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File

Alameda County

JAN 10 2006

Environmental Health

Denis L. Brown

Shell Oil Products US
HSE – Environmental Services
20945 S. Wilmington Ave.
Carson, CA 90810-1039
Tel (707) 865 0251
Fax (707) 865 2542
Email denis.l.brown@shell.com

January 4, 2006

Jerry Wickham
Alameda County Health Care Services Agency
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

Re: Subsurface Investigation Work Plan
Shell-branded Service Station
230 West MacArthur Boulevard
Oakland, California
SAP Code 135676
Incident No. 98995741

Dear Mr. Wickham:

Attached for your review and comment is a copy of the *Subsurface Investigation Work Plan* for the above referenced site. Upon information and belief, I declare, under penalty of perjury, that the information contained in the attached document is true and correct.

If you have any questions or concerns, please call me at (707) 865-0251.

Sincerely,

Denis L. Brown
Sr. Environmental Engineer

CAMBRIA

January 4, 2006

Mr. Jerry Wickham
Alameda County Health Care Services Agency
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502-6577

Re: **Subsurface Investigation Work Plan**
Shell-branded Service Station
230 West MacArthur Boulevard
Oakland, California
Incident # 98995741
Cambria Project #247-0902-010

Dear Mr. Wickham:

On behalf of Equilon Enterprises LLC dba Shell Oil Products US (Shell), Cambria Environmental Technology, Inc. (Cambria) has prepared this *Subsurface Investigation Work Plan* in response to the October 20, 2005 letter from the Alameda County Health Care Services Agency (ACHCSA). To assess the extent of hydrocarbon-impacted soil and groundwater, Cambria proposes a soil and discrete-depth groundwater investigation to vertically profile the site's lithology, to determine the effectiveness of the existing groundwater monitoring network, and to further assess the nature and extent of hydrocarbon impact to soil and groundwater.

SITE CHARACTERISTICS AND HISTORY

Site Location: This Shell-branded service station is located on the northern corner of West MacArthur Boulevard and Piedmont Avenue in Oakland, California (Figure 1). Three underground storage tanks (USTs), two dispenser islands, and a kiosk are currently on site (Figure 2). Commercial properties and Kaiser Hospital surround the site. A former Gulf service station, now the Oakland Auto Works auto repair shop, is located northwest and adjacent to the site.

1986 Site Investigation: In April 1986, Emcon Associates of San Jose, California drilled four exploratory borings (S-A through S-D) within the tank complex to total depths of 20.5 feet below grade (fbg). Groundwater was encountered at approximately 13 fbg. Soil samples were collected and analyzed for total hydrocarbons and benzene, toluene, ethylbenzene, and xylenes (BTEX).

Cambria Environmental Technology, Inc.

5900 Hollis Street
Suite A
Emeryville, CA 94608
Tel (510) 420-0700
Fax (510) 420-9170

Total hydrocarbon concentrations up to 5,700 parts per million (ppm) were detected in samples collected at depths ranging from 4 to 15 fbg. Historical soil sampling results are included in this report as Table 1. The report for this investigation could not be located at the time of this writing.

1986 Additional Site Assessment: In December 1986, W.W. Irwin, Inc. analyzed soil gas vapors from 38 probe locations located throughout the site. The highest hydrocarbon concentrations were reported in the area of the tank complex and dispenser islands. Cambria was unable to locate a report of this investigation.

1987 Recovery Well Installation: In March 1987, Wayne Perry Construction, Inc. (Wayne Perry) installed three 4-inch-diameter, 13-foot-deep, soil-vapor recovery wells (VR-1, VR-2, and VR-3). A soil venting system utilizing an activated carbon scrubber operated between April and November 1987. On August 28, 1987, soil borings B-1 and B-2 were advanced to characterize petroleum hydrocarbons remaining in the soil. The maximum total hydrocarbon concentration of 1,870 ppm was detected in boring B-1 at a depth of 8 fbg. In their January 26, 1988 *Review of Venting Operations,* Wayne Perry concluded that the venting operation had significantly decreased the contamination levels.

1987 UST Removal: On November 2, 1987, the USTs were removed and soil samples A1, A2, B1, B2, C1, C2, D1, and D2 were collected in native soil from the bottom of the 15-foot-deep UST excavation. Hydrocarbon concentrations ranged from 8.6 to 480 ppm, as documented in Kaprealian Associates December 1, 1987 *Soil Sampling Investigation* report. New USTs were installed in the same excavation.

1988 Soil and Groundwater Investigation: On July 11 and 12, 1988, Ensco Environmental Services Inc. (Ensco) of Fremont, California installed three groundwater monitoring wells (MW-1 through MW-3). MW-1 was completed to 31.5 fbg, and MW-2 and MW-3 were completed to 30 fbg. MW-1 is screened from 10 to 30 fbg, MW-2 is screened from 10 to 28 fbg, and MW-3 is screened from 11.5 to 28.5 fbg. From soil samples collected during well installation, total petroleum hydrocarbons as gasoline (TPHg) were detected in soil at a concentration of 278 ppm in the boring for MW-3 at 20.5 fbg. Ensco's September 30, 1988 *Soil and Groundwater Investigation* report documents this investigation's results.

1989 Phase II Supplemental Soil Investigation: On August 16, 1989, Ensco advanced three soil borings (SB-1, SB-2, and SB-3) to investigate possible hydrocarbon impacts to soil adjacent to the pump islands. The only TPHg concentration detected was 490 ppm in boring SB-3 at 15.5 fbg. Benzene was not detected in any soil samples collected during this investigation. Investigation results are documented in Ensco's October 9, 1989 *September Quarterly Report.*

1989 Phase II Shallow Groundwater Survey: On October 10, 1989, Ensco subcontractor NET Pacific of Santa Rosa, California advanced three probes (GS-1, GS-2, and GS-3) to sample the shallow groundwater adjacent to the pump islands. TPHg was detected in samples GS-2 and GS-3 at concentrations of 5,600 parts per billion (ppb) and 8,800 ppb, respectively. Benzene was detected in samples GS-2 and GS-3 at concentrations of 340 ppb and 380 ppb, respectively. Neither TPHg nor BTEX was detected in sample GS-1. Ensco's January 19, 1990, *December Quarterly Report* documents investigation results. Historical grab groundwater sampling results are included in this report as Table 2.

1990 Well Installation: On January 9, 1990, Ensco drilled one exploratory boring at the site and converted it to monitoring well MW-4. Well MW-4 is screened from 15 to 25 fbg. Ensco's March 29, 1990 *March Quarterly Report* documents the well installation.

1990 Shallow Groundwater Investigation: On May 19, 1990, Exceltech subcontractor CHIPS Environmental Consulting, Inc. advanced six probes (Probe 1 through Probe 6) in the sidewalk along West MacArthur Boulevard and collected shallow groundwater samples. TPHg was detected in Probe 2 and Probe 6 at concentrations of 25,000 ppb and 31,000 ppb, respectively. Benzene was detected in Probes 2, 4, 5, and 6 at a concentrations ranging from 1 to 430 ppb. Investigation results were documented in Exceltech's July 3, 1990 *June Quarterly Report.*

1998 Dispenser and Turbine Sump Upgrades: In February 1998, Paradiso Mechanical of San Leandro, California upgraded fuel-related equipment at the service station. Secondary containment was added to the existing dispensers and the turbine sumps above the USTs. Cambria inspected the dispenser and tank excavation areas. The City of Oakland required sampling at dispensers only if there was evidence of hydrocarbon impact. No field indications of hydrocarbons, such as staining or odor, were observed during the site visit; therefore, no sampling was required. Cambria's March 10, 1998, *1998 Upgrade Site Inspection Report* presents details.

2002 Sensitive Receptor Survey (SRS), Conduit Study Report, and Subsurface Investigation Work Plan: The October 31, 2002 *Sensitive Receptor Survey, Conduit Study Report, and Subsurface Investigation Work Plan* included a conduit study which reported that a storm drain located just west of the site, along West MacArthur Boulevard, might intersect groundwater, and that the conduit backfill material may act as a preferential pathway for contaminant migration. The SRS identified two wells of unknown use located approximately ½-mile downgradient of the site and one well of unknown use located approximately 1,500 feet upgradient of the site. Neither of the downgradient wells is likely to be impacted by petroleum hydrocarbons or fuel oxygenates originating from the subject site because Glen Echo Creek, the nearest surface water body identified by Cambria, is located approximately 600 feet south of the site. Since calculated groundwater flow direction at the site has been to the west-southwest, petroleum hydrocarbons and fuel oxygenates from the site are not expected to impact Glen Echo Creek.

2003 SRS: In October 2003, Cambria completed an SRS for the site at Shell's request. The SRS targeted the following as potential sensitive receptors: basements within 200 feet, surface water and sensitive habitats within 500 feet, hospitals, residential care and childcare facilities within 1,000 feet, and water wells within ½ mile. No basements were observed within 200 feet, nor were any surface water or sensitive habitats observed within 500 feet. Snow White Day Care (214 West MacArthur Boulevard) is located approximately 150 feet from the site. Kaiser Permanente Hospital (280 West MacArthur Boulevard) is located approximately 450 feet from the site. National Hispanic University (262 Grand Avenue) is located approximately 825 feet from the site. No water wells in addition to those mentioned above were identified within ½ mile of the site.

2004 Subsurface Investigation: In March 2004, two soil borings were advanced to 20 fbg adjacent to the storm drain located just west of the site, and soil and groundwater samples were collected. TPHg was detected in only three soil samples (SB-1-17', SB-1-19.5', and SB-2-19.5') at concentrations of 12 ppm, 43 ppm, and 10 ppm, respectively. BTEX was not detected in any soil sample collected during this investigation. Methyl tert butyl ether (MTBE) was detected in only two soil samples (SB-1-15'and SB-2-17') at concentrations of 0.0078 ppm and 0.0099 ppm, respectively. All soil samples with detectable TPHg and/or MTBE concentrations were from saturated soils or from within the capillary fringe. TPHg was detected in both grab groundwater samples SB-1-W and SB-2-W at concentrations of 10,000 ppb and 520 ppb, respectively. Benzene was detected in both grab groundwater samples at concentrations of 430 ppb and 4.9 ppb, respectively. Toluene, ethylbenzene, and total xylenes were detected only in grab groundwater sample SB-1-W at concentrations of 75 ppb, 98 ppb, and 44 ppb, respectively. MTBE was detected in both grab groundwater samples at concentrations of 110 ppb and 320 ppb, respectively. Cambria concluded that the investigation results indicate that the highest TPHg and MTBE concentrations in groundwater are localized near the western corner of the Shell site and that MTBE concentrations in groundwater appear to be decreasing with distance from the Shell site. Cambria's July 2, 2004 *Subsurface Investigation Report* details the investigation.

2005 Fueling System Upgrade: In April 2005, Cambria collected soil samples from beneath the site's dispensers and at selected piping locations following an upgrade of the site's fueling system. Five dispenser soil samples were collected at depths of between 1.5 and 4 fbg and into native soil, and five piping trench soil samples were collected at depths of between 2 and 4.5 fbg and into native soil. Field indications of hydrocarbons, including staining and odor, were observed in the vicinity of the sample locations in the western portion of the site. TPHg was detected in three of five dispenser samples, with a maximum concentration of 1,700 ppm in D-2-1.5. TPHg was detected in three of five piping samples, with a maximum concentration of 2,700 ppm. Benzene was detected in two of five piping samples, with a maximum concentration of 4.2 ppm. Based on the field observations and laboratory results, Cambria, at Shell's request,

directed over-excavation. Due to the Oakland Fire Department's concern over encountering shallow groundwater, the vertical extent of over-excavation was limited to 6 fbg. The lateral extent of over-excavation was limited by the proximity of the site's canopy supports and the site kiosk foundation. Cambria collected eight over-excavation bottom and side-wall samples. Staining and odors were observed in all over-excavation sample locations. TPHg was detected in six of eight over-excavation samples, with a maximum concentration of 830 ppm. Benzene, MTBE, ethyl tert butyl ether, and tert-amyl methyl ether concentrations in soil were below the laboratory detection limits in all eight over-excavation samples. Details of the sampling are included in Cambria's June 23, 2005 *Dispenser and Piping Upgrade and Limited Over-Excavation Soil Sampling Report.*

2005 Site Conceptual Model (SCM): Cambria submitted an SCM to the ACHCSA on September 23, 2005. Cambria concluded that current groundwater conditions appear to be low-risk for all identified potential receptors and that current soil conditions in previously impacted and remediated areas are not known. Based on the site's history and current conditions, Cambria recommended additional soil sampling, a semi-annual groundwater monitoring schedule for all site wells, continued coordinated monitoring with 240 W. MacArthur Blvd., and the evaluation of site soil and groundwater conditions versus San Francisco Regional Water Quality Control Board environmental screening levels and City of Oakland risk-based screening levels.

Groundwater Monitoring Program: Quarterly groundwater monitoring has been performed at the site since July 1988. Depth to water has ranged historically between 11.31 and 16.76 fbg. During the third quarter 2005 monitoring and sampling event, the depth to water in the wells ranged from 13.91 to 14.78 fbg, The groundwater flow direction, as calculated from depth to water measurements in on-site monitoring wells, is typically toward the west to southwest, but has occasionally ranged to the northwest.

During the third quarter 2005 monitoring and sampling event, monitoring well MW-4 contained 1,200 ppb TPHg, 2.7 ppb benzene, 140 ppb MTBE, 8.4 ppb di-isopropyl ether (DIPE), and 280 ppb tert-butyl alcohol (TBA). Monitoring well MW-2 contained 31 ppb MTBE and 5.6 ppb TBA. Wells MW-1 and MW-3 were not sampled this quarter.

Since the fourth quarter of 2003, coordinated monitoring and sampling has been conducted with the adjacent former gas station (currently Oakland Auto Works) at 240 West MacArthur Boulevard.

PROPOSED SCOPE OF WORK

Cambria proposes advancing one off-site and five on-site borings to investigate the vertical and lateral extent of petroleum hydrocarbons in soil and groundwater. In addition, Cambria proposes installing groundwater monitoring wells at locations SB-8 and SB-9.

Upon ACHCSA approval of this work plan, Cambria will complete the following tasks:

Permits: Cambria will obtain the required permits for encroachment, boring advancement and monitoring well installation.

Site Safety Plan: Cambria will prepare a comprehensive site safety plan to protect site workers. The plan will be kept on site during field activities and signed by each site worker.

Utility Clearance: Cambria will mark proposed drilling locations, and the locations will be cleared through Underground Service Alert prior to drilling. Additionally, a private utility locator survey will be conducted prior to drilling to identify subsurface obstacles to drilling.

Soil Borings: Cambria proposes to advance six borings (SB-4 through SB-9) using direct-push technology to investigate the vertical and lateral extent of petroleum hydrocarbons in soil and groundwater beneath the site. Assuming the absence of overhead and subsurface obstructions, Cambria will advance borings at the approximate locations shown on Figure 2.

- Borings SB-4 and SB-7 will be advanced adjacent to monitoring wells MW-2 and MW-1, respectively. Boring SB-8 will be advanced downgradient of the UST complex and the dispensers. The borings will be logged continuously, and samples will be screened for organic vapors using a photo-ionization detector (PID) and collected for laboratory analysis every 5 feet to first-encountered groundwater. If saturated sediments are identified, a second boring will be advanced adjacent to each initial boring, and where sufficient groundwater is available, a "dual-tube" sampling system will be used to collect discrete grab groundwater samples at 5-foot intervals from first-encountered groundwater to approximately 35 fbg.
- Borings SB-5 and SB-6 will be advanced within the 2005 piping upgrade area in the southwestern portion of the site. The borings will be logged continuously, and samples will be screened for organic vapors using a PID and collected for laboratory analysis every 3 feet to first-encountered groundwater. The borings will be advanced as close to the current piping as possible to accurately characterize the soils. All reasonable care will be taken to ensure that product piping is not damaged during soil boring placement.
- Boring SB-9 will be advanced off site. The boring will be logged continuously, and samples will be screened for organic vapors using a PID and collected for laboratory

analysis every 5 feet to first-encountered groundwater. If saturated sediments are identified, a second boring will be advanced adjacent to the initial boring, and where sufficient groundwater is available, a "dual-tube" sampling system will be used to collect discrete grab groundwater samples at 5-foot intervals from first-encountered groundwater to approximately 35 fbg.

Upon sampling completion, all borings except SB-8 and SB-9 will be grouted from the bottom to the surface with neat Portland Type II cement and surfaced to match the existing grade. Soil and groundwater samples will be transported to a State-of-California-approved analytical laboratory for chemical analysis. Cambria's Standard Field Procedures for Geoprobe® Soil and Groundwater Sampling is presented as Attachment A.

Under the supervision of a California professional geologist or civil engineer, a Cambria geologist will oversee the borings. Between groundwater sampling events, the drill rods and stainless steel bailer used to collect groundwater samples will be decontaminated to prevent cross contamination from one zone to another. Soil samples for laboratory analysis will be retained in the Geoprobe® plastic liner, cut into 6-inch lengths, and covered on both ends with Teflon sheets and plastic end caps. Groundwater samples will be collected with stainless steel bailers and transferred into vials containing hydrochloric acid preservative with no head space. Soil and groundwater samples will be labeled, entered onto a chain-of-custody record, and placed into a cooler with ice for transport to a State-certified laboratory for analysis. Cambria will request a standard two week turnaround time for laboratory results.

Monitoring Well Installation: If saturated sediments are identified, borings SB-8 and SB-9 will be over-drilled using a hollow-stem-auger drill rig to allow for monitoring well installation. The wells will be constructed using 4-inch diameter Schedule 40 PVC casing and screened with 10 feet of 0.010-inch machined slot. The well depths and screened intervals will be based on static groundwater depths at the time of drilling and the lithology encountered during this investigation. The filter pack will be placed from the bottom of the well screen up to 2 feet above the top of the well screen, followed by a 2-foot-thick bentonite seal and cement grout to grade. Actual well construction details will be based on soil types and field conditions encountered during drilling. The wells will be secured with locking caps under traffic-rated well boxes. Cambria's standard field procedures for monitoring well installation are presented as Attachment B.

Well Development and Sampling: Blaine Tech Services, Inc. (Blaine) of San Jose, California will develop the new groundwater monitoring wells. Monitoring wells at the site are currently sampled during the final month of each quarter. Depending on when the well installations and development are completed, Blaine will either sample the new monitoring wells immediately after development and submit the samples to a State-certified laboratory for chemical analysis, or

the wells will be added to the existing monitoring well network and sampled during the next scheduled sampling event.

Chemical Analyses: A State-approved analytical laboratory will analyze soil and groundwater samples for TPHg, BTEX, MTBE, TBA, di-isopropyl ether, ethyl tert butyl ether, and tert amyl methyl ether by EPA Method 8260B.

Wellhead Survey Activities: Following monitoring well installations, a licensed surveyor will survey the wellhead elevations relative to mean sea level and each well's latitude and longitude.

Report Preparation: Cambria will prepare a written report which will include field procedures, laboratory results, boring logs, hydrogeologic cross-sections, conclusions, and recommendations.

SCHEDULE

Upon receiving written work plan approval, Cambria will acquire permits and schedule field activities. As requested by ACHCSA in their October 20, 2005 letter, a report summarizing this proposed investigation will be submitted within 120 days after ACHCSA work plan approval, contingent upon encroachment permit receipt.

CLOSING

If you have any questions regarding the scope of work outlined in this work plan, please call David Gibbs at (510) 420-3363.

Sincerely,
Cambria Environmental Technology, Inc.

David M. Gibbs, P.G.
Project Geologist

Aubrey K. Cool, P.G.
Senior Project Geologist

Figures: 1 - Vicinity /Area Well Survey Map
2 - Proposed Soil Boring Location Map

Tables: 1 - Cumulative Soil Analytical Data
2 - Cumulative Grab Groundwater Analytical Data

Attachments: A - Standard Field Procedures for Geoprobe® Soil and Groundwater Sampling
B - Standard Field Procedures for Monitoring Well Installation

cc: Denis Brown, Shell Oil Products US, 20945 S. Wilmington Ave., Carson, CA 90810

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09/11/03

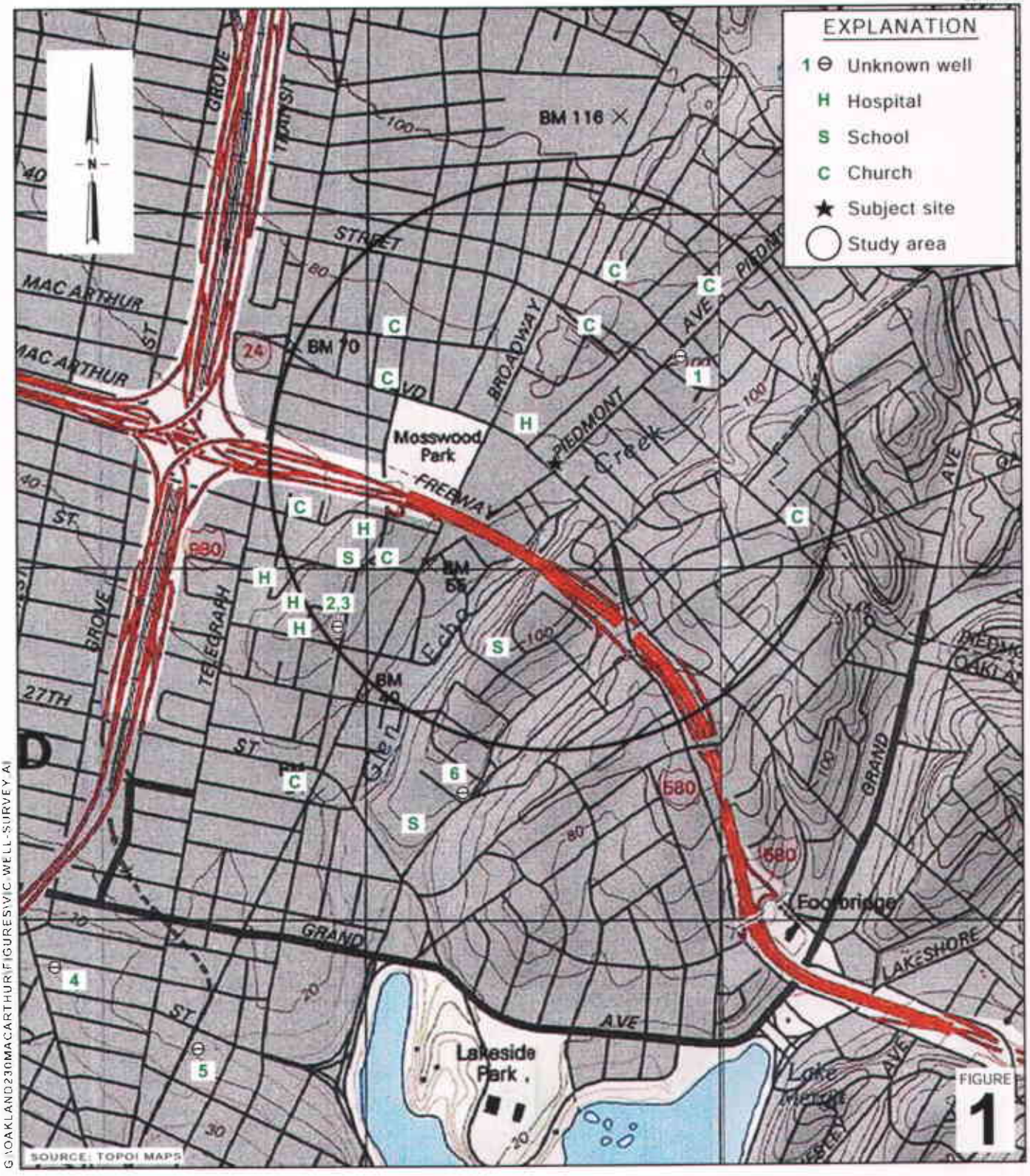

FIGURE 1

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0 1/8 1/4 1/2 1

SCALE : 1" = 1/4 MILE

Shell-branded Service Station
230 West MacArthur Boulevard
Oakland, California
Incident #98995741

CAMBRIA

Vicinity/Area Well Survey Map
(1/2-Mile Radius)

01/03/05

Proposed Soil Boring Location Map

Groundwater Flow Direction
(Shell, 4Q96 through 3Q05)

EXPLANATION

- SB-4 — Proposed soil boring location
- EX-1-6 — Over-excavation soil sample location (4/27/05)
- D-1-4.0 — Soil sample location (4/18/05)
- MW-1 — Monitoring well location (Shell, 7/11-12/88)
- MW-1 — Monitoring well location (240 W. MacArthur)
- SB-1 — Soil boring location (3/24/04)
- Probe 1 — Grab groundwater sample location (05/19/90)
- GS-1 — Grab groundwater sample location (10/17/89)
- SB-1 — Soil boring location (8/16/89)
- A1 — Soil sample location (11/05/87)
- B-1 — Soil boring location (8/27/87)
- VR-1 — Soil venting well location (3/12/87)
- S-A — Soil boring location (4/14/86)
- Storm drain line (SD)
- Sanitary sewer line (SS)
- Water line (W)
- Gas line (G)
- Electrical line (E)
- Flow direction
- Storm drain inlet
- FL — Flow line elevation, in feet above mean sea level
- fbg — Feet below grade
- 1 — Product dispenser number

HOWE STREET

PIEDMONT AVENUE

WEST MACARTHUR BOULEVARD

Oakland Auto Works
240 W. MacArthur

Former USTs

Former W/O sump

Former W/O UST

Shell-branded Service Station
230 W. MacArthur

former USTs

current USTs

kiosk

Over-excavation areas

Kaiser MB Center
235 W. MacArthur

Site features for 240 W. MacArthur based on figure provided by Stetler Environmental Solutions, Inc.

0 15 30 60
SCALE 1:30 FEET

FIGURE 2

Shell-branded Service Station
230 West MacArthur Boulevard
Oakland, California
Incident No.98995741

CAMBRIA

G:\OAKLAND 230 MACARTHUR\FIGURES\SITE PLAN 12-05 AI

Table 1. Cumulative Soil Analytical Data - TPHg, BTEX, MTBE, Oxygenates, and Lead - Shell-branded Service Station - Incident # 98995741, 230 W. MacArthur Boulevard, Oakland, California

Sample ID	Date	Depth (feet)	TPHg	Benzene	Toluene	Ethyl-benzene	Total Xylenes	TBA	MTBE	DIPE	ETBE	TAME	Total Lead	Organic Lead
			← parts per million →											
1986 Site Investigation														
S-A	4/14/1986	4 - 5.5	**17**[a]	--	--	--	--	--	--	--	--	--	--	--
S-A	4/14/1986	8.5 - 10	**1,200**[a]	--	--	--	--	--	--	--	--	--	--	--
S-A	4/14/1986	11 - 12.5	**4,300**[a]	--	--	--	--	--	--	--	--	--	--	--
S-A	4/14/1986	13.5 - 15	ND[a]	--	--	--	--	--	--	--	--	--	--	--
S-B	4/14/1986	5 - 6.5	**36**[a]	--	--	--	--	--	--	--	--	--	--	--
S-B	4/14/1986	8 - 9.5	**78**[a]	--	--	--	--	--	--	--	--	--	--	--
S-B	4/14/1986	12 - 13	**6.4**[a]	--	--	--	--	--	--	--	--	--	**11.0**[b]	--
S-C	4/14/1986	4 - 5.5	ND[a]	--	--	--	--	--	--	--	--	--	---	---
S-C	4/14/1986	7 - 8.5	ND[a]	--	--	--	--	--	--	--	--	--	---	---
S-C	4/14/1986	11 - 12.5	ND[a]	--	--	--	--	--	--	--	--	--	---	---
S-C	4/14/1986	13.5 - 15	**5,700**[a]	--	--	--	--	--	--	--	--	--	---	---
S-D	4/14/1986	Composite	**571**[a]	--	--	--	--	--	--	--	--	--	--	--
1987 Soil Borings (associated with Recovery Well Installation)														
B-1	8/28/1987	4	**412**	<0.05	<0.05	<0.1	**5.4**	--	--	--	--	--	**65.9**[b]	--
B-1	8/28/1987	6	**1,440**	<0.05	<0.05	<0.1	**130**	--	--	--	--	--	**26.4**[b]	--
B-1	8/28/1987	8	**1,870**	<0.05	**4.3**	**14**	**325**	--	--	--	--	--	**14.3**[b]	--
B-1	8/28/1987	10	<10	<0.05	<0.05	<0.1	<0.1	--	--	--	--	--	<5[b]	--
B-1	8/28/1987	12	**122**	**0.60**	**0.36**	**0.38**	**0.33**	--	--	--	--	--	<5[b]	--
B-1	8/28/1987	14	**52**	<0.05	<0.05	<0.1	<0.1	--	--	--	--	--	<5[b]	--

Table 1. Cumulative Soil Analytical Data - TPHg, BTEX, MTBE, Oxygenates, and Lead - Shell-branded Service Station - Incident # 98995741, 230 W. MacArthur Boulevard, Oakland, California

Sample ID	Date	Depth (feet)	TPHg	Benzene	Toluene	Ethyl-benzene	Total Xylenes	TBA	MTBE	DIPE	ETBE	TAME	Total Lead	Organic Lead
			← parts per million →											
B-2	8/28/1987	5	<10	<0.05	**1.5**	**5.7**	<0.1	--	--	--	--	--	<5[b]	--
B-2	8/28/1987	6 - 7	<10	<0.05	**0.37**	**0.55**	<0.1	--	--	--	--	--	<5[b]	--
B-2	8/28/1987	8 - 9	<10	0.5	**0.4**	**0.3**	<0.1	--	--	--	--	--	<5[b]	--
B-2	8/28/1987	10	<10	<0.05	<0.05	<0.1	<0.1	--	--	--	--	--	<5[b]	--
B-2	8/28/1987	12	<10	<0.05	<0.05	<0.1	<0.1	--	--	--	--	--	<5[b]	--
1987 UST Removal and Soil Sampling														
A1	11/2/1987	15.0	**380**	**1.6**	**2.2**	--	**55**	--	--	--	--	--	---	--
A2	11/2/1987	15.0	**310**	**1.3**	**1.3**	--	**33**	--	--	--	--	--	---	--
B1	11/2/1987	15.0	**480**	**4.3**	**0.5**	--	**22**	--	--	--	--	--	---	--
B2	11/2/1987	15.0	**9.1**	**1.6**	**0.3**	--	**0.1**	--	--	--	--	--	---	--
C1	11/2/1987	15.0	**12**	**1.5**	<0.1	--	**1.1**	--	--	--	--	--	---	--
C2	11/2/1987	15.0	**170**	**4.1**	<0.1	--	**2.4**	--	--	--	--	--	---	--
D1	11/2/1987	15.0	**8.6**	<0.1	<0.1	--	<0.1	--	--	--	--	--	---	--
D2	11/2/1987	15.0	**44**	<0.1	<0.1	--	**5.3**	--	--	--	--	--	---	--
1988 Monitoring Well Installation														
MW1-2	7/11/1988	10	<10	<0.003	**0.0116**	<0.003	<0.003	--	--	--	--	--	---	--
MW1-3	7/11/1988	15	<10	<0.003	**0.0129**	<0.003	**0.0051**	--	--	--	--	--	---	--
MW1-4	7/11/1988	20	<10	<0.003	**0.023**	<0.003	<0.003	--	--	--	--	--	---	--
MW2-1	7/11/1988	5	<10	<0.003	**0.0161**	<0.003	<0.003	--	--	--	--	--	---	--
MW2-2	7/11/1988	10	<10	<0.003	**0.0093**	<0.003	<0.003	--	--	--	--	--	---	--
MW2-3	7/11/1988	15	<10	<0.003	**0.01**	<0.003	<0.003	--	--	--	--	--	---	--
MW3-1	7/12/1988	10	**278**	<0.05	**0.388**	<0.003	**0.411**	--	--	--	--	--	**11**[c]	--
MW3-2	7/12/1988	15	<10	<0.003	**0.0367**	<0.003	<0.003	--	--	--	--	--	**8.3**[c]	--
MW3-3	7/12/1988	20	<10	<0.003	**0.0304**	**0.0076**	<0.003	--	--	--	--	--	---	--

Table 1. Cumulative Soil Analytical Data - TPHg, BTEX, MTBE, Oxygenates, and Lead - Shell-branded Service Station - Incident # 98995741, 230 W. MacArthur Boulevard, Oakland, California

Sample ID	Date	Depth (feet)	TPHg	Benzene	Toluene	Ethyl-benzene	Total Xylenes	TBA	MTBE	DIPE	ETBE	TAME	Total Lead	Organic Lead
			← parts per million →											
1989 Phase II Supplemental Soil Investigation														
SB1-1	8/16/1989	5	<1.0	<0.05	<0.1	<0.1	<0.1	--	--	--	--	--	---	--
SB1-2	8/16/1989	10	<1.0	<0.05	<0.1	<0.1	<0.1	--	--	--	--	--	---	--
SB1-3	8/16/1989	15	<1.0	<0.05	<0.1	<0.1	<0.1	--	--	--	--	--	---	--
SB1 (composite)	8/16/1989	Composite	--	--	--	--	--		--	--	--	--	**4.5**[a]	<0.05
SB2-1	8/16/1989	5.5	<1.0	<0.05	<0.1	<0.1	<0.1	--	--	--	--	--	--	--
SB2-2	8/16/1989	10.5	<1.0	<0.05	<0.1	<0.1	<0.1	--	--	--	--	--	--	--
SB2-3	8/16/1989	15.5	**490**	<0.05	**0.28**	**1.3**	**1.0**	--	--	--	--	--	--	--
SB2 (composite)	8/16/1989	Composite	--	--	--	--	--	--	--	--	--	--	**2.5**[a]	<0.05
SB3-1	8/16/1989	4.5	**6.6**	<0.05	**0.26**	**0.14**	**0.63**	--	--	--	--	--	--	--
SB3-2	8/16/1989	9.5	<1.0	<0.05	<0.1	<0.1	<0.1	--	--	--	--	--	--	--
SB3-3	8/16/1989	15.5	<1.0	<0.05	<0.1	<0.1	<0.1	--	--	--	--	--	--	--
SB3 (composite)	8/16/1989	Composite	--	--	--	--	--	--	--	--	--	--	**5.5**[a]	<0.05
2004 Subsurface Investigation														
SB-1-5'	3/24/2004	5	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	--	<0.0050	--	--	--	--	--
SB-1-10'	3/24/2004	10	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	--	<0.0050	--	--	--	--	--
SB-1-15'	3/24/2004	15	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	--	**0.0078**	--	--	--	--	--
SB-1-17'	3/24/2004	17	**12**	<0.025	<0.025	<0.025	<0.025	--	<0.025	--	--	--	--	--
SB-1-19.5'	3/24/2004	19.5	**43**	<0.024	<0.024	<0.024	<0.024	--	<0.024	--	--	--	--	--
SB-2-5'	3/24/2004	5	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	--	<0.0050	--	--	--	--	--
SB-2-10'	3/24/2004	10	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	--	<0.0050	--	--	--	--	--
SB-2-15'	3/24/2004	15	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	--	<0.0050	--	--	--	--	--
SB-2-17'	3/24/2004	17	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	--	**0.0099**	--	--	--	--	--
SB-2-19.5'	3/24/2004	19.5	**10**	<0.025	<0.025	<0.025	<0.025	--	<0.025	--	--	--	--	--

Table 1. Cumulative Soil Analytical Data - TPHg, BTEX, MTBE, Oxygenates, and Lead - Shell-branded Service Station - Incident # 98995741, 230 W. MacArthur Boulevard, Oakland, California

Sample ID	Date	Depth (feet)	TPHg	Benzene	Toluene	Ethyl-benzene	Total Xylenes	TBA	MTBE	DIPE	ETBE	TAME	Total Lead	Organic Lead
			← parts per million →											
2005 Dispenser, Piping, and Limited Over-Excavation Soil Sampling														
D-1-4.0	4/18/2005	4.0	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	**6.2**	--
D-2-1.5	4/18/2005	1.5	**1,700**	<0.40	**2.4**	**3.8**	**5.4**	<2.0	<0.40	<0.40	<0.40	<0.40	**130**	--
D-2-3.5	4/18/2005	3.5	**940**	**0.060**	**6.6**	**9.5**	**85**	<0.15	<0.025	<0.025	<0.025	<0.025	**8.0**	--
D-3-3.0	4/18/2005	3.0	**2.5**	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	**6.5**	--
D-4-4.0	4/18/2005	4.0	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	**0.0050**	<0.0050	<0.0050	<0.0050	**8.1**	--
P-1-2.0	4/18/2005	2.0	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	**4.2**	--
P-2-4.5	4/18/2005	4.5	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	**9.7**	--
P-3-3.5	4/18/2005	3.5	**620**	<0.025	**0.20**	**1.6**	**6.1**	**0.18**	**0.066**	<0.025	<0.025	<0.025	**22**	--
P-4-4.0	4/18/2005	4.0	**2,700**	**4.2**	**1.6**	**39**	**78**	<1.5	**0.30**	<0.25	<0.25	<0.25	**140**	--
P-5-4.0	4/18/2005	4.0	**1,600**	**0.98**	**0.28**	**7.4**	**13**	<1.5	<0.25	<0.25	<0.25	<0.25	**11**	--
EX-1-6	4/28/2005	6.0	**830**	<0.50	**1.4**	**4.1**	<0.50	<2.5	<0.50	<1.0	<0.50	<0.50	**7.2**	--
EX-2-6	4/28/2005	6.0	**200**	<0.50	<0.50	<0.50	<0.50	<2.5	<0.50	<1.0	<0.50	<0.50	**7.1**	--
EX-3-6	4/28/2005	6.0	**7.3**	<0.0050	<0.0050	<0.0050	<0.0050	**0.015**	<0.0050	<0.010	<0.0050	<0.0050	**4.1**	--
EX-4-6	4/28/2005	6.0	**21**	<0.023	<0.023	<0.023	<0.023	<0.046	<0.023	<0.023	<0.023	<0.023	**12**	--
EX-B-6.5	4/28/2005	6.5	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	**0.017**	<0.0050	<0.010	<0.0050	<0.0050	**3.6**	--
EX-5-6	4/28/2005	6.0	**7.6**	<0.019	<0.019	<0.019	**0.10**	<0.038	<0.019	<0.038	<0.019	<0.019	**4.1**	--
EX-6-6	4/28/2005	6.0	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	**0.013**	<0.0050	<0.010	<0.0050	<0.0050	**7.3**	--
EX-B2-6.5	4/28/2005	6.5	**260**	<0.50	<0.50	**1.6**	**1.5**	<2.5	<0.50	**3.3**	<0.50	<0.50	**4.0**	--

Table 1. Cumulative Soil Analytical Data - TPHg, BTEX, MTBE, Oxygenates, and Lead - Shell-branded Service Station - Incident # 98995741, 230 W. MacArthur Boulevard, Oakland, California

Sample ID	Date	Depth (feet)	TPHg	Benzene	Toluene	Ethyl-benzene	Total Xylenes	TBA	MTBE	DIPE	ETBE	TAME	Total Lead	Organic Lead
			← parts per million →											

Abbreviations and Notes:

TPHg = Total petroleum hydrocarbons as gasoline analyzed by EPA Method 8260B (before 2004, analyzed by EPA method 8015).

Benzene, ethylbenzene, toluene, total xylenes by EPA method 8260B (before 2004, analyzed by EPA Method 8020).

MTBE = Methyl tert-butyl ether by EPA Method 8260B.

TBA = Tert-butyl alcohol analyzed by EPA Method 8260B.

DIPE = Di-isopropyl ether, analyzed by EPA Method 8260B.

ETBE = Ethyl tert butyl ether, analyzed by modified EPA Method 8260B.

TAME = Tert-amyl methyl ether, analyzed by EPA Method 8260B.

Organic lead analyzed by Cal LUFT Manual, 12/87

Lead by EPA Method 6010

ND = Below detection limit

<n = Below detection limit of n

-- = Not analyzed

Shading identifies pre-excavation sample locations that were subsequently removed

a = Analytical method is unknown

b = Total lead analyzed by unknown method

c = Lead analyzed by EPA method 7421

Table 2. Cumulative Grab Groundwater Analytical Data - Shell-branded Service Station - 230 W. MacArthur Boulevard, Oakland, California - Incident # 98995741

Sample ID	Date	TPHg	Benzene	Toluene	Ethylbenzene	Total Xylenes	MTBE
		← (ppb) →					
GS-1[a]	10/17/1989	<50[b]	<0.5[b]	<0.5[b]	<0.6[b]	<1.5[b]	---
GS-2[a]	10/17/1989	**5,600[b]**	**340[b]**	**27[b]**	**1,200[b]**	**62[b]**	---
GS-3[a]	10/17/1989	**8,800[b]**	**380[b]**	**6[b]**	**580[b]**	**42[b]**	---
Probe 1	5/19/1990	<50	<0.5	<0.5	<0.5	<0.5	---
Probe 2	5/19/1990	**25,000**	**280**	**290**	**160**	**470**	---
Probe 3	5/19/1990	<50	<0.5	<0.5	<0.5	<0.5	---
Probe 4	5/19/1990	<50	**5**	<0.5	**2**	<0.5	---
Probe 5	5/19/1990	<50	**1**	**2**	**1**	**4**	---
Probe 6	5/19/1990	**31,000**	**430**	**600**	**240**	**1,400**	---
SB-1-W	3/24/2004	**10,000**	**430**	**75**	**98**	**44**	**110**
SB-2-W	3/24/2004	**520**	**4.9**	<1.0	<1.0	<2.0	**320**

Abbreviations and Notes:

TPHg = Total petroleum hydrocarbons as gasoline analyzed by EPA method 8260B; before 2004, analyzed by EPA method 8015 .

Benzene, ethylbenzene, toluene, total xylenes analyzed by EPA method 8260B; before 2004, analyzed by EPA method 8020.

MTBE = Methyl tert-butyl ether analyzed by EPA method 8260B.

ppb = Parts per billion

<x = Below detection limit of x

--- = Not analyzed

a = Sample taken from temporary well

b = Analyzed by unknown method

ATTACHMENT A

Standard Field Procedures for Geoprobe®
Soil and Groundwater Sampling

CAMBRIA

STANDARD FIELD PROCEDURES FOR GEOPROBE® SOIL AND GROUNDWATER SAMPLING

This document describes Cambria Environmental Technology's standard field methods for GeoProbe® soil and ground water sampling. These procedures are designed to comply with Federal, State and local regulatory guidelines. Specific field procedures are summarized below.

Objectives

Soil samples are collected to characterize subsurface lithology, assess whether the soils exhibit obvious hydrocarbon or other compound vapor odor or staining, estimate ground water depth and quality and to submit samples for chemical analysis.

Soil Classification/Logging

All soil samples are classified according to the Unified Soil Classification System by a trained geologist or engineer working under the supervision of a California Professional Geologist (PG) or a Certified Engineering Geologist (CEG). The following soil properties are noted for each soil sample:

- Principal and secondary grain size category (i.e., sand, silt, clay or gravel)
- Approximate percentage of each grain size category,
- Color,
- Approximate water or separate-phase hydrocarbon saturation percentage,
- Observed odor and/or discoloration,
- Other significant observations (i.e., cementation, presence of marker horizons, mineralogy), and
- Estimated permeability.

Soil Sampling

GeoProbe® soil samples are collected from borings driven using hydraulic push technologies. A minimum of one and one half ft of the soil column is collected for every five ft of drilled depth. Additional soil samples can be collected near the water table and at lithologic changes. Samples are collected using samplers lined with polyethylene or brass tubes driven into undisturbed sediments at the bottom of the borehole. The ground surface immediately adjacent to the boring is used as a datum to measure sample depth. The horizontal location of each boring is measured in the field relative to a permanent on-site reference using a measuring wheel or tape measure.

Drilling and sampling equipment is steam-cleaned or washed prior to drilling and between borings to prevent cross-contamination. Sampling equipment is washed between samples with trisodium phosphate or an equivalent EPA-approved detergent.

Sample Storage, Handling and Transport

Sampling tubes chosen for analysis are trimmed of excess soil and capped with Teflon® tape and plastic end caps. Soil samples are labeled and stored at or below 4°C on either crushed or dry ice, depending upon local regulations. Samples are transported under chain-of-custody to a State-certified analytic laboratory.

Field Screening

After a soil sample has been collected, soil from the remaining tubing is placed inside a sealed plastic bag and set aside to allow hydrocarbons to volatilize from the soil. After ten to fifteen minutes, a portable GasTech® or photoionization detector measures volatile hydrocarbon vapor concentrations in the bag's headspace, extracting the vapor through a slit in the plastic bag. The measurements are used along with the field observations, odors, stratigraphy and ground water depth to select soil samples for analysis.

Grab Ground Water Sampling

Ground water samples are collected from the open borehole using bailers, advancing disposable Tygon® tubing into the borehole and extracting ground water using a diaphragm pump, or using a hydro-punch style sampler with a bailer or tubing. The ground water samples are decanted into the appropriate containers supplied by the analytic laboratory. Samples are labeled, placed in protective foam sleeves, stored on crushed ice at or below 4° C, and transported under chain-of-custody to the laboratory.

Discrete Depth Soil and Ground Water Sampling

Soil and groundwater samples are collected for lithologic and chemical analysis using a direct driven, dual tube soil coring system. A hydraulic hammer drives sampling rods into he ground to collect continuous soil cores. Two nested sampling rods are driven at the same time: a larger diameter outer rod to act as a temporary drive casing and a smaller inner rod to retrieve soil cores. As the rods are advanced the soil is driven into a sample barrel that is attached to the end of the inner rod. The outer rod ensures that the sample is collected from the desired interval by preventing sloughing of the overlying material. After reaching the desired depth the inner rods are removed from the boring and the sleeves containing the soil sample are removed from the inner sample barrel. Sampling tubes chosen for analysis are trimmed of excess soil and capped with Teflon® tape and plastic end caps. Soil samples are labeled and stored at or below 4°C on either crushed or dry ice, depending upon local regulations. Samples are transported under chain-of-custody to a State-certified analytic laboratory.

When collecting groundwater samples, the sample barrel and inner rods are removed from the boring once the targeted water bearing zone has been reached. The drive casing is pulled up from 0.5 to 5 feet to allow groundwater to enter the borehole. Small diameter well casing and screen is then installed in the borehole to facilitate sample collection. The drive casing is then pulled up sufficiently to expose the desired length of screen and samples are collected using a bailer, peristaltic, bladder or inertial pump. The ground water samples are decanted into the appropriate containers supplied by the analytic laboratory. Samples are labeled, placed in protective foam sleeves, stored on crushed ice at or below 4° C, and transported under chain-of-custody to the laboratory.

Duplicates and Blanks

Blind duplicate water samples are usually collected only for monitoring well sampling programs, at a rate of one blind sample for every 10 wells sampled. Laboratory-supplied trip blanks accompany samples collected for all sampling programs to check for cross-contamination caused by sample handling and transport. These trip blanks are analyzed if the internal laboratory quality assurance/quality control (QA/QC) blanks contain the suspected field contaminants. An equipment blank may also be analyzed if non-dedicated sampling equipment is used.

Grouting

If the borings are not completed as wells, the borings are filled to the ground surface with cement grout poured or pumped through a tremie pipe.

ATTACHMENT B

Standard Field Procedures for Monitoring Well Installation

STANDARD FIELD PROCEDURES FOR MONITORING WELL INSTALLATION

This document presents standard field methods for drilling and sampling soil borings and installing, developing and sampling groundwater monitoring wells. These procedures are designed to comply with Federal, State and local regulatory guidelines. Specific field procedures are summarized below.

SOIL BORINGS

Objectives

Soil samples are collected to characterize subsurface lithology, assess whether the soils exhibit obvious hydrocarbon or other compound vapor or staining, and to collect samples for analysis at a State-certified laboratory. All borings are logged using the Unified Soil Classification System by a trained geologist working under the supervision of a California Professional Geologist (P.G.) or Professional Engineer (P.E.).

Soil Boring and Sampling

Soil borings are typically drilled using hollow-stem augers or direct-push technologies such as the Geoprobe®. Soil samples are collected at least every five ft to characterize the subsurface sediments and for possible chemical analysis. Additional soil samples are collected near the water table and at lithologic changes. Samples are collected using lined split-barrel or equivalent samplers driven into undisturbed sediments at the bottom of the borehole.

Drilling and sampling equipment is steam-cleaned prior to drilling and between borings to prevent cross-contamination. Sampling equipment is washed between samples with trisodium phosphate or an equivalent EPA-approved detergent.

Sample Analysis

Sampling tubes chosen for analysis are trimmed of excess soil and capped with Teflon tape and plastic end caps. Soil samples are labeled and stored at or below 4° C on either crushed or dry ice, depending upon local regulations. Samples are transported under chain-of-custody to a State-certified analytic laboratory.

Field Screening

One of the remaining tubes is partially emptied leaving about one-third of the soil in the tube. The tube is capped with plastic end caps and set aside to allow hydrocarbons to volatilize from the soil. After ten to fifteen minutes, a portable volatile vapor analyzer measures volatile hydrocarbon vapor concentrations in the tube headspace, extracting the vapor through a slit in the cap. Volatile vapor analyzer measurements are used along with the field observations, odors, stratigraphy and groundwater depth to select soil samples for analysis.

Water Sampling

Water samples, if they are collected from the boring, are either collected using a driven Hydropunch® type sampler or are collected from the open borehole using bailers. The groundwater samples are decanted into the appropriate containers supplied by the analytic laboratory. Samples are labeled, placed in protective foam sleeves, stored on crushed ice at or below 4°C, and transported under chain-of-custody to the laboratory. Laboratory-supplied trip blanks accompany the samples and are analyzed to check for cross-contamination. An equipment blank may be analyzed if non-dedicated sampling equipment is used.

Grouting

If the borings are not completed as wells, the borings are filled to the ground surface with cement grout poured or pumped through a tremie pipe.

MONITORING WELL INSTALLATION, DEVELOPMENT AND SAMPLING

Well Construction and Surveying

Groundwater monitoring wells are installed to monitor groundwater quality and determine the groundwater elevation, flow direction and gradient. Well depths and screen lengths are based on groundwater depth, occurrence of hydrocarbons or other compounds in the borehole, stratigraphy and State and local regulatory guidelines. Well screens typically extend 10 to 15 fee below and 5 feet above the static water level at the time of drilling. However, the well screen will generally not extend into or through a clay layer that is at least three feet thick.

Well casing and screen are flush-threaded, Schedule 40 PVC. Screen slot size varies according to the sediments screened, but slots are generally 0.010 or 0.020 inches wide. A rinsed and graded sand occupies the annular space between the boring and the well screen to about one to two feet above the well screen. A two feet thick hydrated bentonite seal separates the sand from the overlying sanitary surface seal composed of Portland type I,II cement.

Well-heads are secured by locking well-caps inside traffic-rated vaults finished flush with the ground surface. A stovepipe may be installed between the well-head and the vault cap for additional security.

The well top-of-casing elevation is surveyed with respect to mean sea level and the well is surveyed for horizontal location with respect to an onsite or nearby offsite landmark.

Well Development

Wells are generally developed using a combination of groundwater surging and extraction. Surging agitates the groundwater and dislodges fine sediments from the sand pack. After about ten minutes of surging, groundwater is extracted from the well using bailing, pumping and/or reverse air-lifting through an eductor pipe to remove the sediments from the well. Surging and extraction continue until at least ten well-casing volumes of groundwater are extracted and the sediment volume in the groundwater is negligible. This process usually occurs prior to installing the sanitary surface seal to ensure sand pack stabilization. If development occurs after surface seal installation, then development occurs 24 to 72 hours after seal installation to ensure that the Portland cement has set up correctly.

All equipment is steam-cleaned prior to use and air used for air-lifting is filtered to prevent oil entrained in the compressed air from entering the well. Wells that are developed using air-lift evacuation are not sampled until at least 24 hours after they are developed.

Groundwater Sampling

Depending on local regulatory guidelines, three to four well-casing volumes of groundwater are purged prior to sampling. Purging continues until groundwater pH, conductivity, and temperature have stabilized. Groundwater samples are collected using bailers or pumps and are decanted into the appropriate containers supplied by the analytic laboratory. Samples are labeled, placed in protective foam sleeves, stored on crushed ice at or below 4°C, and transported under chain-of-custody to the laboratory. Laboratory-supplied trip blanks accompany the samples and are analyzed to check for cross-contamination. An equipment blank may be analyzed if non-dedicated sampling equipment is used.

Waste Handling and Disposal

Soil cuttings from drilling activities are usually stockpiled onsite and covered by plastic sheeting. At least three individual soil samples are collected from the stockpiles and composited at the analytic laboratory. The composite sample is analyzed for the same constituents analyzed in the borehole samples in addition to any analytes required by the receiving disposal facility. Soil cuttings are transported by licensed waste haulers and disposed in secure, licensed facilities based on the composite analytic results.

Groundwater removed during development and sampling is typically stored onsite in sealed 55-gallon drums. Each drum is labeled with the drum number, date of generation, suspected contents, generator identification and consultant contact. Upon receipt of analytic results, the water is either pumped out using a vacuum truck for transport to a licensed waste treatment/disposal facility or the individual drums are picked up and transported to the waste facility where the drum contents are removed and appropriately disposed.