Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906

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REPORT
ENVIRONMENTAL INVESTIGATION
RELATED TO UNDERGROUND TANK REMOVAL
at
ARCO Service Station No. 0374
Telegraph Avenue and Alcatraz Avenue
Oakland, California

AGS Job No. 018039-2

Report prepared for

ARCO Products Company
2000 Alameda de las Pulgas
P.O. Box 5811
San Mateo, California

by
Applied GeoSystems

William R. Short
Project Geologist

Gillian S. Holmes
G.E. 2023

August 1, 1988

Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906

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REPORT
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at
ARCO Service Station No. 0374
Telegraph Avenue and Alcatraz Avenue
Oakland, California

For ARCO Products Company

INTRODUCTION

ARCO Products Company requested that Applied GeoSystems conduct an environmental investigation in conjunction with the removal of four underground gasoline product-storage tanks at the above-referenced site. This investigation involved inspecting the removed tanks, testing for the presence of hydrocarbon product in the soil and ground water under and adjacent to the old and new tanks, testing hydrocarbon levels of excavated soil in the field prior to transport to a Class I landfill, and testing excavated and aerated soil generated during removal of the tanks. This report describes the work associated with inspecting the tanks, collecting and analyzing the soil and water samples, and monitoring the aerated and removed soil.

Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906

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August 10, 1988
0810tger
AGS 018039-2

Mr. T. M. Gerow
Alameda County Environmental Health Department
80 Swan Way, No. 200
Oakland, California 94621.

Subject: Transmittal of Applied GeoSystems Report No. 018039-2, Environmental Investigation Related to Underground Tank Removal at ARCO Service Station No. 0374, Telegraph Avenue and Alcatraz Avenue, Oakland, California

Mr. Gerow:

As per ARCO's request of August 10, 1988, we are submitting a copy of the above-referenced report for your review. Please do not hesitate to call if you have any questions regarding this report.

Sincerely,
Applied GeoSystems

William R. Short
Project Geologist

enclosure

SITE DESCRIPTION AND BACKGROUND

ARCO Service Station No. 0374 is an operating service station located on the northwest corner of the intersection of Telegraph Avenue and Alcatraz Avenue in Oakland, California. The site location is shown on the Site Vicinity Map, Plate P-1. The property and approximate locations of selected features at the site is shown on the Generalized Site Plan, Plate P-2. The site is situated on a relatively flat, asphalt- and concrete-covered lot. Four underground petroleum product-storage tanks were located along the west side of the site, as shown on Plate P-2. We understand that the tanks were used to store regular, unleaded, and supreme-unleaded gasoline for retail sale. A new tank pit was excavated at the northeast corner of the property, and two new 12,000-gallon fiberglass tanks were installed in the pit. The soil from the new excavation was used to backfill the old tank pit following removal of the tanks.

Apartments are located adjacent to the west and north sides of the service station. Small shops and apartments are located across Telegraph and Alcatraz Avenues to the east and south of the site, and an abandoned service station is located on the southeast corner of the intersection of Telegraph and Alcatraz Avenues.

REGIONAL AND LOCAL HYDROGEOLOGY

The site is located on the East Bay Alluvial Plain, near the base of the East Bay Hills, at an elevation of approximately 160 feet above mean sea level. The site is underlain by late Pleistocene alluvial deposits that consist of poorly sorted silt, sand, and gravel deposits (Helley et al., 1979). The site area is underlain by a complex distribution of continuous and discontinuous perched layers and aquifers which vary from a few to tens of feet in thickness. The shallow soils at the site consist of silty to sandy clay. The local ground-water table was encountered at a depth of approximately 11 and 14 feet below the ground surface at the time of excavation.

Applied GeoSystems performed a limited site assessment on April 8, 1988, to evaluate if soil contamination was present in the vicinity of the underground storage tanks (Applied GeoSystems Report No. 018039-1, dated June 15, 1988); this work involved drilling four soil borings near the product storage tanks. The locations of the borings are shown on Plate P-2. Ground water was encountered at about 11 feet below the ground surface. The analytical results of the soil samples from these borings are summarized in Table 1.

TABLE 1
RESULTS OF CHEMICAL ANALYSES OF SOIL SAMPLES
ARCO Service Station No. 0374
Telegraph Avenue and Alcatraz Avenue
Oakland, California

Sample Number	Total Petroleum Hydrocarbons	Detection Limits
S-05-B1	165	2
S-10-B1	48	2
S-05-B2	260	2
S-8.5-B2	60	2
S-05-B3	64	2
S-09-B3	62	2
S-05-B4	389	5
S-8.5-B4	930	10

Results in milligrams per kilogram (mg/kg), or parts per million (ppm)
Total petroleum hydrocarbons analyzed by modified EPA Method 8015
Sample identification:
S-05-B1
- S: Soil sample
- 05: Approximate sample interval in feet below existing grade
- B1: Boring number

TANK REMOVAL AND INSPECTION

A field geologist from Applied GeoSystems arrived at the site on June 1, 1988, to sample soil excavated from the new tank pit

located at the northeast corner of the site. The pit was excavated to approximately 14.5 feet below the ground surface, and approximately 2 inches of water was observed in the lowest portion of the excavation. An organic vapor analyzer (OVA) was used to field the relative levels of hydrocarbon concentration in the excavated soil. No OVA readings above ambient levels were measured. A composite sample consisting of four brass sleeves of soil was collected from the stockpile and analyzed in Applied GeoSystems' laboratory. The level of total petroleum hydrocarbons level in the sample was below the 2 part per million (ppm) detection limit for the analytical method. Copy of the Chain of Custody Record and the laboratory Analysis Report are attached to the Appendix to this report.

A field geologist from Applied GeoSystems was present at the site from June 7 through 10, 1988, to observe removal of tanks T1 through T4, inspect their outer surfaces, and collect soil samples from the tank pit. The locations of the tanks are shown on Plate P-2.

Dry ice was placed inside each tank by personnel from Golden West Construction Company of Walnut Creek, California approximately 2 hours prior to removal to create a nonexplosive environment inside the tanks, in accordance with regulations set by the

Alameda County Department of Environmental Health. Golden West Construction Company excavated the tanks; H and H Ship Service Company of San Francisco, California, transported the removed tanks to an appropriate disposal facility; and Universal Engineering of Benicia, California, transported hydrocarbon-contaminated soil to a Class I landfill.

The tanks were lifted from their cavities and rolled on their sides for inspection. The outer surface of each tank was inspected by an Applied GeoSystems field geologist for signs of leakage, through-going holes, pitting, or areas of weakness. The sides and ends of each tank were scraped, and particular attention was given to seams and points directly below each tank fill port. A summary of the observations made is presented in Table 2. After inspection, we understand that the tanks were transported to an appropriate disposal facility by H and H Ship Service Company.

SOIL AND WATER INSPECTION AND SAMPLING

Sandy backfill material was excavated around the tanks. The native material adjacent to and below the tanks consisted predominantly of silty clay. A strong product odor was obvious near the tanks during the removal and soil sampling. Soil

TABLE 2
SUMMARY OF OBSERVATIONS DURING TANK INSPECTION
ARCO Service Station No. 0374
Telegraph Avenue and Alcatraz Avenue
Oakland, California

Tank T1	(gasoline): steel, tar-coated, 4,000-gallon capacity, slightly rusted, no signs of through-going holes, evidence of spillage (dissolved tar coating around fill port).
Tank T2	(gasoline): steel, tar-coated, 6,000-gallon capacity, slightly rusted, no signs of through-going holes, evidence of spillage (dissolved tar coating around fill port).
Tank T3	(gasoline): steel, tar-coated, 4,000-gallon capacity, very slightly rusted, no signs of through-going holes, evidence of spillage (dissolved tar coating around fill port).
Tank T4	(gasoline): steel, tar-coated, 8,000-gallon capacity, very slightly rusted, no signs of through-going holes, evidence of spillage (dissolved tar coating around fill port).

samples were collected from the native soil beneath each tank. Ground water was observed seeping slowly into the northwest portion of the tank pit at a depth of approximately 12 feet during sample collection.

One sample of the native soil was collected adjacent to each end of tanks T1 through T4 at the approximate locations shown on

Plate P-2. An additional soil sample was collected from the north end of tank T4 following further lateral and vertical excavation, and a water sample was collected from the area beneath tank T1.

The samples were collected by driving a clean brass sleeve into a hydraulic-excavator bucket load of soil after it was brought to the surface. The samples were immediately sealed with aluminum foil, plastic caps, and airtight tape; labeled; and placed in iced storage for transport to the testing laboratory. Chain-of-custody protocol was observed throughout the process of handling the samples.

LABORATORY ANALYSES

The ten soil samples collected from the area near tanks T1 through T4 were analyzed at Applied GeoSystems' laboratory in Fremont, California, for total petroleum hydrocarbons by Environmental Protection Agency (EPA) Method 8015 (modified for gasoline) and the hydrocarbon constituents benzene, ethylbenzene, toluene, and total xylene isomers by EPA Method 8020. Applied GeoSystems' laboratory is certified by the State of California to undertake the analyses requested. The results of the chemical

analyses are presented in Table 3 and in the laboratory Analysis Reports included in the Appendix to this report.

TABLE 3
RESULTS OF CHEMICAL ANALYSES OF
SOIL AND WATER SAMPLES FROM EXCAVATIONS
ARCO Service Station No. 0374
Telegraph Avenue and Alcatraz Avenue
Oakland, California

Sample Number	TPH	Benzene	Ethyl-benzene	Toluene	Total Xylenes
S-11-T1A	399	14.7	20.0	20.5	91.9
S-11-T1B	8	2.57	0.74	0.39	2.75
S-12-T2A	4	0.35	0.10	0.38	0.70
S-12-T2B	75	0.91	1.77	3.61	11.92
S-12-T3A	4	2.54	0.13	<0.05	0.13
S-12-T3B	<2	<0.05	<0.05	<0.05	<0.05
S-12-T4A	1,097	16.3	34.5	81.6	188.2
S-12-T4A2*	795	23.1	24.9	67.1	130.9
S-12-T4B	3	0.76	<0.05	<0.05	<0.05
W-13-PIT	3.6	0.738	0.038	0.154	0.566

Soil results in milligrams per kilogram (mg/kg), or parts per million (ppm)
Water results in milligrams per liter (mg/L), or ppm
TPH = Total petroleum hydrocarbons
< = Less than the detection limit for the method of analysis
* = Resample of area near T4A following additional excavation
Sample identification:

S-11-T1N
- S = Sample matrix (S = soil, W = water)
- 11 = Approximate sample depth in feet below grade
- T1N = Tank number

The results of the analyses indicate that the majority of the hydrocarbon-contaminated soil has been removed from the area of the tanks, with the exception of two areas that contain hydrocarbons over 100 ppm in the soil. The water in a portion of the tank pit showed a film of hydrocarbon product; therefore, two 4-inch-diameter wells were installed in the tank cavity prior to backfilling.

A field geologist returned to the site on July 22, 1988, to perform subjective analysis of the water in the two wells in the old tank pit and the two wells in the new tank pit. The locations of the wells are shown on Plate P-2. Ground-water level data were collected using a Solinst water-level indicator to obtain a depth-to-water measurement from each well. Following the water-level measurements, liquid in the wells was subjectively analyzed for evidence of hydrocarbon contamination. Samples for subjective analysis were collected by gently lowering approximately half the length of a clean Teflon bailer past the air/liquid interface and recovering a representative sample of the liquid at the surface in each well. A sheen was detected on the water in the two wells in the old tank pit (well W-1, well W-2). The results of the subjective inspections conducted at the site are presented on Table 4.

TABLE 4
SUBJECTIVE ANALYSES
OF WATER SAMPLES
ARCO Service Station No. 0374
Telegraph Avenue and Alcatraz Avenue
Oakland, California

Well Number	Date	Depth to Water	Floating Product	Sheen
MW-1	07/22/88	8.10	NONE	PRESENT
MW-2	07/22/88	9.80	NONE	PRESENT
MW-3	07/22/88	9.05	NONE	NONE
MW-4	07/22/88	8.10	NONE	NONE

Depth to water measured in feet below top of casing.

DISPOSAL OF HYDROCARBON-CONTAMINATED SOIL

Approximately 515 cubic yards of hydrocarbon-contaminated soil were removed from the tank pit. We understand that the excavated soil was transported to a Class I landfill by Universal Engineering under contract to ARCO. A field geologist from Applied GeoSystems was present at the site from June 8 through 10, 1988 to monitor contaminant levels and observe loading of the soil. An OVA was used to monitor the hydrocarbon levels in

the excavated soil. All of the soil excavated measured above 100 ppm on the OVA.

AERATION OF GASOLINE-CONTAMINATED SOIL

Approximately 20 cubic yards of gasoline-contaminated soil were aerated at the site. A field geologist from Applied GeoSystems arrived at the site on June 17, 1988, to sample approximately 50 cubic yards of subjectively clean soil and approximately 20 cubic yards of contaminated soil stockpiled at the site. One set of three soil samples was collected from the subjectively clean soil. A photoionization detector was used to characterize the relative levels of organic vapor in the stockpiled soil. One soil sample was collected from the area with the highest organic vapor reading, and two soil samples were collected from the areas with the second highest organic vapor reading.

The samples were collected by first excavating approximately 1 foot into the soil at the three locations to be sampled and measuring the organic vapor concentration at the bottom of each excavation. The samples were collected by driving a hand-held sampler with a clean brass sleeve into the bottom of the excavation. Each sample was immediately sealed with aluminum foil, plastic caps, and airtight tape. The samples were then

labeled and placed in iced storage for transport to Applied GeoSystems' laboratory for analysis. The samples were composited in the laboratory and analyzed for total petroleum hydrocarbons by EPA Method 8015 (modified for gasoline). The results of the laboratory analysis of the subjectively clean soil showed total petroleum hydrocarbons at levels less than 2 ppm. A Copy of the Chain of Custody Record and the laboratory Analysis Report are included in the Appendix to this report. We understand that Golden West Construction hauled the soil to a local landfill after receiving the results of the laboratory analysis.

The Bay Area Air Quality Management District was notified of the proposed aeration on June 17, 1988. Golden West Construction began aerating the contaminated soil on June 18, 1988, by spreading and frequently turning the soil with a backhoe.

A geologist from Applied GeoSystems returned to the site on June 24, 1988, to collect samples for laboratory analysis from the approximately 20 cubic yards of soil that had been aerated. One set of three soil samples was collected from the aerated soil in the same manner as described above. The results of the laboratory analysis of the aerated soil showed total petroleum hydrocarbons at 10 ppm. A copy of the Chain of Custody Record and the laboratory Analysis Report are included in the Appendix

to this report. We understand that Golden West Construction hauled the aerated soil to a local landfill after receiving the results of the laboratory analysis.

We recommend that ARCO forward copies of this report to Mr. Greg Zentner of the California Regional Water Quality Control Board, San Francisco Bay Region, 1111 Jackson Street, Room 6040, Oakland, California 94607, and Mr. T. M. Gerow of the Alameda County Environmental Health Department, 80 Swan Way No. 200, Oakland, California 94621.

LIMITATIONS

This report was prepared in accordance with generally accepted standards of environmental geological practice in California at the time this investigation was performed. This investigation was conducted solely for the purpose of evaluating environmental conditions of the soil with respect to hydrocarbon-product contamination at the subject site. No soil engineering or geotechnical implications are stated or should be inferred. Evaluation of the geologic conditions at the site for the purpose of this investigation is made from a limited number of observation points. Subsurface conditions may vary away from the data points available. Additional work, including further

subsurface investigation, can reduce the inherent uncertainties associated with this type of investigation.

REFERENCE CITED

Helley, E.S., Lajoie, K.R., Spangle, W.E., and Blair, M.L., 1979, Flatland deposits of the San Francisco Bay region, California: U.S. Geological Survey Professional Paper 943, 87 p.

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

N

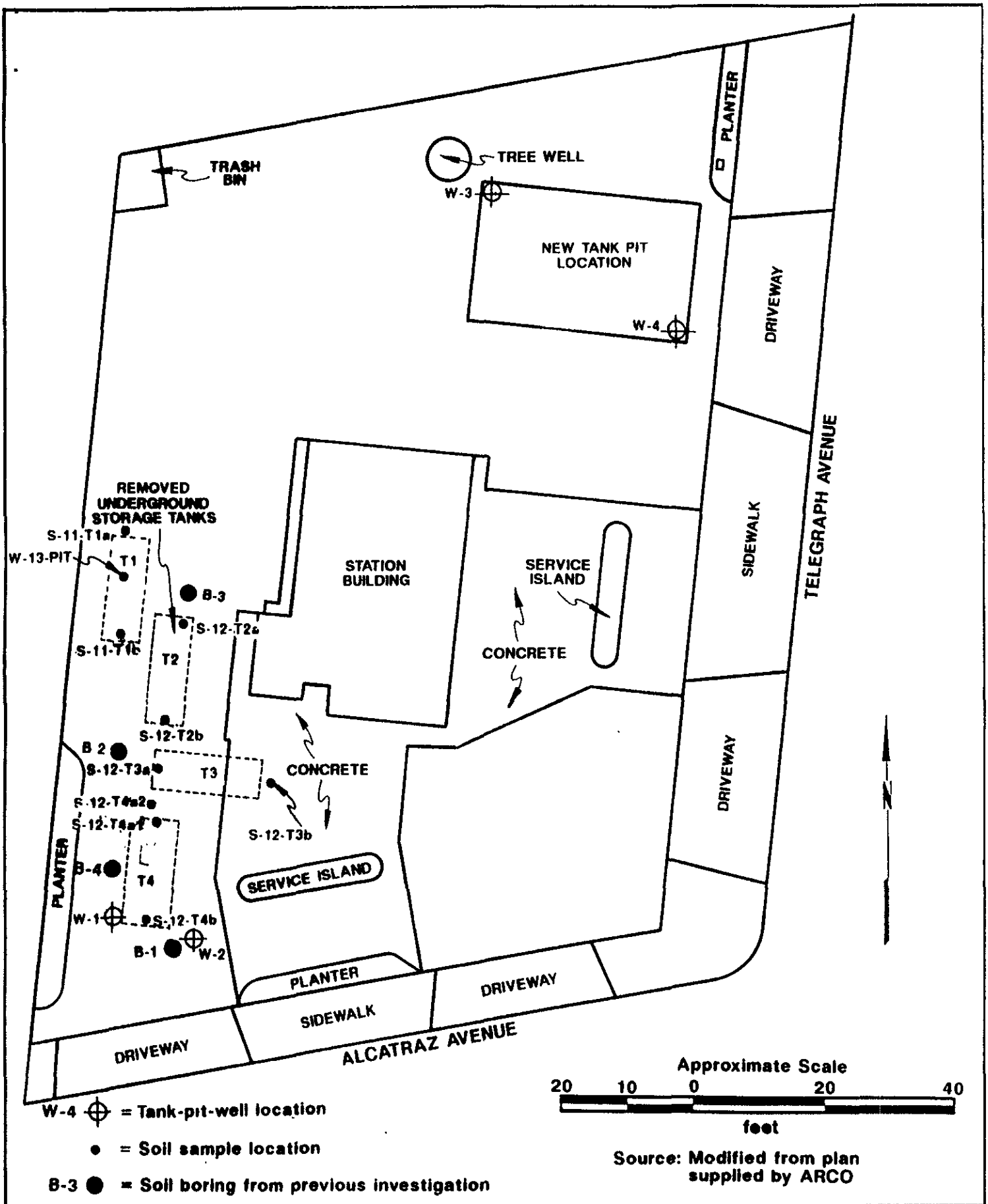
Approximate Scale
2000 1000 0 2000 4000
feet

Applied GeoSystems

PROJECT NO. 18039-2

SITE VICINITY MAP
ARCO Station No. 374
Telegraph and Alcatraz Avenues
Oakland, California

PLATE
P - 1



Applied GeoSystems

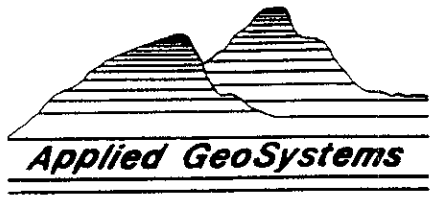
PROJECT NO. 18039-2

GENERALIZED SITE PLAN
ARCO Station No. 374
Telegraph and Alcatraz Avenues
Oakland, California

PLATE
P - 2

APPENDIX

CHAIN OF CUSTODY RECORD



43255 Mission Blvd Suite B Fremont, CA 94539 (415) 651-1906

SAMPLER (signature): James Orr

Phone: (415) 659-1906

LABORATORY: Applied GeoSystems
Fremont, CA

TURNAROUND TIME: <24 hours

Project Leader: Bill Short

Phone No. (415) 659-1906

SHIPPING INFORMATION:

Shipper _____

Address _____

Date Shipped _____

Service Used _____

Airbill No. _____ Cooler No. _____

Relinquished by: (signatures)	Received by: (signatures)	Date	Time
James Orr	William R. Short	6-1-88	2:00 p.m.
William R. Short	Received for laboratory by:	6-1-88	1400

LABORATORY SHOULD SIGN UPON RECEIPT AND RETURN A COPY OF THIS FORM WITH THE LABORATORY RESULTS

Sample No.	Site Identification	Date Sampled	Analyses Requested	Sample Condition Upon Receipt
S-0601-2 (Composited)	018039-2	6-1-88 (Composited)		ICED
S-0601-6	018039-2	6-1-88	TPH	ICED
S-0601-8	018039-2	6-1-88		ICED
S-0601-10	018039-2	6-1-88		ICED

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ANALYSIS REPORT

0212lab.frm

Report Prepared for:
Applied GeoSystems
43255 Mission Blvd.
Fremont, CA 94539
Attention: William R. Short

Date Received: 6-01-88
Laboratory Number: 06001S01
Project: 018039-2
Sample: S-0601-(2,6,8,10)
Matrix: Soil

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline	ND		2		06-01-88	
TEH as Diesel						NR
Benzene						NR
Toluene						NR
Ethylbenzene						NR
Total Xylenes						NR

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

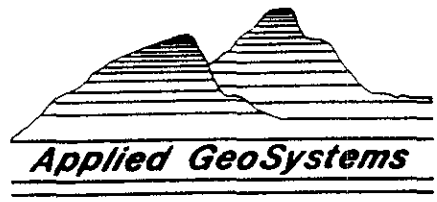
TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

6-01-88
Date Reported

CHAIN OF CUSTODY RECORD



43255 Mission Blvd Suite B Fremont, CA 94539 (415) 651-1906

SAMPLER (signature): Dan Kirkman

Phone: 651-1906

LABORATORY: Applied GeoSystems

TURNAROUND TIME: 24 hr

Project Leader: Bill Short

Phone No. 651-1906

SHIPPING INFORMATION:

Shipper

Address

Date Shipped

Service Used

Airbill No. Cooler No.

Relinquished by: (signatures)	Received by: (signatures)	Date	Time
Dan Kirkman			
	Received for laboratory by:	6-7-88	900

LABORATORY SHOULD SIGN UPON RECEIPT AND RETURN A COPY OF THIS FORM WITH THE LABORATORY RESULTS

Sample No.	Site Identification	Date Sampled	Analyses Requested	Sample Condition Upon Receipt
S-11-T1a	018039-2	6-7-88	TPH + BTEX	Iced
S-11-T1b	DK	DK	DK	DK
S-12-T2a				
S-12-T2b	DK	DK	DK	DK

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ANALYSIS REPORT

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Report Prepared for:
Applied GeoSystems
43255 Mission Blvd.
Fremont, CA 94539
Attention: William R. Short

Date Received: 6-07-88
Laboratory Number: 06025S01
Project: 018039-2
Sample: S-11-T1A
Matrix: Soil

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline	399		5		06-08-88	
TEH as Diesel						NR
Benzene	14.7		0.5		06-08-88	
Toluene	20.5		0.5		06-08-88	
Ethylbenzene	20.0		0.5		06-08-88	
Total Xylenes	91.9		0.5		06-08-88	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

6-20-88
Date Reported

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ANALYSIS REPORT

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Report Prepared for:
Applied GeoSystems
43255 Mission Blvd.
Fremont, CA 94539
Attention: William R. Short

Date Received: 6-07-88
Laboratory Number: 06025S02
Project: 018039-2
Sample: S-11-T1B
Matrix: Soil

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline	8		2		06-08-88	
TEH as Diesel						NR
Benzene	2.57		0.05		06-08-88	
Toluene	0.39		0.05		06-08-88	
Ethylbenzene	0.74		0.05		06-08-88	
Total Xylenes	2.75		0.05		06-08-88	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
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PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

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TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

6-20-88
Date Reported

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ANALYSIS REPORT

02121ab.frm

Report Prepared for:
Applied GeoSystems
43255 Mission Blvd.
Fremont, CA 94539
Attention: William R. Short

Date Received: 6-07-88
Laboratory Number: 06025S03
Project: 018039-2
Sample: S-12-T2A
Matrix: Soil

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline	4		2		06-08-88	
TEH as Diesel						NR
Benzene	0.35		0.05		06-08-88	
Toluene	0.38		0.05		06-08-88	
Ethylbenzene	0.10		0.05		06-08-88	
Total Xylenes	0.70		0.05		06-08-88	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

6-20-88
Date Reported

Applied GeoSystems 43255 Mission Boulevard, Fremont, CA 94539 (415) 651-1906

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ANALYSIS REPORT

0212lab.frm

Report Prepared for:
Applied GeoSystems
43255 Mission Blvd.
Fremont, CA 94539
Attention: William R. Short

Date Received: 6-07-88
Laboratory Number: 06025S04
Project: 018039-2
Sample: S-12-T2B
Matrix: Soil

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline	75		2		06-08-88	
TEH as Diesel						NR
Benzene	0.91		0.05		06-08-88	
Toluene	3.61		0.05		06-08-88	
Ethylbenzene	1.77		0.05		06-08-88	
Total Xylenes	11.92		0.05		06-08-88	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

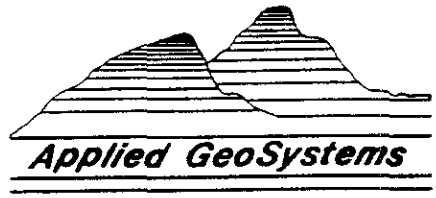
TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

6-20-88
Date Reported

CHAIN OF CUSTODY RECORD



Applied GeoSystems

43255 Mission Blvd Suite B Fremont, CA 94539 (415) 651-1906

SAMPLER (signature): Dan Kirkman

Phone: 651-1906

LABORATORY: Applied GeoSystems

TURNAROUND TIME: 24 hr

Project Leader: Bill Short

Phone No. 551-1906

SHIPPING INFORMATION:

Shipper _____

Address _____

Date Shipped _____

Service Used _____

Airbill No. _____ Cooler No. _____

Relinquished by: (signatures)	Received by: (signatures)	Date	Time
Dan Kirkman		6-9-88	4:30 pm
	Received for laboratory by:	6/9/88	4:30 pm

LABORATORY SHOULD SIGN UPON RECEIPT AND RETURN A COPY OF THIS FORM WITH THE LABORATORY RESULTS

Sample No.	Site Identification	Date Sampled	Analyses Requested	Sample Condition Upon Receipt
S-12-T3a	018039-2	6-9-88	TPH + BETX	iced
S-12-T3b	DK	DK	DK	DK
S-12-T4a				
S-12-T4b				
W-13-P.4	DK	DK	DK	DK

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ANALYSIS REPORT

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Report Prepared for:
Applied GeoSystems
43255 Mission Blvd.
Fremont, CA 94539
Attention: William R. Short

Date Received: 6-09-88
Laboratory Number: 06031S01
Project: 018039-2
Sample: S-12-T3A
Matrix: Soil

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline	4		2		06-09-88	
TEH as Diesel						NR
Benzene	2.54		0.05		06-09-88	
Toluene	ND		0.05		06-09-88	
Ethylbenzene	0.13		0.05		06-09-88	
Total Xylenes	0.13		0.05		06-09-88	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

6-20-88
Date Reported

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ANALYSIS REPORT

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Report Prepared for:
Applied GeoSystems
43255 Mission Blvd.
Fremont, CA 94539
Attention: William R. Short

Date Received: 6-09-88
Laboratory Number: 06031S02
Project: 018039-2
Sample: S-12-T3B
Matrix: Soil

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline	ND		2		06-09-88	
TEH as Diesel						NR
Benzene	ND		0.05		06-09-88	
Toluene	ND		0.05		06-09-88	
Ethylbenzene	ND		0.05		06-09-88	
Total Xylenes	ND		0.05		06-09-88	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

6-20-88
Date Reported

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ANALYSIS REPORT

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Report Prepared for:
Applied GeoSystems
43255 Mission Blvd.
Fremont, CA 94539
Attention: William R. Short

Date Received: 6-09-88
Laboratory Number: 06031S03
Project: 018039-2
Sample: S-12-T4A
Matrix: Soil

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline	1097		20		06-09-88	
TEH as Diesel						NR
Benzene	16.3		0.5		06-09-88	
Toluene	81.6		0.5		06-09-88	
Ethylbenzene	34.5		0.5		06-09-88	
Total Xylenes	188.2		0.5		06-09-88	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

6-20-88
Date Reported

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Report Prepared for:
Applied GeoSystems
43255 Mission Blvd.
Fremont, CA 94539
Attention: William R. Short

Date Received: 6-09-88
Laboratory Number: 06031S04
Project: 018039-2
Sample: S-12-T4B
Matrix: Soil

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline	3		2		06-09-88	
TEH as Diesel						NR
Benzene	0.76		0.05		06-09-88	
Toluene	ND		0.05		06-09-88	
Ethylbenzene	ND		0.05		06-09-88	
Total Xylenes	ND		0.05		06-09-88	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

6-20-88
Date Reported

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ANALYSIS REPORT

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Report Prepared for:
Applied GeoSystems
43255 Mission Blvd.
Fremont, CA 94539
Attention: William R. Short

Date Received: 6-09-88
Laboratory Number: 06032W01
Project: 018039-2
Sample: W-13-PIT
Matrix: Water

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline		3.6		0.1	06-09-88	
TEH as Diesel						NR
Benzene		0.738		0.005	06-09-88	
Toluene		0.154		0.005	06-09-88	
Ethylbenzene		0.038		0.005	06-09-88	
Total Xylenes		0.566		0.005	06-09-88	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

6-20-88
Date Reported

CHAIN OF CUSTODY RECORD

Applied GeoSystems

43255 Mission Blvd Suite B Fremont, CA 94539 (415) 651-1906

SAMPLER (signature): Dan Kirkman

Phone: 651-1906

LABORATORY: Applied GeoSystems

TURNAROUND TIME: 24hr

Project Leader: Bill Short

Phone No. 651-1906

SHIPPING INFORMATION:

Shipper

Address

Date Shipped

Service Used

Airbill No. Cooler No.

Relinquished by: (signatures)	Received by: (signatures)	Date	Time
Dan Kirkman		6-10-88	3:00
	Received for laboratory by: [signature]	6.10.88	3 45 pm

LABORATORY SHOULD SIGN UPON RECEIPT AND RETURN A COPY OF THIS FORM WITH THE LABORATORY RESULTS

Sample No.	Site Identification	Date Sampled	Analyses Requested	Sample Condition Upon Receipt
S-12-T4A2	018039-2	6-10-88	TPH + BETX	Iced

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ANALYSIS REPORT

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Report Prepared for:
Applied GeoSystems
43255 Mission Blvd.
Fremont, CA 94539
Attention: William R. Short

Date Received: 6-10-88
Laboratory Number: 06038S01
Project: 018039-2
Sample: S-12-T4A2
Matrix: Soil

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline	795		20		06-10-88	
TEH as Diesel						NR
Benzene	23.1		0.5		06-10-88	
Toluene	67.1		0.5		06-10-88	
Ethylbenzene	24.9		0.5		06-10-88	
Total Xylenes	130.9		0.5		06-10-88	

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

6-21-88
Date Reported

CHAIN OF CUSTODY RECORD

Applied GeoSystems
43255 Mission Blvd Suite B Fremont, CA 94539 (415) 651-1906

SAMPLER (signature): James R. Cline
Phone: (415) 651-1906

LABORATORY: Applied GeoSystems
Fremont, CA

TURNAROUND TIME: 24 hour

Project Leader: BILL SHORT
Phone No. (415) 651-1906

SHIPPING INFORMATION:
Shipper
Address
Date Shipped
Service Used
Airbill No. Cooler No.

Relinquished by: (signatures)	Received by: (signatures)	Date	Time
James R. Cline	William R. Short	6-17-88	11:45
William R. Short	Received for laboratory by:	6-17-88	1200

LABORATORY SHOULD SIGN UPON RECEIPT AND RETURN A COPY OF THIS FORM WITH THE LABORATORY RESULTS

Sample No.	Site Identification	Date Sampled	Analyses Requested	Sample Condition Upon Receipt
S-0617-1a	018039-2	6-17-88		ICED
S-0617-1b	018039-2	6-17-88	TPH	ICED
S-0617-1c	018039-2	6-17-88		ICED

Composite (S-0617-1a, S-0617-1b, S-0617-1c)
Composite

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ANALYSIS REPORT

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Report Prepared for:
Applied GeoSystems
43255 Mission Blvd.
Fremont, CA 94539
Attention: William R. Short

Date Received: 6-17-88
Laboratory Number: 06051S01
Project: 018039-2
Sample: S0617-1(ABC)
Matrix: Soil

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline	ND		2		06-17-88	
TEH as Diesel						NR
Benzene						NR
Toluene						NR
Ethylbenzene						NR
Total Xylenes						NR

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

6-23-88
Date Reported

CHAIN OF CUSTODY RECORD

Applied GeoSystems
43255 Mission Blvd Suite B Fremont, CA 94539 (415) 651-1906

SAMPLER (signature): Dan Kirkman
Phone: 651-1906

LABORATORY:
Applied GeoSystems
Fremont, CA

TURNAROUND TIME: 24 hour
Project Leader: Bill Short
Phone No. 651-1906

SHIPPING INFORMATION:
Shipper
Address
Date Shipped
Service Used
Airbill No. Cooler No.

Relinquished by: (signatures)	Received by: (signatures)	Date	Time
Dan Kirkman	William R. Short	6-24-88	14:30
William R. Short	Received for laboratory by:	6-24-88	1430

LABORATORY SHOULD SIGN UPON RECEIPT AND RETURN A COPY OF THIS FORM WITH THE LABORATORY RESULTS

Sample No.	Site Identification	Date Sampled		Analyses Requested	Sample Condition Upon Receipt
S-0624-1a	018039-2	6-24-88	COMPOSITE	TPH	iced
S-0624-1b	018039-2	6-24-88		TPH	iced
S-0624-1c	018039-2	6-24-88		TPH	iced

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ANALYSIS REPORT

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Report Prepared for:
Applied GeoSystems
43255 Mission Blvd.
Fremont, CA 94539
Attention: William R. Short

Date Received: 6-24-88
Laboratory Number: 06067S01
Project: 018039-2
Sample: S0624-1(ABC)
Matrix: Soil

Parameter	Result (mg/kg)	Result (mg/L)	Detection Limit (mg/kg)	Detection Limit (mg/L)	Date Analyzed	Notes
TVH as Gasoline						NR
TPH as Gasoline	10		2		06-27-88	
TEH as Diesel						NR
Benzene						NR
Toluene						NR
Ethylbenzene						NR
Total Xylenes						NR

mg/kg = milligrams per kilogram = parts per million (ppm).
mg/L = milligrams per liter = ppm.
ND = Not detected. Compound(s) may be present at concentrations below the detection limit.
NR = Analysis not required.

PROCEDURES

TVH/BTEX--Total volatile hydrocarbons (TVH) and benzene, toluene, ethylbenzene, and total xylene isomers (BTEX) are measured by extraction according to EPA Method 5030 followed by analysis by a EPA Method 8020/602 (modified for TVH) which uses a gas chromatograph (GC) equipped with a photo-ionization detector (PID) and a flame-ionization detector (FID) in series. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TPH--Total petroleum hydrocarbons (low-to-medium boiling points) are measured by extraction according to EPA Method 5030 followed by analysis by a modified EPA Method 8015 which uses a GC equipped with an FID. Soil extracts and water samples are subjected to purge-and-trap introduction into the GC.

TEH--Total extractable hydrocarbons (high boiling points) are measured by extraction according to EPA Method 3550 for soils or EPA Method 3510 for water followed by a modified EPA Method 8015 with direct sample injection into a GC equipped with an FID.

Tia Tran, Laboratory Supervisor

7-01-88
Date Reported