Applied GeoSystems

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

90 JUL -2 AM11:30

TRANSMITTAL

TO: MR. GIL WISTAR
HAZARDOUS MATERIALS SPECIALIST
DEPARTMENT OF ENVIRONMENTAL HEALTH
80 SWAN WAY, ROOM 200
OAKLAND, CA 94621

DATE: 6/28/90
PROJECT NUMBER: 60000-1
SUBJECT: LIMITED SUBSURFACE ASSESSMENT AT ARCO STATION 771, 899 AVENUE, LIVERMORE, CA.

FROM: STEVE BITTMAN
TITLE: STAFF GEOLOGIST

WE ARE SENDING YOU [XX] Attached [ ] Under separate cover via _____ the following items:

[ ] Shop drawings [ ] Prints [XX] Reports [ ] Specifications

[ ] Letters [ ] Change Orders [ ] _____

COPIES	DATED	NO.	DESCRIPTION
1	6/22/90	60000-1	LIMITED SUBSURFACE ENVIRONMENTAL ASSESSMENT AT ARCO STSTION 771, 899 RINCON AVENUE, LIVERMORE, CA.

THESE ARE TRANSMITTED as checked below:

[ ] For review and comment [ ] Approved as submitted [ ] Resubmit ___ copies for approval

[ ] As requested [ ] Approved as noted [ ] Submit___ copies for distribution

[ ] For approval [ ] Return for corrections [ ] Return ___ corrected prints

[XX] For your files [ ] _____

REMARKS: PER ARCO'S AUTHORIZATION, REPORT IS BEING FORWARDED.

Copies: 1 to AGS project file no. 60000-1 SJ READER'S FILE

Applied GeoSystems 3315 Almaden Expressway, Suite 34, San Jose, CA 95118 (408) 264-7723

• FREMONT • IRVINE • HOUSTON • BOSTON • SACRAMENTO • CULVER CITY • SAN JOSE

LIMITED SUBSURFACE ENVIRONMENTAL ASSESSMENT
at
ARCO Station 771
899 Rincon Avenue
Livermore, California

AGS Job 60000-1

Report prepared for

ARCO Products Company
P.O. Box 5811
San Mateo, California 94403

by
Applied GeoSystems

Steve Bittman
Staff Geologist

REGISTERED GEOLOGIST
DIANE M. BARCLAY
No. EG1366
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

June 22, 1990

LIMITED SUBSURFACE
ENVIRONMENTAL ASSESSMENT
at
ARCO Station 771
899 Rincon Avenue
Livermore, California

For ARCO Products Company

INTRODUCTION

This report describes the work conducted by Applied GeoSystems for ARCO Products Company (ARCO) at ARCO Station 771 to evaluate the presence of gasoline hydrocarbons in the subsurface soil in the area adjacent to four underground gasoline-storage tanks prior to the planned removal of the tanks. The assessment included drilling three soil borings, collecting and laboratory analyzing 12 soil samples from the borings, and preparing this report presenting our procedures, results, and conclusions.

SITE DESCRIPTION AND BACKGROUND

ARCO Station 771, 899 Rincon Avenue, Livermore, California, is an operating gasoline station and mini-market in a commercial and residential area. Residential homes lie to the north of the site, and east of the site across Rincon Avenue. A shopping center lies to the south and west of the site. The site location is shown on the Site Vicinity Map (Plate 1). The elevation of the site is approximately 450 feet above mean sea level.

It is our understanding from information provided by ARCO that one 10,000-gallon underground gasoline-storage tank (designated T1), one 6,000-gallon underground gasoline-storage tank (designated T2) and two 4,000-gallon underground gasoline-storage tanks (designated T3 and T4) are present at the site. We also understand that tanks T2, T3, and T4 were installed approximately 25 years ago and tank T1 was installed approximately 15 years ago. In addition, we understand that a 240-gallon waste-oil tank had been removed from the site in 1987. The locations of these tanks and other site features are shown on the Generalized Site Plan (Plate 2).

PREVIOUS WORK

On August 25, 1987, a 240-gallon waste-oil tank was removed from the site by Crosby and Overton Environmental Management, Inc., of Oakland, California. The waste-oil tank pit was excavated to a depth of 10 feet and a soil sample (AL-1) was collected by Brown and Caldwell (B&C) of Sacramento, California, for laboratory analysis. Results of analyses indicated total petroleum fuel hydrocarbon levels of 378 parts per million (ppm). Solvents, benzene, toluene, and total xylene isomers (BTX), and Polychlorinated Biphenols (PCB's) were not detected. One sample (WO-1) of the waste oil sludge from the tank and two samples (LS-1 and LS-2) from the stockpiled soil were also collected and analyzed by B&C (B&C, 1987).

On September 1, 1987, the waste-oil tank pit was further excavated and B&C collected a soil sample (AL-2) from a depth of 12 feet. Petroleum fuel hydrocarbons were not detected in the sample. On October 19, 1987, waste-oil contaminated soil was transported to a Class I landfill in Casmalia, California (B&C, 1987). Table 1 summarizes the analytical results from August and September, 1987.

TABLE 1
ANALYTICAL RESULTS OF SOIL AND SLUDGE SAMPLES
BY BROWN AND CALDWELL
ARCO Station 771
899 Rincon Avenue
Livermore, California
August 25, 1987

Sample Identification	HVC	TPFH	B	T	X	PCBs
AL-1	ND	378	ND	ND	ND	ND
AL-2	ND	ND	ND	ND	ND	ND
LS-1	ND	3,779	ND	0.009	0.05	ND
LS-2	ND	808	ND	0.011	0.06	ND
WO-1	ND	256,508	ND	2.920	0.128	ND

Results in milligrams per kilogram (mg/kg) or parts per million (ppm).
HVC: Halogenated volatile compounds by EPA Method 8010.
TPFH: Total petroleum fuel hydrocarbons by modified EPA Method 8015.
B: Benzene by EPA Method 8020.
T: Toluene by EPA Method 8020.
X: Total xylene isomers by EPA Method 8020.
PCBs: Polychlorinated biphenyls (PCBs) by EPA Method 8080.
ND: Below laboratory reported detection concentration.

Sample designation: LS-2
- Sample number
- AL = Soil sample
- LS = Stockpile sample
- WO = Waste oil sample

REGIONAL AND LOCAL HYDROGEOLOGY

The site is in the north-central portion of the Livermore Valley, within the Coast Ranges Geomorphic Province of Northern California. The Livermore Valley is approximately 13 miles long in an east-west direction, approximately 4 miles wide, and is surrounded by hills of the Diablo Range (California Department of Water Resources, 1974). The valley slopes gently toward the west. The principal streams in the area are the Arroyo Valle and Arroyo Mocho, which flow toward the western end of the valley. Arroyo Mocho is approximately 1/10 mile south-southwest of the site, and Arroyo Valle is approximately 2-3/4 miles southwest of the site.

The Livermore Valley ground-water basin is divided into sub-basins on the basis of fault traces or other hydrogeologic discontinuities (California Department of Water Resources, 1974). The ground-water system in Livermore Valley is a multi-layered system with an unconfined aquifer overlying a sequence of leaky or semiconfined aquifers. Ground water in the basin flows downslope toward the east-west-trending axis of the valley and then flows generally to the west. Regional ground water is inferred to flow to the west-northwest and is approximately 30 feet below the ground surface (Alameda County Flood Control, Zone 7, 1986).

FIELD WORK

Drilling and Soil Sampling

A Ground Water Protection Ordinance Permit to drill soil borings was obtained from Alameda County Flood Control and Water Conservation District, Zone 7, before drilling. A copy of the permit is included in Appendix A. Prior to drilling, Underground Service Alert was notified of our intent to drill, and known underground utility lines and structures were marked.

Three soil borings, B-1, B-2 and B-3, were drilled to depths ranging from 31-1/2 to 35 feet below the ground surface in the immediate vicinity of the underground storage tanks on February 1 and 2, 1990. The locations of the borings are shown on Plate 2. The borings were drilled by Bakersfield Well and Pump of Bakersfield, California, utilizing a CME-55 truck-mounted drilling rig. Field methods used in the drilling of the borings and collecting the soil samples are described in Appendix B. The borings were backfilled to the surface with a bentonite/cement grout.

Subsurface Materials

The earth materials encountered during this assessment consisted primarily of clayey to sandy gravel and some sandy to gravelly clay. A summary of the Unified Soil Classification System used to identify the soil excavated during drilling is presented on Plate 3. Descriptions of earth materials encountered in borings B-1 through B-3 are presented on the Logs of Borings (Plates 4 through 9). Geologic cross-section A-A' (Plate 10) illustrates an interpretation of the soil stratigraphy and a summary of the organic vapor meter (OVM) readings measured during drilling.

OVM readings from soil samples above 20 feet were all less than 20 parts per million (ppm). In samples taken at and below 20 feet OVM readings increased to as high as 800 ppm. Field instruments such as the OVM are useful for measuring relative concentrations of vapor content, but cannot be used to measure levels of hydrocarbons with the confidence of laboratory analysis.

Ground water was encountered at a depth of approximately 33 feet below the ground surface in boring B-1. Borings B-2 and B-3 were terminated above ground water. A ground-water "grab" sample was obtained from B-1 using a disposable PVC bailer for visual inspection. Approximately 1/8-inch of floating product was noted on the water in the bailer.

LABORATORY ANALYSES

Twelve soil samples were selected on the basis of field OVM readings and delivered to Anametrix, Inc., of San Jose, California, (Hazardous Waste Testing Laboratory Certification No. 151), for analysis according to the following methods:

- Total petroleum hydrocarbons as gasoline (TPHg) by EPA Method 8015 after extraction by EPA Method 5030.

- Benzene, toluene, ethylbenzene, and total xylenes (BTEX) by modified EPA Method 8020 after extraction by EPA Method 5030.

Results of laboratory analyses for soil samples collected from the soil borings, and detection limits for the test methods used, are summarized in Table 2. Analysis data sheets and a copy of the Chain of Custody record are included in Appendix C.

TABLE 2
RESULTS OF LABORATORY ANALYSES
OF SOIL SAMPLES
ARCO Station 771
899 Rincon Avenue
Livermore, California

Sample Identification	Date	TPHg	Benzene	Toluene	Ethyl-benzene	Total Xylenes
S-10-B1	2/1/90	<1.0	<0.005	<0.005	<0.005	<0.005
S-19.5-B1	2/1/90	<1.0	0.022	0.024	<0.005	0.022
S-24.5-B1	2/1/90	<1.0	0.022	0.015	0.010	0.048
S-29.5-B1	2/1/90	<1.0	<0.005	<0.005	<0.005	<0.005
S-10-B2	2/1/90	<1.0	<0.005	<0.005	<0.005	<0.005
S-20-B2	2/1/90	<1.0	0.016	0.020	<0.005	0.025
S-25-B2	2/1/90	1.4	<0.01	<0.01	<0.01	0.018
S-31-B2	2/1/90	<1.0	<0.005	<0.005	<0.005	<0.005
S-10-B3	2/2/90	<1.0	<0.005	<0.005	<0.005	<0.005
S-19.5-B3	2/2/90	<1.0	0.028	<0.005	<0.005	0.017
S-25-B3	2/2/90	4.5	0.047	<0.01	0.011	0.038
S-32-B3	2/2/90	190	<1.0	<1.0	<1.0	1.7

Results in parts per million (ppm)
TPHg = Total Petroleum Hydrocarbons as gasoline
< = Indicates less than the detection limit for the specified method of analysis.

S-25-B2
- S: Soil sample
- 25: Approximate sample depth
- B2: Boring number

CONCLUSIONS

The following conclusions are based on the results of this limited assessment:

- The shallow soil in the area of the four underground gasoline-storage tanks has been affected by gasoline hydrocarbons. This is based on laboratory analytical results indicating a TPHg concentration of 190 ppm present in a soil sample collected from an approximate depth of 32 feet in boring B-3, and on elevated OVM readings noted from soil samples collected from borings B-1, B-2 and B-3.

- The first-encountered ground water beneath the site appears to have been affected by hydrocarbon contamination. This conclusion is based on the 1/8-inch-thick layer of floating product observed on the surface of a ground water "grab" sample collected from boring B-1.

- The high OVM readings and relatively low concentrations detected by the laboratory analyses suggest that vapor in soil near the tank cavity contains vapor-phase hydrocarbons.

LIMITATIONS

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

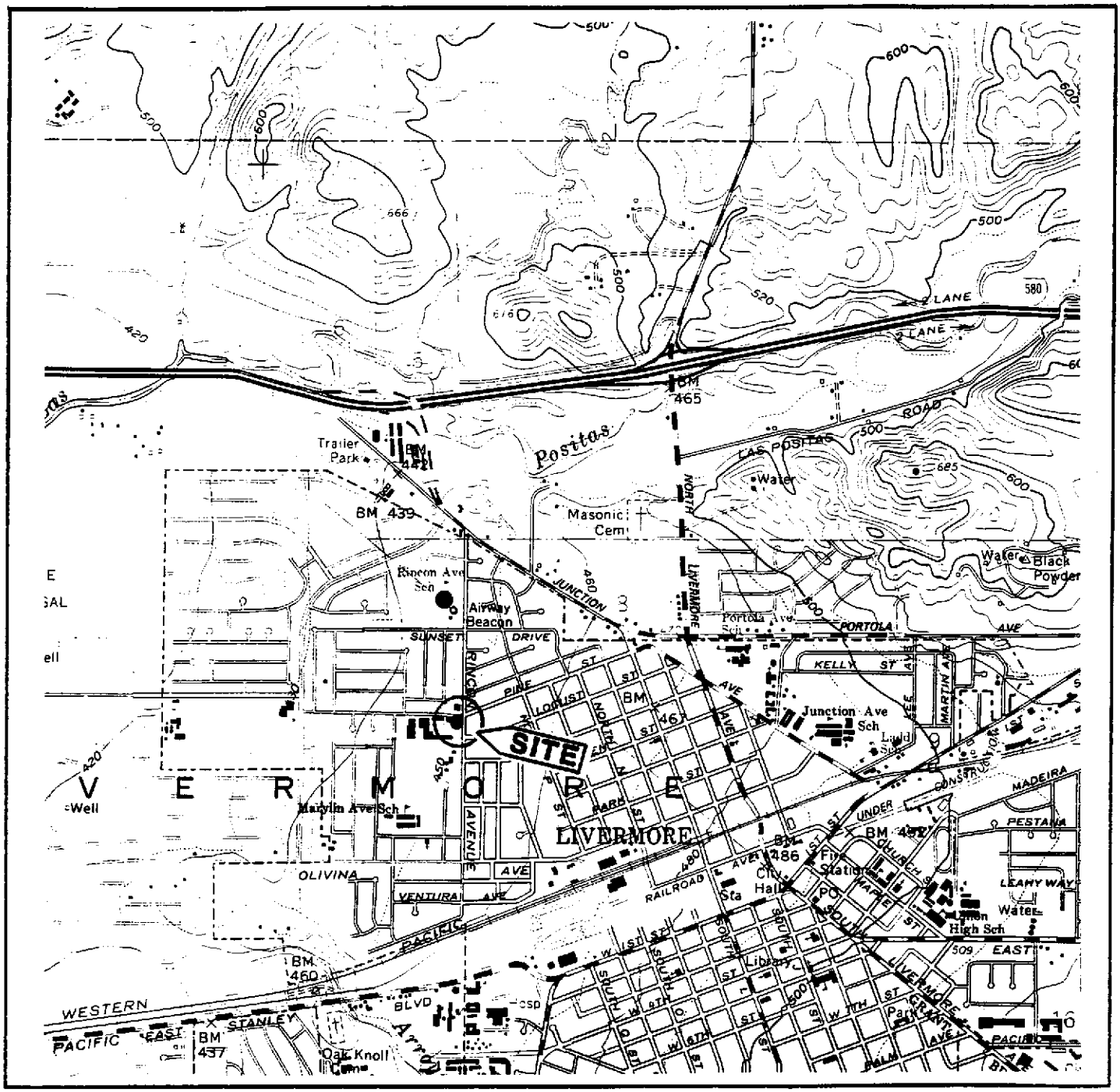
REFERENCES

Alameda County Flood Control and Water Conservation District, Zone 7, Water Resources Engineering. 1986. Water Level Contours. 1 inch = 3000 feet scale map.

Applied GeoSystems. January 20, 1990. Site Safety Plan Subsurface Environmental Assessment at the ARCO Service Station No. 771, 899 Rincon Avenue, Livermore, California: AGS Report No. 60000-1S.

Brown and Caldwell. September 16, 1987. Soil Sample Results for Waste Oil Tank Removal, ARCO Station 771: Report No. 17/3456-02/3.

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



Source: U.S. Geological Survey
7.5-Minute Quadrangle
Livermore, California
Photorevised 1980

N

Approximate Scale

2000 1000 0 2000 4000

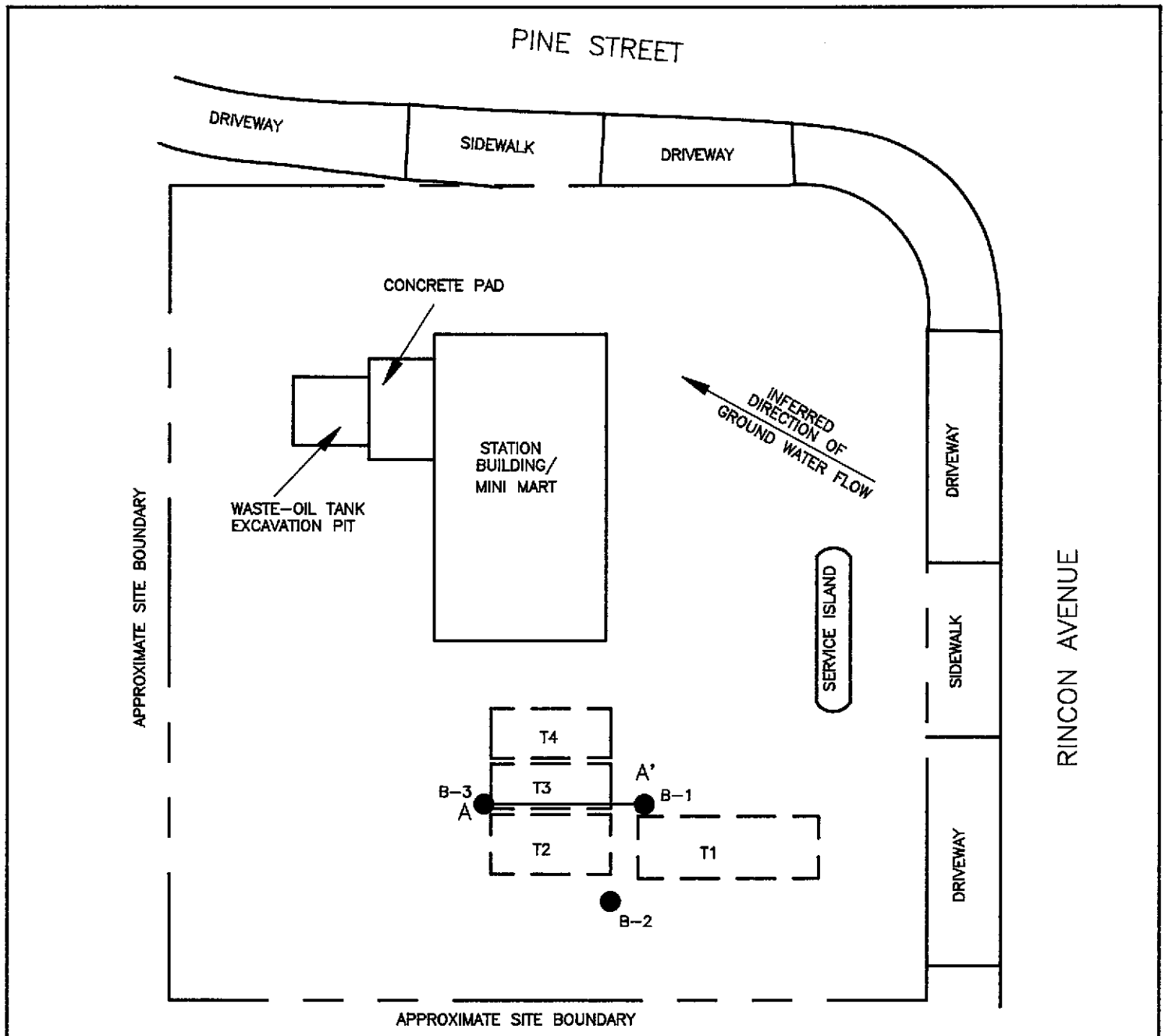
feet

Applied GeoSystems

PROJECT 60000-1

SITE VICINITY MAP
ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 1



EXPLANATION

B-3 ● = Soil boring

A——A' = Cross section

T4 = Underground gasoline-storage tank

N

Approximate Scale

20 10 0 20 40

feet

Source: Modified from plan supplied by ARCO.

Applied GeoSystems

PROJECT 60000-1

GENERALIZED SITE PLAN
ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 2

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		LTR	DESCRIPTION	MAJOR DIVISIONS		LTR	DESCRIPTION
Coarse-grained soils	Gravel and gravelly soils	GW	Well-graded gravels of gravel-sand mixtures, little or no fines	Fine-grained soils	Silts and clays LL<50	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		GM	Silty gravels, gravel-sand-silt mixtures			OL	Organic silts and organic silt-clays of low plasticity
		GC	Clayey gravels, gravel-sand-clay mixtures		Silts and clays LL>50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils. Elastic silts
	Sand and sandy soils	SW	Well-graded sand of gravelly sands, little or no fines			CH	Inorganic clays of high plasticity, fat clays
		SP	Poorly-graded sands or gravelly sands, little or no fines			OH	Organic clays of medium to high plasticity, organic silts
		SM	Silty sands, sand-silt mixtures	Highly organic soils		PT	Peat and other highly organic soils
		SC	Clayey sands, sand-clay mixtures				


Depth through which sampler is driven


Relatively undisturbed sample


No sample recovered


Static water level observed in well


Initial water level observed in boring

S-10 Sample number


Sand pack


Bentonite annular seal


Neat cement annular seal


Caved native soil


Blank PVC


Machine-slotted PVC

P.I.D. Photoionization detector

BLOWS REPRESENT THE NUMBER OF BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES TO DRIVE THE SAMPLER THROUGH EACH 6 INCHES OF AN 18-INCH PENETRATION.

DASHED LINES SEPARATING UNITS ON THE LOG REPRESENT APPROXIMATE BOUNDARIES ONLY. ACTUAL BOUNDARIES MAY BE GRADUAL. LOGS REPRESENT SUBSURFACE CONDITIONS AT THE BORING LOCATION AT THE TIME OF DRILLING ONLY.

Applied GeoSystems

PROJECT 60000-1

UNIFIED SOIL CLASSIFICATION SYSTEM AND SYMBOL KEY
ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 3

Total depth of boring: 35 feet **Diameter of boring:** 6 inches **Date drilled:** 2/1/90

Casing diameter: N/A **Length:** N/A **Slot size:** N/A

Screen diameter: N/A **Length:** N/A **Material type:** N/A

Drilling Company: Bakersfield Well & Pump **Driller:** Sid & Tom

Method Used: Hollow-Stem Auger **Field Geologist:** Steve Bittman

Signature of Registered Professional: _____

Registration No.: _____ **State:** CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0						
					Asphalt (6 inches).	
2				GW	Sandy gravel with clay, brown, damp, dense with subrounded gravel.	
4		7				
		10				
6	S-5	19	0			
8						
		16				
10		27				
	S-10	39	2.4		Moist, very dense, noticeable odor.	
12						
14		27				
	S-14.5	45	20			
16						
18					Obvious odor.	
		31				
20	S-19.5	50+	200			

(Section continues downward)

Applied GeoSystems

PROJECT 60000-1

LOG OF BORING B - 1

ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 4

Depth	Sample No.	BLOWS	P.I.D.	USCS Code	Description	Well Const.
22				GW	Sandy gravel with clay, brown, moist, very dense, obvious odor.	
24	S-24.5	27 50+	800			
26						
28					Increase clay.	
30	S-29.5	31 50+	20			
32				▽		
34	S-34.5	36 50+	100			
36					Total Depth = 35 feet.	
38						
40						
42						
44						
46						
48						
50						

Applied GeoSystems

PROJECT 60000-1

LOG OF BORING B - 1

ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 5

Total depth of boring: 31.5 feet **Diameter of boring:** 6 inches **Date drilled:** 2/1/90

Casing diameter: N/A **Length:** N/A **Slot size:** N/A

Screen diameter: N/A **Length:** N/A **Material type:** N/A

Drilling Company: Bakersfield Well & Pump **Driller:** Sid & Tom

Method Used: Hollow-Stem Auger **Field Geologist:** Steve Bittman

Signature of Registered Professional:

Registration No.: **State:** CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0					Asphalt (6 inches).	
2				GW	Sandy gravel with clay, brown, damp, dense with subrounded gravel.	
4		10				
	S-5	17	5		Noticeable odor.	
6		20				
8						
		11				
10	S-10	17	0			
		29				
12						
14		17				
		20	10		Gray.	
	S-15	15				
16						
18				CL	Sandy clay, gray, moist, low to medium plasticity, stiff, noticeable odor.	
		20		GC	Clayey gravel with sand, gray-brown, moist, very dense with subangular gravel, obvious odor.	
20		41	210			
	S-20	50+			(Section continues downward)	

Applied GeoSystems

PROJECT 60000-1

LOG OF BORING B - 2

ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 6

Depth	Sample No.	BLOWS	P.I.D.	USCS Code	Description	Well Const.
22				GC	Clayey gravel with sand, gray–brown, moist, very dense with subangular gravel, obvious odor.	
24		21				
		37				
	S–25	50+	35			
26						
28						
30		7				
		15		CL	Gravelly clay, brown, moist, subangular gravel, medium plasticity, hard.	
	S–31	40	2			
32					Total Depth = 31–1/2 feet.	
34						
36						
38						
40						
42						
44						
46						
48						
50						

Applied GeoSystems

PROJECT 60000-1

LOG OF BORING B - 2

ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 7

Total depth of boring: 32.5 feet **Diameter of boring:** 6 inches **Date drilled:** 2/1/90

Casing diameter: N/A **Length:** N/A **Slot size:** N/A

Screen diameter: N/A **Length:** N/A **Material type:** N/A

Drilling Company: Bakersfield Well & Pump **Driller:** Sid & Tom

Method Used: Hollow-Stem Auger **Field Geologist:** Steve Bittman

Signature of Registered Professional: _____

Registration No.: _____ **State:** CA

Depth	Sample No.	Blows	P.I.D.	USCS Code	Description	Well Const.
0						
					Asphalt (6 inches).	
2				GW	Sandy gravel with clay, brown, damp, medium dense with subrounded gravel.	
4		6				
		8				
6	S-5	9	0			
8						
		24				
10		37				
	S-10	25	0		Very dense.	
12						
14		41				
	S-14.5	50+	2		Moist.	
16						
18						
		27		GC	Clayey gravel with sand, gray-brown, moist, very dense with subangular gravel, noticeable odor.	
20	S-19.5	50+	110			
					(Section continues downward)	

Applied GeoSystems

PROJECT 60000-1

LOG OF BORING B - 3

ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 8

Depth	Sample No.	BLOWS	P.I.D.	USCS Code	Description	Well Const.
22				GC	Clayey gravel with sand, gray–brown, moist, very dense with subangular gravel, noticeable odor.	
24		25				
26	S–25	50+	240		Obvious odor.	
28						
30		24 45				
	S–30	45	700			
		30				
32		41				
	S–32	50	720		Obvious odor.	
					Total Depth = 32–1/2 feet.	
34						
36						
38						
40						
42						
44						
46						
48						
50						

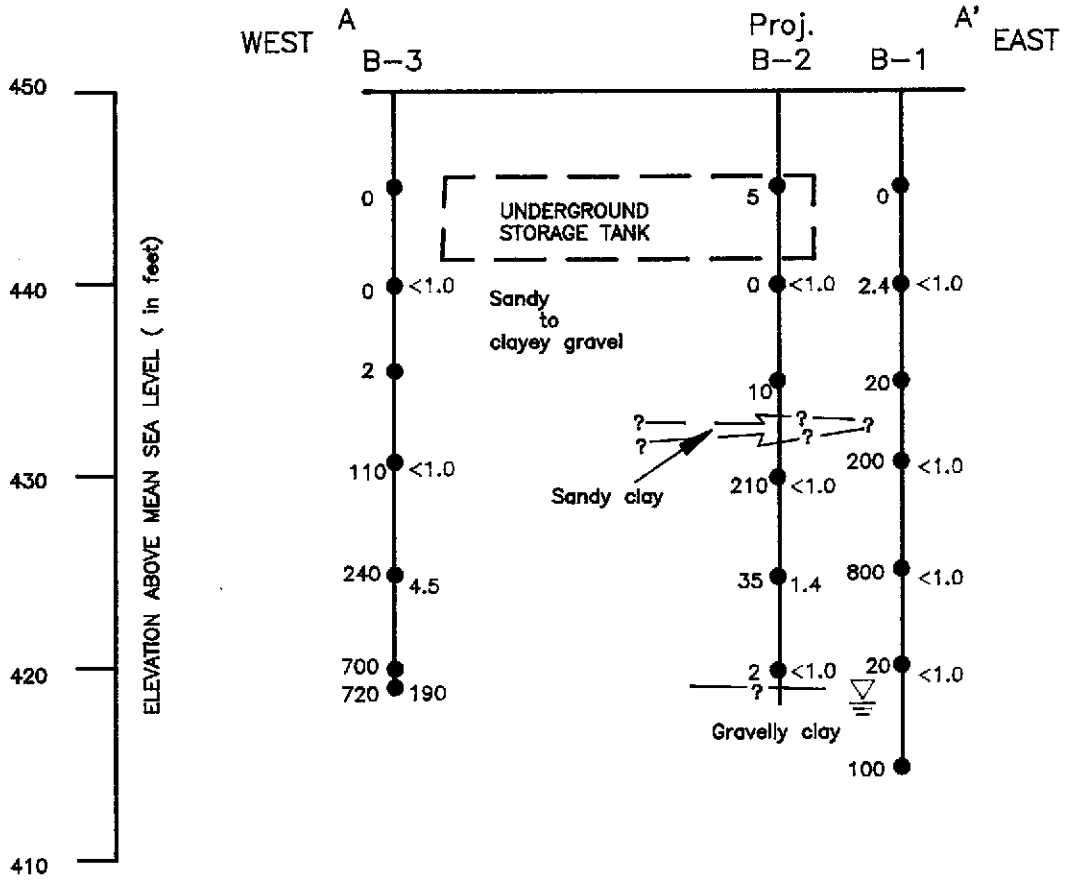
Applied GeoSystems

PROJECT 60000-1

LOG OF BORING B - 3

ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE 9



EXPLANATION

190 = Laboratory analyzed soil sample showing concentration of TPH as gasoline in ppm

800 = Field organic vapor measurement

= Boring

= Initial water level in boring

Approximate Horizontal and Vertical Scale

10 5 0 10 20

feet

Applied GeoSystems

PROJECT 60000-1

GEOLOGIC CROSS SECTION A - A'
ARCO Station 771
899 Rincon Avenue
Livermore, California

PLATE
10

APPENDIX A

ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

5997 PARKSIDE DRIVE • PLEASANTON, CALIFORNIA 94566 • (415) 484-2600

GROUNDWATER PROTECTION ORDINANCE PERMIT APPLICATION

FOR APPLICANT TO COMPLETE

(1) LOCATION OF PROJECT Arco SS #771
899 Rincon Ave.
Livermore, CA 94550

(2) CLIENT
Name ARCO Products Company
Address P.O Box 5811 Phone (415) 571-2434
City San Mateo Zip 94402

(3) APPLICANT
Name Applied GeoSystems
Address 3315 Almaden Expw #34 Phone (408) 264-7723
City San Jose Zip 95118

(4) DESCRIPTION OF PROJECT
Water Well Construction ___ Geotechnical Investigation
Cathodic Protection ___ General ___
Well Destruction ___ Contamination ✓

(5) PROPOSED WATER WELL USE
Domestic ___ Industrial ___ Irrigation ___
Municipal ___ Monitoring ___ Other ___

(6) PROPOSED CONSTRUCTION
Drilling Method:
Mud Rotary ___ Air Rotary ___ Auger ✓
Cable ___ Other ___

DRILLER'S LICENSE NO. C57 # ~~334467~~ 551920

WELL PROJECTS
Drill Hole Diameter ___ in. Maximum
Casing Diameter ___ in. Depth ___ ft.
Surface Seal Depth ___ ft. Number ___

GEOTECHNICAL PROJECTS
Number of Borings 5 Maximum
Hole Diameter 8 in. Depth 30 ft.

(7) ESTIMATED STARTING DATE February 12, 1990
ESTIMATED COMPLETION DATE February 13, 1990

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

APPLICANT'S SIGNATURE Kenton C Sowers Date 1/23/90

FOR OFFICE USE

PERMIT NUMBER 90046
LOCATION NUMBER

PERMIT CONDITIONS

Circled Permit Requirements Apply

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

B. WATER WELLS, INCLUDING PIEZOMETERS
1. Minimum surface seal thickness is two inches cement grout placed by tremie.
2. Minimum seal depth is 50 feet for municipal an industrial wells or 20 feet for domestic, irriga tion, and monitoring wells unless a lesser dep is specially approved.

(C.) GEOTECHNICAL. Backfill bore hole with compacted cu tings or heavy bentonite and upper two feet with co pacted material. In areas of known or suspecte contamination, tremied cement grout shall be used place of compacted cuttings.

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

E. WELL DESTRUCTION. See attached.

Approved Wyman Hong Date 25 Jan 90
Wyman Hong

210

APPENDIX B

APPENDIX B

FIELD METHODS

Site Safety Plan

Field work performed by Applied GeoSystems on behalf of ARCO Products Company at the site was conducted in accordance with Applied GeoSystems' Site Safety Plan No. 60000-1S, (Applied GeoSystems, 1990). This plan describes the safety requirements for the evaluation of soil and ground water, including soil sampling and drilling of soil borings. The site safety plan is applicable to personnel of Applied GeoSystems and its subcontractors. Applied GeoSystems personnel and subcontractors of Applied GeoSystems scheduled to perform the work at the site were briefed on the contents of the site safety plan before work began. A copy of the site safety plan was available for reference by appropriate parties during the work. The Staff Geologist of Applied GeoSystems acted as the Site Safety Officer.

Soil Sampling In Borings

Soil samples were collected at 5-foot intervals from the ground surface to the total depth of the borings. The soil samples were collected by advancing the boring to a point immediately above the sampling depth, and then driving a California-modified, split-spoon sampler containing brass sleeves through the hollow center of the auger into the soil. The sampler and brass sleeves were laboratory-cleaned, steam-cleaned, or washed thoroughly with Alconox and water prior to each use. The sampler was driven 18 inches with a standard 140-pound hammer repeatedly dropped 30 inches. The number of blows to drive the sampler each successive 6 inches was counted and recorded to evaluate the relative consistency of the soil.

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

One of the samples in brass sleeves not selected for laboratory analysis at each sampling interval was tested in the field with an OVM. This testing was performed by placing the soil in a zip-lock plastic bag, waiting a short period of time to allow any hydrocarbons to

volatilize and then placing the intake probe of the OVM through a small slit in the plastic bag to measure any volatile organics present. Field instruments such as the OVM are useful for measuring relative concentrations of vapor content, but cannot be used to measure levels of hydrocarbons with the confidence of laboratory analysis. The OVM readings are presented in the Logs of Borings.

Drill Cuttings

Drill cuttings evaluated as having hydrocarbon contamination at concentrations greater than 100 parts per million (ppm) were separated from those evaluated as having hydrocarbon contamination levels less than 100 ppm. Evaluation was based either on subjective evidence of soil discoloration or on measurements taken using an OVM. Drill cuttings from the borings were stockpiled behind the service station on visqueen and then covered with visqueen and remain the responsibility of ARCO. Applied GeoSystems can dispose of the soil cuttings at additional cost to ARCO.

Logging of Borings

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

APPENDIX C

Applied GeoSystems

CHAIN-OF-CUSTODY RECORD

PROJ. NO.	PROJECT NAME
690000-1	Arco 771 Livermore, CA
P.O. NO.	SAMPLERS (Signature)
	Steve Bittman

To: Anametrix Inc.
1961 Concourse Dr
Suite E
San Jose, CA

DATE MM/DD/YY	TIME	SAMPLE I.D.	No. of Containers	ANALYSIS: TPHg	BTEX	TPHd	Full EPA 5050 Extracted by EPA 5030 with PID/FID in Series	Preserved?	LABORATORY I.D. NUMBER
2-1-90		S-10-B1	1	X	X			ice	# 151
2-1-90		S-19.5-B1	1	X	X			ice	
2-1-90		S-24.5-B1	1	X	X			ice	
2-1-90		S-29.5-B1	1	X	X			ice	
2-1-90		S-10-B2	1	X	X			ice	
2-1-90		S-20-B2	1	X	X			ice	
2-1-90		S-25-B2	1	X	X			ice	
2-1-90		S-31-B2	1	X	X			ice	
2-2-90		S-10-B3	1	X	X			ice	
2-2-90		S-19.5-B3	1	X	X			ice	
2-2-90		S-25-B3	1	X	X			ice	
2-2-90		S-32-B3	1	X	X			ice	

RELINQUISHED BY (Signature):	DATE / TIME	RECEIVED BY (Signature):	REMARKS:
Steve Bittman	2-9-90 13:15	Karen Glen 2/1/90 13:15	Note: Sample dates! 1 week Turnaround!
RELINQUISHED BY (Signature):	DATE / TIME	RECEIVED BY (Signature):	
RELINQUISHED BY (Signature):	DATE / TIME	RECEIVED FOR LABORATORY BY (Signature):	

SEND RESULTS TO:
Applied GeoSystems
3315 Almaden Expressway
Suite 34
San Jose, California 95118
(408) 264-7723

Proj. Mgr.: Kent Bowen

REPORT SUMMARY
ANAMETRIX, INC. (408) 432-8192

Client : Applied GeoSystems
Address : 3315 Almaden Expressway
Suite 34
City : San Jose, CA 94118
Attn. : Kent Bowen

Anametrix W.O.#: 9002085
Date Received : 02/09/90
Purchase Order#: N/A
Project No. : 690000-1
Date Released : 02/23/90

Anametrix I.D.	Sample I.D.	Matrix	Date Sampled	Method	Date Extract	Date Analyzed	Inst I.D.
RESULTS							
9002085-01	S-10-B1	SOIL	02/01/90	TPH		02/12/90	N/A
9002085-02	S-19.5-B1	SOIL	02/01/90	TPH		02/12/90	N/A
9002085-03	S-24.5-B1	SOIL	02/01/90	TPH		02/14/90	N/A
9002085-04	S-29.5-B1	SOIL	02/01/90	TPH		02/13/90	N/A
9002085-05	S-10-B2	SOIL	02/01/90	TPH		02/13/90	N/A
9002085-06	S-20-B2	SOIL	02/01/90	TPH		02/13/90	N/A
9002085-07	S-25-B2	SOIL	02/01/90	TPH		02/13/90	N/A
9002085-08	S-31-B2	SOIL	02/01/90	TPH		02/14/90	N/A
9002085-09	S-10-B3	SOIL	02/02/90	TPH		02/13/90	N/A
9002085-10	S-19.5-B3	SOIL	02/02/90	TPH		02/13/90	N/A
9002085-11	S-25-B3	SOIL	02/02/90	TPH		02/13/90	N/A
9002085-12	S-32-B3	SOIL	02/02/90	TPH		02/14/90	N/A

ANALYSIS DATA SHEET - PETROLEUM HYDROCARBON COMPOUNDS
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : 690000-1 S-10-B1
Matrix : SOIL
Date sampled : 02/01/90
Date anl.TPHg: 02/12/90
Date ext.TPHd: N/A
Date anl.TPHd: N/A

Anametrix I.D. : 9002085-01
Analyst : mh
Supervisor : TC
Date released : 02/23/90
Date ext. TOG : N/A
Date anl. TOG : N/A

CAS #	Compound Name	Reporting Limit (ug/kg)	Amount Found (ug/kg)
71-43-2	Benzene	5	ND
108-88-3	Toluene	5	ND
100-41-4	Ethylbenzene	5	ND
1330-20-7	Total Xylenes	5	ND
	TPH as Gasoline	1000	ND

ND - Not detected at or above the practical quantitation limit for the method.
TPHg - Total Petroleum Hydrocarbons as gasoline is determined by GCFID using EPA Method 5030.
BTEX - Benzene, Toluene, Ethylbenzene, and Total Xylenes are determined by modified EPA 8020.

All testing procedures follow California Department of Health Services (Cal-DHS) approved methods.

ANALYSIS DATA SHEET - PETROLEUM HYDROCARBON COMPOUNDS
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : 690000-1 S-19.5-B1
Matrix : SOIL
Date sampled : 02/01/90
Date anl.TPHg: 02/12/90
Date ext.TPHd: N/A
Date anl.TPHd: N/A

Anametrix I.D. : 9002085-02
Analyst : mk
Supervisor : TC
Date released : 02/23/90
Date ext. TOG : N/A
Date anl. TOG : N/A

CAS #	Compound Name	Reporting Limit (ug/kg)	Amount Found (ug/kg)
71-43-2	Benzene	5	22
108-88-3	Toluene	5	24
100-41-4	Ethylbenzene	5	ND
1330-20-7	Total Xylenes	5	22
	TPH as Gasoline	1000	ND

ND - Not detected at or above the practical quantitation limit for the method.
TPHg - Total Petroleum Hydrocarbons as gasoline is determined by GCFID using EPA Method 5030.
BTEX - Benzene, Toluene, Ethylbenzene, and Total Xylenes are determined by modified EPA 8020.

All testing procedures follow California Department of Health Services (Cal-DHS) approved methods.

ANALYSIS DATA SHEET - PETROLEUM HYDROCARBON COMPOUNDS
ANAMETRIX, INC. (408) 432-8192

Sample I.D.	: 690000-1 S-24.5-B1	Anametrix I.D.	: 9002085-03
Matrix	: SOIL	Analyst	: mh
Date sampled	: 02/01/90	Supervisor	: TC
Date anl.TPHg	: 02/14/90	Date released	: 02/23/90
Date ext.TPHd	: N/A	Date ext. TOG	: N/A
Date anl.TPHd	: N/A	Date anl. TOG	: N/A

CAS #	Compound Name	Reporting Limit (ug/kg)	Amount Found (ug/kg)
71-43-2	Benzene	10	22
108-88-3	Toluene	10	15
100-41-4	Ethylbenzene	10	10
1330-20-7	Total Xylenes	10	48
	TPH as Gasoline	1000	1000

ND - Not detected at or above the practical quantitation limit for the method.
TPHg - Total Petroleum Hydrocarbons as gasoline is determined by GCFID using EPA Method 5030.
BTEX - Benzene, Toluene, Ethylbenzene, and Total Xylenes are determined by modified EPA 8020.

All testing procedures follow California Department of Health Services (Cal-DHS) approved methods.

ANALYSIS DATA SHEET - PETROLEUM HYDROCARBON COMPOUNDS
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : 690000-1 S-29.5-B1
Matrix : SOIL
Date sampled : 02/01/90
Date anl.TPHg: 02/13/90
Date ext.TPHd: N/A
Date anl.TPHd: N/A

Anametrix I.D. : 9002085-04
Analyst : MM
Supervisor : TC
Date released : 02/23/90
Date ext. TOG : N/A
Date anl. TOG : N/A

CAS #	Compound Name	Reporting Limit (ug/kg)	Amount Found (ug/kg)
71-43-2	Benzene	5	ND
108-88-3	Toluene	5	ND
100-41-4	Ethylbenzene	5	ND
1330-20-7	Total Xylenes	5	ND
	TPH as Gasoline	1000	ND

ND - Not detected at or above the practical quantitation limit for the method.
TPHg - Total Petroleum Hydrocarbons as gasoline is determined by GCFID using EPA Method 5030.
BTEX - Benzene, Toluene, Ethylbenzene, and Total Xylenes are determined by modified EPA 8020.

All testing procedures follow California Department of Health Services (Cal-DHS) approved methods.

ANALYSIS DATA SHEET - PETROLEUM HYDROCARBON COMPOUNDS
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : 690000-1 S-10-B2
Matrix : SOIL
Date sampled : 02/01/90
Date anl.TPHg: 02/13/90
Date ext.TPHd: N/A
Date anl.TPHd: N/A

Anametrix I.D. : 9002085-05
Analyst : [illegible]
Supervisor : [illegible]
Date released : 02/23/90
Date ext. TOG : N/A
Date anl. TOG : N/A

CAS #	Compound Name	Reporting Limit (ug/kg)	Amount Found (ug/kg)
71-43-2	Benzene	5	ND
108-88-3	Toluene	5	ND
100-41-4	Ethylbenzene	5	ND
1330-20-7	Total Xylenes	5	ND
	TPH as Gasoline	1000	ND

ND - Not detected at or above the practical quantitation limit for the method.
TPHg - Total Petroleum Hydrocarbons as gasoline is determined by GCFID using EPA Method 5030.
BTEX - Benzene, Toluene, Ethylbenzene, and Total Xylenes are determined by modified EPA 8020.

All testing procedures follow California Department of Health Services (Cal-DHS) approved methods.

ANALYSIS DATA SHEET - PETROLEUM HYDROCARBON COMPOUNDS
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : 690000-1 S-20-B2
Matrix : SOIL
Date sampled : 02/01/90
Date anl.TPHg: 02/13/90
Date ext.TPHd: N/A
Date anl.TPHd: N/A

Anametrix I.D. : 9002085-06
Analyst : SR
Supervisor : TC
Date released : 02/23/90
Date ext. TOG : N/A
Date anl. TOG : N/A

CAS #	Compound Name	Reporting Limit (ug/kg)	Amount Found (ug/kg)
71-43-2	Benzene	5	16
108-88-3	Toluene	5	20
100-41-4	Ethylbenzene	5	ND
1330-20-7	Total Xylenes	5	25
	TPH as Gasoline	1000	ND

ND - Not detected at or above the practical quantitation limit for the method.
TPHg - Total Petroleum Hydrocarbons as gasoline is determined by GCFID using EPA Method 5030.
BTEX - Benzene, Toluene, Ethylbenzene, and Total Xylenes are determined by modified EPA 8020.

All testing procedures follow California Department of Health Services (Cal-DHS) approved methods.

ANALYSIS DATA SHEET - PETROLEUM HYDROCARBON COMPOUNDS
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : 690000-1 S-25-B2
Matrix : SOIL
Date sampled : 02/01/90
Date anl.TPHg: 02/13/90
Date ext.TPHd: N/A
Date anl.TPHd: N/A

Anametrix I.D. : 9002085-07
Analyst : GA
Supervisor : TC
Date released : 02/23/90
Date ext. TOG : N/A
Date anl. TOG : N/A

CAS #	Compound Name	Reporting Limit (ug/kg)	Amount Found (ug/kg)
71-43-2	Benzene	10	ND
108-88-3	Toluene	10	ND
100-41-4	Ethylbenzene	10	ND
1330-20-7	Total Xylenes	10	18
	TPH as Gasoline	1000	1400

ND - Not detected at or above the practical quantitation limit for the method.
TPHg - Total Petroleum Hydrocarbons as gasoline is determined by GCFID using EPA Method 5030.
BTEX - Benzene, Toluene, Ethylbenzene, and Total Xylenes are determined by modified EPA 8020.

All testing procedures follow California Department of Health Services (Cal-DHS) approved methods.

ANALYSIS DATA SHEET - PETROLEUM HYDROCARBON COMPOUNDS
ANAMETRIX, INC. (408) 432-8192

Sample I.D.	: 690000-1 S-31-B2	Anametrix I.D.	: 9002085-08
Matrix	: SOIL	Analyst	:
Date sampled	: 02/01/90	Supervisor	:
Date anl.TPHg	: 02/14/90	Date released	: 02/23/90
Date ext.TPHd	: N/A	Date ext. TOG	: N/A
Date anl.TPHd	: N/A	Date anl. TOG	: N/A

CAS #	Compound Name	Reporting Limit (ug/kg)	Amount Found (ug/kg)
71-43-2	Benzene	5	ND
108-88-3	Toluene	5	ND
100-41-4	Ethylbenzene	5	ND
1330-20-7	Total Xylenes	5	ND
	TPH as Gasoline	1000	ND

ND - Not detected at or above the practical quantitation limit for the method.
TPHg - Total Petroleum Hydrocarbons as gasoline is determined by GCFID using EPA Method 5030.
BTEX - Benzene, Toluene, Ethylbenzene, and Total Xylenes are determined by modified EPA 8020.

All testing procedures follow California Department of Health Services (Cal-DHS) approved methods.

ANALYSIS DATA SHEET - PETROLEUM HYDROCARBON COMPOUNDS
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : 690000-1 S-10-B3
Matrix : SOIL
Date sampled : 02/02/90
Date anl.TPHg: 02/13/90
Date ext.TPHd: N/A
Date anl.TPHd: N/A

Anametrix I.D. : 9002085-09
Analyst : [illegible]
Supervisor : TC
Date released : 02/23/90
Date ext. TOG : N/A
Date anl. TOG : N/A

CAS #	Compound Name	Reporting Limit (ug/kg)	Amount Found (ug/kg)
71-43-2	Benzene	5	ND
108-88-3	Toluene	5	ND
100-41-4	Ethylbenzene	5	ND
1330-20-7	Total Xylenes	5	ND
	TPH as Gasoline	1000	ND

ND - Not detected at or above the practical quantitation limit for the method.
TPHg - Total Petroleum Hydrocarbons as gasoline is determined by GCFID using EPA Method 5030.
BTEX - Benzene, Toluene, Ethylbenzene, and Total Xylenes are determined by modified EPA 8020.

All testing procedures follow California Department of Health Services (Cal-DHS) approved methods.

ANALYSIS DATA SHEET - PETROLEUM HYDROCARBON COMPOUNDS
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : 690000-1 S-19.5-B3
Matrix : SOIL
Date sampled : 02/02/90
Date anl.TPHg: 02/13/90
Date ext.TPHd: N/A
Date anl.TPHd: N/A

Anametrix I.D. : 9002085-10
Analyst : CB
Supervisor : TC
Date released : 02/23/90
Date ext. TOG : N/A
Date anl. TOG : N/A

CAS #	Compound Name	Reporting Limit (ug/kg)	Amount Found (ug/kg)
71-43-2	Benzene	5	28
108-88-3	Toluene	5	ND
100-41-4	Ethylbenzene	5	ND
1330-20-7	Total Xylenes	5	17
	TPH as Gasoline	1000	ND

ND - Not detected at or above the practical quantitation limit for the method.
TPHg - Total Petroleum Hydrocarbons as gasoline is determined by GCFID using EPA Method 5030.
BTEX - Benzene, Toluene, Ethylbenzene, and Total Xylenes are determined by modified EPA 8020.

All testing procedures follow California Department of Health Services (Cal-DHS) approved methods.

ANALYSIS DATA SHEET - PETROLEUM HYDROCARBON COMPOUNDS
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : 690000-1 S-25-B3
Matrix : SOIL
Date sampled : 02/02/90
Date anl.TPHg: 02/13/90
Date ext.TPHd: N/A
Date anl.TPHd: N/A

Anametrix I.D. : 9002085-11
Analyst : mh
Supervisor : TC
Date released : 02/23/90
Date ext. TOG : N/A
Date anl. TOG : N/A

CAS #	Compound Name	Reporting Limit (ug/kg)	Amount Found (ug/kg)
71-43-2	Benzene	10	47
108-88-3	Toluene	10	ND
100-41-4	Ethylbenzene	10	11
1330-20-7	Total Xylenes	10	38
	TPH as Gasoline	1000	4500

ND - Not detected at or above the practical quantitation limit for the method.
TPHg - Total Petroleum Hydrocarbons as gasoline is determined by GCFID using EPA Method 5030.
BTEX - Benzene, Toluene, Ethylbenzene, and Total Xylenes are determined by modified EPA 8020.

All testing procedures follow California Department of Health Services (Cal-DHS) approved methods.

ANALYSIS DATA SHEET - PETROLEUM HYDROCARBON COMPOUNDS
ANAMETRIX, INC. (408) 432-8192

Sample I.D. : 690000-1 S-32-B3
Matrix : SOIL
Date sampled : 02/02/90
Date anl.TPHg: 02/14/90
Date ext.TPHd: N/A
Date anl.TPHd: N/A

Anametrix I.D. : 9002085-12
Analyst : JG
Supervisor : TC
Date released : 02/23/90
Date ext. TOG : N/A
Date anl. TOG : N/A

CAS #	Compound Name	Reporting Limit (ug/kg)	Amount Found (ug/kg)
71-43-2	Benzene	1000	ND
108-88-3	Toluene	1000	ND
100-41-4	Ethylbenzene	1000	ND
1330-20-7	Total Xylenes	1000	1700
	TPH as Gasoline	20000	190000

ND - Not detected at or above the practical quantitation limit for the method.
TPHg - Total Petroleum Hydrocarbons as gasoline is determined by GCFID using EPA Method 5030.
BTEX - Benzene, Toluene, Ethylbenzene, and Total Xylenes are determined by modified EPA 8020.

All testing procedures follow California Department of Health Services (Cal-DHS) approved methods.