GROUNDWATER TECHNOLOGY ®

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MESSAGE:

Here is a copy of the C-o-C from Brown & Caldwell Analytical for samples presented in our 1986 report for former Texaco # 155R Washington, San Lorenzo. Let me know if there is any addit'l information you may need.

MAC

rec. ~ 4/93

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS
4080 Pike Lane, Suite D, Concord, CA 94520-1227 (415) 671-2387

~~685-7852~~

Gary Meyer - (salesmanager) - Industrial acct's)
Talk to: ⟹ Erik Zalaf - (salesmanager - petroleum acct's)
*2300.00 for water tests
(I pay for 1/2) = # 1150.00 Before funding

REPORT
SUBSURFACE HYDROCARBON INVESTIGATION
TEXACO SERVICE STATION
15595 WASHINGTON STREET
SAN LORENZO, CALIFORNIA
October 17, 1986

This report found < 50 ppb Benzene in MW 1
(measured in mg/L) x 1000 = ppb
Anything less than .05 mg/Litre could not be detected using instruments during this year!! This is same as PPM!
- conversion factor: mg/L x 1000 = ppb and mg/L = ppm

Prepared for:

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#20-8132

Prepared by:

Groundwater Technology
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District Manager
Certified Engineering
Geologist No. 1061

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SUBSURFACE INVESTIGATION AND ASSESSMENT
TEXACO SERVICE STATION
15595 WASHINGTON STREET
SAN LORENZO, CALIFORNIA
October 17, 1986

INTRODUCTION

This report presents the results of Groundwater Technology Inc.'s hydrogeologic investigation at the Texaco Service Station located at 15595 Washington Street, San Lorenzo, California (See Figure 1, Site Location Map). Groundwater Technology was retained by Mr. Patrick Donahue of Texaco U.S.A. to perform the investigation and provide an assessment of subsurface contamination by petroleum hydrocarbons. The investigation and assessment were conducted to comply with Texaco's Environmental Investigation Requirements prior to the site being placed for sale by the Marketing Division.

BACKGROUND

SITE SETTING

The Texaco site is located in the city of San Lorenzo and is situated approximately 1 1/2 miles northeast of the eastern shore of the San Francisco Bay. The general surface topography slopes gently to the west-southwest and the site is at an elevation of approximately 20 feet above sea level. The area within a quarter mile of the site consists of residential dwellings, small business and two schools. An apartment complex is located immediately behind the site and a vacant lot faces the property. Small businesses are located on both sides of the Texaco Station. San ~~Leandro~~ Lorenzo Creek passes less than one quarter mile

FIGURE 1
SITE LOCATION MAP

TEXACO USA / WASHINGTON AVE.
SAN LORENZO, CALIFORNIA

GROUNDWATER TECHNOLOGY

north of the site flowing intermittently to the southwest toward the San Francisco Bay. The groundwater table in the vicinity of the site is reported to be shallow, with a regional groundwater gradient direction to the west.

SITE HISTORY

The site was operated as a Texaco Service Station until it was closed several years ago. The exact date of closure is not available to Groundwater Technology at this time. The underground storage tanks remain on-site but have been purged of all product.

SCOPE OF WORK

The Scope of Work performed by Groundwater Technology at the Washington Street site consisted of drilling six exploratory borings, the collection of soil and water samples for laboratory analysis, and an assessment of the site sensitivity to subsurface contamination with regards to local ground and surface waters. Because hydrocarbon odors were detected in the soil borings suggesting contamination, three selected soil borings were converted into monitoring wells. The details of the work steps implemented are presented in the following sections.

SOIL BORINGS

The purpose of the soil borings was to explore the site for the presence of subsurface hydrocarbon contamination, and to define the vertical and areal extent of the contamination should any be found. Texaco U.S.A. requested that a total of six borings be drilled at the site; five to a depth of 15 feet and one to a depth of 25 feet or groundwater, whichever was encountered first. Four borings were to be drilled at the corners of the underground tank pit area, and two in the area of the pump islands and product lines (See Figure 2, Site Plan).

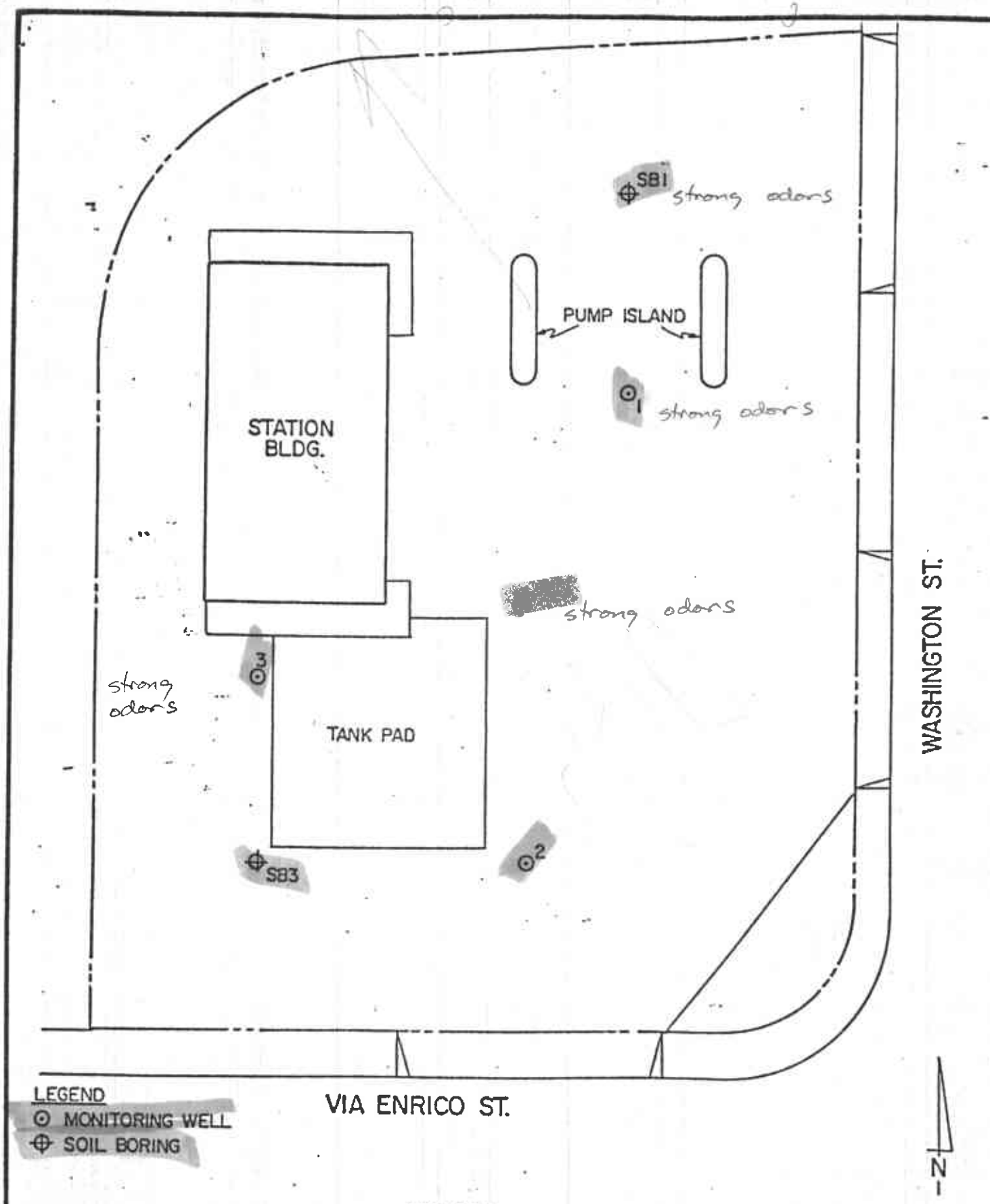

FIGURE 2
SITE PLAN

TEXACO USA
SAN LORENZO, CALIFORNIA

GROUNDWATER TECHNOLOGY

10/86

All of the soil borings were drilled with a truck mounted drill rig using 7 1/2 inch O.D. (outside diameter) hollow stem augers. The drilling was performed under the direction of a geologist who also maintained a continuous log of the materials encountered (See Appendix I for Drilling Logs).

The soil borings not converted into monitoring wells were abandoned by backfilling with clean, native material and capped with 1.5 feet of cement. The contaminated soil was piled on the site for volatilization of hydrocarbons and disposal at a later date.

MONITORING WELL INSTALLATION/CONSTRUCTION

Three selected soil borings were converted to groundwater monitoring wells when strong petroleum odors were noticed in four borings (MW-1, MW-3, SB-1 & SB-2). The three monitoring wells were constructed of two inch diameter PVC pipe and well screen. The two inch diameter, 0.020 inch slotted, well screen was installed from the bottom of the boring to five feet below the ground surface. Blank casing was then installed to the surface. A well pack consisting of #2 Monterey sand was placed in the annulus (the space between the bore hole and well casing) from the bottom of the well borings to approximately 3 feet below ground surface. The wells were completed with a bentonite seal, cement and a traffic rated street box to provide access to the well. (See Appendix II for well construction details).

SOIL SAMPLING

Soil samples were obtained during drilling using a 2.5 inch O.D. split spoon sampler lined with three, 2" x 6" brass sample tubes and was driven eighteen inches at each sampling point. The samples were collected at 5 foot intervals from 5 feet below ground surface to the water table. The collected samples were

sealed, capped and packed on ice in an insulated cooler for subsequent delivery to the laboratory for analysis. Each sample was labeled with boring number, sample designation number, time of day and depth.

All samples remained in possession of the project geologist until delivery to the laboratory. A chain of custody manifest was included with the samples at all times. (See Appendix II - Standard Operating Procedures).

A composite soil sample for each boring was formed at the laboratory by combining one sample tube from each sampling interval and performing analysis for lead, benzene, toluene, xylene and total hydrocarbon concentrations. Analysis were performed by purge and trap gas chromatography, with flame ionization detection and photo-ionization detection as per EPA Methods 5030, 8015 and 8020.

GROUNDWATER SAMPLING

Groundwater was encountered in all of the soil borings at a depth of approximately 11 feet below grade. Groundwater samples were recovered from the borings that were not converted into monitoring wells immediately following drilling. The borings converted into monitoring wells were developed by hand bailing and sampled with an EPA approved teflon and glass sampler. The groundwater samples were collected, preserved and transported to the laboratory where they were then analyzed for benzene, toluene, and xylene under Chain of Custody as per guidelines outlined in Groundwater Technology's Standard Operating Procedures SOP 9, 10 and 11 (See Appendix II).

SITE CONDITIONS

GEOLOGY

The study area is located on the western margin of the San Lorenzo Alluvial Cone which formed at the base of Walpert Ridge in the Diablo Mountains. The San Lorenzo Cone is composed of sediments deposited by San Lorenzo Creek. The creek deposited sands and gravels in its braided channel and during times of flood flow, the overbank spread of water deposited finer grained silts and clays. These sediments were derived from erosion of the Franciscan formation of consolidated marine sediments, serpentine and igneous intrusions which make up the highlands. Marine inundations from San Francisco Bay have also deposited silts and clays over the alluvial deposits on the Bay margins.

Examination of the drill logs suggests the soils at the site can be divided into three general units, although correlation from well to well is not entirely consistent. The upper unit, extending to a depth of about 5 feet below surface grade, consists mainly of brown soft sandy clay. The middle unit of brown loose medium grained clayey sands, varies in thickness from about 2 feet (MW3, SB1, SB2 and SB3) to about 5 feet (MW2). The lower unit first occurs about 7 feet below surface grade and consists of a dark brown stiff clay of undetermined thickness.

HYDROGEOLOGY

The site is located on the San Lorenzo alluvial cone of the San Francisco Bay Plain depression. The cone is composed of interlayered deposits of relatively impervious clays and permeable alluvial sands and gravels which form a series of small confined aquifers. At the site, groundwater was encountered in the lower stiff clay unit in all borings at a depth of approximately 11 feet below grade.

Groundwater in this region has been increasingly degraded by the intrusion of sea water. Mr. John Monser from the Alameda County Flood Control District reports that one groundwater testing well was located within 1/2 mile of the site. However, this well was abandoned by the county in 1983 when analysis of a water sample drawn from 55-83 feet below ground surface reported total dissolved solids (TDS) higher than EPA drinking water standards. (See Table 1) Mr. Monser also indicated that some agricultural wells may exist within the project area. Exact locations for these agricultural wells are not known, but Mr. Monser believes they draw water from deeper aquifers. Research shows that no drinking water wells exist within 1/2 mile of the site.

SUBSURFACE CONTAMINATION

Analysis of the data collected during the hydrogeologic investigation at the Washington Street Station in San Lorenzo indicates that a minor amount of contamination is present in the site soils. The contamination, according to field data, appears as hydrocarbon odor in the lowest soil unit drilled between 7 and 12 feet below grade. Laboratory analysis of soil samples detected lead in each sample in concentrations of 12 to 20 parts per million (ppm). No detectable levels of BTX or total petroleum hydrocarbon were reported in the composite soil samples. The laboratory report presenting these test results is included in Appendix III.

Six groundwater samples were collected for laboratory analysis of petroleum hydrocarbons. Two samples, SB-1 and MW-1 which are located in the vicinity of the pump island, contained minor amounts of hydrocarbon contamination. The sample collected from the soil boring, SB-1 contained 0.22 ppm benzene, 0.39 ppm

TABLE 1

WATER QUALITY

Alameda County Flood Control and Water Conservation District

Element (ppm)	Maximum EPA levels in drinking water (ppm)*	Well 13B2 Testing Date September 1983 (ppm)
CA	*	84.0
MG	125.0	50.0
NA	No limit	159.0
K	*	0.9
CO_3	*	<1.0
HCO_3	*	497.0
SO_4	250.0	123.0
CI	250.0	92.0
NO_3	10.0	34.0
FL	1.8	<1.0
B	1.0	1.0
SIO_2	*	<1.0
TDS	500.0	854.0

* Maximum EPA levels allowed in drinking water has not been documented.

toluene and 0.68 ppm xylene, however, this sample was drawn prior to developing a good hydraulic communication with the aquifer. Although minor contamination does occur in this location, additional contamination could have been introduced during drilling. Detectable amounts of xylene were found in MW-1, but the level was within EPA standards for safe drinking water. The laboratory test results are presented in Appendix IV.

CONCLUSIONS AND RECOMMENDATIONS

The effects of any residual soil contamination on the groundwater was shown to be negligible in all but two of the soil borings (MW-1 and SB-1). These borings are located upgradient and to the north of the other monitoring wells in the vicinity of the pump island indicating the initial contamination originated near the pumps. Xylene concentrations were slightly higher than the more volatile benzene and toluene suggesting that the contamination is due to an older leak. While the BTX components reported in these water samples are slightly above EPA standards for safe drinking water, the lack of any detectable contamination in the downgradient wells suggests that a small localized loss likely occurred at the pump island.

The contamination present at the site appears to be an older leak of gasoline from around the pump island. Because the laboratory results detected negligible concentrations of petroleum hydrocarbons in the soil samples and minor to negligible concentrations of petroleum hydrocarbons in the groundwater samples it is Groundwater Technology's opinion that the investigation should be closed. This is based upon the fact that the contamination is localized and non-reoccurring, the groundwater in the vicinity does not presently meet EPA standards for drinking water (See Table 1), and the regional hydrogeology consists of small confined aquifers controlled by the intervening clay layers.

Any decision to abandon the 3 monitoring wells installed by Groundwater Technology should be based upon the intended use of the site by the new owners. If the site is to be an operating retail gasoline or automotive service station the monitoring wells could be maintained for possible use by the new owners. The monitoring wells should be abandoned following regional guidelines when the underground storage tanks are removed for site usage other than described above.

CLOSURE

Groundwater Technology would like to thank Texaco U.S.A for the opportunity to have been of service on this project. If you have any questions regarding this report, please feel free to contact our office at your earliest convenience.

GROUNDWATER TECHNOLOGY, INC.
OIL RECOVERY SYSTEMS
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DISCLAIMER

The author of this report, GROUNDWATER TECHNOLOGY, INC., of Concord, County of Contra Costa, State of California, hereby gives notice that any statement of opinion contained in this report prepared by GROUNDWATER TECHNOLOGY, INC., shall not be construed to create any warranty or representation that the real property on which the investigation was conducted is free of pollution or complies with all applicable regulatory and statutory requirements; or that the property is fit for any particular purpose. Statements, descriptions or opinions are informational only and are not made or given as a warranty of the property in any way. Any purchaser of the property shall be solely responsible for determining the adequacy of the property for any and all uses for which the purchaser shall use the property. Any purchaser of the property which is subject of this report should enter into any purchase on sole reliance of his own judgement and upon his own personal investigation of the property he is to receive, and not in reliance upon any representation by GROUNDWATER TECHNOLOGY, INC., regarding such property, the character, quality or value thereof.

GROUNDWATER TECHNOLOGY

Division of Oil Recovery Systems, Inc.

Drilling L

Well Number MW-1

Project: Texaco/San Lorenzo Owner: Texaco U.S.A.

Location: 15595 Washington Project Number: 20-8132

Date Drilled: 8/8/86 Total Depth of Hole: 15 ft. Diameter: 8 in.

Surface Elevation: _____ Water Level, Initial: 11.5 ft 24-hrs: _____

Screen: Dia. 2 in. Length: 10 ft. Slot Size: .020 in

Casing: Dia. 2 in. Length: 5 ft. Type: P.V.C.

Drilling Company: HEW Drilling Drilling Method: h. s. auger

Driller: A. Boden Log by: A. Sager

Sketch Map

Notes

Depth (Feet)	Well Construction	Notes	Sample Number	Graphic Log	Description/Soil Classification (Color, Texture, Structures)
0		roadbox		SP	Light gray sand and gravel, very dry
1		cement seal			
2					Brown sandy clay, moist, slight odor
3		bentonite seal		CL	
4			4-4-5 MW-1 A		
5		gravel pack			Orange-brown medium sand, loose, moist, slight odor
6				SW	
7					
8					Dark brown stiff clay, moist, [redacted]
9			5-6-11 MW-1 B		
10					
11				CH	
12					
13					
14					
15			4-5-9 MW-1 C		Dark brown firm clay, moist, strong odor.

GROUNDWATER TECHNOLOGY

Division of Oil Recovery Systems, Inc.

Well Number MW-2

Drilling L

Project: Texaco/San Lorenzo Owner Texaco, U.S.A

Location 15595 Washington Project Number 20-8132

Date Drilled 8/8/86 Total Depth of Hole 15 ft. Diameter 8 in.

Surface Elevation ____ Water Level, Initial 9 ft. 24-hrs. ____

Screen: Dia. 2 in. Length 10 ft. Slot Size 0.020 in.

Casing: Dia. 2 in. Length 5 ft. Type P.V.C.

Drilling Company HEW Drilling Drilling Method h. s. auger

Driller A. Boden Log by A. Sager

Sketch Map

Notes

Depth (Feet)	Well Construction	Notes	Sample Number	Graphic Log	Description/Soil Classification (Color, Texture, Structures)
0		roadbox		SP	Light brown medium sand, loose, dry
1		cement			
2				CL	Dark brown sandy clay, moist, slight odor
3		bentonite seal			
4			4-4-4 MW-2 A		
5		gravel pack			Orangish brown medium sand with some clay, loose, moist.
6					
7				SW	Dark brown stiff clay (some with orange stains)
8					
9					
10			4-6-10 MW-2 B	CL	Dark brown firm clay, moist, slight odor
11					
12					
13				CH	Light brown clay, pliable, very moist, no odor
14					
15			5-6-10 MW-2 C		Light brown clay, stiff, no odor.

GROUNDWATER TECHNOLOGY
Division of Oil Recovery Systems, Inc.

Drilling L

Well Number MW 3

Project Texaco/San Lorenzo Owner Texaco, U.S.A.

Location 15595 Washington Project Number 20-8132

Date Drilled 8/8/86 Total Depth of Hole 16 ft. Diameter 8 in.

Surface Elevation ____ Water Level, Initial 12 ft 24-hrs. ____

Screen: Dia. 2 in. Length 10 ft. Slot Size 0.020 in.

Casing: Dia. 2 in. Length 5 ft. Type P.V.C.

Drilling Company HEW Drilling Drilling Method h. s. auger

Driller A. Boden Log by A. Sager

Sketch Map

Notes

Depth (Feet)	Well Construction	Notes	Sample Number	Graphic Log	Description/Soil Classification (Color, Texture, Structures)
0		roadbox		SP	Light brown sand and gravel, loose, dry
1		cement			
2				SW	Light brown medium sand
3		bentonite seal			
4				CH	Dark brown pliable clay, moist, no petroleum odor
5			5-4-3 MW-3 A		
6		gravel pack		SW	Light brown medium sand with some clay, firm, no petroleum odor.
7					
8					
9					
10			0-2-2 MW-3 B	CL	Dark brown gritty clay, pliable, very soft wet, strong petroleum odor.
11					
12					
13					
14					
15			4-5-7 MW-3 C		Dark gray stiff clay, slight petroleum odor.
16					

GROUNDWATER TECHNOLOGY

Division of Oil Recovery Systems, Inc

SOIL BORING SB 1

Drilling I

Project Texaco/San Lorenzo Owner Texaco U.S.A.

Location 15595 Washington Project Number 20-8132

Date Drilled 8/8/86 Total Depth of Hole 15 ft. Diameter 8 in.

Surface Elevation _____ Water Level, Initial 11 ft. 24-hrs. _____

Screen: Dia. _____ Length _____ Slot Size _____

Casing: Dia. _____ Length _____ Type _____

Drilling Company HEW Drilling Drilling Method h. s. auger

Driller A. Boden _____ Log by A. Sager

Sketch Map

Notes

Depth (Feet)	Well Construction	Notes	Sample Number	Graphic Log	Description/Soil Classification (Color, Texture, Structures)
0	NO WELL CONSTRUCTED			SP	Light brown medium sand and gravel, dry
1					
2				CL	Dark brown silty clay with some sand, moist
3					
4					
5			2-1-2	SW	Greenish-gray medium sand with occassional pebble, loose, moist, slight petroleum odor
6					
7			SB-1 A	CL	Mottled greenish and dark gray stiff clay, strong petroleum odor
8				CH	
9			4-6-10	CL	Dark gray very stiff clay, moist, slight petroleum odor
10			SB-1 B		
11					
12					
13				CH	Light greenish gray pliable clay, very moist strong petroleum odor
14			3-7-10		
15			SB-1 C	CL	Dark gray, very stiff clay, moist, slight petroleum odor

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GROUNDWATER TECHNOLOGY
Division of Oil Recovery Systems, Inc.

Drilling

SOIL BORING SB 2

Project Texaco/San Lorenzo Owner Texaco U.S.A.

Location 15595 Washington Project Number 20-8132

Date Drilled 8/8/86 Total Depth of Hole 15 ft. Diameter 8 in.

Surface Elevation _____ Water Level, Initial 11.5 24-hrs. _____

Screen: Dia. 2 in. Length 10 ft. Slot Size .020 in.

Casing: Dia. 2 in. Length 5 ft. Type P.V.C.

Drilling Company HEW Drilling Drilling Method h.s. auger

Driller A. Boden Log by A. Seger

Sketch Map

Notes

Depth (Feet)	Well Construction	Notes	Sample Number	Graphic Log	Description/Soil Classification (Color, Texture, Structures)
0	NO WELL CONSTRUCTED			SP	Light brown medium sand and gravel, dry
3			3-4-6 SB-2 A	SM	Dark brown silty sand, moist, slight petrole odor
5				SW	Dark brown medium sand with few pebbles, loc
7				CL	Dark brown stiff clay, moist, slight petroleum odor
9			4-8-12 SB-2 B	CL	Dark brown very stiff clay, moist, strong petroleum odor
13				CH	Light chocolate brown pliable clay, wet, no petroleum odor
14			3-7-9 SB-2 C	CL	Dark brown very stiff clay, moist
15					

GROUNDWATER TECHNOLOGY
Division of Oil Recovery Systems, Inc.

SOIL BORING — SB - 3 — Drilling

Project Texaco/San Lorenzo — Owner Texaco U.S.A.
Location 15595 Washington — Project Number 20-8132
Date Drilled 8/8/86 — Total Depth of Hole 15 ft. — Diameter 8 in.
Surface Elevation ____ — Water Level, Initial 9.5 ft. — 24-hrs. ____
Screen: Dia. ____ — Length ____ — Slot Size ____
Casing: Dia. ____ — Length ____ — Type ____
Drilling Company HEW Drilling — Drilling Method h.s. auger
Driller A. Boden — Log by A. Sager

Sketch Map

Notes

Depth (Feet)	Well Construction	Notes	Sample Number	Graphic Log	Description/Soil Classification (Color, Texture, Structures)
0	NO WELL CONSTRUCTED			SP	Light brown sand and gravel, loose, dry
1					
2				SC	Dark brown medium sand with some clay, mois
3					slight petroleum odor
4			2-3-4 SB-3 A		
5				SW	Light brown medium sand, very loose, moist.
6					
7				SC	Dark brown medium sand with some clay, mois
8					slight petroleum odor.
9			4-6-9 SB-3 B		
10				CL	Dark brown firm clay, moist, no petroleum odor
11					
12					
13				CL	Light greenish-gray stiff clay, moist, no c
14			4-5-8 SB-3 C	CH	Light greenish-gray pliable clay, wet, no c
15					Dark gray stiff clay, moist, no odor

GROUNDWATER TECHNOLOGY
STANDARD OPERATING PROCEDURE
CONCERNING WATER SAMPLING METHODOLOGY
SOP 9

Prior to water sampling, each well shall be purged by pumping a minimum of four well volumes or until the discharge water indicates stabilization of temperature, conductivity, and pH. If the well is evacuated before four well volumes are removed or stabilization is achieved, the sample should be taken when the water level in the well recovers to 80% of its initial level.

Retrieval of the water sample, sample handling and sample preservation shall be conducted in accordance with Groundwater Technology Laboratory Standard Operating Procedure (GTL SOP 10) concerning Sampling For Volatiles in Water". The sampling equipment used shall consist of a teflon and/or stainless steel samplers, which meets EPA regulations. Glass vials with teflon lids should be used to store the collected samples.

To insure sample integrity, each vial shall be filled with the sampled water such that the water stands above the lip of the vial. The cap should then be quickly placed on the vial and tightened securely. The vial should then be checked to ensure that air bubbles are not present prior to labeling of the sample. Label information should include a sample identification number, job identification, date, time, type of analysis requested and the sampler's name. Chain-of-Custody forms shall be completed as per Groundwater Technology Laboratory Standard Operating Procedure (SOP 11) concerning Chain of Custody.

The vials should be immediately placed in high quality coolers for shipment to the laboratory. The coolers should be packed with sufficient ice or freezer packs to ensure that the samples are kept below 4C. Samples which are received at the Groundwater Technology Laboratory above 10 C. will be considered substandard. To minimize sample degradation the prescribed analysis shall take place within seven days of sample collection unless specially prepared acidified vials are used.

To minimize the potential for cross contamination between wells, all the well development and water sampling equipment which contacts the groundwater shall be cleaned between each well sampling. As a second precautionary measure, the wells shall be sampled in order of increasing contaminant concentrations as established by previous analysis.

GROUNDWATER TECHNOLOGY LABORATORY (GTL)
STANDARD OPERATING PROCEDURE
CONCERNING SAMPLING FOR VOLATILES IN WATER (DISSOLVED GASOLINE, SOLVENTS, ETC.).
SOP 10

1. Use only vials properly washed and baked, available from GTL or Pierce Chemical.

2. Use clean sampling equipment. Scrub with Alconox or equivalent laboratory detergent and water followed by a thorough water rinse. Complete with a distilled water rinse.

   Sampling equipment which has come into contact with liquid hydrocarbons (free product) should be regarded with suspicion. Such equipment should have tubing and cables replaced and all resilient parts washed with laboratory detergent solution, as above. Visible deposits may have to be removed with hexane, breath methanol fumes. Solvent washing should be followed be detergent washing as above.

   This procedure is valid for volatile organics analysis only. For extractable organics (for example, pesticides, or base neutrals for EPA method 625) a final rinse with pesticide grade isopropyl alcohol, followed by overnight or oven drying, will be necessary.

3. Take duplicate samples for GTL. Mark on forms as a single sample with two containers to avoid duplication of analysis.

4. Take a site blank using distilled water or known uncontaminated source. This sample will be run at the discretion of the project manager.

5. Fill out labels and forms as much as possible ahead of time. Use an indelible laundry marker or a Space pen.

11. Unless the fabric type label is used, place scotch tape over the label to preserve its integrity.

12. For Chain of Custody reasons, sample vial should be wrapped end-for-end with scotch tape or evidence tape and signed with indelible ink where the end of the tape seals on itself. The septum needs to be covered.

13. Chill samples immediately. Samples to be stored should be kept at 4°C (39°F). Samples received at the laboratory above 10°C (as measured at glass surface by a thermocouple probe), after overnight shipping will be considered substandard, so use a high quality cooler with sufficient ice or freezer packs. (Coolers are available from GTL).

14. Fill out Chain of Custody and Analysis Request form. (See Chain of Custody Procedures SOP11).

GROUNDWATER TECHNOLOGY
STANDARD OPERATING PROCEDURE
CONCERNING MONITORING WELL INSTALLATION
SOP 13

The boreholes for the monitoring wells shall be drilled using a truck mounted hollow stem auger drill rig. The outside diameter (O.D.) of the auger should be a minimum of eight inches when installing 4-inch well screen. The hollow stem auger provides minimal interuption of drilling while permitting soil sampling at specific intervals. Soil samples can be taken at desired depths by hammering a conventional split barrel sampler containing precleaned 2 inch brass sample tubes.

The construction details of the monitoring wells to be drilled at the site are graphically depicted in the attached figure titled "Typical Detail of Monitoring Well Construction" (See Figure 1). The wells should be constructed of 4 inch PVC, .020 inch machine slotted screen and blank casing. The screened portion of the well will extend 5 feet above and 10 feet below the present water table. An appropriate sand pack as determined by grain size analysis shall be placed in the annular space between the casing and drilled hole to inhibit silt buildup around the well. An annular seal installed above the sand pack should consist of bentonite pellets overlain by neat cement or cement grout to the surface. The wellhead shall be protected below grade within a traffic rated street box. Each well shall have a permanently attached identification plate containing the following information (1) Well Number, (2) Wellhead Elevation, (3) Depth of Well, (4) Screened Interval.

Subsequent to installation the wells shall be developed to remove silts and improve well performance. The well development shall be conducted by air lifting the water within the well until groundwater pumped from the wells is silt free.

To assure that cross contamination does not occur between the drilling and development of successive wells all equipment contacting subsurface soils or ground water shall be steam cleaned. The steam cleaned equipment should include but not limited to the following (1) Drilling Augers, (2) Split Barrel Sampler, (3) Groundwater Monitoring and Sampling Equipment, (4) Well Development Piping and Sparging Equipment.

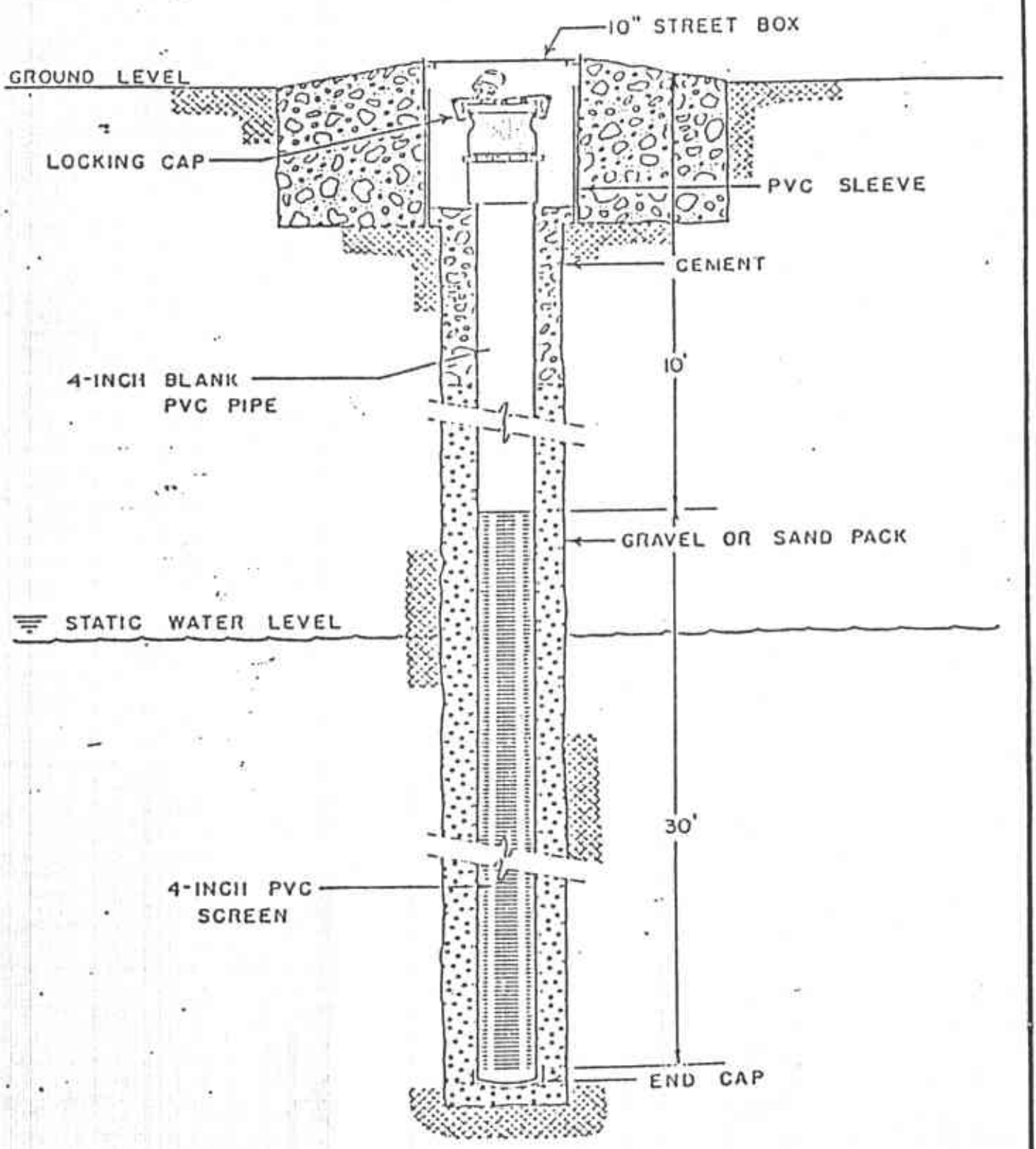

FIGURE 1

TYPICAL DETAIL

MONITORING WELL CONSTRUCTION

ARMOUR OIL - DAVIS, CALIF.

GROUNDWATER TECHNOLOGY
STANDARD OPERATING PROCEDURE
CONCERNING SOIL SAMPLING METHODOLOGY
SOP 14

Soil samples should be collected and preserved in accordance with Groundwater Technology Laboratory's Standard Operating Procedure (GTL SOP 15) concerning Soil Sample Collection and Handling when Sampling for Volatile Organics. A hollow stem soil auger should be used to drill to the desired sampling depth. A standard 2 inch diameter split spoon sampler 18 inches in length shall be used to collect the samples. The samples are contained in 2 inch diameter by 6 inch long thin walled brass tube liners fitted into the split spoon sampler (three per sampler).

The split spoon sampler should be driven the full depth of the spoon into the soil using a 140 pound hammer. The spoon shall then be extracted from the borehole and the brass tube liners containing the soil sample removed from the sampler. The ends of the liner tubes should be immediately covered with aluminum foil, sealed with a teflon or plastic cap, and then taped with duct tape. After being properly identified with sample data entered on a standard chain of custody form the samples shall be placed on dry ice (maintained below 4°C) and transported to the laboratory within 24 hours.

One of the three soil samples retreived at each sample depth shall be analyzed in the field using a photoionization detector and/or explosimeter. The purpose of the field analysis is to provide a means to choose samples to be laboratory analyzed for hydrocarbon concentrations and to enable comparisions between the field and laboratory analyses. The soil sample shall be sealed in a plastic bag and placed in the sun to accelerate the vaporization of volatile hydrocarbons from the soil. One of the two field vapor instruments shall be used to quantify the amount of hydrocarbon released to the air from the soils. The data shall be recorded on the drill logs at the depth corresponding to the sample point.

GROUNDWATER TECHNOLOGY
STANDARD OPERATING PROCEDURE
CONCERNING SOIL SAMPLE COLLECTION AND
HANDLING WHEN SAMPLING FOR VOLATILE ORGANICS
SOP 15

1. Use a sampling means which maintains the physical integrity of the samples. The project sampling protocol will designate a preferred sampling tool. A split spoon sampler with liners or similar tube sampler which can be sealed is best.

2. At the discretion of the project manager, the samples should be either.

   A. sealed in liner with teflon plugs (The "California Sampler") or

   B. field prepped for sample analysis.

   Projects using method (A) will incur a separate sample preparation charge of $ 10.00 per sample in the laboratory. For method (B), prepared and pre-weighed vials, and sample coring syringes must be ordered at least 2 weeks ahead of time from the laboratory before sampling. (Vials are free if samples will be sent to Groundwater Technology Laboratory).

3. For sending whole-core samples (2A above):

   A. Seal ends of liner with teflon plugs leaving no free air space inside.

   B. Tape with duct tape.

   C. Cover with a non-contaminating sealant (paraffin).

   D. Place in plastic bag labeled with indelible marker. Use Well #, depth, date, and job #.

   E. Place inside a second bag and place a labelling tag inside outer bag.

   F. Enclose samples in a cooler with sufficient ice or dry ice to maintain samples at 4 degrees during shipment.

   G. Seal cooler with a lock or tape with samplers signature so tampering can be detected.

H. Package cooler in a box with insulating material. Chain of custody forms can be placed in a plastic bag in this outer box.

I. If dry ice is used, a maximum of 5 pounds is allowed by Federal Express without special documents (documents are easy to obtain but just not necessary for under 5 pounds). Simply write "ORM-A dry ice," "_____ pounds, for research" on outside packaging and on regular airbill under classification. UPS does not accept dry ice.

J. Make yourself a supplies list necessary before going into the field.

K. Soil cores kept a 4 degrees C are only viable for up to 7 days when aromatic hydrocarbons are involved. The lab will prepare them in methanol as above once in the lab, but we will need a call ahead of time to schedule personnel.

4. For field-prepping (Step 2B above):

A. Obtain prepared sample containers from the laboratory. Order for # of samples intended and add 50%. This should be sufficient for QA requirements (below), breakage, and additional samples taken by discretion of sampler.

B. Organize containers consecutively - they are all numbered and pre-weighed. Make a necessary supplies list before going into the field.

C. For a 6" liner section retrieved from the spoon sampler, spread a 12" square piece of broiler (heavy) aluminum foil and slice it lengthwise with a clean stainless steel spatula.

D. Immediately sample with a coring syringe with plunger removed. Poke tube into mid-section of core (into undisturbed soil) to capture a 1/2 to 1 inch plug.

E. Immediately transfer to the sample vial with methanol by using plunger. Clean around lip of vial to remove soil with clean laboratory paper towelling

CAUTION: WORK ONLY IN WELL VENTILATED AREA. DO NOT BREATH METHANOL VAPOR. IT IS TOXIC. SEE MSDS ATTACHED.

and seal septum onto the vial with lid, teflon side (shiny) toward the sample. shake sample enough to break it up so that whole sample is immersed in methanol. The rapid progression of steps indicated here is necessary to prevent loss of volatiles from the soil. Do not leave vials unopened for any extended period - the methanol evaporates quickly. Grit left on threads of vial can cause vial to break.

F. * If required (see 5 below). Take a duplicate sample from the other half directly across from the first sample, or where ever undisturbed, yet representative soil occurs.

G. Label vial with legible information as follows:

1. Job name or number.

2. Date.

3. Time.

4. Depth and well number.

5. Samplers initials.

H. Tape vial across septum with scotch tape and around cap and sign on the tape with indelible ink to prevent tampering.

I. Wrap up a representative section of the core equivalent in volume to cube 3 cm on a side in the aluminum foil square, discarding the rest appropriately. Seal in saran wrap. This section is for dry weight determination. Close it in plastic bag with a tag or write on the bag with an indelible marker. These samples go into a separate cooler or box and not with the vials. The cooler for dry weight samples need not be iced, but overnight delivery is requested.

J. Discard plastic coring syringe, clean the spatula, and get clean equipment ready for next sample.

K. Ice the sample vials immediately and keep them iced through shipment.

L. Fill out chain of custody form. SOP 11 gives major details. Make sure sample requests is for proper analysis type.

M. Shipping of hazardous materials (methanol) requires special documents from Federal Express and UPS. Have this all arranged ahead of time (once set up with documents, the actual process will be little different than normal). Briefly you will need to add following to outside of package and on documents:

1. Flammable liquid label (some will come from lab with the vials).

2. "UN1230 methyl alcohol".

3. For UPS, a "Hazardous Material" label.

N. Ship overnight delivery to the lab. If dry ice is available, up to 5 pounds per package can be sent via Federal Express by simply writing "ORM-A dry ice", "_____ pounds, for research" on outside of package and on shipping document. UPS does not accept dry ice shipments.

5. Good sampling practice would include preparing 1 out of 5 samples to be prepared in duplicates for analysis. These 4 out of 20 samples will be for the following purposes.

A. One in every 20 samples should be analyzed as a field replicate to evaluate the precision of the sampling technique. A minimum of 1 sample per data set is suggested.

B. An additional 1 in 20 samples should be selected by sampler to be prepared in duplicate as alternative to Step (A). Choose a different soil type if available.

C. The lab does spiking with reference materials for internal QC so additionally a minimum of 2 in 20 samples need to be prepared in duplicate.

6. Other QC procedures can be specified at the project manager's discretion. See Table 3-2 (reference 2) attached.

7. Decontamination of equipment in the field requires a detergent wash, a water rinse, and spectrographic quality acetone rinse followed by distilled water.

REFERENCES

1. Soil Sampling Quality Assurance Users Guide, U.S. EPA Environmental Monitoring Systems Laboratory, Las Vegas, NV, EPA 600/4-84-043, May 1984.

2. Preparation of Soil Sampling Protocol. Techniques and Strategies, U.S. EPA, Environmental Monitoring Systems Laboratory, Las Vegas, NV, EPA 600/4-83-020, August 1983 (PB83-206979).

3. Test Methods for Evaluating Solid Waste, U.S. EPA, Office of Solid Waste and Emergency Response, Washington, D.C., SW 846, July 1982.

BROWN AND CALDWELL
ANALYTICAL LABORATORIES

RECEIVED
AUG 29 1986
Anal.

LOG NO: E86-08-202

Received: 11 AUG 86
Reported: 28 AUG 86

Ms. Amy Sager
Groundwater Technology
4080 Pike Lane, Suite D
Concord, California 94520

Purchase Order: 464

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION , SOIL SAMPLES	DATE SAMPLED
08-202-1	MW-1 Composite	08 AUG 86
08-202-2	MW-2 Composite	08 AUG 86
08-202-3	MW-3 Composite	08 AUG 86
08-202-4	SB-1 Composite	08 AUG 86
08-202-5	SB-2 Composite	08 AUG 86

PARAMETER	08-202-1	08-202-2	08-202-3	08-202-4	08-202-5
Lead, mg/kg	12	12	18	14	20
Nitric Acid Digestion, Date	08.18.86	08.18.86	08.18.86	08.18.86	08.18.86
Benzene,Toluene,Xylene Isomers					
Benzene, mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Toluene, mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Total Xylene Isomers, mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
Total Fuel Hydrocarbons, mg/kg	<10	<10	<10	<10	<10

BROWN AND CALDWELL

ANALYTICAL LABORATORIES

LOG NO: E86-08-202

Received: 11 AUG 86
Reported: 28 AUG 86

Ms. Amy Sager
Groundwater Technology
4080 Pike Lane, Suite D
Concord, California 94520

Purchase Order: 464

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION , SOIL SAMPLES	DATE SAMPLED
08-202-6	SB-3 Composite	08 AUG 86

PARAMETER	08-202-6
Lead, mg/kg	12
Nitric Acid Digestion, Date	08.18.86
Benzene,Toluene,Xylene Isomers	
Benzene, mg/kg	<0.5
Toluene, mg/kg	<0.5
Total Xylene Isomers, mg/kg	<1.0
Total Fuel Hydrocarbons, mg/kg	<10

BROWN AND CALDWELL

ANALYTICAL LABORATORIES

LOG NO: E86-08-202

Received: 11 AUG 86
Reported: 28 AUG 86

Revised 09/17/86

Ms. Amy Sager
Groundwater Technology
4080 Pike Lane, Suite D
Concord, California 94520

Purchase Order: Texaco/San Lorenzo

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION , SOIL SAMPLES	DATE SAMPLED
08-202-1	MW-1 Composite	08 AUG 86
08-202-2	MW-2 Composite	08 AUG 86
08-202-3	MW-3 Composite	08 AUG 86
08-202-4	SB-1 Composite	08 AUG 86
08-202-5	SB-2 Composite	08 AUG 86

PARAMETER	08-202-1	08-202-2	08-202-3	08-202-4	08-202-5
Lead, mg/kg	12	12	18	14	20
Nitric Acid Digestion, Date	08.18.86	08.18.86	08.18.86	08.18.86	08.18.86
Benzene,Toluene,Xylene Isomers					
Benzene, mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Toluene, mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Total Xylene Isomers, mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
Total Fuel Hydrocarbons, mg/kg	<10	<10	<10	<10	<10

BROWN AND CALDWELL BC
ANALYTICAL LABORATORIES

LOG NO: E86-08-202

Received: 11 AUG 86
Reported: 28 AUG 86

Ms. Amy Sager
Groundwater Technology
4080 Pike Lane, Suite D
Concord, California 94520

Purchase Order: Texaco/San Lorenzo

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION , SOIL SAMPLES	DATE SAMPLED
08-202-6	SB-3 Composite	08 AUG 86

PARAMETER	08-202-6
Lead, mg/kg	12
Nitric Acid Digestion, Date	08.18.86
Benzene,Toluene,Xylene Isomers	
Benzene, mg/kg	<0.5
Toluene, mg/kg	<0.5
Total Xylene Isomers, mg/kg	<1.0
Total Fuel Hydrocarbons, mg/kg	<10

BROWN AND CALDWELL
ANALYTICAL LABORATORIES

LOG NO: E86-08-202

Received: 11 AUG 86
Reported: 28 AUG 86

Ms. Amy Sager
Groundwater Technology
4080 Pike Lane, Suite D
Concord, California 94520

Purchase Order: Texaco/San Lorenzo

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION , GROUND WATER SAMPLES	DATE SAMPLED
08-202-7	MW-1	08 AUG 86
08-202-8	MW-2	08 AUG 86
08-202-9	MW-3	08 AUG 86
08-202-10	SB-1	08 AUG 86
08-202-11	SB-2	08 AUG 86

PARAMETER	MW-1 08-202-7	MW-2 08-202-8	MW-3 08-202-9	SB-1 08-202-10	SB-2 08-202-11
Benzene, Toluene, Xylene Isomers					
Benzene, mg/L	<0.05	<0.05	<0.05	0.22 220	<0.05
Toluene, mg/L	<0.05	<0.05	<0.05	0.39 390	<0.05
Total Xylene Isomers, mg/L	0.082 82	<0.05	<0.05	0.68 680	<0.05

PPB measured 1000 fold

MW-1

50ppb detection limit

SB-1

BROWN AND CALDWELL
ANALYTICAL LABORATORIES

LOG NO: E86-08-202

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Ms. Amy Sager
Groundwater Technology
4080 Pike Lane, Suite D
Concord, California 94520

Purchase Order: 464

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION , GROUND WATER SAMPLES	DATE SAMPLED
08-202-7	MW-1	08 AUG 86
08-202-8	MW-2	08 AUG 86
08-202-9	MW-3	08 AUG 86
08-202-10	SB-1	08 AUG 86
08-202-11	SB-2	08 AUG 86

PARAMETER	08-202-7	08-202-8	08-202-9	08-202-10	08-202-11
Benzene,Toluene,Xylene Isomers					
Benzene, mg/L	<0.05	<0.05	<0.05	0.22	<0.05
Toluene, mg/L	<0.05	<0.05	<0.05	0.39	<0.05
Total Xylene Isomers, mg/L	0.082	<0.05	<0.05	0.68	<0.05

BROWN AND CALDWELL BC
ANALYTICAL LABORATORIES

LOG NO: E86-08-202

Received: 11 AUG 86
Reported: 28 AUG 86

Ms. Amy Sager
Groundwater Technology
4080 Pike Lane, Suite D
Concord, California 94520

Purchase Order: Texaco/San Lorenzo

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION , GROUND WATER SAMPLES	DATE SAMPLED
08-202-12	SB-3	08 AUG 86

PARAMETER	08-202-12
Benzene,Toluene,Xylene Isomers	
Benzene, mg/L	<0.05
Toluene, mg/L	<0.05
Total Xylene Isomers, mg/L	<0.05

Robert P Perkins for
D. A. McLean, Laboratory Director

BROWN AND CALDWELL
ANALYTICAL LABORATORIES

LOG NO: E86-08-202

Received: 11 AUG 86
Reported: 28 AUG 86

Ms. Amy Sager
Groundwater Technology
4080 Pike Lane, Suite D
Concord, California 94520

Purchase Order: 464

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION , GROUND WATER SAMPLES	DATE SAMPLED
08-202-12	SB-3	08 AUG 86

PARAMETER	08-202-12
Benzene,Toluene,Xylene Isomers	
Benzene, mg/L	<0.05
Toluene, mg/L	<0.05
Total Xylene Isomers, mg/L	<0.05

Linda Brack FOR
D. A. McLean, Laboratory Director

CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST PO# 464

PROJ. NO.	PROJECT NAME
	Texaco/San Lorenzo

SAMPLERS: (Signature) Amy Sager

	I.D. NO	DATE	TIME	COMP	GRAB	STATION & LOCATION	NO. OF CONTAINERS	ANALYSIS TYPE REQUESTED: THC	LEAD	BTX	REMARKS
4	SB-1	8/8	9a	✓		SB-1 // SS-1, SS-2, SS-3	3	✓	✓	✓	composite soil samples
5	SB-2		10a	✓		SB-2 // SS-1, SS-2, SS-3	3	✓	✓	✓	"
1	MW-1		11a	✓		MW-1 // SS-1, SS-2, SS-3	3	✓	✓	✓	"
2	MW-2		12p	✓		MW-2 // SS-1, SS-2, SS-3	3	✓	✓	✓	" A-C
3	MW-3		200	✓		MW-3 // SS-1, SS-2, SS-3	3	✓	✓	✓	"
6	SB-3		300	✓		SB-3 // SS-1, SS-2, SS-3	3	✓	✓	✓	"
10	SB-1		12a		✓	SB-1	2			✓	water samples
11	SB-2		1pm		✓	SB-2	2			✓	
7	MW-1		2pm		✓	MW-1	2			✓	
8	MW-2		3pm		✓	MW-2	2			✓	
9	MW-3		4pm		✓	MW-3	2			✓	
12	SB-3		5pm		✓	SB-3	2			✓	

Send To: GROUNDWATER TECHNOLOGY LABORATORY
Division of Oil Recovery Systems
4 Mill Street
Greenville, NH 03048
(603) 878-2500

Relinquished by:	Date	Time	Received by:	Relinquished by:	Date	Time	Received by:
Amy Sager	8/8	6pm					
Relinquished by:	Date	Time	Received by:	Relinquished by:	Date	Time	Received by:
Relinquished by:	Date	Time	Received by Laboratory:	Date 8-8	Time 17:15	REMARKS (Shipping Related):	

P.02

AUG-14-1995 18:17

08/15/95 09:43 ☎510 685 9148 GROUNDWATER TECH ☑002/002