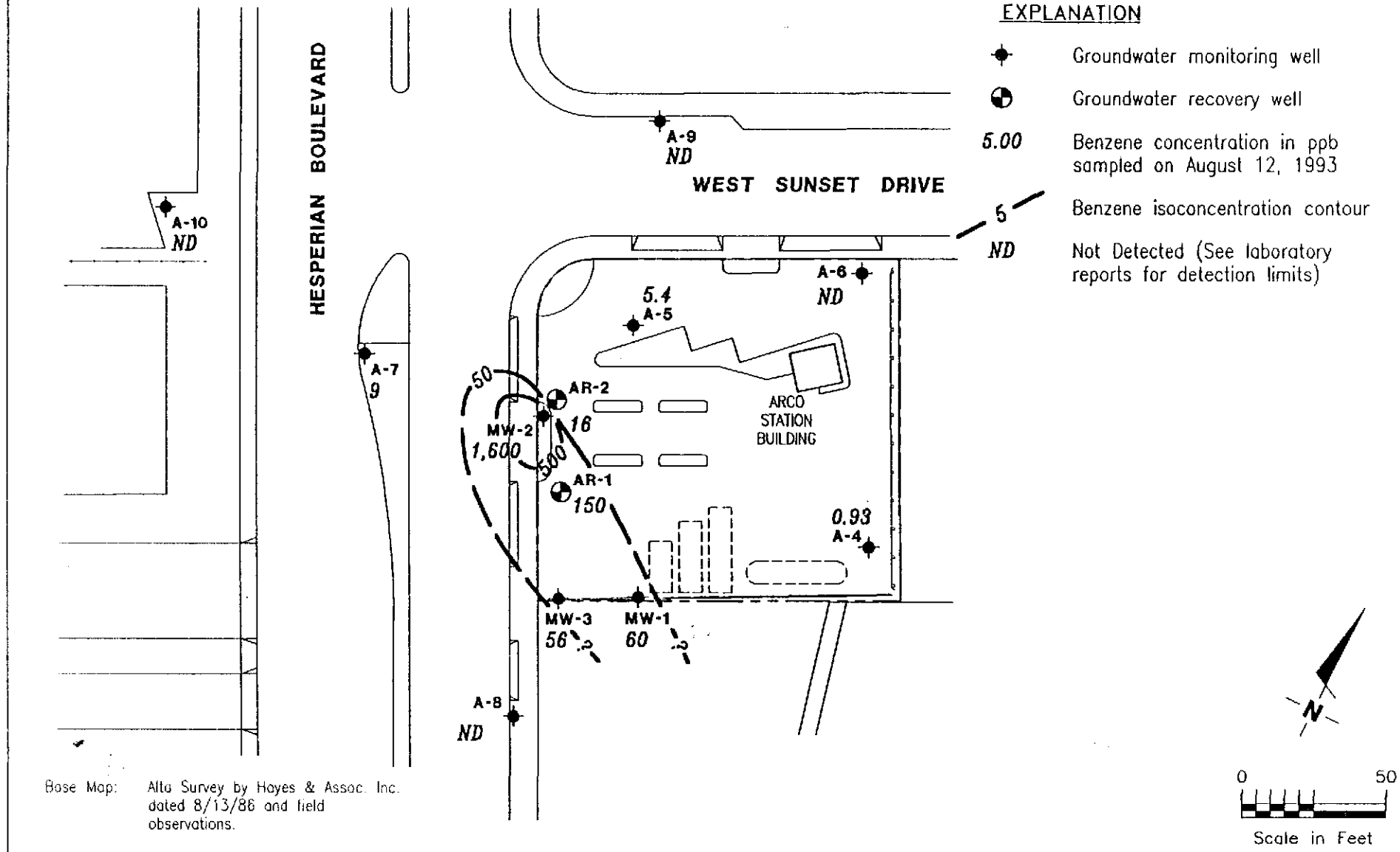
Base Map: Alta Survey by Hayes & Assoc. Inc dated 8/13/86 and field observations.

GeoStrategies Inc.

TPH-G ISOCONCENTRATION MAP
ARCO Service Station #5387
20200 Hesperian Boulevard
San Lorenzo, California

PLATE
6

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
792608-11		12/93	



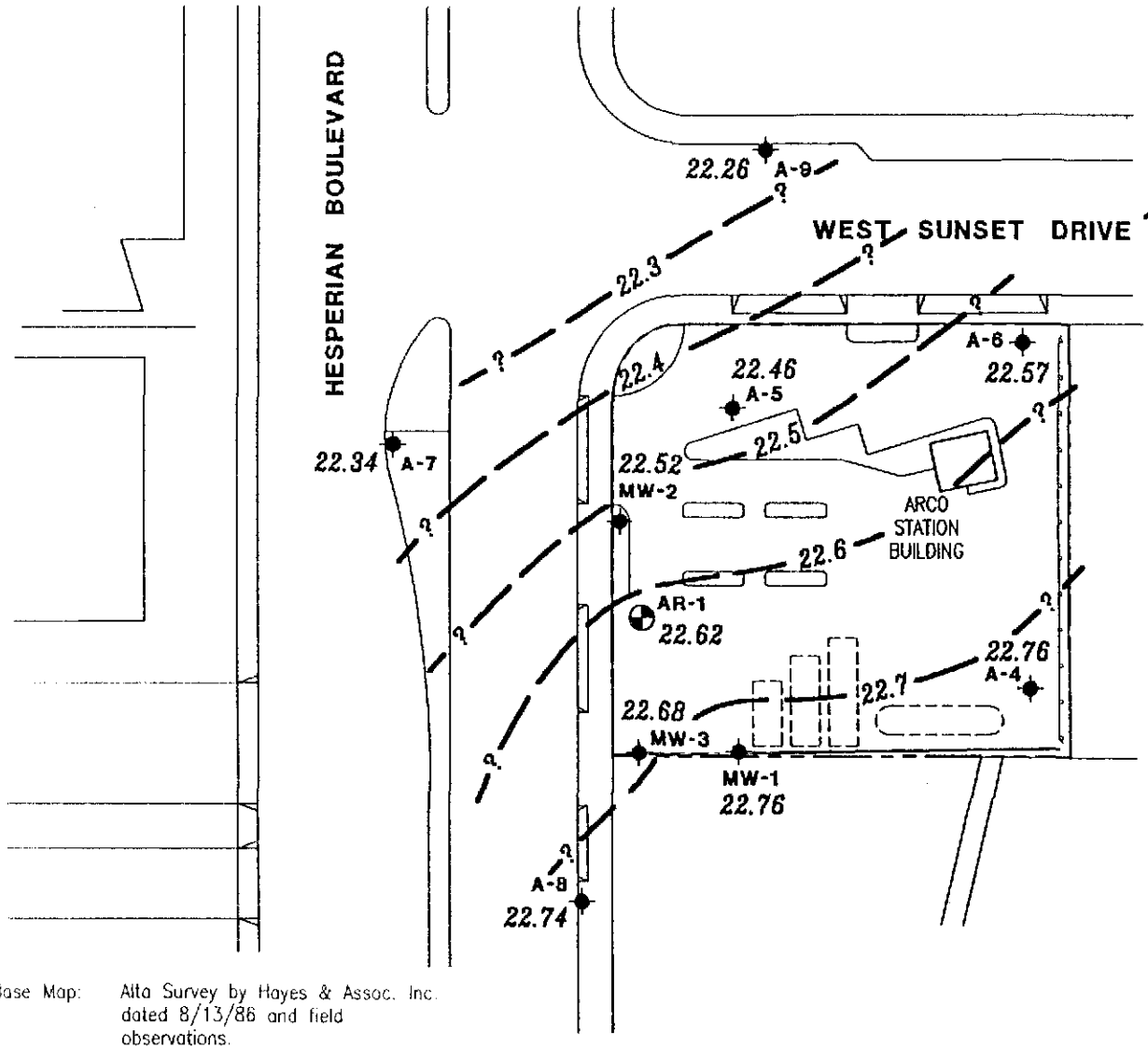
Base Map: Alta Survey by Hayes & Assoc. Inc. dated 8/13/86 and field observations.

GeoStrategies Inc.

BENZENE ISOCONCENTRATION MAP
ARCO Service Station #5387
20200 Hesperian Boulevard
San Lorenzo, California

PLATE **7**

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
7926008-11		12/93	



EXPLANATION

- Ground-water monitoring well
- Ground-water recovery well
- 99.99 — Ground-water elevation contour. Approximate Gradient = 0.003
- 99.99 — Ground-water elevation in feet referenced to Mean Sea Level (MSL) measured on October 13, 1992

NOTES:
1. Contours may be influenced by irrigation practices and/or site construction activities.

Base Map: Alta Survey by Hayes & Assoc. Inc. dated 8/13/86 and field observations.

N

0 50

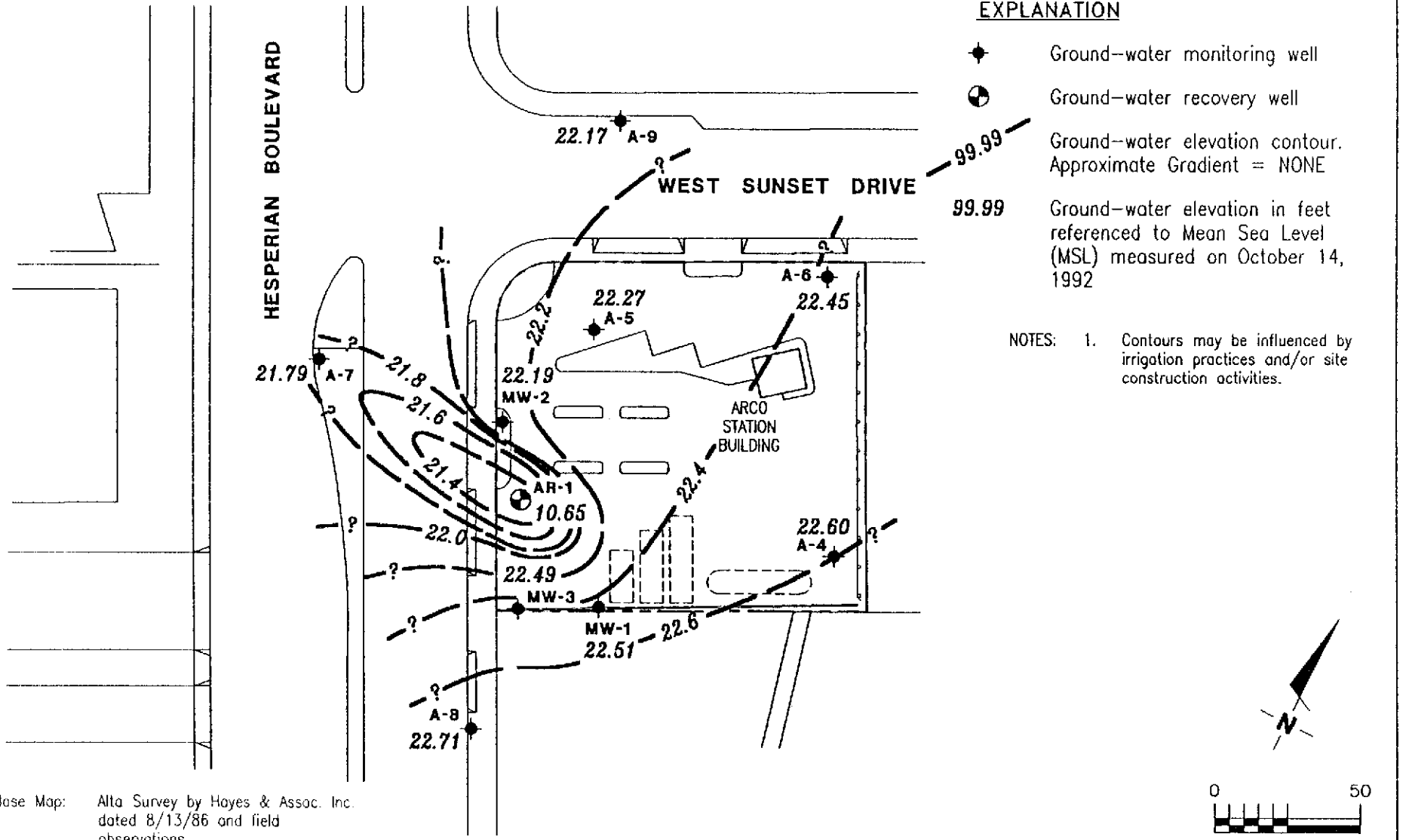
Scale in Feet

GeoStrategies Inc.

WATER LEVEL MAP PRIOR TO PUMPING
ARCO Service Station #5387
20200 Hesperian Boulevard
Hayward, California

PLATE 8

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
792608-11		12/93	



GeoStrategies Inc.

WATER LEVEL MAP AFTER PUMPING
ARCO Service Station #5387
20200 Hesperian Boulevard
Hayward, California

PLATE
9

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
792608-11		12/93	

Plate 10

Vapor Extraction Test 1
Extraction Well AV-3
Responding Wells A-4, AV-1

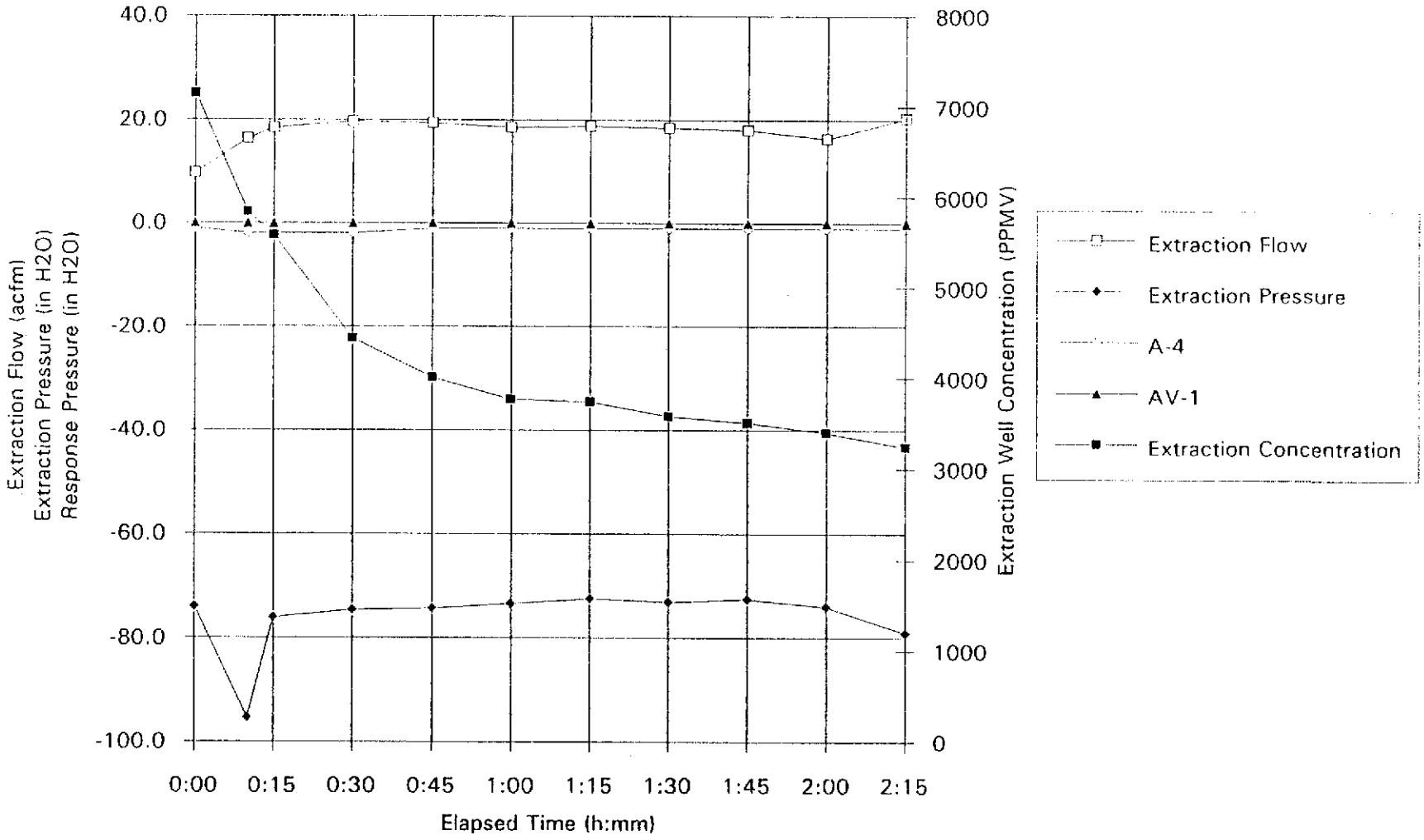
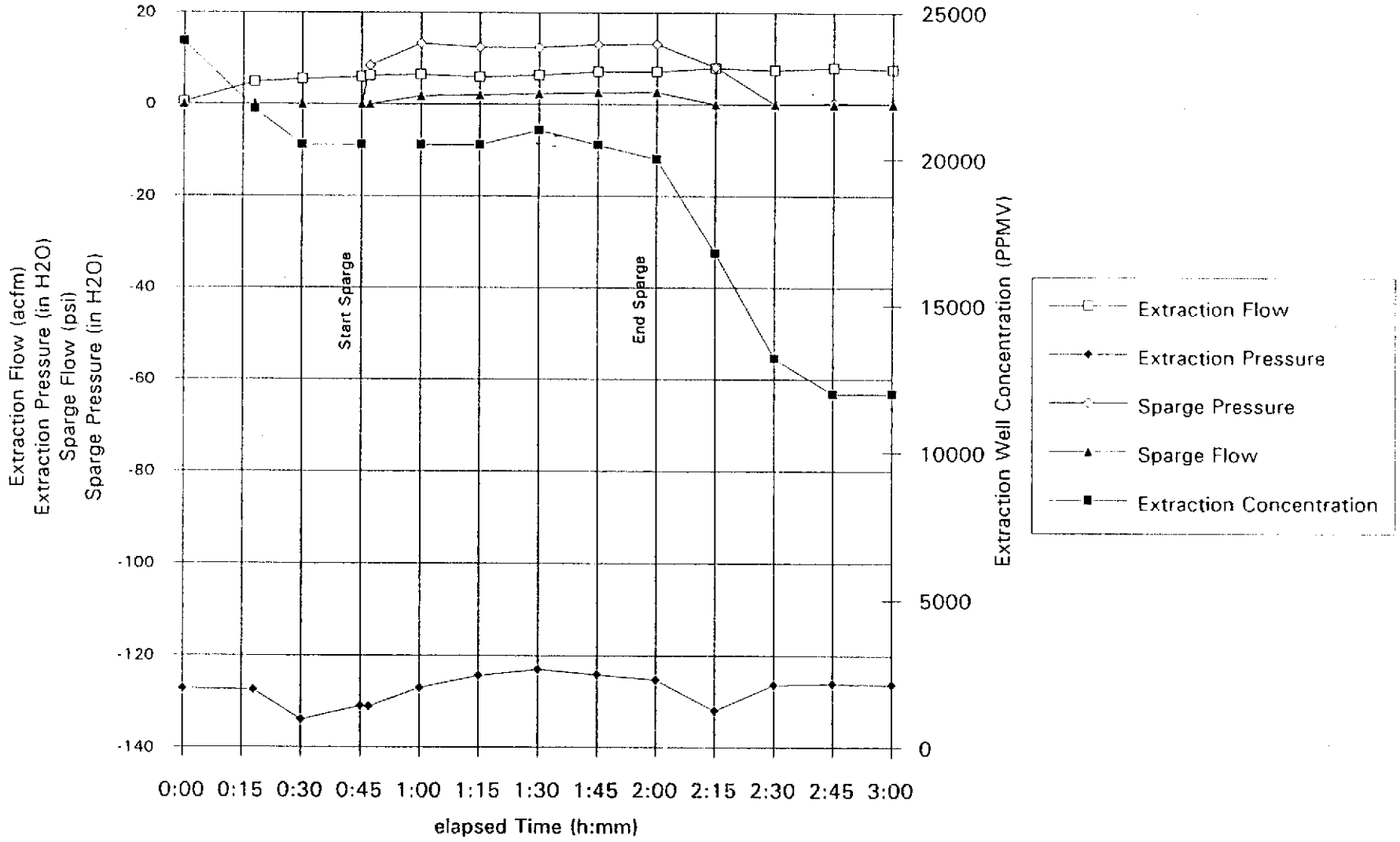


Plate 11

Vapor Extraction\Air Sparge Test 2
Extraction Well AV-1, Sparge Well AS-1



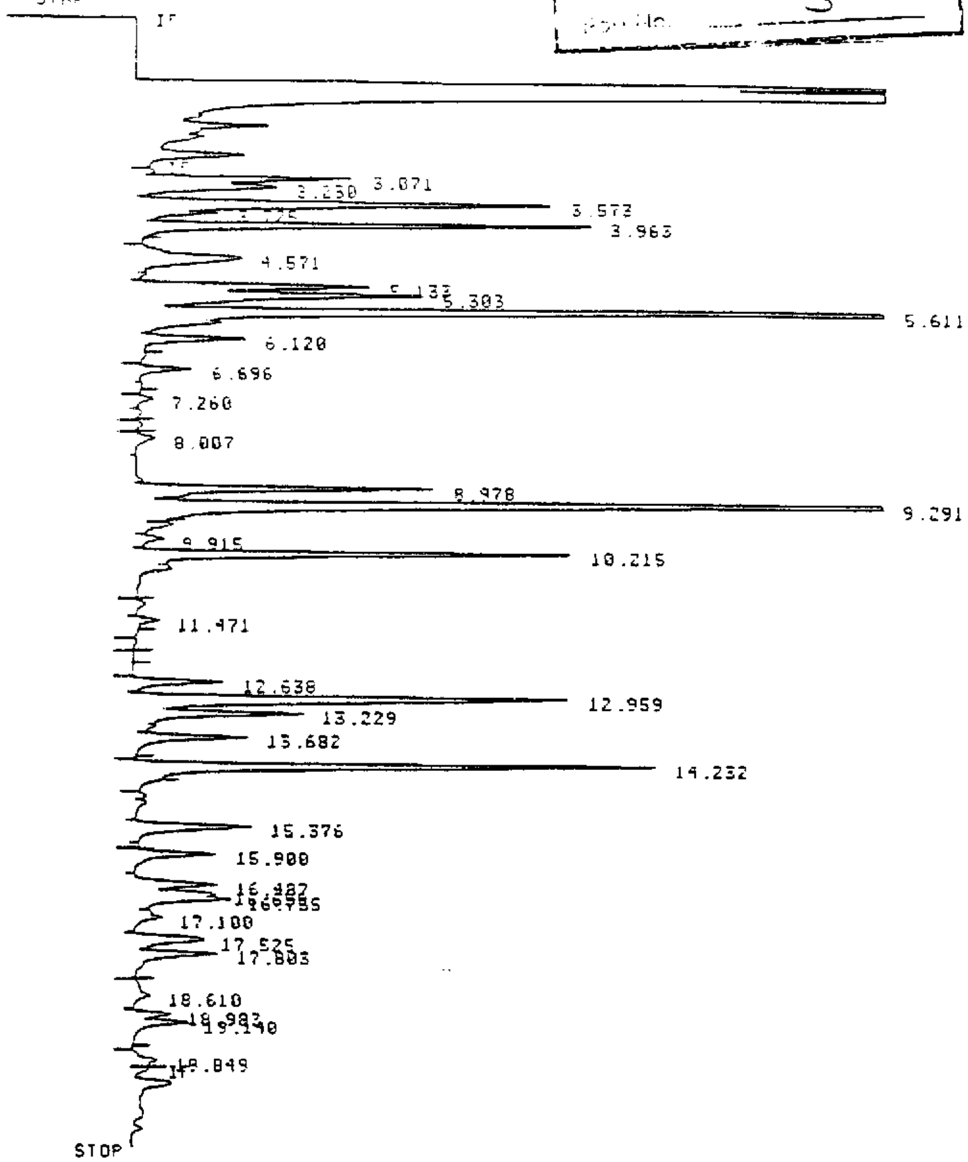
(5)

GSTD-E12532
GSTD080936
10 X
250 ppm
PF-10
3

RUN #29514-004

• RUN #29515 AUG 13, 1993 10:41:29

START



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RUN #29515-002

RUN# 29515 AUG 13, 1993 10:41:29

IDENTIFIER : GCHP-3 / FID
SIGNAL FILE: M:SIGNAL.BNC
AREA%

RT	AREA	TYPE	WIDTH	AREA%
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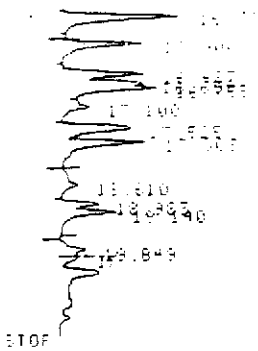
3.230	167256	VP	.129	2.13815
3.573	477266	PV	.121	6.10122
3.725	61375	VV	.084	.78460
3.963	415722	VB	.096	5.31446
4.571	215351	BV	.213	2.75298
5.133	255644	PV	.113	3.26808
5.303	400861	VV	.146	5.12449
5.611	1058012	VV	.099	13.52530
6.120	108099	VB	.108	1.38190
6.696	50863	BP	.096	.65047
7.260	15313	BP	.098	[illegible]



RUN #29515-002

RUN# 29515 AUG 13, 1993 10:41:29

IDENTIFIER : GCHP-3 / FID
SIGNAL FILE: M:SIGNAL.BNC
AREA%

RT	AREA	TYPE	WIDTH	AREA%
3.071	199176	VV	.099	2.54620
3.230	167256	VP	.129	2.13815
3.575	477266	PV	.121	6.10122
3.725	61375	VV	.084	.78460
3.963	415722	VB	.096	5.31446
4.571	215351	BV	.213	2.75298
5.153	255644	PV	.113	3.26808
5.393	400861	VV	.146	5.12449
5.611	1058012	VV	.099	13.52530
6.120	108099	VB	.108	1.38190
6.696	50883	BP	.096	.65047
7.260	15313	BP	.098	.19576
8.007	26829	BP	.130	.34297
8.978	285727	PV	.102	3.65265
9.291	1101511	VB	.104	14.08138
9.915	21964	PP	.100	.28078
10.215	417847	PV	.100	5.34163
11.471	22380	PB	.092	.28610
12.638	96099	BV	.106	1.22850
12.959	555731	VV	.132	7.10429
13.229	201172	VV	.120	2.57172
13.682	141067	VB	.126	1.80336
14.232	523396	PB	.106	6.69093
15.376	151055	PV	.132	1.93104
15.900	88889	PP	.112	1.13633
16.487	103809	PV	.126	1.32706
16.659	86135	VV	.105	1.10112
16.755	118258	VV	.124	1.51177
17.100	54242	VP	.104	.69341
17.525	117747	PV	.167	1.50524
17.803	115492	VB	.139	1.47641
18.610	36998	BP	.205	.47297
18.983	42200	PV	.106	.53947
19.140	73569	VB	.133	.94048
19.849	15390	PB	.092	.19674

TOTAL AREA=7822464
MUL FACTOR=1.0000E+00

$CF = \frac{7822 - 004}{2500} = 2.97$

$\%D = 11$

RUN #29515-003

G61E081373 —
methyl BIE —

File ID 29526-005-01A
Client ID INF-1
Vol. Inj. 100
Dil./Conc.
Detector FID
Port No. 4

Run #29526-004

17

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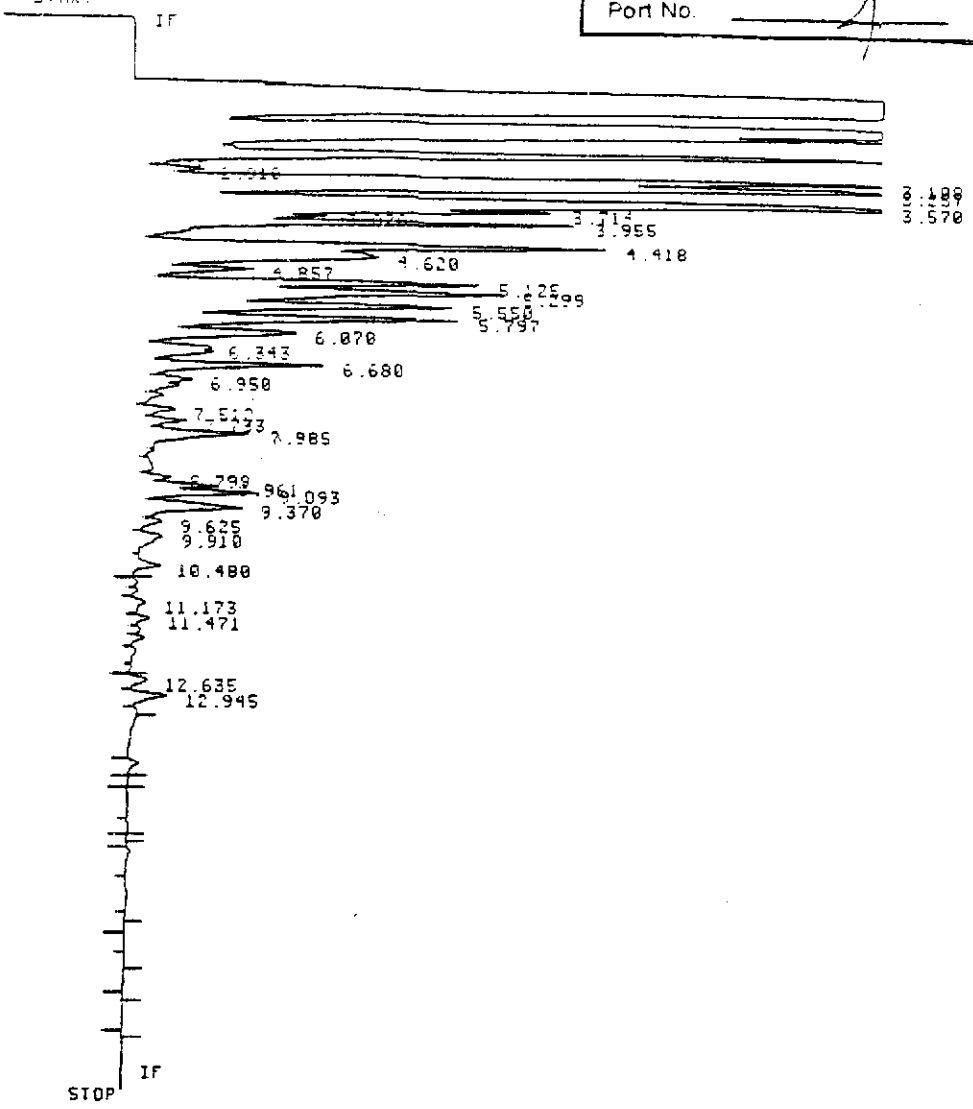

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Run #29527-002

Run #29527 AUG 13, 1993 17:23:40

IDENTIFIER 1: GCHP-2 , FID
SIGNAL FILE: M:SIGNAL.BHC
AREA%

PT	AREA	TYPE	WIDTH	AREA%
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3.257	948300	VV	.124	11.28279
3.570	1348516	VV	.166	16.01607
3.714	338127	VV	.083	4.01587
3.828	134698	VV	.091	1.59979
3.955	422256	VV	.104	5.01596
4.418	578698	PV	.131	6.87309
4.620	423599	VV	.191	5.03101
4.857	115382	VV	.113	1.37057
5.125	385753	VV	.120	4.58157

RUN #29527-002

RUN# 29527   AUG 13, 1993 17:23:40

IDENTIFIER : GCMP-3   FID
SIGNAL FILE: A:SIGNAL.BNC
AREA%

RT	AREA	TYPE	WIDTH	AREA%
2.910	31637	BV	.081	.37646
3.108	834605	VV	.112	9.91245
3.257	948500	VV	.124	11.26274
3.570	1348516	VV	.166	16.01607
3.714	338127	VV	.088	4.01587
3.828	134698	VV	.081	1.59978
3.955	422256	VV	.104	5.01506
4.416	578698	PV	.151	6.87309
4.620	423599	VV	.191	5.03101
4.957	115382	VV	.113	1.37037
5.125	385753	VV	.120	4.58152
5.299	542905	VV	.158	6.44798
5.550	403111	VV	.136	4.78768
5.797	410845	VV	.135	4.87955
6.070	231235	VV	.156	2.74634
6.343	63023	VV	.097	.74851
6.680	206596	VV	.118	2.45370
6.950	57394	VV	.118	.68166
7.512	38225	PV	.112	.45399
7.733	52416	VV	.117	.62254
7.985	170709	VV	.160	2.02748
8.799	32977	VV	.102	.39166
8.961	81316	VV	.102	.96578
9.093	132841	VV	.112	1.57773
9.370	168760	VV	.164	2.00433
9.625	38270	VV	.147	.45453
9.910	55273	VV	.203	.65647
10.480	40986	VB	.153	.48678
11.173	27583	PV	.174	.32760
11.471	25858	VV	.127	.30711
12.635	26263	BP	.139	.31192
12.945	51547	PP	.140	.61221

TOTAL AREA=8.4198E+06
MUL FACTOR=1.0000E+00

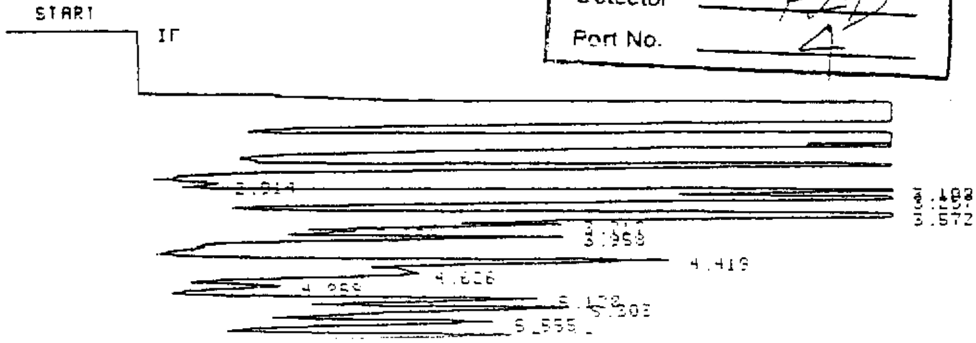
$$\frac{8420 - 404}{(.1)(2.97)} = 27{,}000$$ ug/L

File ID	Air 9308-695-02A
Client ID	ZHC
Vol. Inj.	800
Dil./Conc.	1
Detector	FID
Port No.	4

(B)

RUN #29527-003

* RUN #29528   AUG 13, 1993 17:52:17
START



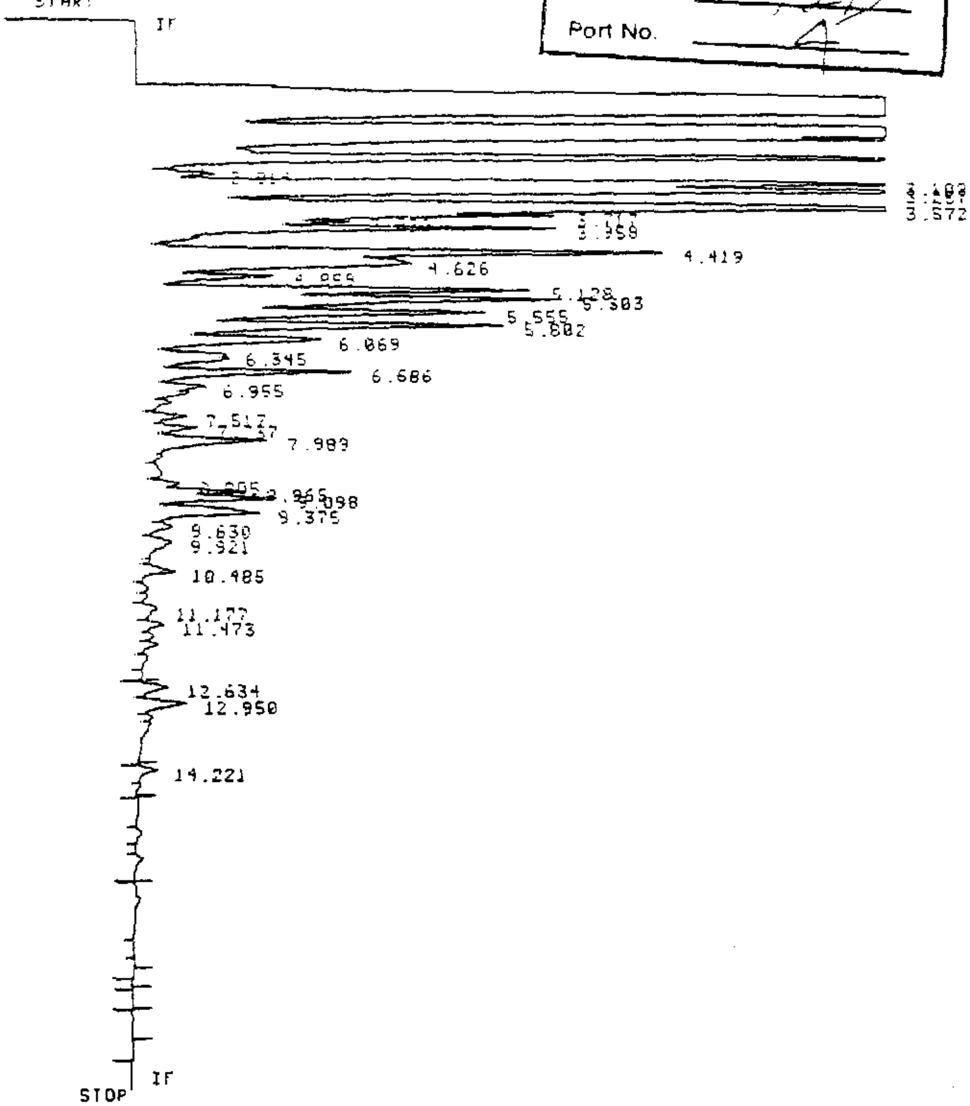
RUN #29527-003

(18)

File ID	CL-... -02A
Client ID	
Vol. Inj.	200
Dil./Conc.	1
Detector	FID
Port No.	4

* RUN #29528 AUG 13, 1993 17:52:17

START



Closing signal file M:SIGNAL .BNC

RUN #29528-002

RUN# 29528 AUG 13, 1993 17:52:17

IDENTIFIER : GCHP-3 / FID
SIGNAL FILE: M:SIGNAL.BNC
AREA%

RT	AREA	TYPE	WIDTH	AREA%
2.914	37799	BV	.081	.40858
3.108	898927	VV	.113	9.71685
3.257	998945	VV	.123	10.79796
3.572	1462266	VV	.168	15.80620
3.717	327051	VV	.085	3.53522
3.830	155947	VV	.084	1.68569
3.958	393606	VV	.102	4.25464
4.419	643824	PV	.132	6.95934
4.626	479223	VV	.193	5.18011
4.859	131324	VV	.114	1.41953
5.128	439599	VV	.121	4.75169
5.303	620950	VV	.157	6.70560

ARCO Products Company
Division of AtlanticRichfieldCompany

Task Order No. 5387-93-2 AND 2S

Chain of Custody

ARCO Facility no. 5387	City (Facility) HAYWARD	Project manager (Consultant) JOEL COFFMAN	Laboratory name SEQUOIA
ARCO engineer Mike Whelan	Telephone no. (ARCO)	Telephone no. (Consultant) (510) 783 7500	Fax no. (Consultant) (510) 783 1089
Consultant name GETTLER-RYAN INC	Address (Consultant) 2150 W. WINTON AVE HAYWARD, CA 94545		Contract number 07-073

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Matrix: Water	Matrix: Other	Preservation: Ice	Preservation: Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH EPA M602/8020/8015	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals ☐ VOA ☐ Semi VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org./DHS ☐ Lead EPA 7420/7421 ☐		
INF1		1			X			8-13-93	0805		X				9308635-01A							
INF2		2			X			8-13-93	1005		X						↓	-02A				

Method of shipment

Special detection Limit/reporting

Special QA/QC

Remarks
GR# 9926

Lab number

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

Condition of sample:

Temperature received:

Relinquished by sampler: Barry E. McCoy	Date 8-13-93	Time 1318	Received by
Relinquished by	Date	Time	Received by
Relinquished by	Date	Time	Received by laboratory: [signature] Date 8/13/93 Time 13:18

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

Plate 12

Vapor Extraction\Air Sparge Test 2
Extraction Well AV-1, Sparge Well AS-1
Responding Wells AR-1, AS-1, MW-1, MW-3

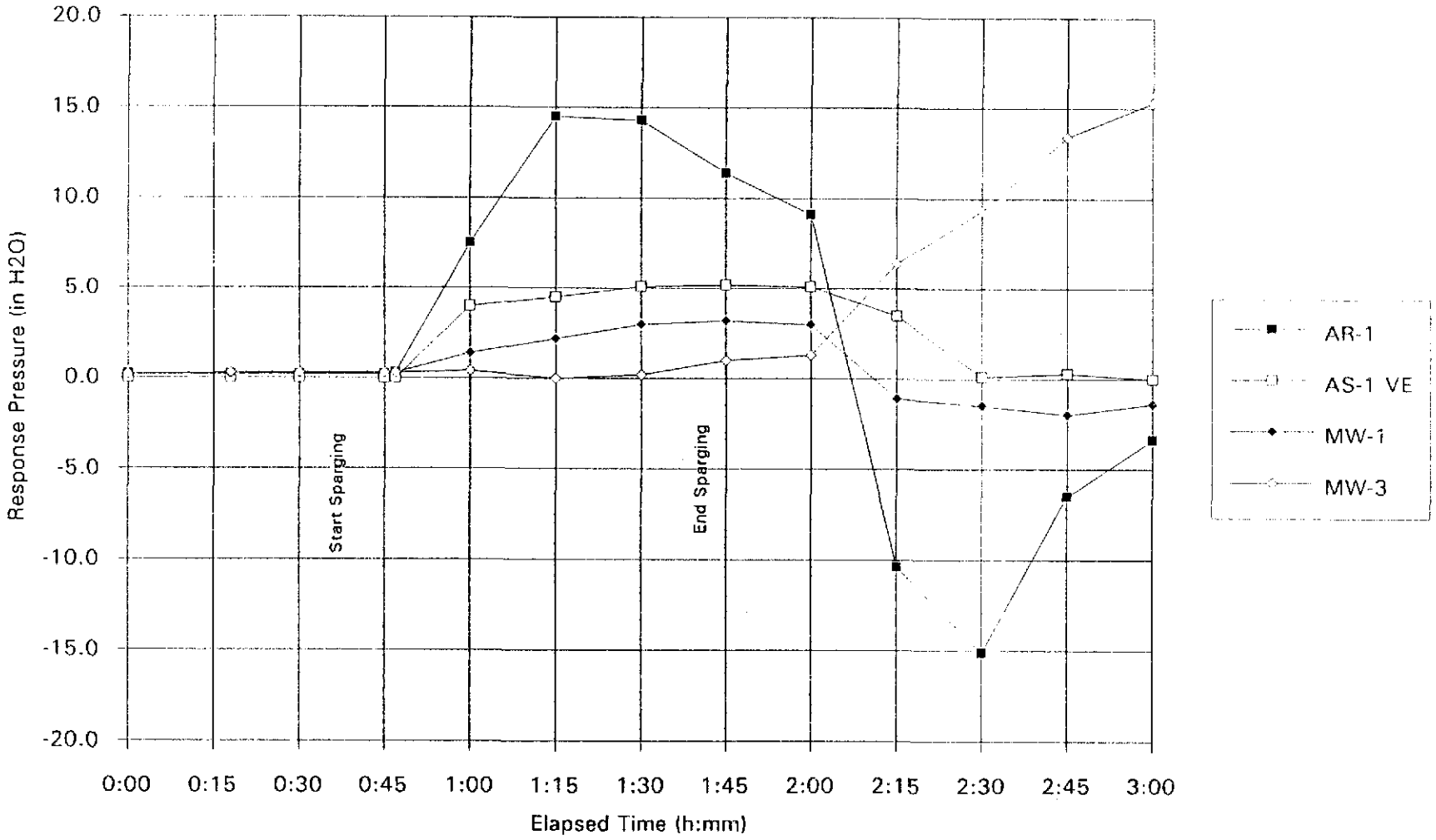


Plate 13

Vapor Extraction\Air Sparge Test 3
Extraction Well AR-1, Sparge Well AS-2
Extraction Pressure = 54 to 56 in. H2O

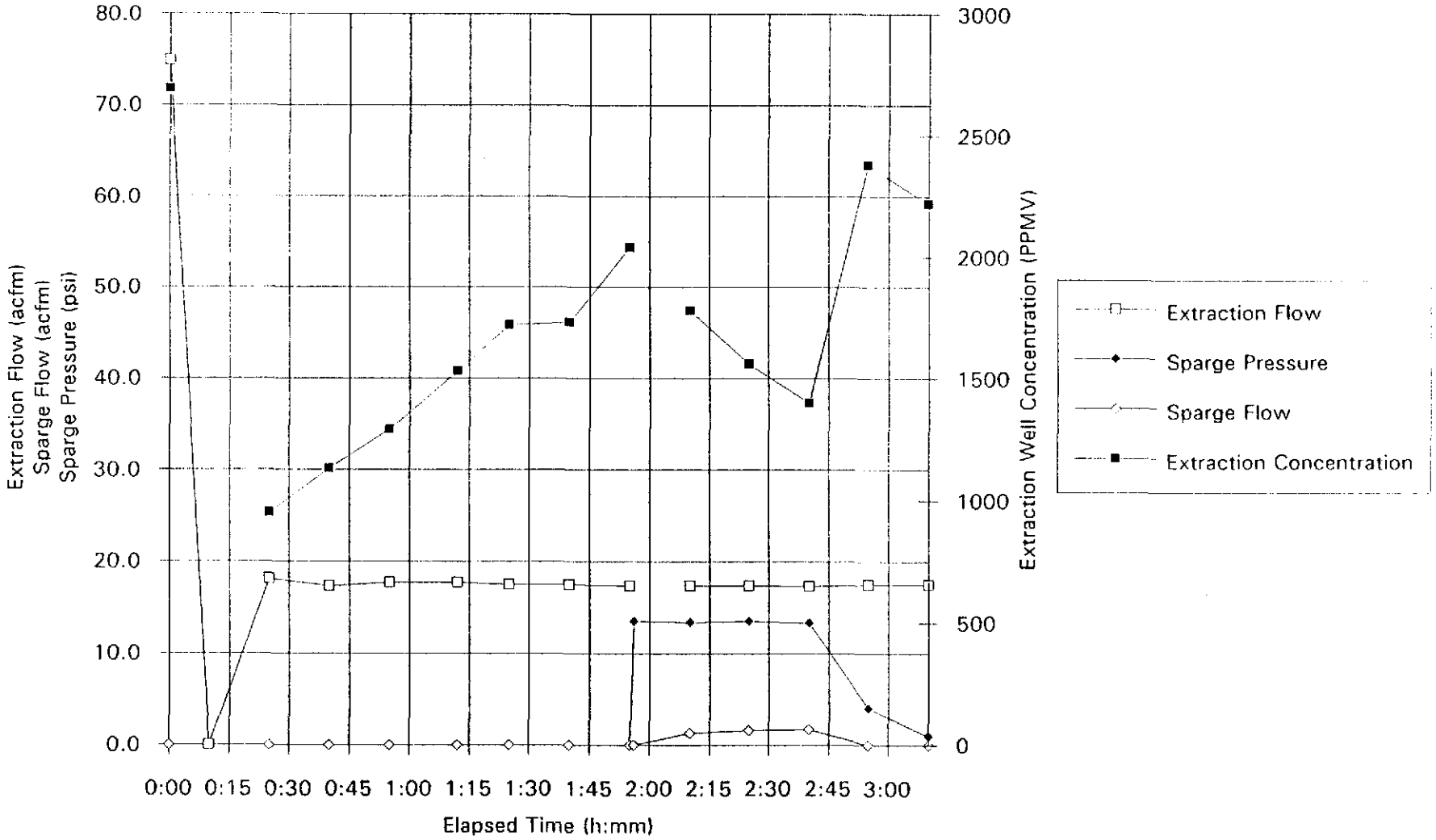


Plate 14

Vapor Extraction\Air Sparge Test 3
Extraction Well AR-1, Sparge Well AS-2
Responding Wells AR-2, AS-1 VE, MW-2

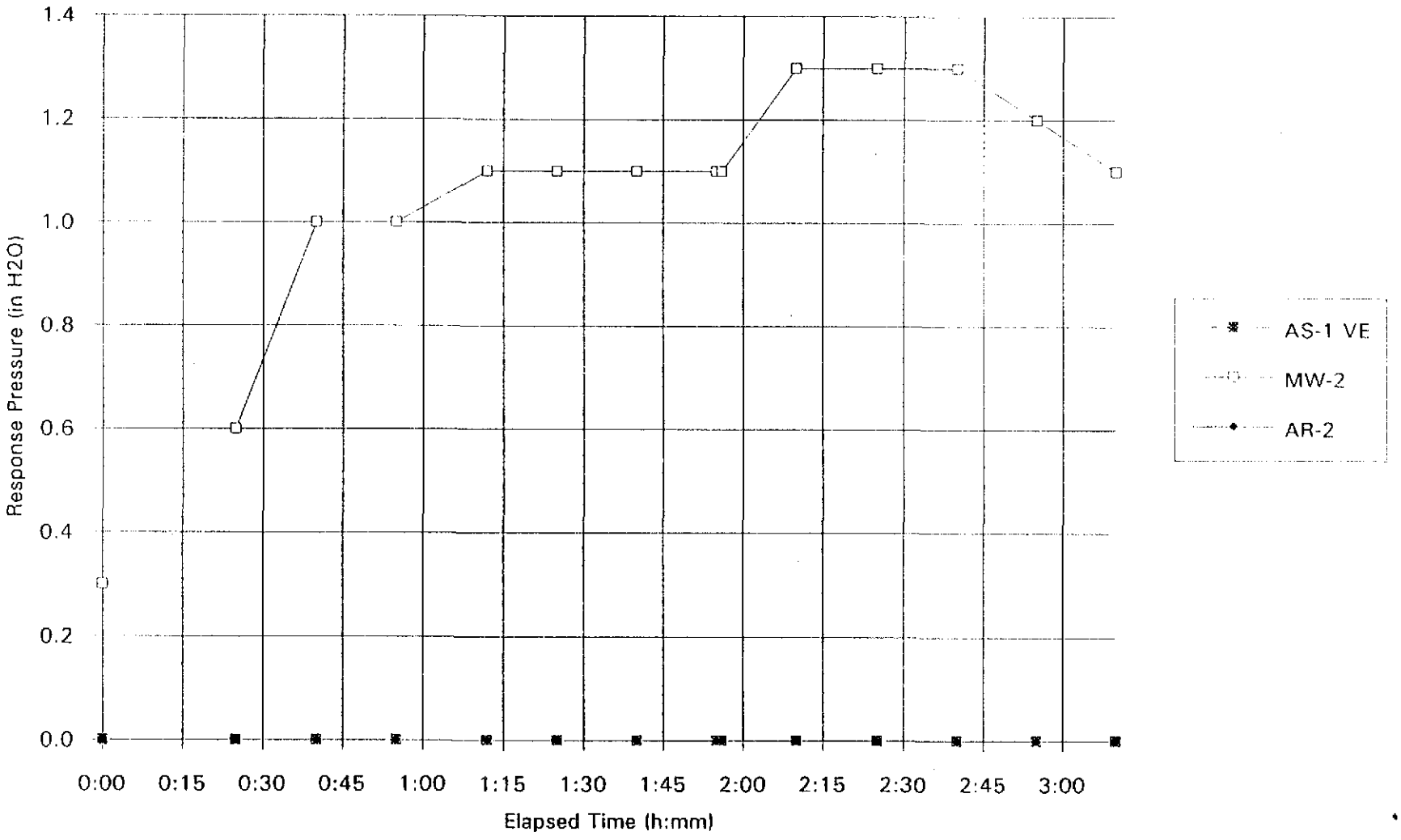


Plate 15

Vapor Extraction Test 4
Extraction Well AR-2

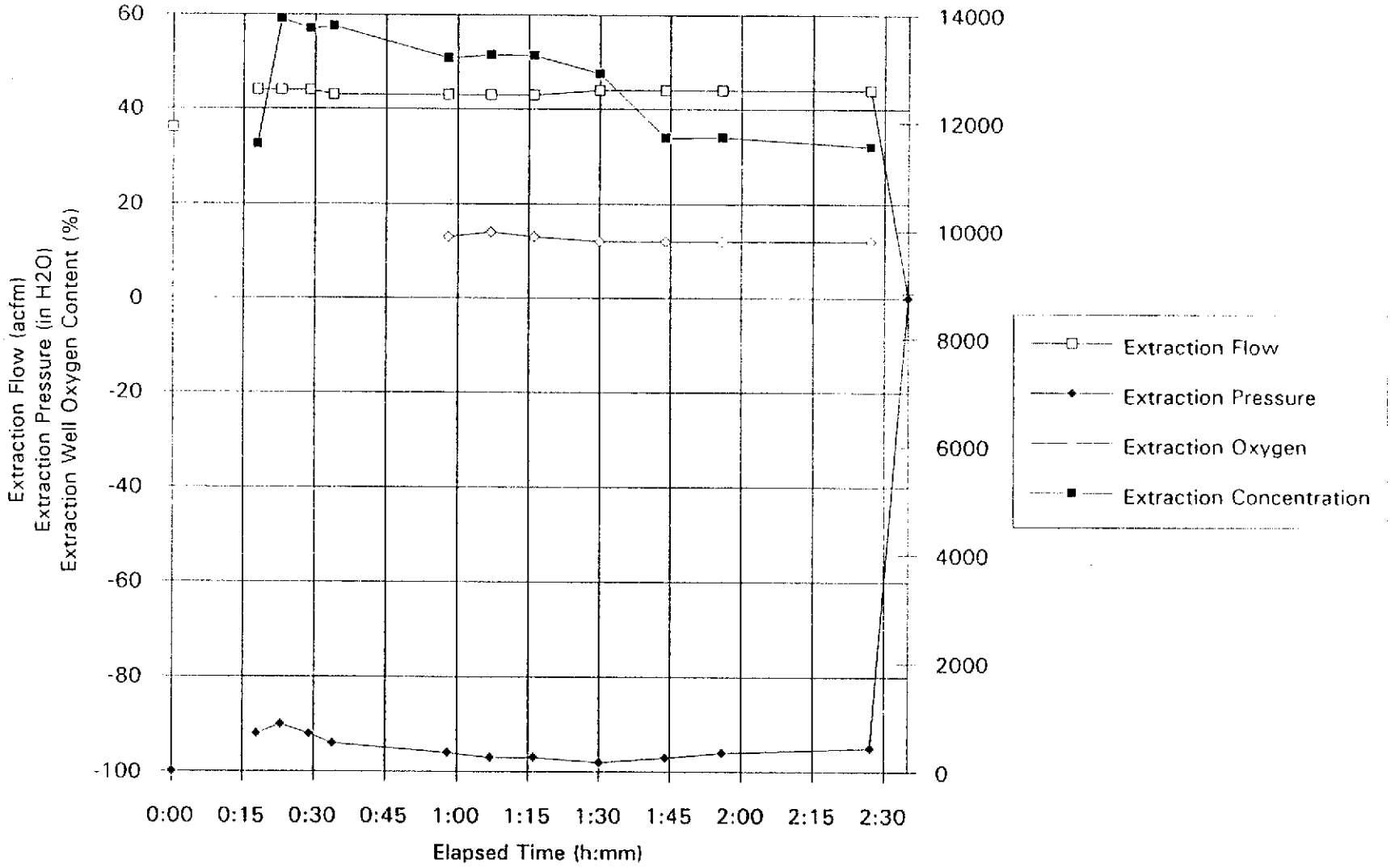


Plate 16

Vapor Extraction Test 4
Extraction Well AR-2
Responding Wells MW-2, AS-1, A-5, A-7, A-9, AR-1 estimated

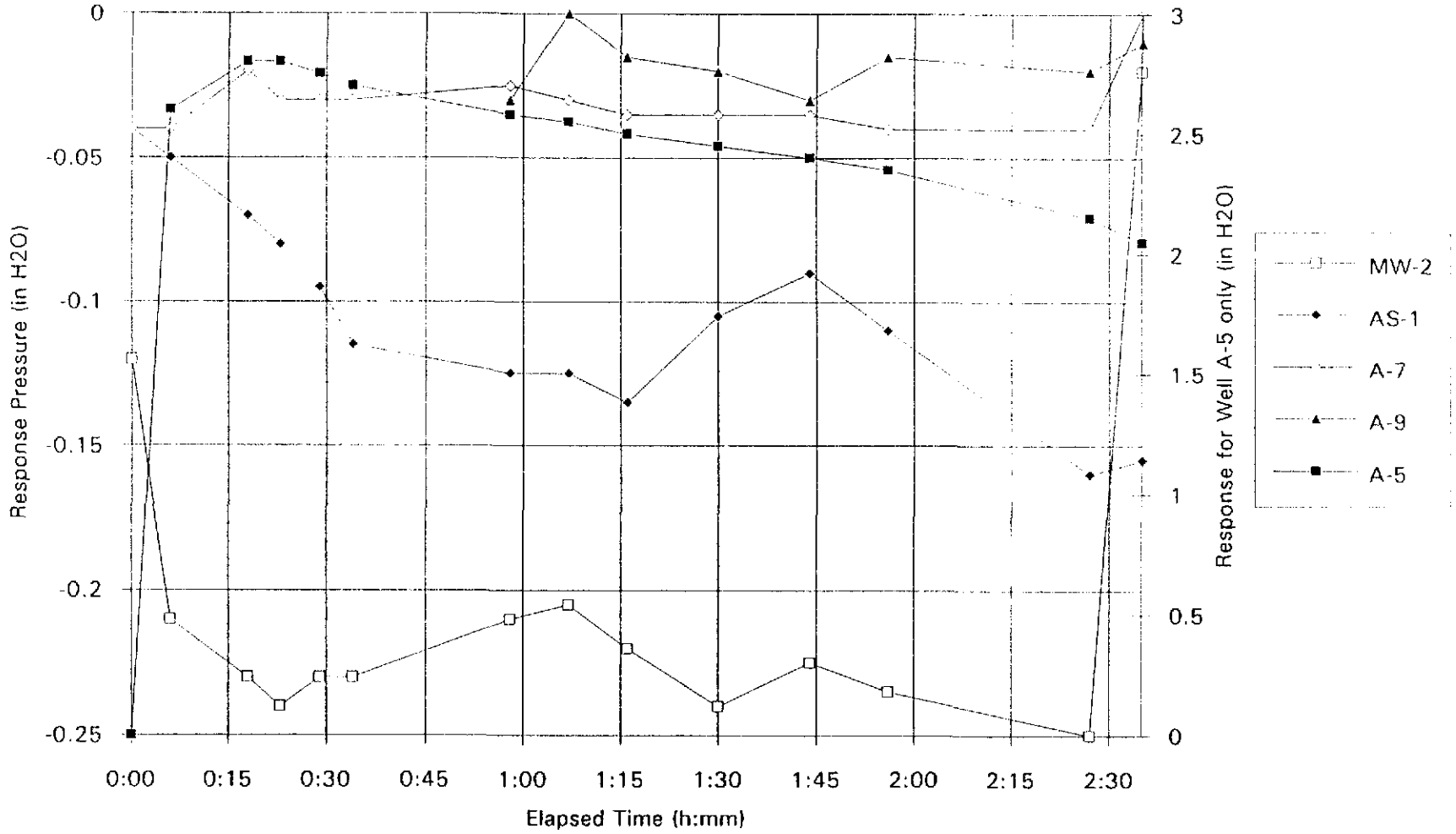
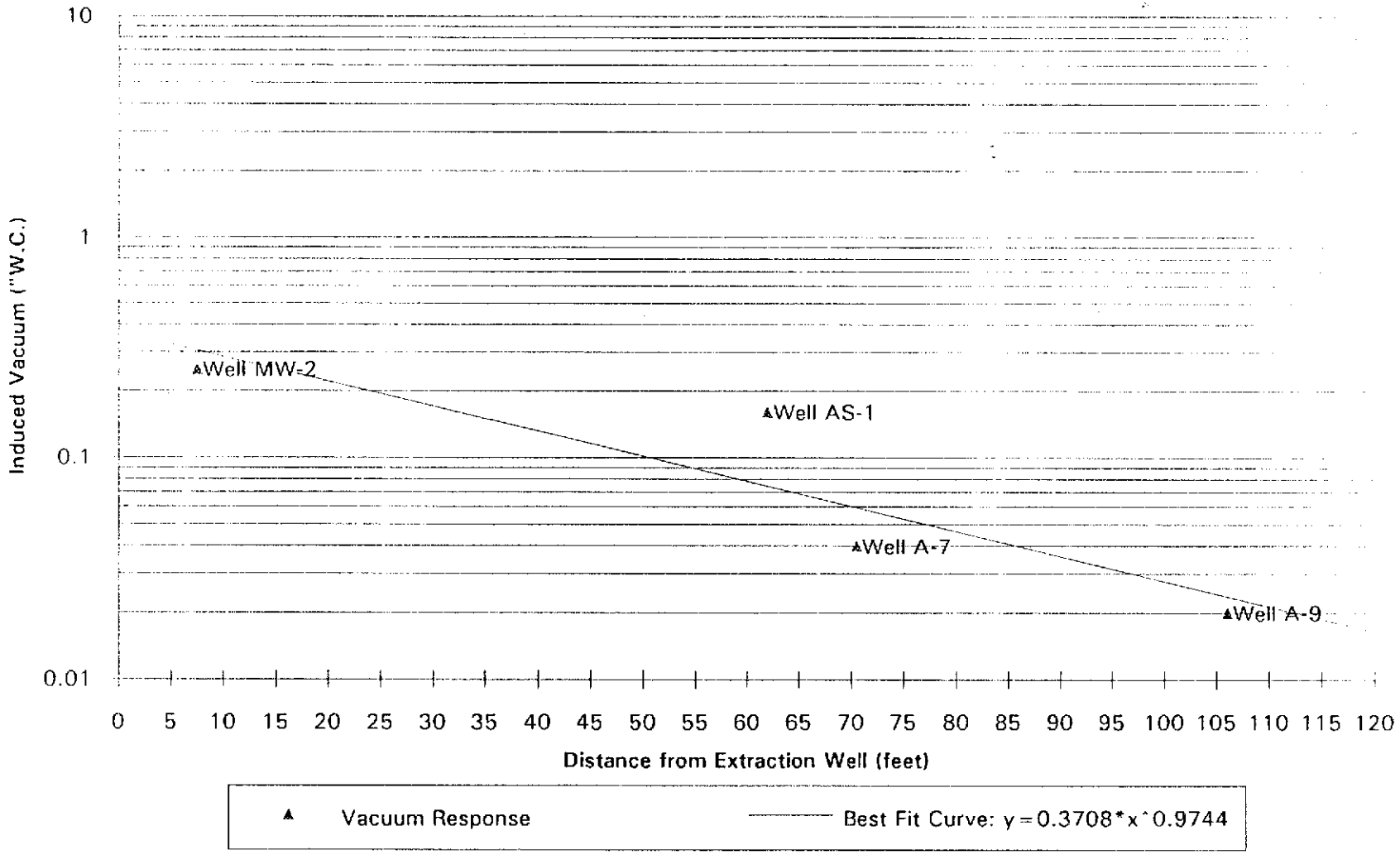
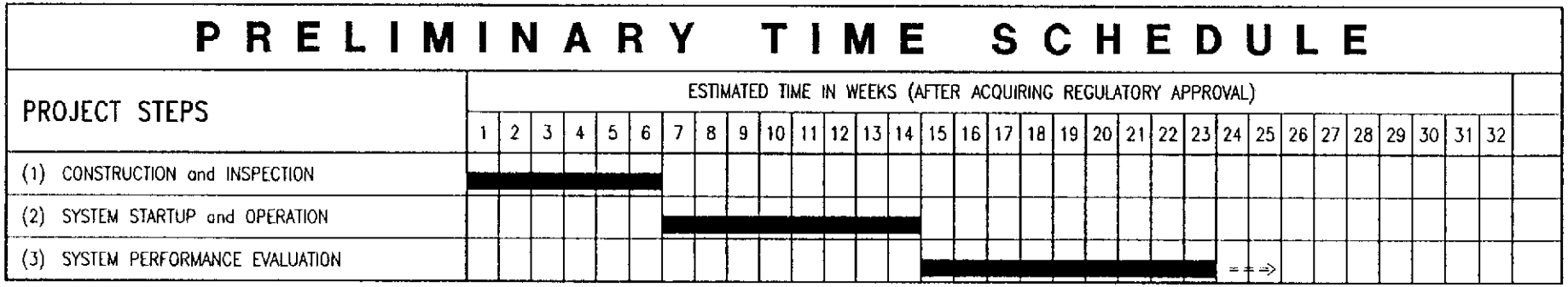


Plate 17

Radius of Influence - Extraction Well AR-2
Vapor Extraction Test 4, August 13, 1993
ARCO Station 5387, San Lorenzo, CA



PRELIMINARY TIME SCHEDULE



NOTES:
1. IF ARCO HAS NOT RECEIVED REGULARORY APPROVAL OF THIS WORK PLAN WITHIN 60 DAYS, THEY WILL PROCEED AS STATED IN TITLE 23, ARTICLE 11, CHAPTER 16, SECTIONS 2722 (b)(5) AND 2726 (c).

LEGEND

ESTIMATED SCHEDULE

GeoStrategies Inc.

PRELIMINARY TIME SCHEDULE
ARCO Service Station #5387
20200 Hesperian Boulevard
Hayward, California

PLATE 18

JOB NUMBER	REVIEWED BY	DATE	REVISED DATE
792608-11		12/93	

ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

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

DRILLING PERMIT APPLICATION

FOR APPLICANT TO COMPLETE

LOCATION OF PROJECT 20200 Hesperian Blvd. San Lorenzo

CLIENT
Name ARCO Products Company
Address PO Box 5811 Phone (415) 571-2449
City San Mateo Zip 94402

APPLICANT
Name GeoStrategies Inc.
Address 2140 W. Winton Ave Phone (510) 552-4800
City Hayward Zip 94545

TYPE OF PROJECT

Well Construction		Geotechnical Investigation	
Cathodic Protection	___	General	___
Water Supply	___	Contamination	___
Monitoring	X	Well Destruction	___

PROPOSED WATER SUPPLY WELL USE
Domestic ___ Industrial ___ Other Continuing Site investigation
Municipal ___ Irrigation ___

DRILLING METHOD:
Mud Rotary ___ Air Rotary ___ Auger Hollow Stem
Cable ___ Other ___

DRILLER'S LICENSE NO. 720793

WELL PROJECTS
Drill Hole Diameter 8/12 in. Maximum
Casing Diameter 6/4/2 in. Depth 35 ft.
Surface Seal Depth 5 ft. Number 3-5

GEOTECHNICAL PROJECTS
Number of Borings ___ Maximum
Hole Diameter ___ in. Depth ___ ft.

ESTIMATED STARTING DATE March 16, 1993
ESTIMATED COMPLETION DATE March 17, 1993

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

APPLICANT'S SIGNATURE Clint Ammatz for GeoStrategies Inc Date Mar 10 '93

FOR OFFICE USE

PERMIT NUMBER 93116
LOCATION NUMBER ___

PERMIT CONDITIONS

Circled Permit Requirements Apply

(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.

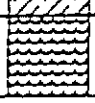
C. GEOTECHNICAL. Backfill bore hole with compacted cuttings or heavy bentonite and upper two feet with compacted material. In areas of known or suspected contamination, tremied cement grout shall be used in place of compacted cuttings.

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

E. WELL DESTRUCTION. See attached.

Approved Wyman Hong Date 10 Mar 93
Wyman Hong

51991

MAJOR DIVISIONS					TYPICAL NAMES
COARSE-GRAINED SOILS MORE THAN HALF IS COARSER THAN NO. 200 SIEVE	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE SIZE	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW		WELL GRADED GRAVELS WITH OR WITHOUT SAND, LITTLE OR NO FINES
			GP		POORLY GRADED GRAVELS WITH OR WITHOUT SAND, LITTLE OR NO FINES
		GRAVELS WITH OVER 15% FINES	GM		SILTY GRAVELS SILTY GRAVELS WITH SAND
			GC		CLAYEY GRAVELS, CLAYEY GRAVELS WITH SAND
	SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE SIZE	CLEAN SANDS WITH LITTLE OR NO FINES	SW		WELL GRADED SANDS WITH OR WITHOUT GRAVEL, LITTLE OR NO FINES
			SP		POORLY GRADED SANDS WITH OR WITHOUT GRAVEL, LITTLE OR NO FINES
		SANDS WITH OVER 15% FINES	SM		SILTY SANDS WITH OR WITHOUT GRAVEL
			SC		CLAYEY SANDS WITH OR WITHOUT GRAVEL
FINE-GRAINED SOILS MORE THAN HALF IS FINER THAN NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT 50% OR LESS		ML		INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTS WITH SANDS AND GRAVELS
			CL		INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY CLAYS WITH SANDS AND GRAVELS, LEAN CLAYS
			OL		ORGANIC SILTS OR CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50%		MH		INORGANIC SILTS, MICACEOUS OR DIATOMACIOUS, FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH		INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH		ORGANIC SILTS OR CLAYS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS			PT		PEAT AND OTHER HIGHLY ORGANIC SOILS

LL	- Liquid Limit (%)
PI	- Plastic Index (%)
PID	- Volatile Vapors in ppm
MA	- Particle Size Analysis
2.5 YR 6/2	- Soil Color according to Munsell Soil Color Charts (1975 Edition)
5 GY 5/2	- GSA Rock Color Chart

☒	- No Soil Sample Recovered
■	- "Undisturbed" Sample
⊠	- Bulk or Classification Sample
▽	- First Encountered Ground Water Level
▼	- Piezometric Ground Water Level
Penetration	- Sample drive hammer weight - 140 pounds falling 30 inches. Blows required to drive sampler 1 foot are indicated on the logs

GeoStrategies Inc.

Unified Soil Classification - ASTM D 2488-85
and Key to Test Data

Field location of boring: (See Plate 2)	Project No: 792608	Date: 3/16/93	Boring No: AR-2
	Client: ARCO Products Company SS#5387		
	Location: 20200 Hesperian Boulevard		
	City: San Lorenzo		Sheet: 1 of 2
	Logged by: RCM	Driller: W. Hazmat	
Drilling method: Holiow Stem Auger	Casing installation data		
Hole diameter: 12 inches	Top of Box Elevation: 38.39		Datum: MSL

								Water Level	13.5'	14.9	
								Time	14:35	16:48	
								Date	3/16/93	3/16/93	
FID (ppm)	Blows/ft * or Pressure (psi)	Type of Sample	Sample Number	Depth (ft)	Sample	Well Detail	Soil Group Symbol (USCS)	Description			
								PAVEMENT SECTION - 0.5 ft.			
				1				SILTY CLAY (CL/ML) - black (10YR 2/1); medium stiff, damp, medium plasticity; 55% clay, 45% silt.			
				2							
				3				SILT (ML) - dark brown (10YR 4/3); medium stiff, damp, medium plasticity; 70% silt, 15% clay, 15% fine sand.			
		S&H		4							
			AR-2					Color change to dark olive gray (5Y 3/2) at 3.5 ft.1 1-inch *medium sand lens at 4.0 ft*			
0	36		5.0	5							
				6							
				7							
				8							
		S&H		9				Greenish gray (5G 4/1); discoloration in rootholes, moist at 8.5 ft.			
			AR-2								
62	10		10.0	10							
				11							
				12							
				13							
		S&H		14		▽		Saturated at 13.5 ft.			
			AR-2								
1167	18		15.0	15							
				16							
				17							
				18							
		S&H		19				Color change to yellowish brown (10YR 5/6) with greenish gray (5G 4/1); discoloration at 18.5 ft, decrease in sand to 5%.			
			AR-2								
121	10		20.0	20							

Remarks: * Converted to equivalent standard penetration blows/ft.

GSI GeoStrategies Inc.

Log of Boring

BORING NO: AR-2

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
792608		3/93		

Field location of boring: (See Plate 2)	Project No: 792608	Date: 3/16/93	Boring No: AR-2
	Client: ARCO Products Company SS#5387		
	Location: 20200 Hesperian Boulevard		
	City: San Lorenzo		Sheet: 2 of 2
	Logged by: RCM	Driller: W. Hazmat	
	Casing installation date:		
Drilling method: Hollow Stem Auger			
Hole diameter: 12 inches	Top of Box Elevation:	Datum:	

Water Level:
Time:
Date:

PID (ppm)	Blows/ft.* or Pressure (psi)	Type of Sample	Sample Number	Depth (ft.)	Sample	Well Detail	Soil Group Symbol (USCS)	Description
				21				
				22				
				23				
		S&H		24				
107	19		AR-2					SILTY SAND (SM) - dark yellowish brown (10YR 4/4);
			25.0	25				medium dense, saturated; 75% fine sand, 25% silt.
				26				
				27				Lens of fine to coarse sand at 28.5 ft.
				28				
		S&H		29				SILT (ML) - olive brown (2.5Y 4/4); very stiff, very moist,
			AR-2					medium plasticity; 70% silt, 25% clay, 5% fine sand
83	29		30.0	30				
				31				
				32				
				33				SILTY SAND (SM) - olive brown (2.5 Y 4/4); medium
		S&H		34				dense, very moist; 65% fine to coarse sand, 30% silt, 5%
			AR-2					clay.
51	25		35.0	35				
				36				
								Bottom of boring at 35.0 ft.
				37				3/16/93
				38				
				39				
				40				

Remarks: * Converted to equivalent standard penetration blows/ft.

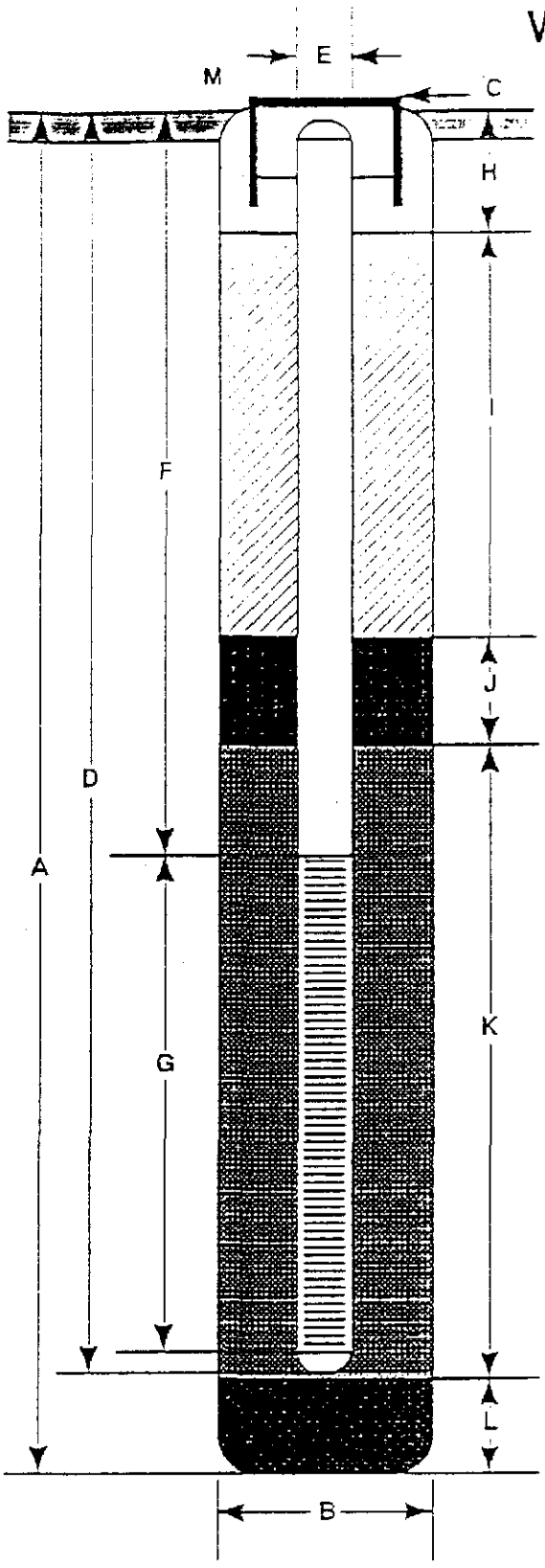
GSI GeoStrategies Inc.

Log of Boring

BORING NO. AR-2

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
792608		3/93		

WELL CONSTRUCTION DETAIL



A Total Depth of Boring 35.0 ft.

B Diameter of Boring 12 in.
Drilling Method Hollow Stem Auger

C Top of Box Elevation 38.39 ft.
[x] Referenced to Mean Sea Level
[ ] Referenced to Project Datum

D Casing Length 35.0 ft.
Material Sch. 40 PVC, Stls. Stl., Cbn Stl.

E Casing Diameter 6 in.

F Depth to Top Perforations 5.0 ft.

G Perforated Length 30.0 ft.
Perforated Interval from 5.0 to 35.0 ft.
Perforation Type Continuous Wrap
Perforation Size 0.020 in.

H Surface Seal from 0 to 1.0 ft.
Seal Material Concrete

I Backfill from 1.0 to 4.0 ft.
Backfill Material Neat Cement

J Seal from 4.0 to 4.5 ft.
Seal Material Bentonite

K Gravel Pack from 4.5 to 35.0 ft.
Pack Material Lonestar #2/12 Graded Sand

L Bottom Seal ft.
Seal Material

M Waterproof vault box with locking cap and lock.

Note: Depths measured from initial ground surface.

GeoStrategies Inc.

Well Construction Detail

WELL NO
AR-2

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
792608		3/93		

Field location of boring: (See Plate 2)	Project No: 792608	Date: 3/16/93	Boring No: AS-1
	Client: ARCO Product Company SS#5387		
	Location: 20200 Hesperian Boulevard		
	City: San Lorenzo		Sheet: 1 of 2
	Logged by: RCM	Driller: W. Hazmat	
	Casing installation date:		
Drilling method: Hollow Stem Auger			
Hole diameter: 12 inches	Top of Box Elevation:	Datum: MSL	
	Water Level: 12.0		
	Time: 9:18		
	Date: 3/16/93		

PID (ppm)	Blows/ft.* or Pressure (psi)	Type of Sample	Sample Number	Depth (ft.)	Sample	Well Detail	Soil Group Symbol (USCS)	Description
								PAVEMENT SECTION - 0.25 ft.
				1				
								SILTY CLAY (CL) - very dark gray (10YR 3/1); medium stiff, damp, medium plasticity; 60% clay, 40% silt.
				2				
				3				
		S&H		4				SILT (ML) - very dark brown (10YR 2/2); very stiff, damp, medium plasticity; 80% silt, 20% clay, trace fine sand.
			AS-1					
9	25		5.0	5				
				6				Color change to dark olive gray (10YR 3/2) at 4.5 ft.
				7				
				8				
		S&H		9				Color change to olive gray (5Y 4/2), moist, stiff at 8.5 ft.
			AS-1					
98	13		10.0	10				
				11				
				12		▽		
				13				
		S&H		14				Color change to dark greenish gray (5BG 4/1), saturated at 13.5 ft.
			AS-1					
440	17		15.0	15				
				16				
				17				
				18				
		S&H		19				Color change to olive (5Y 4/3), very stiff, decrease clay to 5%, increase in fine sand to 15%, greenish gray (5GY 4/1); discoloration in rootholes at 18.5 ft.
			AS-1					
15	19		20.0	20				

Remarks: * Converted to equivalent standard penetration blows/ft.

GeoStrategies Inc.

Log of Boring

BORING NO. AS-1

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
792608		3/93		

Field location of boring: (See Plate 2)

Project No.	792608	Date	3/16/93
Client:	ARCO Products Company SS#5387		
Location:	20200 Hesperian Boulevard		
City:	San Lorenzo		
Logged by:	RCM	Driller:	W. Hazmat

Boring No. AS-1

Sheet 2 of 2

Casing installation date:

Drilling method: Hollow Stem Auger

Hole diameter: 12 inches

Top of Box Elevation: Datum:

Water Level:
Time:
Date:

PID (ppm)	Blows/ft * or Pressure (psi)	Type of Sample	Sample Number	Depth (ft.)	Sample	Well Detail	Soil Group Symbol (USCS)	Description
				21				
				22				
				23				
		S&H		24				Color change to dark yellowish brown (10YR 4/4);
14	19		AS-1					decrease fine sand to a trace, increase clay to 20%;
			25.0	25				moist, black (10YR 2/1); mottling at 23.5 ft.
				26				
				27				
				28				
		S&H		29				SILTY SAND (SM) - olive brown (2.5Y 4/4); medium
			AS-1					dense, saturated; 55% fine sand, 40% silt, 5% clay.
11	24		30.0	30				
				31				
				32				
				33				Medium coarse sand at 33.5 ft.
		S&H		34				
			AS-1					
6	27		35.0	35				
				36				Bottom of boring at 35.0 ft.
				37				3/16/93
				38				
				39				
				40				

Remarks:

GSI GeoStrategies Inc.

Log of Boring

BORING NO. AS-1

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
792608		3/93		

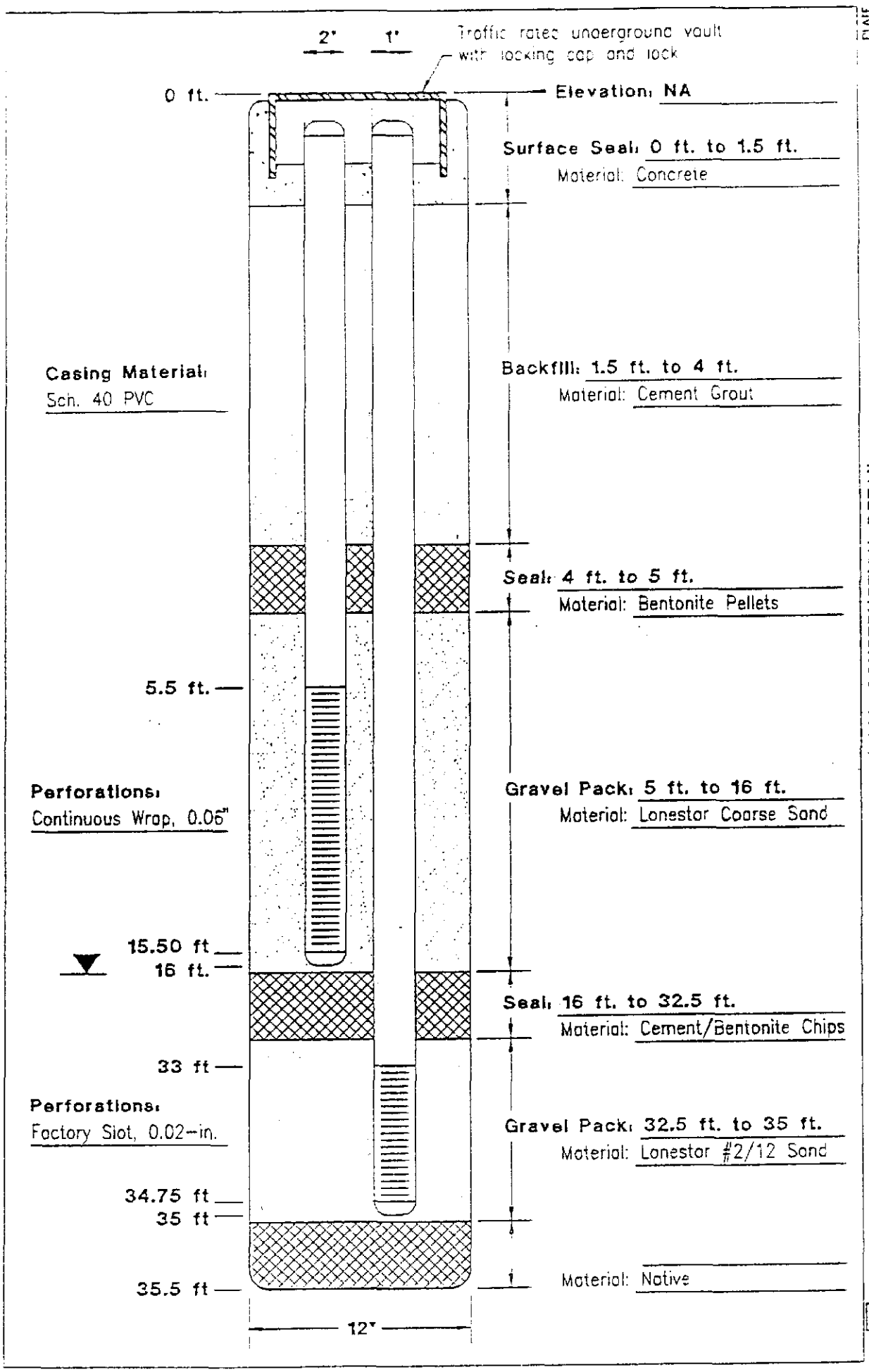


FIGURE AS-1

WELL CONSTRUCTION DETAIL
Dual Completion Air sparge/Vapor Extraction

GeoStrategies Inc.

REVISED DATE

DATE 5/93

REVIEWED BY

JOB NUMBER 792608-11

Field location of boring: (See Plate 2)

Project No: 792608	Date: 3/17/93	Boring No: AS-2	
Client: ARCO Products Company SS# 5387			
Location: 20200 Hesperian Boulevard			
City: San Lorenzo		Sheet: 1 of 2	
Logged by: RCM	Driller: W. Hazmat		

Casing installation data:

Drilling method: Hollow Stem Auger

Hole diameter: 8 inches

Top of Box Elevation: Datum:

Water Level: 13.5
Time: 14:10
Date: 3/17/93

PID (ppm)	Blows/ft.* or Pressure (psi)	Type of Sample	Sample Number	Depth (ft.)	Sample	Well Detail	Soil Group Symbol (USCS)	Description
				1				PAVEMENT SECTION - 0.5 ft
				2				SILTY CLAY (CL/ML) - black (10YR 2/1); medium stiff, damp, medium plasticity; 60% clay, 40% silt, rootholes.
				3				
		S&H		4				SILT (ML) - very dark brown (10YR); very stiff, damp, medium plasticity; 80% silt, 15% clay, 5% fine sand, rootholes.
			AS-2					
6	19		5.0	5				
				6				
				7				
				8				
				9				Color change to dark green gray (5GY 4/1); stiff, moist at 8.5 ft.
		S&H						
			AS-2					
7	11		10.0	10				
				11				
				12				
				13				
						▽		Color change to olive (5Y 4/3); with dark greenish discolored rootholes; saturated at 13.5 ft.
		S&H		14				
			AS-2					
247	11		15.0	15				
				16				
				17				
				18				
		S&H		19				
			AS-2					Color change to dark yellowish brown (10YR 4/6); moist with black mottling (10YR 2/1) at 19.5 ft.
11	37		20.0	20				

Remarks: * Converted to equivalent standard penetration blows/ft.

Log of Boring

BORING NO: AS-2

GeoStrategies Inc.

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
792608		3/93		

Field location of boring: (See Plate 2)	Project No: 792608	Date: 3/17/93	Boring No: AS-2
	Client: ARCO Products Company SS#5387		
	Location: 20200 Hesperian Boulevard		
	City: San Lorenzo		Sheet: 2 of 2
	Logged by: RCM	Driller: W. Hazmat	
	Casing installation data		
Drilling method: Hollow Stem Auger			
Hole diameter: 8 inches	Top of Box Elevation:	Datum:	

FID (ppm)	Blows/ft. or Pressure (psi)	Type of Sample	Sample Number	Depth (ft.)	Sample	Well Detail	Soil Group Symbol (USCS)	Water Level / Time / Date	Description
				21					
				22					
				23					Increase clay to to 20%; saturated at 23.5 ft.
		S&H		24					
			AS-2	25					
0	9		25.0	26					
				27					
				28					
				29					SILTY SAND (SM) - light olive brown (2.5Y 5/4); very dense, saturated; 75% fine sand, 20% silt, 5% clay
		S&H		30					
			AS-2	31					
0	69		30.0	32					Descrease fine to coarse sand to 55%
		SPT		33					Increase clay to 15%, silt to 30%, at 30.5 ft.
	11			34					
				35					Bottom of boring at 31.5 ft
				36					3/17/93
				37					
				38					
				39					
				40					

Remarks:

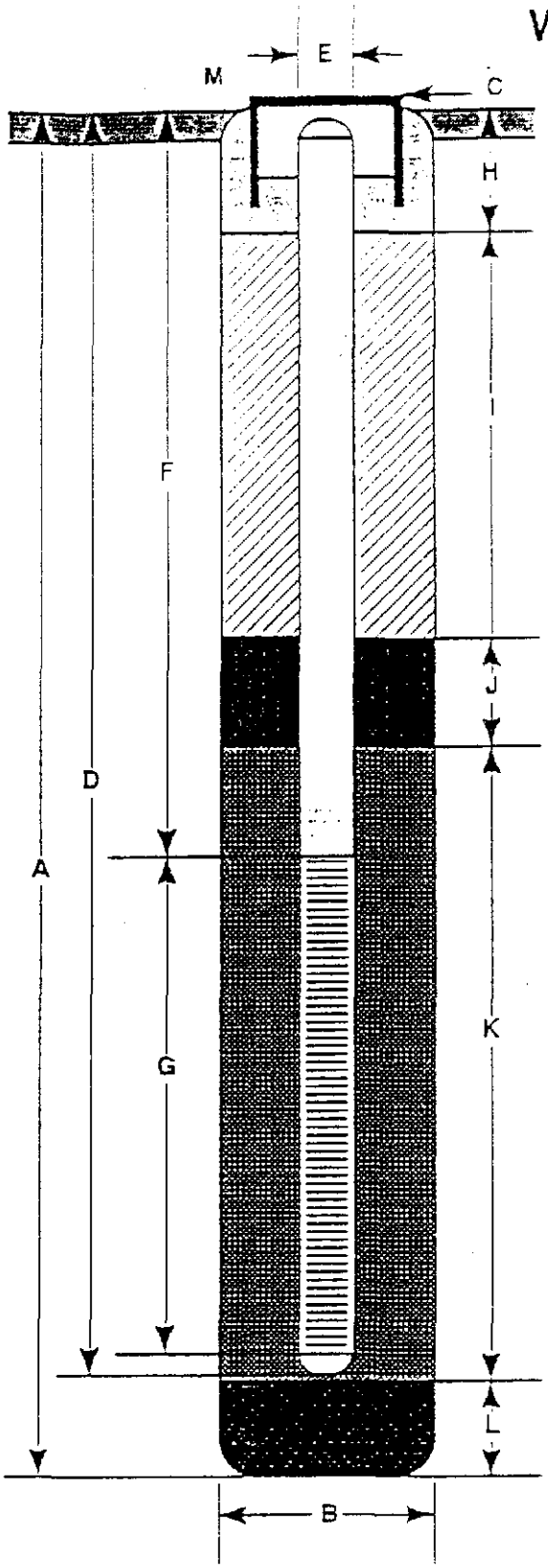
GSI GeoStrategies Inc.

Log of Boring

BORING NO. AS-2

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
792608		3/93		

WELL CONSTRUCTION DETAIL



A Total Depth of Boring 31.5 ft.

B Diameter of Boring 8.0 in.
Drilling Method Hollow Stem Auger

C Top of Box Elevation ft.
☐ Referenced to Mean Sea Level
☐ Referenced to Project Datum

D Casing Length 30.0 ft.
Material Schedule 40 PVC

E Casing Diameter 1 in.

F Depth to Top Perforations 28.0 ft.

G Perforated Length 2.0 ft.
Perforated Interval from 28.0 to 30.0 ft.
Perforation Type Machine Slotted
Perforation Size 0.020 in.

H Surface Seal from 0 to 1.0 ft.
Seal Material Concrete

I Backfill from 1.0 to 15.0 ft.
Backfill Material Neat Cement

J Seal from 15.0 to 27.5 ft.
Seal Material Bentonite

K Gravel Pack from 27.5 to 30.0 ft.
Pack Material Lonestar #2/12 Graded Sand

L Bottom Seal 1.5 ft.
Seal Material Bentonite

M Waterproof vault with slip cap.

Note: Depths measured from initial ground surface.

GSI GeoStrategies Inc.

Well Construction Detail

WELL NO.
AS-2

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
792608		3/93		

Field location of boring: (See Plate 2)

Project No: 792608	Date: 3/17/93	Boring No: A-A#	
Client: ARCO Products Company SS#5387			
Location: 20200 Hesperian Boulevard			
City: San Lorenzo		Sheet: 1	
Logged by: RCM	Driller: W. Hazmat	of: 1	

Drilling method: Hollow Stem Auger

Hole diameter: 10 inches

Casing installation data:

Top of Box Elevation: Datum:

Water Level: 13.5
Time: 12:55
Date: 3/17/93

FID (ppm)	Blows/ft or Pressure (psi)	Type of Sample	Sample Number	Depth (ft)	Sample	Well Detail	Soil Group Symbol (USCS)	Description
								PAVEMENT SECTION - 0.25 ft
				1				SILTY CLAY (CL/ML) - black (10YR 2/1); medium stiff, damp, medium plasticity; 70% clay, 30% silt, trace wood fragments (fill).
				2				
				3				
114								
		S&H		4				
			A-A					Trace fill gravel; very stiff at 4.5 ft.
85	18		5.0	5				
				6				
				7				
				8				SILT (ML) - greenish gray (5G 5/1); stiff, moist, medium plasticity; 85% silt, 15% clay, trace fine sand, rootholes.
		S&H		9				
			A-A					
270	13		10.0	10				
				11				Very stiff at 11.0 ft.
		S&H						
			A-A	12				
120	25		12.5					
				13				
						▽		Increase silt to 95%; saturated at 13.5 ft.
		S&H		14				
			A-A					
283	23		15.0	15				
				16				
								Bottom of boring at 15.0 ft.
				17				3/17/93
				18				
				19				
				20				

Remarks: # Boring A-A was completed as Vapor Extraction Well AV-1
* Converted to equivalent standard penetration blows/ft.

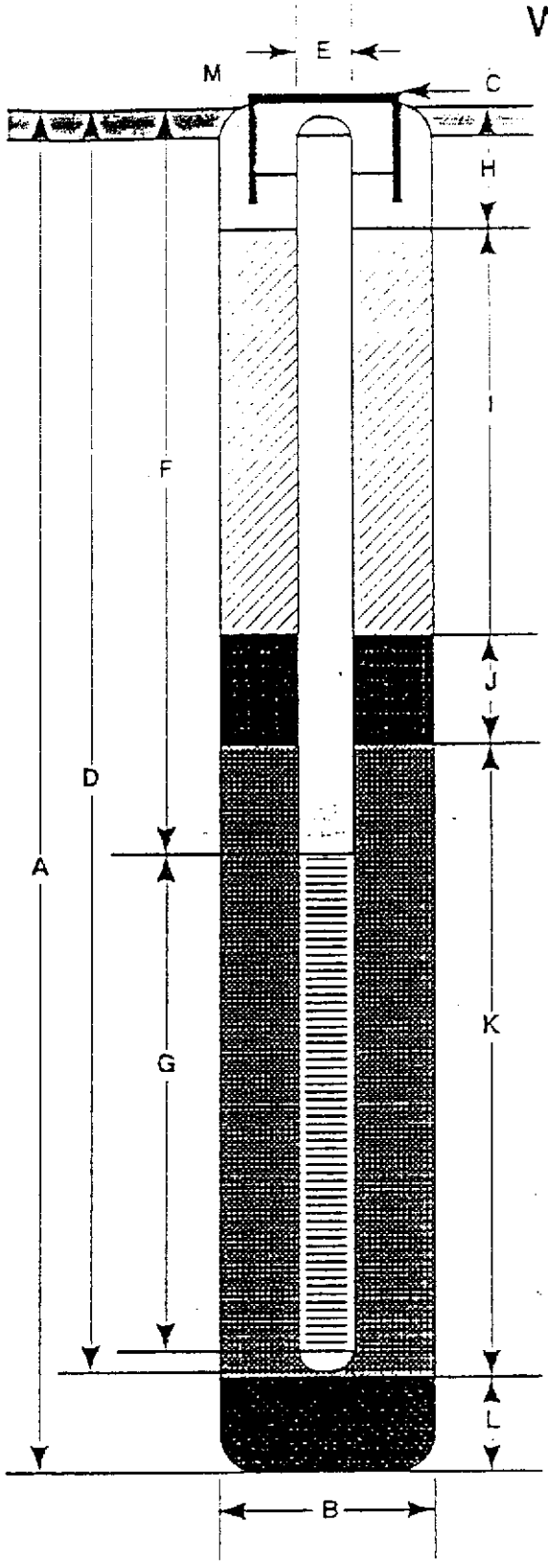
GSI GeoStrategies Inc.

Log of Boring

BORING NO.
A-A

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
792608		3/93		

WELL CONSTRUCTION DETAIL



A Total Depth of Boring 15.0 ft.

B Diameter of Boring 10 in.
Drilling Method Hollow Stem Auger

C Top of Box Elevation _____ ft.
☐ Referenced to Mean Sea Level
☐ Referenced to Project Datum

D Casing Length 15.0 ft.
Material Schedule 40 PVC

E Casing Diameter 4 in.

F Depth to Top Perforations 5.0 ft.

G Perforated Length 10.0 ft.
Perforated Interval from 5.0 to 15.0 ft.
Perforation Type Continuous Wrap
Perforation Size 0.020 in.

H Surface Seal from 0 to 1.0 ft.
Seal Material Concrete

I Backfill from 1.0 to 4.0 ft.
Backfill Material Neat Cement

J Seal from 4.0 to 4.5 ft.
Seal Material Bentonite

K Gravel Pack from 4.5 to 15.0 ft.
Pack Material Lonestar Coarse Aq. Sand

L Bottom Seal _____ ft.
Seal Material _____

M Waterproof vault box with waterproof locking cap and lock.

Note: Depths measured from initial ground surface.

GeoStrategies Inc.

Well Construction Detail

WELL NO.
AV-1

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
792608		3/93		

Field location of boring

(See Plate 2)

Project No.	792608	Date	3/17/93
Client:	ARCO Products Company SS#5387		
Location:	20200 Hesperian Boulevard		
City:	San Lorenzo		
Logged by:	RCM	Driller:	W. Hazmat

Boring No. A-B#

Sheet 1 of 1

Casing installation data

Drilling method: Hollow Stem Auger

Hole diameter: 10 inches

Top of Box Elevation: Datum:

Water Level: 13.5
Time: 9:39
Date: 3/17/93

PID (ppm)	Blows/ft * or Pressure (psi)	Type of Sample	Sample Number	Depth (ft.)	Sample	Well Detail	Soil Group Symbol (USCS)	Description
								PAVEMENT SECTION - 0.25 ft.
				1				
								SILTY CLAY (CL/ML) - black (10YR 2/1); medium stiff,
				2				damp, medium plasticity; 60% clay, 35% silt, 5% fine to
				3				medium sand.
		S&H		4				
			A-B					
1	9		5.0	5				Gravel, concrete (fill); medium dense, wood fragments at
				6				3.5 ft.
				7				
				8				
		S&H		9				
			A-B					
0	18		10.0	10				SILT (ML) - olive brown (2.5Y 4/4); very stiff, moist; 75%
				11				silt, 20% clay, 5% fine sand, wood fragements/roots.
				12				
				13				
		S&H		14		▽		
			A-B					
10	15		15.0	15				Greenish gray (5G 5/1), discoloration in rootlets; very
				16				moist to saturated at 13.5 ft.
				17				
				18				Bottom of boring at 15.0 ft
				19				3/17/93
				20				

Remarks: # Boring A-B was completed as Vapor Extraction Well AV-2.
* Converted to equivalent standard penetration blows/ft

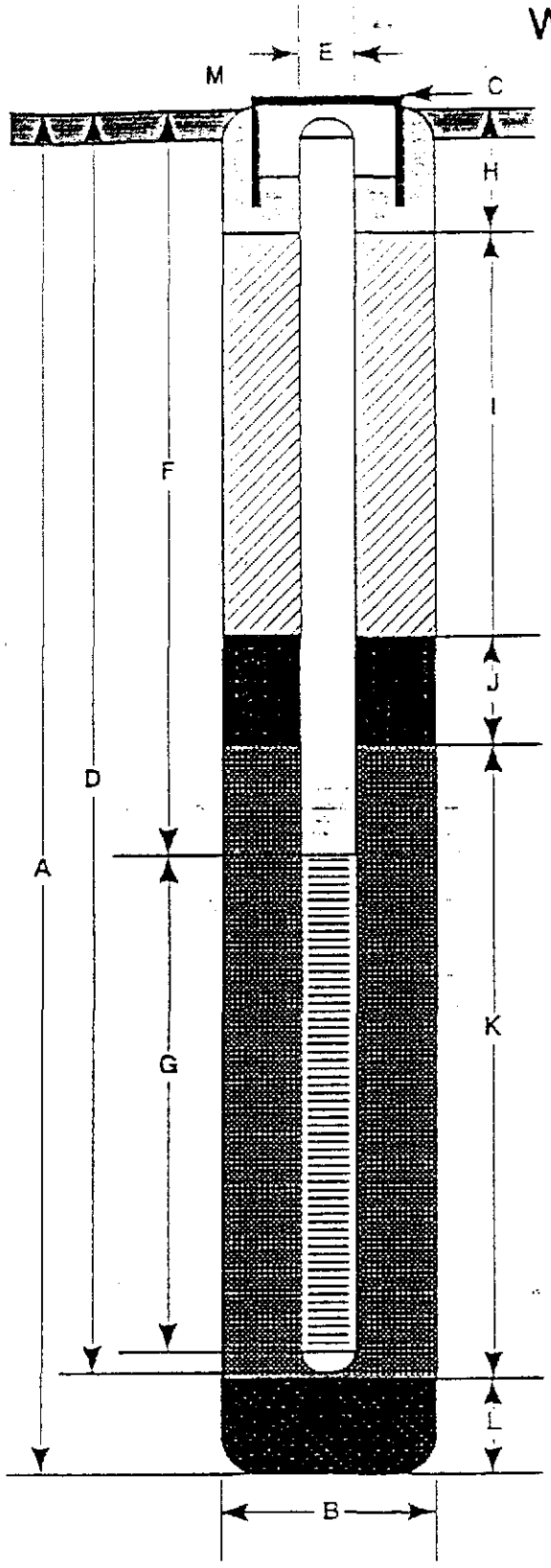
Log of Boring

BORING NO. A-B

GeoStrategies Inc.

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
792608		3/93		

WELL CONSTRUCTION DETAIL



A Total Depth of Boring 15.0 ft.

B Diameter of Boring 10.0 in.
Drilling Method Hollow Stem Auger

C *Top of Box Elevation* ____ ft.
☐ Referenced to Mean Sea Level
☐ Referenced to Project Datum

D Casing Length 15.0 ft.
Material Schedule 40 PVC

E Casing Diameter 4 in.

F Depth to Top Perforations 7.0 ft.

G Perforated Length 8.0 ft.
Perforated Interval from 7.0 to 15.0 ft.
Perforation Type Continuous Wrap
Perforation Size 0.020 in.

H Surface Seal from 0 to 1.0 ft.
Seal Material Concrete

I Backfill from 1.0 to 6.0 ft.
Backfill Material Neat Cement

J Seal from 6.0 to 6.5 ft.
Seal Material Bentonite

K Gravel Pack from 6.5 to 15.0 ft.
Pack Material Lonestar Coarse Aq. Sand

L Bottom Seal ____ ft.
Seal Material ____

M Waterproof vault box with waterproof locking cap and lock.

Note: Depths measured from initial ground surface.

GeoStrategies inc.

Well Construction Detail

WELL NO.
AV-2

JOB NUMBER	REVIEWED BY RG/DEG	DATE	REVISED DATE	REVISED DATE
792608		3/93		

Field location of boring

(See Plate 2)

Project No	792608	Date	3/17/93
Client	ARCO Products Company SS# 5387		
Location	20200 Hesperian Boulevard		
City	San Lorenzo		
Logged by	RCM	Driller	W. Hazmat

Boring No: A-C#

Sheet 1 of 1

Casing installation data

Drilling method: Hollow Stem Auger

Hole diameter: 10 inches

Top of Box Elevation: Datum:

Water Level: 13.5
Time: 11:01
Date: 3/17/93

PID (ppm)	Blows/ft.* or Pressure (psi)	Type of Sample	Sample Number	Depth (ft)	Sample	Well Detail	Soil Group Symbol (USCS)	Description
								PAVEMENT SECTION - 0.25 ft
				1				SILT CLAY (CL/ML) - black (10YR 2/1); medium stiff,
				2				damp, medium plasticity; 70% clay, 30% silt, trace fine
				3				sand.
		S&H		4				
			A-C					Color change to dark olive gray (5Y 3/2) - very stiff, fine
16	20		5.0	5				rootlets at 4.0 ft.
				6				
				7				SILT (ML) - dark olive gray (5Y 3/2); very stiff, moist,
				8				medium plasticity, 65% silt, 30% clay, 5% fine sand,
		S&H		9				rootlets.
			A-C					
106	18		10.0	10				
				11				
		S&H						Decreased clay to 10% at 8.5 ft.
			A-C	12				
208	31		12.5					
				13				
						▽		
		S&H		14				
		(Push)	A-C					
847			15.0	15				Greenish gray (5G 5/1) - discoloration in rootlets and
								13.5 ft.
				16				
				17				
				18				Bottom of boring at 15.0 ft
								3/17/93
				19				
				20				

Remarks: # Boring A-C completed as Vapor Extraction Well AV-3
* Converted to equivalent standard penetration blows/ft.

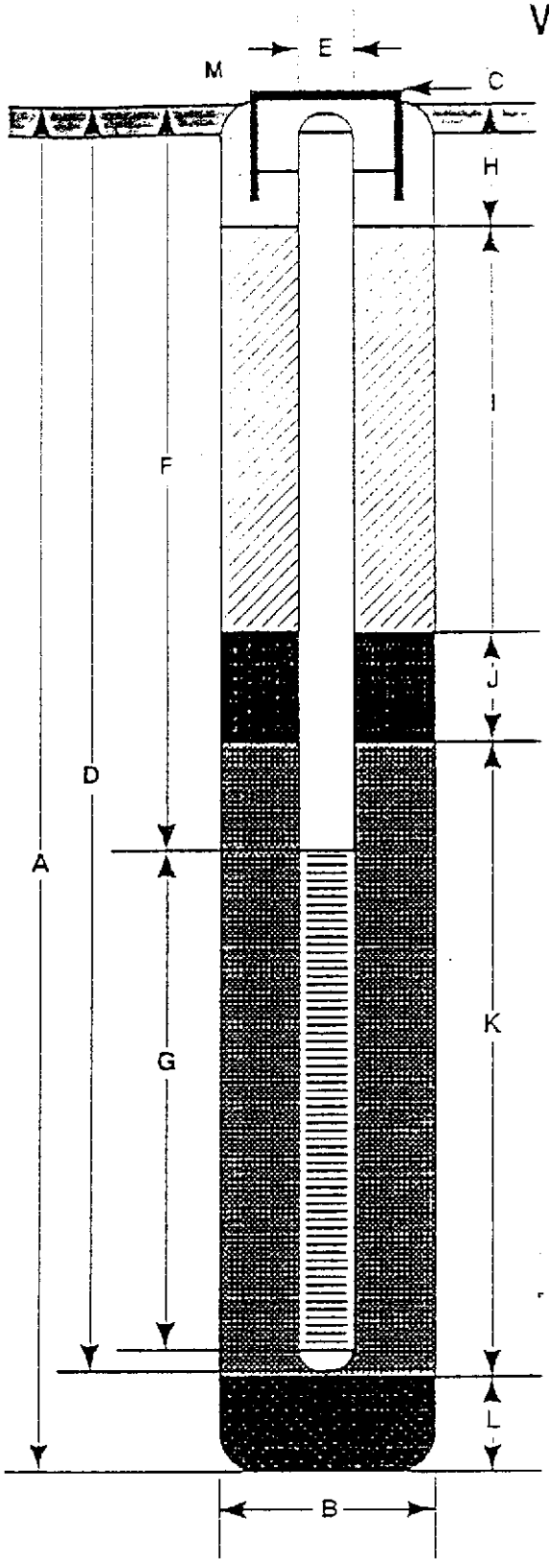
GeoStrategies Inc.

Log of Boring

BORING NO: A-C

JOB NUMBER	REVIEWED BY RG/CEG	DATE	REVISED DATE	REVISED DATE
792608		3/93		

WELL CONSTRUCTION DETAIL



A Total Depth of Boring 15.0 ft.

B Diameter of Boring 10.0 in.
Drilling Method Hollow Stem Auger

C Top of Box Elevation ft.
☐ Referenced to Mean Sea Level
☐ Referenced to Project Datum

D Casing Length 10.0 ft.
Material Schedule 40 PVC

E Casing Diameter 4.0 in.

F Depth to Top Perforations 5.0 ft.

G Perforated Length 10.0 ft.
Perforated Interval from 5.0 to 15.0 ft.
Perforation Type Continuous Wrap
Perforation Size 0.060 in.

H Surface Seal from 0 to 1.0 ft.
Seal Material Concrete

I Backfill from 1.0 to 4.0 ft.
Backfill Material Neat Cement

J Seal from 4.0 to 4.5 ft.
Seal Material Bentonite

K Gravel Pack from 4.5 to 15.0 ft.
Pack Material Lonestar Coarse Aq. Sand

L Bottom Seal ft.
Seal Material

M Waterproof vault box with waterproof locking cap and lock.

Note: Depths measured from initial ground surface.

GSI GeoStrategies Inc.

Well Construction Detail

WELL NO.
AV-3

JOB NUMBER	REVIEWED BY RS/CEG	DATE	REVISED DATE	REVISED DATE
792608		3/93		

KIER & WRIGHT
Civil Engineers & Surveyors, Inc.

March 26, 1993
K & W Job No. 91638
GR Job No. 9926.02

Table of Elevations

Arco Service Station No. 5387

20200 Hesperian Blvd.

Hayward, California

Well No.	Elevation	
AR-2	38.39	Punch mark on North rim of box
	37.99	Cut Notch on top North side of PVC casing

Benchmark: U.S.C. & G. S. Benchmark disk stamped "G738 Reset 1960" 1.0 mile west along West A Street from the Southern Pacific Company railroad station at Hayward, at the intersection of Hesperian Boulevard, at the north entrance to Hayward Municipal Airport, in the top of the concrete curb above the south corner of a 3 x 4-foot storm water inlet, 86.4 feet northwest of the centerline of West A Street, 71.4 feet southwest of the powerline pole 369, 45.4 feet southwest of the centerline of Hesperian Boulevard, 0.7 foot above the gutter, and about level with the boulevard.

Elevation = 37.02 M.S.L.

5880 West Las Positas Boulevard, Suite 34 • Pleasanton, California 94588 • (510) 734-8060 • FAX (510) 734-8064

SEQUOIA ANALYTICAL

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

Gettler Ryan
2150 W. Winton Avenue
Hayward, CA 94545
Attention: John Vargas

Project: 5387-93-2, Arco 5387, San Lorenzo

Enclosed are the results from 11 soil samples received at Sequoia Analytical on March 19,1993. The requested analyses are listed below:

SAMPLE #	SAMPLE DESCRIPTION	DATE OF COLLECTION	TEST METHOD
3C94001	Soil, AS-1-10.0	3/16/93	EPA 5030/8015/8020
3C94002	Soil, AS-1-15.0	3/16/93	EPA 5030/8015/8020
3C94003	Soil, AR-2-10.0	3/16/93	EPA 5030/8015/8020
3C94004	Soil, AR-2-15.0	3/16/93	EPA 5030/8015/8020
3C94005	Soil, A-A-10.0	3/16/93	EPA 5030/8015/8020
3C94006	Soil, A-A-15.0	3/16/93	EPA 5030/8015/8020
3C94007	Soil, A-B-10.0	3/16/93	EPA 5030/8015/8020
3C94008	Soil, A-B-15.0	3/16/93	EPA 5030/8015/8020
3C94009	Soil, A-C-10.0	3/16/93	EPA 5030/8015/8020
3C94010	Soil, A-C-15.0	3/16/93	EPA 5030/8015/8020
3C94011	Soil, AS-2-10.0	3/16/93	EPA 5030/8015/8020
3C94012	Soil, AS-2-15.0	3/16/93	EPA 5030/8015/8020

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

Very truly yours,

SEQUOIA ANALYTICAL

Nokowhat D. Herrera
Project Manager

926-A

SEQUOIA ANALYTICAL

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

Gettler Ryan	Client Project ID:	5387-93-2, Arco 5387, San Lorenzo	Sampled:	Mar 16, 1993
2150 W. Winton Avenue	Sample Matrix:	Soil	Received:	Mar 19, 1993
Hayward, CA 94545	Analysis Method:	EPA 5030/8015/8020	Reported:	Mar 30, 1993
Attention: John Vargas	First Sample #:	3C94001		

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit mg/kg	Sample I.D. 3C94001 AS-1-10.0	Sample I.D. 3C94002 AS-1-15.0	Sample I.D. 3C94003 AR-2-10.0	Sample I.D. 3C94004 AR-2-15.0	Sample I.D. 3C94005 A-A-10.0	Sample I.D. 3C94006 A-A-15.0
Purgeable Hydrocarbons	1.0	N.D.	17	N.D.	16	4.4	32
Benzene	0.0050	N.D.	0.027	0.11	0.061	0.022	0.12
Toluene	0.0050	N.D.	0.018	N.D.	0.015	N.D.	0.042
Ethyl Benzene	0.0050	N.D.	0.090	N.D.	0.14	0.033	0.38
Total Xylenes	0.0050	0.0070	0.16	0.022	0.56	0.030	0.22
Chromatogram Pattern:		Discrete Peak	Non-Gas Mix C6-C12	Non-Gas Mix < C8	Non-Gas Mix < C4-C12	Non-Gas Mix < C4-C12	Non-Gas Mix < C4-C12

Quality Control Data

Report Limit Multiplication Factor:	1.0	1.0	1.0	1.0	1.0	2.0
Date Analyzed:	3/23/93	3/24/93	3/24/93	3/24/93	3/24/93	3/24/93
Instrument Identification:	GCHP-7	GCHP-6	GCHP-6	GCHP-6	GCHP-6	GCHP-6
Surrogate Recovery, %: (QC Limits = 70-130%)	102	111	98	120	102	105

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

SEQUOIA ANALYTICAL

Nokowhat D. Herrera
Project Manager

SEQUOIA ANALYTICAL

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

Gettler Ryan	Client Project ID:	5387-93-2, Arco 5387, San Lorenzo	Sampled:	Mar 16, 1993
2150 W. Winton Avenue	Sample Matrix:	Soil	Received:	Mar 19, 1993
Hayward, CA 94545	Analysis Method:	EPA 5030/8015/8020	Reported:	Mar 30, 1993
Attention: John Vargas	First Sample #:	3C94007		

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTIW

Analyte	Reporting Limit mg/kg	Sample I.D. 3C94007 A-B-10.0	Sample I.D. 3C94008 A-B-15.0	Sample I.D. 3C94009 A-C-10.0	Sample I.D. 3C94010 A-C-15.0	Sample I.D. 3C94011 AS-2-10.0	Sample I.D. 3C94012 AS-2-15.0
Purgeable Hydrocarbons	1.0	N.D.	N.D.	1.0	11	1.3	26
Benzene	0.0050	N.D.	N.D.	0.010	0.027	0.042	0.085
Toluene	0.0050	N.D.	N.D.	0.0060	0.081	N.D.	0.012
Ethyl Benzene	0.0050	N.D.	N.D.	0.050	0.11	N.D.	0.26
Total Xylenes	0.0050	N.D.	N.D.	0.0080	0.52	0.020	0.22
Chromatogram Pattern:		--	--	Non-Gas Mix C4-C12	Non-Gas Mix C4-C12	Non-Gas Mix C4-C12	Non-Gas Mix C4-C12

Quality Control Data

Report Limit Multiplication Factor:	1.0	1.0	1.0	1.0	1.0	1.0
Date Analyzed:	3/24/93	3/24/93	3/24/93	3/24/93	3/24/93	3/24/93
Instrument Identification:	GCHP-6	GCHP-6	GCHP-6	GCHP-6	GCHP-6	GCHP-6
Surrogate Recovery, %: (QC Limits = 70-130%)	90	85	104	96	91	104

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

SEQUOIA ANALYTICAL

Nokowhat D. Herrera
Project Manager

SEQUOIA ANALYTICAL

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

Gettler Ryan
2150 W. Winton Avenue
Hayward, CA 94545
Attention: John Vargas

Client Project ID: 5387-93-2, Arco 5387, San Lorenzo
Matrix: Soil

QC Sample Group 3C94001 - 12

Reported: Mar 30, 1993

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-Benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	R.Geckler	R.Geckler	R.Geckler	R.Geckler
Conc. Spiked:	0.20	0.20	0.20	0.20
Units:	mg/kg	mg/kg	mg/kg	mg/kg
LCS Batch#:	GBLK032393	GBLK032393	GBLK032393	GBLK032393
Date Prepared:	3/23/93	3/23/93	3/23/93	3/23/93
Date Analyzed	3/23/93	3/23/93	3/23/93	3/23/93
Instrument I.D.#:	GCHP-7	GCHP-7	GCHP-7	GCHP-7
LCS % Recovery:	100	105	105	107
Control Limits:	60-140	60-140	60-140	60-140
MS/MSD Batch #:	G3C92501	G3C92501	G3C92501	G3C92501
Date Prepared:	3/23/93	3/23/93	3/23/93	3/23/93
Date Analyzed	3/23/93	3/23/93	3/23/93	3/23/93
Instrument I.D.#:	GCHP-7	GCHP-7	GCHP-7	GCHP-7
Matrix Spike % Recovery:	100	100	105	102
Matrix Spike Duplicate % Recovery:	90	95	95	95
Relative % Difference:	11	5.1	10	7.1

SEQUOIA ANALYTICAL

Nokowhat D. Herrera
Project Manager

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

ARCO Products Company
Division of Atlantic Richfield Company

Task Order No. 5387 - 93 - 2

Chain of Custody

ARCO Facility no. 5387	City (Facility) SAN LORENZO	Project manager (Consultant) JOHN VARGAS	Laboratory name SEQUOIA
ARCO Engineer MICHAEL WHELAN	Telephone no. (ARCO) (510) 571-2449	Telephone no. (Consultant) (510) 352-4800	Fax no. (Consultant) (510) 782-1089	Contract number 07-073
Consultant name GeoSTRATEGIES INC.	Address (Consultant) 2140 WEST WINTON AVE. HAYWARD 94545			Method of shipment COURIER

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Matrix: Water	Matrix: Other	Preservation: Ice	Preservation: Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH EPA M602/8020/8015	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals ☐ Semi VOA ☐ VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org./DHS ☐ Lead EPA 7420/7421 ☐		
AS-1-10.0			✓			✓		3/16/93	9:38		X						9503	940	01			
AS-1-15.0			✓			✓		3/16/93	9:50		X								02			
AS-2-10.0			✓			✓		3/16/93	14:23		X								03			
AS-2-15.0			✓			✓		3/16/93	14:35		X								04			
A-A-10.0			✓			✓		3/17/93	13:55		X								05			
A-A-15.0			✓			✓		3/17/93	14:08		X								06			
A-B-10.0			✓			✓		3/17/93	9:50		X								07			
A-B-15.0			✓			✓		3/17/93	10:05		X								08			
A-C-10.0			✓			✓		3/17/93	10:57		X								09			
A-C-15.0			✓			✓		3/17/93	11:40		X								10			
AS-2-10.0			✓			✓		3/17/93	15:34		X								11			
AS-2-15.0			✓			✓		3/17/93	15:40		X								12			

Special detection Limit/reporting

Special QA/QC

Remarks

Lab number

Turnaround time

Priority Rush 1 Business Day ☐

Rush 2 Business Days ☐

Expedited 5 Business Days ☐

Standard 10 Business Days ☒

Condition of sample: good

Temperature received: cool

Relinquished by sampler	Date 3/19/93	Time 15:55	Received by
Relinquished by	Date 3-19-93	Time 1824	Received by
Relinquished by	Date	Time	Received by laboratory — Date 3-19-93 — Time 1624

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

APEC-3292 (2-91)

SEQUOIA ANALYTICAL

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

Gettler Ryan
2150 W. Winton Avenue
Hayward, CA 94545
Attention: John Vargas

Project: 5357-93-5, Arco 5357-San Lorenzo

Enclosed are the results from 2 water samples received at Sequoia Analytical on March 30,1993. The requested analyses are listed below:

SAMPLE #	SAMPLE DESCRIPTION	DATE OF COLLECTION	TEST METHOD
3CE0101	Water, AR-2	3/30/93	EPA 5030/8015/8020
3CE0102	Water, T.B.	3/30/93	EPA 5030/8015/8020

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

Very truly yours,

SEQUOIA ANALYTICAL

Nokowhat D. Herrera
Project Manager

SEQUOIA ANALYTICAL

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

Gettler Ryan	Client Project ID:	5357-93-5, Arco 5357-San Lorenzo	Sampled:	Mar 30, 1993
2150 W. Winton Avenue	Sample Matrix:	Water	Received:	Mar 30, 1993
Hayward, CA 94545	Analysis Method:	EPA 5030/8015/8020	Reported:	Apr 7, 1993
Attention: John Vargas	First Sample #:	3CE0101		

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit µg/L	Sample I.D. 3CE0101 AR-2	Sample I.D. 3CE0102 T.B.	Sample I.D.	Sample I.D.	Sample I.D.	Sample I.D.
Purgeable Hydrocarbons	50	390	N.D.				
Benzene	0.50	4.1	N.D.				
Toluene	0.50	1.6	N.D.				
Ethyl Benzene	0.50	N.D.	N.D.				
Total Xylenes	0.50	47	N.D.				
Chromatogram Pattern:		Gas	--				

Quality Control Data

Report Limit Multiplication Factor:	1.0	1.0
Date Analyzed:	4/2/93	4/2/93
Instrument Identification:	GCHP-3	GCHP-3
Surrogate Recovery, %: (QC Limits = 70-130%)	95	92

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

SEQUOIA ANALYTICAL

Nokowhat D. Herrera
Project Manager

SEQUOIA ANALYTICAL

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

Gettler Ryan
2150 W. Winton Avenue
Hayward, CA 94545
Attention: John Vargas

Client Project ID: 5357-93-5, Arco 5357-San Lorenzo
Matrix: Water

QC Sample Group: 3CE0101 -02

Reported: Apr 7, 1993

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-Benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	M.Nipp	M.Nipp	M.Nipp	M.Nipp
Conc. Spiked:	10	10	10	30
Units:	µg/L	µg/L	µg/L	µg/L
LCS Batch#:	GBLK040293	GBLK040293	GBLK040293	GBLK040293
Date Prepared:	N.A.	N.A.	N.A.	N.A.
Date Analyzed:	4/2/93	4/2/93	4/2/93	4/2/93
Instrument I.D.#:	GCHP-3	GCHP-3	GCHP-3	GCHP-3
LCS % Recovery:	100	100	98	100
Control Limits:	80-120	80-120	80-120	80-120
MS/MSD Batch #:	G3D02309	G3D02309	G3D02309	G3D02309
Date Prepared:	N.A.	N.A.	N.A.	N.A.
Date Analyzed:	4/2/93	4/2/93	4/2/93	4/2/93
Instrument I.D.#:	GCHP-3	GCHP-3	GCHP-3	GCHP-3
Matrix Spike % Recovery:	100	100	100	100
Matrix Spike Duplicate % Recovery:	120	120	120	127
Relative % Difference:	18	18	18	24

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

SEQUOIA ANALYTICAL

Nokowhat D. Herrera
Project Manager

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

ARCO Products Company

Division of AtlanticRichfieldCompany

Chain of Custody

Task Order No. 5357-93-5

ARCO Facility no. 5357	City (Facility) San Lorenzo	Project manager (Consultant) John Vargas	Laboratory name SEQ
ARCO engineer Mike Whelan	Telephone no. (ARCO)	Telephone no. (Consultant) 510 785-7220	Fax no. (Consultant) 510 783 7057
Consultant name Cambria Ryan Inc	Address (Consultant) 2150 W. Winton Ave. Hayward CA		Contract number

Method of shipment: GSL

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Matrix: Water	Matrix: Other	Preservation: Ice	Preservation: Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH EPA M602/8020/8015	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals ☐ Semi VOA ☐ VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org./DHS ☐ Lead EPA 7420/7421 ☐	
MW2		3		X		X	X	3/30/93	10:30		X									(01)	
MW3		1		X		X	X	3/30/93	—		X									(02)	
									W.O. #	93	03	E0	1								

Special detection Limit/reporting: Standard

Special QA/QC: Standard

Remarks: GSL # 9926.05

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: ICE	
Relinquished by sampler	Date 3-30-93	Time 11:20	Received by
Relinquished by	Date	Time	Received by
Relinquished by	Date	Time	Received by laboratory: Date 3/30/93 Time 1120

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

GETTLER-RYAN INC.

General and Environmental Contractors

WELL SAMPLING
FIELD DATA SHEET

COMPANY Arco # 5387 JOB # 9716.08

LOCATION 20200 Hesperian DATE 3-30-93

CITY San Lorenzo CA TIME

Well ID. AR-2 Well Condition Okay

Well Diameter 6" in. Hydrocarbon Thickness ft.

Total Depth 35.56 ft.

Depth to Liquid- TOC 11.53 11.13 ft.

Volume Factor (VF)	2" = 0.17	3" = 0.38	4" = 0.66	6" = 1.50	8" = 2.60	10" = 4.10	12" = 5.80

(# of casing volumes) 5 x ~~12.97~~ 23.97 x(VF) 1.25 = (Estimated Purge Volume) ~~59.4~~ ~~97~~ 35.9 179 gal.

Purging Equipment Suction

Sampling Equipment Bailer

Starting Time 7:48 Purging Flow Rate gpm.

(Estimated Purge Volume) gal. / (Purging Flow Rate) gpm. = (Anticipated Purging Time) min.

Time	pH	Conductivity	Temperature	Volume
7:51	7.00	1352	66.6	20 55 ls
7:58	6.96	1370	66.6	40
8:07	6.94	1366	66.5	60
8:16	7.00	1350	66.5	80
~~8:18~~ 8:25	7.18	1350	66.6	100
8:30	7.20	1318	66.4	80
10:35	7.15	1320	67.3	85

Did well dewater? Yes. If yes, time Volume

Sampling Time 10:25 Weather Conditions

Analysis Bottles Used

Chain of Custody Number

COMMENTS

SEQUOIA ANALYTICAL

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

Gettler Ryan
2150 W. Winton Avenue
Hayward, CA 94545
Attention: John Vargas

Project: 5387-93-07, Arco 5387-Hayward

Enclosed are the results from 3 air samples, and 3 other samples received at Sequoia Analytical on March 24,1993. The requested analyses are listed below:

SAMPLE #	SAMPLE DESCRIPTION	DATE OF COLLECTION	TEST METHOD
3CA9801	Air, AV-3	3/24/93	EPA 5030/8015/8020
3CA9802	Air, AV-1	3/24/93	EPA 5030/8015/8020
3CA9803	Air, AR-1	3/24/93	EPA 5030/8015/8020
3CA9804	Filter, AV-3	3/24/93	California LUFT Manual, 12/87
3CA9805	Filter, AV-1	3/24/93	California LUFT Manual, 12/87
3CA9806	Filter, AR-1	3/24/93	California LUFT Manual, 12/87

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

Nokowhat D. Herrera
Project Manager

7926-A

SEQUOIA ANALYTICAL

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

Gettler Ryan	Client Project ID:	5387-93-07, Arco 5387-Hayward	Sampled:	Mar 24, 1993
2150 W. Winton Avenue	Sample Matrix:	Air	Received:	Mar 24, 1993
Hayward, CA 94545	Analysis Method:	EPA 5030/8015/8020	Reported:	Mar 29, 1993
Attention: John Vargas	First Sample #:	3CA9801		

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit ppmv	Sample I.D. 3CA9801 AV-3	Sample I.D. 3CA9802 AV-1	Sample I.D. 3CA9803 AR-1	Sample I.D.	Sample I.D.	Sample I.D.
Purgeable Hydrocarbons	2.3	1,900	7,500	790			
Benzene	0.019	91	210	19			
Toluene	0.016	14	45	4.5			
Ethyl Benzene	0.014	23	19	0.76			
Total Xylenes	0.014	35	28	1.1			
Chromatogram Pattern:		Non-Gas < C8	Non-Gas < C8	Non-Gas < C8			

Quality Control Data

Report Limit Multiplication Factor:	100	200	50
Date Analyzed:	3/25/93	3/25/93	3/25/93
Instrument Identification:	GCHP-3	GCHP-3	GCHP-3
Surrogate Recovery, %: (QC Limits = 70-130%)	113	119	100

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

SEQUOIA ANALYTICAL

Nokowhat D. Herrera
Project Manager

Please Note:

A molecular weight of 65 was used to calculate ppmv for Purgeable Hydrocarbons.

SEQUOIA ANALYTICAL

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

Gettler Ryan	Client Project ID:	5387-93-07, Arco 5387-Hayward	Sampled: Mar 24, 1993
2150 W. Winton Avenue	Sample Descript:	Filter	Received: Mar 24, 1993
Hayward, CA 94545	Analysis Method:	California LUFT Manual, 12/87	Extracted: Mar 25, 1993
Attention: Jonn Vargas	First Sample #:	3CA9804	Analyzed: Mar 25, 1993
			Reported: Mar 29, 1993

ORGANIC LEAD

Sample Number	Sample Description	Sample Results µg/filter
3CA9804	AV-3	N.D.
3CA9805	AV-1	N.D.
3CA9806	AR-1	N.D.

Detection Limits:	1.0

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

SEQUOIA ANALYTICAL

Nokowhat D. Herrera
Project Manager

SEQUOIA ANALYTICAL

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

Gettler Ryan
2150 W. Winton Avenue
Hayward, CA 94545
Attention: John Vargas

Client Project ID: 5387-93-07, Arco 5387-Hayward
Matrix: Air

QC Sample Group 3CA9901 - 03

Reported: Mar 29, 1993

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-Benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	M.Nipp	M.Nipp	M.Nipp	M.Nipp
Conc. Spiked:	10	10	10	10
Units:	µg/L	µg/L	µg/L	µg/L
LCS Batch#:	GBLK032593	GBLK032593	GBLK032593	GBLK032593
Date Prepared:	N.A.	N.A.	N.A.	N.A.
Date Analyzed	3/25/93	3/25/93	3/25/93	3/25/93
Instrument I.D.#:	GCHP-3	GCHP-3	GCHP-3	GCHP-3
LCS % Recovery:	90	90	92	90
Control Limits:	80-120	80-120	80-120	80-120
MS/MSD Batch #:	G3C97809	G3C97809	G3C97809	G3C97809
Date Prepared:	N.A.	N.A.	N.A.	N.A.
Date Analyzed	3/25/93	3/25/93	3/25/93	3/25/93
Instrument I.D.#:	GCHP-3	GCHP-3	GCHP-3	GCHP-3
Matrix Spike % Recovery:	100	100	100	100
Matrix Spike Duplicate % Recovery:	110	110	110	110
Relative % Difference:	9.5	9.5	9.5	9.5

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

SEQUOIA ANALYTICAL

Nokowhat D. Herrera
Project Manager

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

SEQUOIA ANALYTICAL

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

Gettler Ryan
2150 W. Winton Avenue
Hayward, CA 94545
Attention: John Vargas

Client Project ID: 5387-93-07, Arco 5387-Hayward
Matrix: Filter
QC Sample Group 3CA9804 - 05

Reported: Mar 29, 1993

QUALITY CONTROL DATA REPORT

ANALYTE	Organic Lead
Method:	LUFT
Analyst:	S.Foster
Conc. Spiked:	0.50
Units:	µg/filter
LCS Batch#:	#032493
Date Prepared:	3/24/93
Date Analyzed	3/25/93
Instrument I.D.#:	SH1000
LCS % Recovery:	107
Control Limits:	75-125

MS/MSD Batch #:	#3030777
Date Prepared:	3/24/93
Date Analyzed	3/25/93
Instrument I.D.#:	SH1000
Matrix Spike % Recovery:	94
Matrix Spike Duplicate % Recovery:	99
Relative % Difference:	5.2

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

SEQUOIA ANALYTICAL

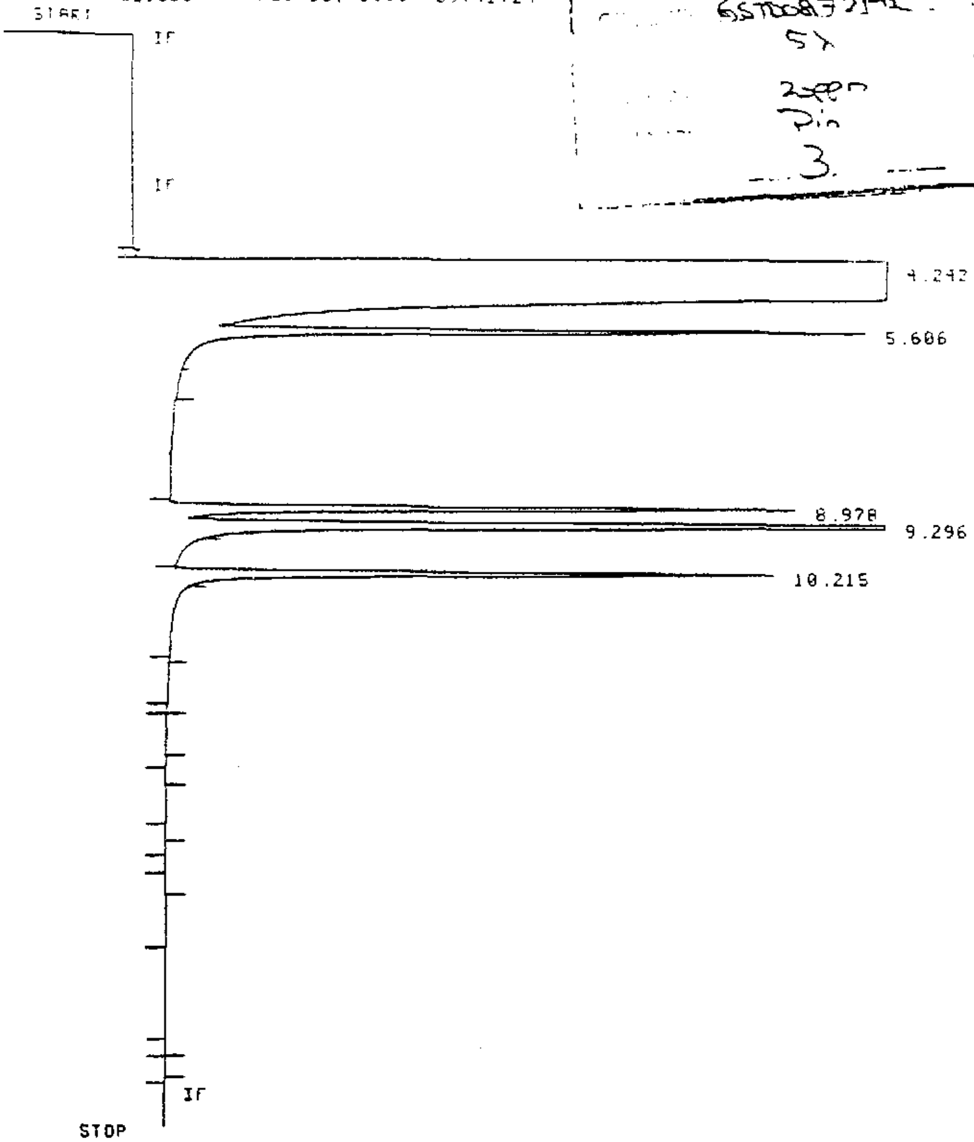
Nokowhat D. Herrera
Project Manager

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

RUN #29512-004 (4)

* RUN #29513 AUG 13, 1993 09:41:24

File ID 65TD081353 C
65TD0837219X
5X
2ppm
Din
3.



Closing signal file M:SIGNAL .BNC

RUN #29513-002

RUN# 29513 AUG 13, 1993 09:41:24

IDENTIFIER : GCHP-3 / FID
SIGNAL FILE: M:SIGNAL.BNC
AREA%

RT	AREA	TYPE	WIDTH	AREA%
4.242	152391040	>SPB	.293	98.11667
5.606	561506	TBP	.090	.36152
8.978	588346	PV	.098	.37881
9.296	1186157	VB	.106	.76370
10.215	589176	PB	.102	.37934

TOTAL AREA=1.5532E+08
MUL FACTOR=1.0000E+00

(15)

6AIR9203A - 01
AV-3
500'
—
FID
11

RUN #24520-004

RUN #24520 MAR 25, 1993 15:46:12

START

IF

3.067
3.577
3.965
4.425
5.311
5.595
5.810
6.093
6.363
6.705
6.970
8.010
8.985
9.304
9.954
10.224
10.518
11.493
12.657
12.990
13.248
14.251
15.404
15.922

IF

RUN #24520-003

STOP

Sliding signal ... ORIGINAL BHC

PRINT THIS SIDE

HEWLETT-PACKARD PART NUMBER 5181-1219

PRINT THIS SIDE

RUN #24920-003

RUN# 24920   MAR 25, 1993 15:48:12

IDENTIFIER : GCHF-5 ./ FID
SIGNAL FILE: M:SIGNAL.BNC
AREA%

RT	AREA	TYPE	WIDTH	AREA%
2.910	41821	BV	.072	45850
3.067	1217167	VV	.113	13.34420
3.155	818603	VV	.125	8.97461
3.577	1631621	VV	.146	17.88800
3.721	191822	VV	.080	2.10302
3.840	104342	VV	.079	1.14394
3.963	403833	VV	.101	4.42735
4.425	460316	PV	.125	5.04660
4.624	441801	VV	.199	4.84361
4.666	102714	VV	.110	1.12609
5.138	493442	VV	.117	5.40977
5.311	735006	VV	.145	8.05811
5.595	364207	VV	.139	3.99292
5.818	314384	VV	.145	3.44670
6.093	223460	VV	.154	2.44987
6.563	60795	VV	.101	.66652
6.705	166815	VV	.124	1.82885
6.970	62804	VV	.118	.68854
7.542	31014	PV	.115	.34002
7.763	43512	VV	.127	.47704
8.010	131201	VV	.161	1.43840
8.831	14750	VV	.082	.16171
8.985	249226	VV	.096	2.73235
9.124	84636	VV	.100	.92791
9.304	402969	VV	.129	4.41788
9.954	6643	PB	.094	.07283
10.224	34717	BP	.091	.38061
10.518	27920	PB	.099	.30610
11.493	18957	BB	.094	.20783
12.657	46516	BV	.117	.50997
12.990	85891	VV	.141	.94165
13.248	19067	VB	.111	.20904
14.251	53342	PV	..106	.58481
15.404	18019	PV	.126	.19755
15.922	17990	BP	.127	.19723

TOTAL AREA=9.1213E+06
MUL FACTOR=1.0000E+00

$= \frac{9121 - 366}{3.45 (0.5\,mL)}$

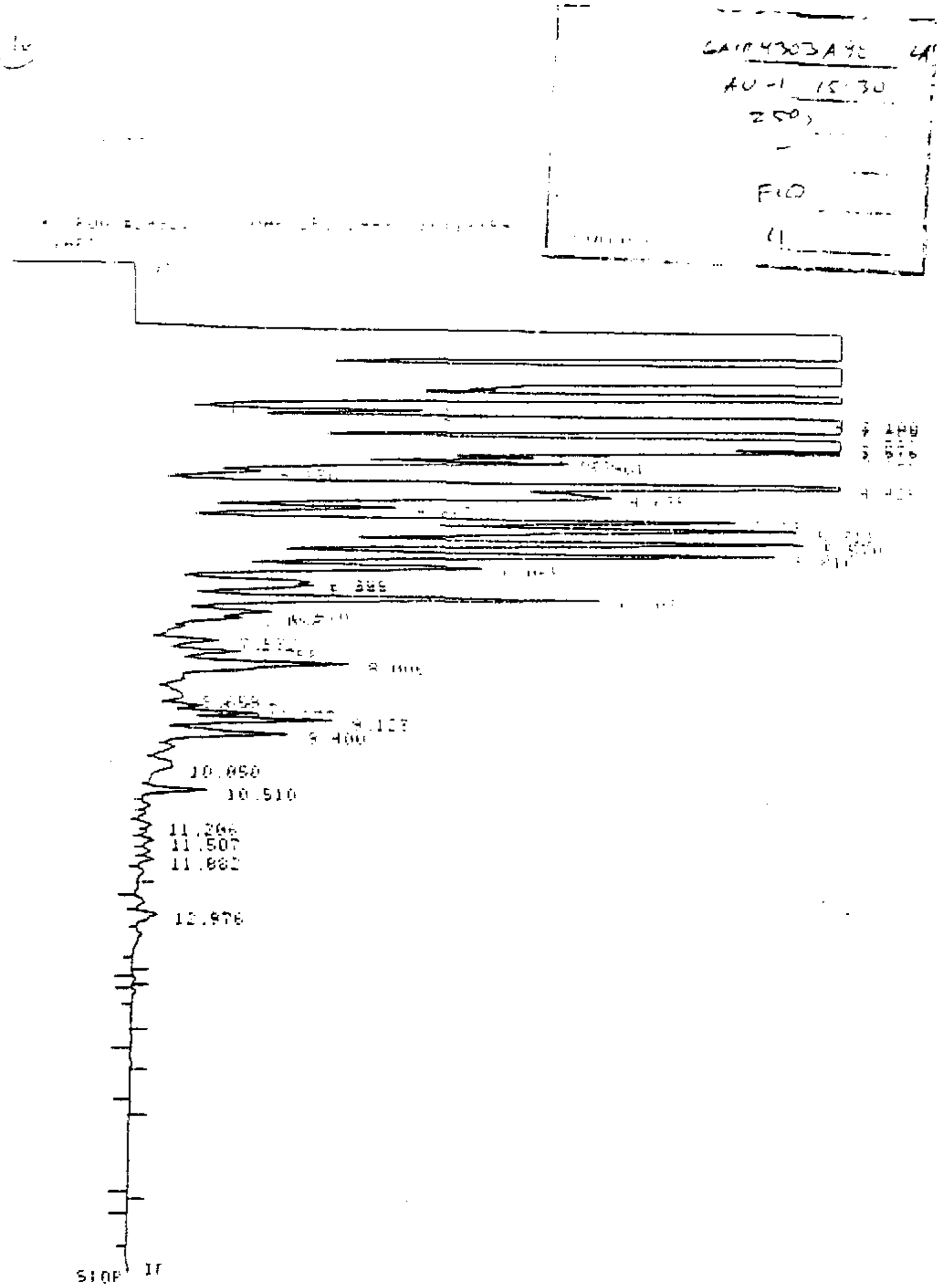
= (5100)

(16)

[illegible]	GAIR9303A98-02A
	AV-1 15:30
	250)
	–
[illegible]	FIO
[illegible]	()

RUN #24920-004

+ RUN #24921 MAR 25, 1993 16:18:54
START
TT



Closing signal file N:SIGNAL .BNC

RUN #24921-002

RUN# 24921   MAR 25, 1995 16:18:54

IDENTIFIER : GCHA-F . FID
SIGNAL FILE: N:SIGNAL.BNC
AREA%

RT	AREA	TYPE	WIDTH	AREA%
2.907	167770	BV	.075	.83194
3.100	2262854	VV	.122	11.56654
3.255	2033711	VV	.119	11.57555
3.576	2665568	VV	.167	15.91544
3.722	663595	VV	.066	3.08574
3.835	329461	VV	.090	1.80768
3.461	411747	VV	.105	2.26498
4.150	80657	VP	.051	.46799
4.415	1264125	PV	.130	7.15214

HEWLETT-PACKARD PART NUMBER 5181-1219 PRINT THIS SIDE

RUN #24521-002

RUN# 24521 MAR 25, 1995 16:16:58

IDENTIFIER : GCHP-3 . FID
SIGNAL FILE: M:SIGNAL.BNC
AREA%

RT	AREA	TYPE	WIDTH	AREA%
2.907	167970	BV	.079	.93194
3.100	2262854	VV	.122	12.56834
3.259	2083711	VV	.113	11.57335
3.576	2865568	VV	.167	15.91594
3.722	663595	VV	.086	3.68574
3.835	325461	VV	.090	1.80768
3.961	411397	VV	.103	2.28498
4.150	80657	VP	.091	.44799
4.425	1284225	PV	.130	7.13284
4.635	859461	VV	.109	4.77362
4.867	271179	VV	.115	1.50618
5.138	719900	VV	.123	3.99847
5.311	1067624	VV	.164	5.92980
5.578	899704	VV	.137	4.99714
5.816	865867	VV	.137	4.80920
6.065	477991	VV	.145	2.65486
6.355	164599	VV	.107	.91422
6.444	197118	VV	.124	1.09483
6.703	554698	VV	.122	3.08090
6.970	142086	VV	.120	.78917
7.088	103317	VV	.115	.57384
7.537	78481	VV	.116	.43590
7.758	112668	VV	.124	.62578
8.006	360057	VV	.178	1.99983
8.659	86228	VV	.243	.47893
8.827	57363	VV	.103	.31861
8.977	114757	VV	.100	.63738
9.123	214061	VV	.112	1.18894
9.400	232338	VV	.157	1.29045
10.050	98265	VV	.312	.54578
10.510	78623	VV	.110	.43669
11.206	19228	PV	.124	.10680
11.507	23146	VV	.128	.12856
11.882	18735	VP	.104	.10406
12.976	41491	VV	.168	.23045

TOTAL AREA=1.8004E+07
MUL FACTOR=1.0000E+00

$= \frac{18004 - 366}{345\ (0.25\ mL)}$

≈ 20,000

6AR9303A98-034
AV-1 19:05
1.0 mL
—
F10
11

(17)

RUN #24521-003

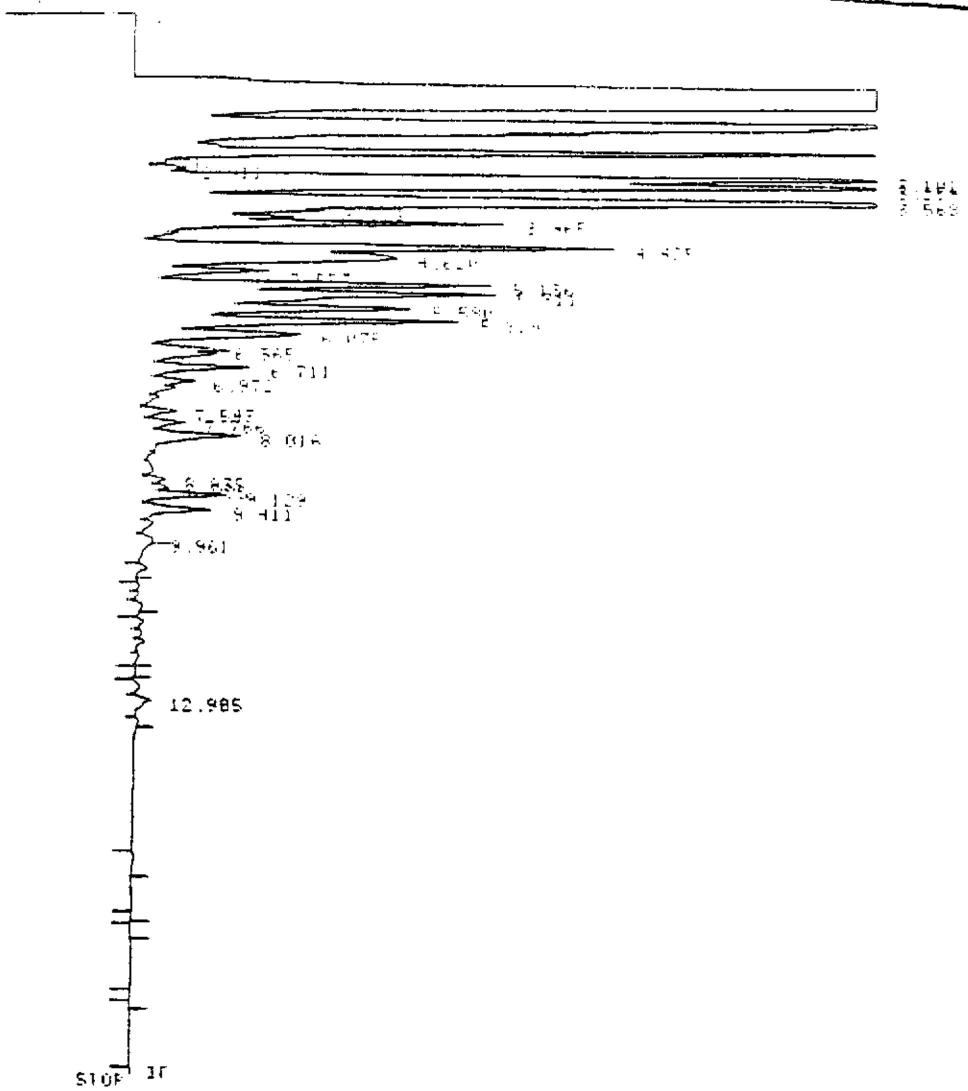
RUN #24521 MAR 25, 1995 16:40:45
START

AV 19 OC

1 Om

FID

11



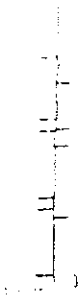
Closing signal file N:SIGNAL .BNC

RUN #24922-002

RUN# 24922   MAR 25, 1993 16:42:43

IDENTIFIER : GCMR-5 . FID
SIGNAL FILE: N:SIGNAL.BNC
AREA%

RT	AREA	TYPE	WIDTH	AREA%
2.911	15571	BV	.072	.20499
3.101	894913	VV	.115	11.78117
3.259	975798	VV	.121	12.84598
3.568	1436988	VV	.158	18.91756
3.721	123424	VV	.074	1.62485
3.840	120111	VV	.087	1.58121
3.965	345619	VV	.106	4.55560
4.415	558774	PV	.127	7.35603
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]



Loading signal file (SIGNAL.BAC

RUN #24933-802

RUN# 24933 MAR 25, 1993 16:42:43

IDENTIFIER : GCMA-5 , TID
SIGNAL FILE: M:SIGNAL.BAC
AREA:

P1	AREA	TYPE	WIDTH	AREA%
2.911	15571	BU	.072	.20499
3.101	894913	UU	.115	11.78117
3.259	975798	UU	.121	12.84598
3.568	1436988	UU	.158	18.91736
3.721	123424	UU	.074	1.62483
3.848	120111	UU	.087	1.58121
3.965	343619	UU	.100	4.52360
4.425	558774	PU	.123	7.35603
4.620	470716	UU	.195	6.19678
4.869	126529	UU	.109	1.66570
5.136	387947	UU	.116	5.10716
5.311	521516	UU	.155	6.86291
5.580	356085	UU	.141	4.69825
5.824	392263	UU	.151	5.17715
6.875	209796	UP	.145	2.76188
6.565	9125	PB	.052	.12013
6.711	97035	PU	.107	1.27745
6.972	44394	UU	.102	.58445
7.545	36996	PU	.107	.48704
7.766	50657	UU	.118	.66668
8.016	154351	UU	.158	2.03197
8.835	24955	UU	.102	.32852
8.985	29256	UU	.105	.38514
9.129	91490	UU	.108	1.20445
9.411	91750	UU	.128	1.20785
9.961	5598	PB	.089	.07370
12.985	24876	PP	.145	.32748

TOTAL AREA=7596154
MUL FACTOR=1.0000E-00

$= \frac{7596-366}{3.45(1.04)}$

$= (2100)$

HEWLETT-PACKARD PART NUMBER 5181-1219 PRINT THIS SIDE

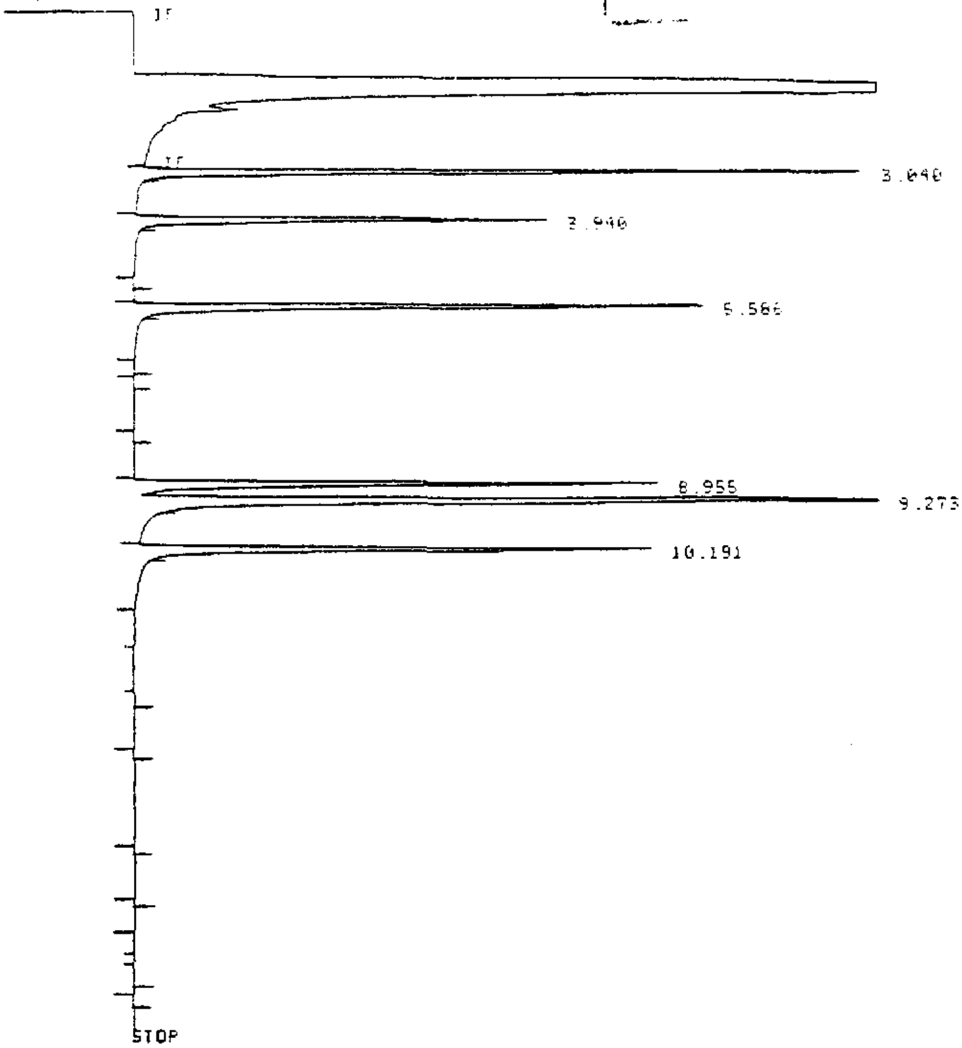
(18)

(3)

RUN #24907-00?

* RUN #24908   MAR 25, 1993 09:07:24
START

6STD0 3DF53 B
6STD0S? C
5 λ
100ng Grey
FID
1



Closing signal file M:SIGNAL   .BNC

RUN #24908-002

RUN# 24908   MAR 25, 1993 09:07:24

IDENTIFIER : GCHP-3 / FID
SIGNAL FILE: M:SIGNAL.BNC
AREA%

RT	AREA	TYPE	WIDTH	AREA%
3.040	533415	SB	.076	16.05202
3.940	365812	PB	.091	11.00856
5.586	515156	PB	.093	15.50255
8.955	478514	PV	.094	14.39688
9.273	952555	VB	.101	28.66516
10.191	477688	PB	.096	14.37503

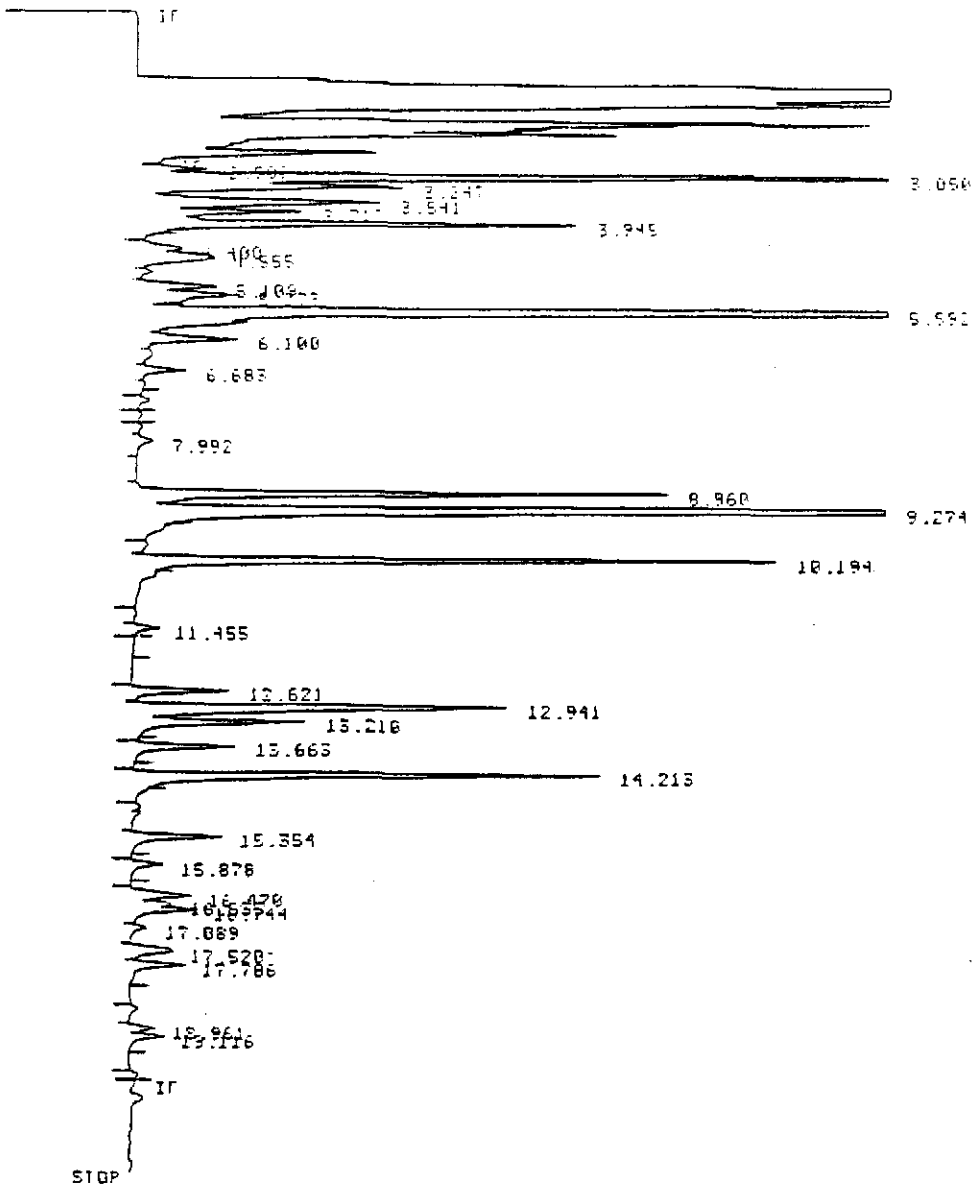
TOTAL AREA=3323040
MUL FACTOR=1.0000E+00

PRINT THIS SIDE PART NUMBER 5181-1219 HEWLETT-PACKARD PRINT THIS SIDE 5181-1219

(4)

RUN #24909-003

* RUN #24909 MAR 25, 1993 09:35:48
START



Closing signal file H:SIGNAL .BHC

RUN #24909-001

RUN# 24909 MAR 25, 1993 09:35:48

IDENTIFIER : GCHP-E FID
SIGNAL FILE: H:SIGNAL.BHC
AREA%

PI	AREA	TYPE	WIDTH	AREA%
2.900	33519	BV	.069	.37074
3.050	916131	VV	.069	10.18748
3.347	251375	VV	.106	2.79552
3.541	271991	VV	.116	3.02457
[illegible]	[illegible]	VV	[illegible]	[illegible]

RUN # [illegible] MAR 25, 1993 [illegible]

IDENTIFIER [illegible]
SIGNAL FILE [illegible]
AREA%

RT	AREA	TYPE	WIDTH	AREA%
[illegible]	[illegible]	BV	.069	[illegible]
3.050	916131	VV	.089	10.18749
3.147	251375	VV	.106	2.79531
3.541	271881	VV	.116	3.02457
3.711	118321	VV	.084	1.31574
3.945	400423	VB	.099	4.45287
4.400	45879	BV	.117	.51018
4.555	132211	VV	.183	1.47021
5.109	22981	PV	.108	[illegible]
5.273	154674	VV	.160	1.72000
5.591	1952894	VV	.095	21.71640
6.100	120881	VV	.116	1.34421
6.683	45996	VP	.103	.51148
7.491	20945	VP	.112	.23291
8.760	477552	PV	.095	5.31044
9.274	1534669	VB	.101	17.06571
10.194	571552	PB	.094	6.35551
11.455	23905	PB	.094	.26580
12.621	94010	BV	.098	1.04540
12.941	462466	VV	.129	5.14268
13.210	177245	VB	.108	1.97099
13.663	97416	PB	.100	1.08328
14.213	445981	PB	.100	4.95936
15.354	101877	PB	.115	1.13288
15.876	53785	BB	.104	.59809
16.470	74917	BV	.124	.83309
16.635	39406	VV	.096	.43820
16.744	84153	VV	.128	.93579
17.089	20604	VP	.122	.22912
17.520	68494	PV	.161	.76166
17.786	69707	VB	.126	.77515
18.961	25508	PV	.098	.28365
19.116	40955	VB	.118	.45542

TOTAL AREA=8.9927E+06
MUL FACTOR=1.0000E+00

$\frac{8993 - 364}{2500} = 3.43$

%D = 3.3

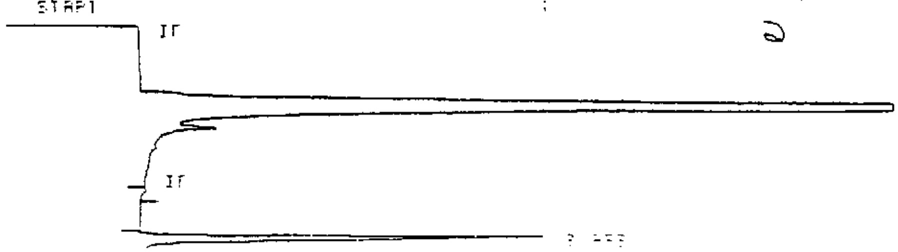
RUN #24909-003

(2)

GB1K05DS53...
method B11C
10mL

F in
2

* RUN #24910 MAR 25, 1993 10:09:25
START



ARCO Products Company
Division of AtlanticRichfieldCompany

Task Order No. 5387-93-07

Chain of Custody

ARCO Facility no. 5387	City (Facility) Hayward	Project manager (Consultant) John Vargue	Laboratory name SEQ
ARCO engineer Mike Whelan	Telephone no. (ARCO)	Telephone no. (Consultant) (510) 783-7500	Fax no. (Consultant) (510) 783-1089
Consultant name Gettler-Ryan	Address (Consultant) 810 W. Winton Hayward, CA 94545		Contract number

Method of shipment: GSL

Special detection Limit/reporting: Standard

Special QA/QC: Standard

Remarks: 001, 11984

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Matrix: Water	Matrix: Other	Preservation: Ice	Preservation: Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH EPA M602/8020/8015	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals ☐ Semi VOA ☐ VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org./DHS ☐ Lead EPA 7420/7421 ☐		
AV-3		1			A.g			3-24-93	1145		X		93	03A	198-	01						
A-1-1		1			A.g			3-24-93	1530		X			↓		02							
MW-1		1			A.g			3-24-93	1905		X			↓		03							
AV-3		1			W.g			3-24-93	1130				930	8A	198-	01	A			X		
AV-1		1			W.g			3-24-93	1550					↓		05	↓			X		
MW-1		1			W.g			3-24-93	1910					↓		06	↓			X		

Condition of sample:

Temperature received:

	Date	Time		Date	Time
Relinquished by sampler	3-24-93	1912	Received by		
Relinquished by	3-24-93	19:45	Received by		
Relinquished by	Date	Time	Received by laboratory	3-24-93	19:45

Lab number:

Turnaround time

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

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

ARCO 3292 (2-91)

SEQUOIA ANALYTICAL

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

Gettler Ryan
2150 W. Winton Avenue
Hayward, CA 94545
Attention: Matt Donohue

Project: 5387-93-2 and 2S/Arco - Hayward

Enclosed are the results from 2 air samples received at Sequoia Analytical on August 13,1993. The requested analyses are listed below:

3H63501	Air, Inf 1	8/13/93	EPA 5030/8015/8020
3H63502	Air, Inf 2	8/13/93	EPA 5030/8015/8020

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

Very truly yours,

SEQUOIA ANALYTICAL

Nokowhat D. Herrera
Project Manager

SEQUOIA ANALYTICAL

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

Gettler Ryan	Client Project ID:	5387-93-2 and 2S/Arco - Hayward	Sampled:	Aug 13, 1993
2150 W. Winton Avenue	Sample Matrix:	Air	Received:	Aug 13, 1993
Hayward, CA 94545	Analysis Method:	EPA 5030/8015/8020	Reported:	Aug 17, 1993
Attention: Matt Donohue	First Sample #:	3H63501		

TOTAL PURGEABLE PETROLEUM HYDROCARBONS with BTEX DISTINCTION

Analyte	Reporting Limit ppmv	Sample I.D. 3H63501 Inf 1	Sample I.D. 3H63502 Inf 2
Purgeable Hydrocarbons	2.3	10,000	5,600
Benzene	0.019	100	59
Toluene	0.016	24	16
Ethyl Benzene	0.014	23	15
Total Xylenes	0.014	23	16
Chromatogram Pattern:		Gas + Non-gas < C8	Gas + Non-gas < C8

Quality Control Data

Report Limit Multiplication Factor:	500	250
Date Analyzed:	8/13/93	8/13/93
Instrument Identification:	GCHP-3	GCHP-3
Surrogate Recovery, %: (QC Limits = 70-130%)	112	98

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

SEQUOIA ANALYTICAL

Nokowhat D. Herrera
Project Manager

Please Note:

A molecular weight of 65 was used to calculate ppmv for Purgeable Hydrocarbons.

SEQUOIA ANALYTICAL

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

Gettler Ryan
2150 W. Winton Avenue
Hayward, CA 94545
Attention: Matt Donohue

Client Project ID: 5387-93-2 and 2S/Arco - Hayward

QC Sample Group: 3H63501-02

Reported: Aug 17, 1993

QUALITY CONTROL DATA REPORT

ANALYTE	Benzene	Toluene	Ethyl-Benzene	Xylenes
Method:	EPA 8020	EPA 8020	EPA 8020	EPA 8020
Analyst:	A. Miraftab	A. Miraftab	A. Miraftab	A. Miraftab
Conc. Spiked:	10	10	10	30
Units:	µg/L	µg/L	µg/L	µg/L
LCS Batch#:	GBLK081393	GBLK081393	GBLK081393	GBLK081393
Date Prepared:	-	-	-	-
Date Analyzed:	8/13/93	8/13/93	8/13/93	8/13/93
Instrument I.D.#:	GCHP-3	GCHP-3	GCHP-3	GCHP-3
LCS % Recovery:	100	93	97	97
Control Limits:	80-120	80-120	80-120	80-120
MS/MSD Batch #:	3H57701	3H57701	3H57701	3H57701
Date Prepared:	-	-	-	-
Date Analyzed:	8/13/93	8/13/93	8/13/93	8/13/93
Instrument I.D.#:	GCHP-3	GCHP-3	GCHP-3	GCHP-3
Matrix Spike % Recovery:	92	91	93	93
Matrix Spike Duplicate % Recovery:	94	93	94	93
Relative % Difference:	2.2	2.2	1.1	0.0

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

SEQUOIA ANALYTICAL

Nokowhat D. Herrera
Project Manager

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