R0173

Shell Oil Products US

January 18, 2005

Roseanna Garcia-La Grille
Alameda County Health Care Services Agency
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502-6577

Subject: **Shell-branded Service Station**
2120 Montana Street
Oakland, California

Dear Ms Garcia-La Grille:

Attached for your review and comment is a copy of the *Interim Remediation Report* 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.

As always, please feel free to contact me directly at (559) 645-9306 with any questions or concerns.

Sincerely,

Shell Oil Products US

Karen Petryna

Karen Petryna
Sr. Environmental Engineer

20945 S. Wilmington Ave., Carson, CA 90810 Phone (559) 645-9306 Facsimile (559) 645-5643

CAMBRIA

January 18, 2005

Roseanna Garcia-La Grille
Alameda County Health Care Services Agency
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502-6577

Re: **Interim Remediation Report**
Shell-branded Service Station
2120 Montana St
Oakland, California
Incident # 98995740
Cambria Project # 247-0733-007

Dear Ms. Garcia-La Grille:

On behalf of Equilon Enterprises LLC dba Shell Oil Products US (Shell), Cambria Environmental Technology, Inc. (Cambria) has prepared this *Interim Remediation Report* for the subject site. This report was prepared to summarize follow-up soil vapor extraction (SVE) proposed in Cambria's September 4, 2002 *Subsurface Investigation, Soil Vapor Extraction Pilot Test Report, and Interim Remediation Work Plan.* In a September 19, 2002 letter, the Alameda County Health Care Services Agency (ACHCSA) agreed with Cambria's recommendation.

Presented below is a summary of the site background and the interim remedial activities.

SITE BACKGROUND

Location and Description: This operating Shell-branded service station is located at the Montana Street and Fruitvale Avenue intersection in Oakland, California (Figures 1 and 2). Commercial properties lie to the north and east of the site, and residential properties lie to the west. Montana Street, a freeway on-ramp, and Highway 580 are located south of the site.

1997 Dispenser/Turbine Sump Upgrades: In November 1997, Paradiso Mechanical (Paradiso) of San Leandro, California upgraded fuel-related equipment at the service station. Secondary containment was added to the three existing dispensers and to the turbine sumps above the underground storage tanks (USTs). Soil samples D-1, D-2, and D-3 were collected from beneath the dispensers at a depth of approximately 5 feet below grade (fbg). Soil samples were not collected from beneath the associated piping since it was not exposed during upgrade activities.

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The maximum total petroleum hydrocarbons as gasoline (TPHg), benzene, and methyl tertiary butyl ether (MTBE) concentrations were reported in sample D-3 at 59 parts per million (ppm), 0.76 ppm, and 1.1 ppm, respectively. Cambria's February 3, 1998 *Dispenser Soil sampling Report* summarizes these activities.

1999 Subsurface Investigation: In October 1999, Cambria advanced soil borings SB-1 through SB-3. SB-1 was advanced to 16 fbg, and SB-2 and SB-3 were advanced to 20 fbg. The maximum detected hydrocarbon concentrations in soil were 54 ppm TPHg in boring SB-1 at 5.0 fbg, 0.019 ppm benzene in boring SB-2 at 15 fbg, and 0.24 ppm MTBE in boring SB-2 at 10.0 fbg. The maximum reported hydrocarbon concentrations in groundwater were 2,380 parts per billion (ppb) TPHg in boring SB-3, 10.6 ppb benzene in SB-2, and 3,210 ppb MTBE in SB-3. Cambria's June 7, 2000 *Subsurface Investigation Report and Work Plan for Installation of Groundwater Monitoring Wells* summarizes these activities.

2001 Monitoring Well Installation: In February 2001, Cambria installed three groundwater monitoring wells (MW-1 through MW-3). The maximum TPHg and MTBE concentrations were found in soil samples collected from monitoring well MW-2, located in Montana Street across from the site. TPHg was detected at 21 fbg at a concentration of 10 ppm, and MTBE was detected at 15.5 fbg at a concentration of 5.2 ppm. The maximum detected benzene concentration of 0.066 ppm was detected in the soil sample collected from monitoring well MW-1 at 10 fbg. Cambria's May 22, 2001 *Groundwater Monitoring Well Installation Report* summarizes these activities.

2001 Sensitive Receptor Survey, Well Survey, and Conduit Study: In August 2001, Cambria conducted a sensitive receptor survey, well survey, and conduit study. ACHCSA requested this work in a July 23, 2001 letter to Shell. The sensitive receptor survey indicated that no known water-producing wells are located within ½-mile radius of the site. The nearest surface water body is Sausal Creek, located approximately 240 feet west-northwest of the site. Sausal Creek is diverted into a 10-foot by 10-foot culvert, located approximately 420 feet west-northwest of the site, with a flow line depth shallower than the typical water table at the site. Sausal Creek resurfaces approximately 730 feet southwest of the site. The utility study indicated that utility conduits in the area do not typically encounter groundwater, and likely do not act as preferential pathways for contaminant migration. Based on this information, no known receptors are likely to be impacted by chemicals at the site. However, at the time of this survey, the potential for hydrocarbon vapor migration to the neighboring residences had not been investigated. Cambria's September 24, 2001 *Sensitive Receptor Survey, Well Survey, and Conduit Study Report* summarizes these activities.

2001-2003 Mobile Groundwater Extraction (GWE): In August 2001, GWE from wells MW-1 and TBW-N using a vacuum truck began at the site. GWE was conducted on a weekly basis

through November 2001, on a bi-weekly basis through December 2001, on a monthly basis through March 2003, and then was conducted on a weekly basis between August 19, 2003 and January 6, 2004. The cumulative estimated mass of TPHg and MTBE removed by GWE at the site was 25.27 pounds and 8.13 pounds, respectively. Additionally, approximately 2.68 pounds of separate-phase hydrocarbons (SPH) were removed from wells MW-1 and TBW-N through both manual bailing and GWE.

2002 SVE Test: In June 2002, Cambria performed a 5-day SVE test to remove petroleum hydrocarbon mass and to determine if extracted vapor concentrations would be sustained over a long period of time. High initial vapor concentrations indicated the presence of source material within the UST facility available for recovery. Operation of the internal combustion engine over the 5-day test period resulted in an order of magnitude decrease in TPHg and MTBE vapor concentrations. Based on operating parameters and vapor sample analytical results collected throughout the test period, the TPHg, benzene, and MTBE vapor-phase mass removal over the test period was estimated at 176, 0.998, and 1.92 pounds, respectively. Cambria's September 4, 2002 *Subsurface Investigation, Soil Vapor Extraction Pilot Test Report, and Interim Remediation Work Plan* summarizes these activities.

2002 Monitoring Well Installation: In June 2002, Cambria installed groundwater monitoring wells MW-4 and MW-5. TPHg, benzene, toluene, ethylbenzene, and xylenes (BTEX) were not detected in soil samples collected from well MW-4. TPHg and benzene were detected only in well MW-5 in the soil samples collected from 9.0 fbg and 19.0 fbg at 1.3 ppm and 18 ppm, respectively. Benzene was detected only in boring MW-5 in soil samples collected from 9.0 fbg and 19.0 fbg at 0.0083 ppm and 0.0071 ppm, respectively. MTBE was not detected in any soil samples collected during this investigation. Table 1 summarizes historical boring and well data. Attachment A presents historical soil analytical data. Cambria's September 4, 2002 *Subsurface Investigation, Soil Vapor Extraction Pilot Test Report, and Interim Remediation Work Plan* summarizes these activities.

2003 GWE System: Cambria's September 4, 2002 *Subsurface Investigation, Soil Vapor Extraction Pilot Test Report, and Interim Remediation Work Plan* proposed GWE as interim remediation. Construction of a GWE system began in early February 2003, and start-up occurred on April 2, 2003. The GWE system extracts groundwater from monitoring well MW-1 and tank backfill well TBW-N. Due to the presence of SPH, Cambria did not operate the GWE system between July 18, 2003 and April 21, 2004. Cambria re-designed the GWE system to include an oil/water separator. Modifications to the GWE system were completed on March 31, 2004. An oil/water separator, two particle filters in parallel, and a series of three 1,000-pound aqueous-phase carbon vessels treat the groundwater stream. Treated groundwater is discharged to the sanitary

sewer under the authorization of an East Bay Municipal Utilities District (EBMUD) wastewater discharge permit.

Table 2 summarizes GWE system analytical data. Table 3 summarizes the GWE system operation and mass removal data. As of November 22, 2004, a total of 232,089 gallons of groundwater has been extracted. A total of 15.0 pounds of TPHg, 0.590 pounds of benzene, and 3.23 pounds of MTBE has been recovered.

2003 Tank Repair: In November 2003, Able Maintenance of Santa Rosa, California exposed the regular grade UST for inspection by the tank manufacturer (Xerxes Company). Xerxes Company found a small crack on the bottom of the tank. The crack was investigated, repaired with fiberglass resin, and air tested for the City of Oakland Fire department by the Xerxes Company. After the Xerxes Company completed their air test, Able Maintenance called in a third-party tank tester to precision test the tank. Afford-a-Test completed that test, and the tank was certified as tight. Able Maintenance monitored the tank through Shell's Veeder-Root monitoring system since the repair, and it passed the associated pressure tests.

2004 Station Upgrades: In May 2004, Paradiso upgraded the station's fuel dispensers and UST sumps. Cambria collected soil samples D-1-4.0, D-2-4.0, and D-3-4.0 from underneath the dispensers. TPHg was detected in two of the three soil samples at concentrations ranging from 110 ppm (D-3-4.0) to 1,900 ppm (D-2-4.0). Benzene was detected in one sample at 1.7 ppm (D-2-4.0). Ethylbenzene was detected in two samples at concentrations ranging from 3.1 ppm (D-3-4.0) to 21 ppm (D-2-4.0). Xylenes were detected in two samples at concentrations ranging from 0.17 ppm (D-1-4.0) to 57 ppm (D-2-4.0). MTBE was detected in all samples at concentrations ranging from 0.65 ppm (D-3-4.0) to 5.8 ppm (D-2-4.0). Lead was detected in all samples at concentrations ranging from 7.3 ppm (D-2-4.0) to 8.7 ppm (D-3-4.0). Cambria's November 1, 2004 *Dispenser Upgrade Sampling Report* summarizes these activities.

Groundwater Monitoring: Quarterly groundwater monitoring has been conducted at the site since well installation in 2001. Tank backfill well TBW-N, one of four tank backfill wells at the site and the only tank backfill well which encounters groundwater, was added to the quarterly monitoring program in September 2001. Since June 2001, SPH have been detected intermittently in monitoring well MW-1 as well as in tank backfill well TBW-N. SPH were observed in well MW-2 near the end of SVE testing in July 2004. Figure 2 presents data from the third quarter 2004 groundwater monitoring event. However, the laboratory report for the fourth quarter 2004 monitoring event was just recently received and the results are discussed herein.

During the fourth quarter 2004, TPHg was detected in groundwater in all monitoring wells except for well MW-3 at concentrations ranging from 3,300 ppb (MW-4) to 64,000 ppb (MW-2). Similarly, benzene was detected in groundwater in all monitoring wells except for well MW-3 at

concentrations ranging from 27 ppb (MW-5) to 2,900 ppb (MW-2). MTBE was detected in all monitoring wells at concentrations ranging from 2.6 ppb (MW-3) to 6,300 ppb (MW-2).

Previously, third quarter 2004 groundwater monitoring samples were analyzed for five oxygenates at Shell's request. Tert butyl alcohol (TBA) was detected in groundwater samples from wells MW-1, MW-2, MW-4, and TBW-N at concentrations of 4,100 ppb, 4,100 ppb, 700 ppb, and 4,500 ppb, respectively. Analytical results for the other oxygenates were below reporting limits. Historical groundwater monitoring data is presented as Attachment B.

SITE CONDITIONS

Site Lithology: The site is located within the East Bay Plain groundwater basin of Alameda County, west of the Hayward Fault. The East Bay Plain area is characterized by Quaternary age Bay Mud composed of unconsolidated plastic clay and silty clay, rich in organic material with some lenses of silt and sand. Beneath the Bay Mud deposits lie unconsolidated younger and older alluvial deposits (Hickenbottom and Muir, 1988).

The site is underlain by interbedded sandy silt, silty sand, clayey sand and sand to the total explored depth of 28 fbg. A small sand lens is observed below 15 fbg (~UST complex bottom) in boring logs from wells MW-1, MW-2, and SB-3. The log for MW-4 shows this lens but at a shallower depth. This sand lens may serve as the main transport pathway. Boring logs are included as Attachment C.

Hydrogeology: The Older Alluvium is the dominant aquifer in the East Bay Plain area west of the Hayward Fault. Regional groundwater flow is to the west-southwest toward San Francisco Bay.

The site elevation is approximately 150 feet above mean sea level. Historically, groundwater depth has ranged from approximately 10.1 to 14.3 fbg, and groundwater flow direction is predominantly to the south-southwest, but has varied to the northwest. A rose diagram of groundwater flow direction is included on Figure 2.

INTERIM REMEDIATION

Consistent with the findings and recommendations in Cambria's September 4, 2002 *Subsurface Investigation, Soil Vapor Extraction Pilot Test Report, and the Interim Remediation Work Plan*, follow-up SVE was warranted based on groundwater monitoring and GWE system operational

data. The primary objective of interim remediation was to provide source area remediation of residual petroleum hydrocarbons and MTBE. Between July 26 and July 30, 2004, Cambria conducted SVE from well MW-1.

Health and Safety Plan: A site-specific Health and Safety Plan was prepared and maintained on site throughout the SVE activities.

Notification: On July 21, 2004, Cambria provided the Bay Area Air Quality Management District with the required notification for conducting the SVE activities.

SVE Equipment: A Solleco trailer-mounted liquid-ring pump with electric catalytic oxidizer (Solleco unit) was used as the extraction and vapor abatement device during the SVE test. A 150-kilowatt generator powered the Solleco unit. A throttle valve was used to control the applied vacuum and vapor extraction flow rate. The Solleco unit is equipped with an auto-dilution valve and a manual dilution valve to further control vacuum and flow, as well as to maintain the oxidizer temperatures within the specified range.

Field vapor concentrations were measured with a Horiba model MEXA554JU organic vapor analyzer. A Thomas Industries model 907CDC18F vacuum pump was used to collect vapor samples in one-liter Tedlar bags. Magnehelic differential pressure gauges were used to monitor vacuum induced in nearby wells and at the wellhead of the extraction point.

Initially, the GWE system's submersible pneumatic pump in well MW-1 was used to dewater the soil formation to the target elevation. However, the groundwater yield exceeded this pump's capacity resulting in insufficient drawdown of the water table. Therefore, Cambria installed a 2-inch diameter Grundfos electric pump in well MW-1 to achieve the required drawdown. The extracted groundwater was treated by the existing remediation system and discharged to the sanitary sewer in compliance with the existing EBMUD wastewater discharge permit.

Data Collection and Sampling: Data was collected on standard forms. Throughout the SVE period, Cambria measured the applied vacuum, air flow, volatile organic vapor concentration, and vacuum influence in nearby wells. Data was collected at 10- to 30-minute intervals for 6 to 8 hours a day, after which the equipment was set to operate overnight. Vapor samples were collected in one-liter tedlar bags for laboratory analysis at the beginning and end of each day.

Analyses: Vapor samples were analyzed by EPA Method 8260B to determine TPHg, BTEX, and MTBE concentrations and to verify field measurements. Severn Trent Laboratories (STL) of Pleasanton, California, a State-certified laboratory, provided sample analysis.

SVE Interim Remediation Results

SVE data is summarized in Table 4. Table 5 presents the vacuum radius of influence information. Field data sheets are presented as Attachment D. Laboratory analytical results are presented as Attachment E. Details of the July 2004 interim remediation are presented below:

July 26, 2004: SVE from well MW-1 began at 13:15 on July 26. The depth to groundwater was measured at 24.87 feet from the top of the well casing in well MW-1 at the outset of SVE. Cambria incrementally increased (stepped) the applied vacuum in order to determine the maximum air flow rate and the optimal operation setting.

Applied vacuum readings were measured at the wellhead. The maximum wellhead vacuum achieved was 105.1-inches of water column-gauge (WC). Vapor-phase hydrocarbon concentrations from well MW-1 exceeded the catalytic oxidizer's capacity, resulting in high temperature shutdown. To accommodate continuous operation of the Solleco unit, Cambria had to introduce additional dilution air to the process stream, which limited the application of higher vacuums.

The extraction flow rate ranged from 10.4 to 25.3 standard cubic feet per minute (scfm) and averaged 16.9 scfm. Cambria personnel observed a maximum vacuum influence of 0.01 inches WC in observation well TBW-N. The GWE rate was maintained at approximately 4.0 gallons per minute (gpm) on this day.

Vapor samples were collected at the wellhead for laboratory analysis. The initial vapor sample collected at 13:30 contained 4,700 parts per million by volume (ppmv) TPHg and 7 ppmv MTBE, and was below the reporting limit (<1.6 ppmv) for benzene. The vapor sample collected at the end of the day (16:00) contained 11,000 ppmv TPHg, 24 ppmv benzene, and 30 ppmv MTBE. The Solleco unit was set to operate overnight to maximize the remedial effort.

July 27, 2004: SVE from well MW-1 continued through the day. An average wellhead vacuum of 61 inches WC was established by the liquid-ring pump generated vacuum of approximately 7.0 inches of mercury-gauge (Hg). The maximum wellhead vacuum achieved was 65.3 inches WC. The extraction flow rate ranged from 24.3 to 31.9 scfm and averaged 27.3 scfm. Cambria personnel observed a vacuum influence of 0.01 inches WC in observation wells MW-4, TBW-W, TBW-N, TBW-E, and MW-3. The GWE rate was maintained at approximately 4.0 gpm on this day.

A vapor sample collected at 8:00 contained 2,300 ppmv TPHg, 9.7 ppmv benzene, and 12 ppmv MTBE. The vapor sample collected at the end of the day (14:00) contained 1,600 ppmv TPHg,

6.5 ppmv benzene, and 8.9 ppmv MTBE. The Solleco unit was set to operate overnight to maximize the remedial effort.

July 28, 2004: SVE from well MW-1 continued through the day. An average wellhead vacuum of 62 inches WC was established by a liquid-ring pump generated vacuum of approximately 7.0 inches Hg. The maximum wellhead vacuum achieved was 63.2 inches WC. The extraction flow rate ranged from 26.4 to 38.5 scfm and averaged 32.5 scfm. Cambria personnel observed a vacuum influence of 0.01 inches WC in observation wells MW-4, TBW-W, TBW-N, TBW-E, and MW-3. The GWE rate was maintained at approximately 4.0 gpm on this day.

A vapor sample collected at 7:00 contained 4,300 ppmv TPHg, 18 ppmv benzene, and 24 ppmv MTBE. The vapor sample collected at the end of the day (13:30) contained 12,000 ppmv TPHg, 42 ppmv benzene, and 52 ppmv MTBE. The Solleco unit was set to operate overnight to maximize the remedial effort.

July 29, 2004: Upon arrival, the submersible pump in well MW-1 was not operating. The cause of the pump shutdown is unknown. Cambria restarted the pump and continued with SVE. An average wellhead vacuum of 62 inches WC was established by a liquid-ring pump generated vacuum of approximately 7.0 inches Hg. The maximum wellhead vacuum achieved was 69 inches WC. The extraction flow rate ranged from 30.4 to 34.4 scfm and averaged 31.6 scfm. Cambria personnel observed a vacuum influence of 0.01 inches WC in observation wells MW-4, TBW-W, TBW-N, TBW-E, and MW-3. The GWE rate was set at 4.5 gpm upon restarting the pump, but was reduced to approximately 4.0 gpm by the end of the day.

A vapor sample collected at 10:00 contained 3,700 ppmv TPHg, 17 ppmv benzene, and 37 ppmv MTBE. The vapor sample collected at the end of the day (14:00) contained 4,700 ppmv TPHg, 18 ppmv benzene, and 33 ppmv MTBE. The Solleco unit was set to operate overnight to maximize the remedial effort.

Cambria periodically monitored depth to groundwater in all wells throughout the SVE period. Groundwater drawdown was observed in all wells throughout SVE. At 12:00 on July 29, Cambria measured 0.13 feet (1.56 inches) of SPH in off-site monitoring well MW-2 at a depth of 16.96 fbg. Approximately 6 feet of groundwater drawdown was observed in this well during SVE.

July 30, 2004: SVE from well MW-1 continued through the day. On this day, Cambria was able to complete step testing of well MW-1. A maximum air flow rate of 61.9 scfm was produced from an applied wellhead vacuum of 105 inches WC. The maximum wellhead vacuum achieved was 157 inches WC. The extraction flow rate ranged from 34.2 to 61.9 scfm and averaged 40 scfm. Cambria personnel observed a vacuum influence of 0.01 inches WC in observation wells TBW-W,

TBW-N, TBW-E, and MW-3. Cambria personnel observed a vacuum influence of 0.7 inches WC in observation well MW-4. The GWE was maintained at approximately 4.0 gpm on this day.

A vapor sample collected at 7:00 contained 6,900 ppmv TPHg, 26 ppmv benzene, and 23 ppmv MTBE. The vapor sample collected at the end of the day (14:00) contained 8,500 ppmv TPHg, 27 ppmv benzene, and 21 ppmv MTBE.

Cambria measured 0.8 feet (9.6 inches) of SPH in off-site monitoring well MW-2 at a depth of 18.90 fbg.

CONCLUSIONS

Monitoring well MW-1 was used for vapor extraction, and monitoring wells MW-3, MW-4, and backfill wells TBW-N, TBW-W, and TBW-E were used to measure vacuum influence. When vacuum was applied to well MW-1, a maximum vacuum of 0.01 inches WC was observed in all wells except for well MW-4. A maximum vacuum of 0.7 inches WC was observed in well MW-4, corresponding to a vacuum of 157 inches WC applied at well MW-1. The effective radius of influence is typically defined as an observed vacuum that is greater than or equal to 1% of that applied to the extraction well. All observed vacuums were less than 1% of the applied vacuum. The low vacuums in these observation wells may be attributed to the proximity of the extraction well to the former UST complex. The more permeable soils (pea gravel) within the UST complex would dissipate the applied vacuum and limit its extent.

SVE data from well MW-1 suggested SVE was effective as interim remediation. A high flow rate was obtained from well MW-1 at an intermediate applied vacuum. High TPHg, BTEX, and MTBE vapor concentrations were sustained over the duration of SVE. The sustained vapor concentrations suggest that significant residual hydrocarbon mass remains. Based on operating parameters and vapor sample analytical results, the total vapor-phase TPHg, benzene and MTBE mass removed from well MW-1 during this SVE event is estimated at 257, 0.822, and 1.22 pounds, respectively (Table 4).

Approximately 20,160 gallons of groundwater were extracted from well MW-1 over 5,946 minutes of SVE operation, which equates to an average extraction rate of 3.39 gpm. As previously discussed, the extracted groundwater was treated by the existing remediation system and discharged to the sanitary sewer. Based on the extracted volume and August 3, 2004 GWE system influent analytical data, the estimated mass removal of dissolved-phase TPHg, benzene, and MTBE is 0.168, 0.009, and 0.066 pounds, respectively.

Although hydrocarbon concentrations in groundwater appear to be decreasing following SVE, data and observations during remedial activities suggests that the lateral extent of SPH is likely more extensive than site investigation and groundwater monitoring data have shown. As previously discussed, a small sand lens is observed below 15 fbg (~UST complex bottom) in boring logs from wells MW-1, MW-2, and SB-3. SPH had been present in well MW-1 and backfill well TBW-N in the past. After the groundwater in well MW-2 was drawn down below 15 fbg during SVE, SPH were observed in this well. Cambria believes this sand lens is the main transport pathway. Since the static groundwater table is above this sand lens, floating SPH may be trapped within the lens and prevent SPH from entering well MW-2 under static conditions. Cambria believes that during pumping of well MW-1, the groundwater table was lowered, which allowed some transport of SPH and caused it to appear in well MW-2.

RECOMMENDATIONS

Based on the data and observations during remedial activities, Cambria recommends further assessment the lateral extent of SPH in the source area and assessment of the potential risks posed by the site conditions to the surrounding properties. Thus, on behalf of Shell, Cambria proposes to install five soil borings and five soil vapor sampling probes (Figure 3).

In addition, for risk assessment purposes, a survey of the neighboring residences building structures (i.e. basements, slab on grade, perimeter foundation, etc) will be conducted. Soil vapor samples will be collected from the vadose zone along the western property line to assess the actual concentration of hydrocarbon vapors migrating upward through soils. The results of the soil vapor samples will then be evaluated to provide information regarding the potential risks to occupants by the indoor air exposure pathway. Results from the investigation and risk assessment will be used to determine if additional remedial action is warranted. Presented below is a description of the proposed work tasks.

Work Tasks

Permits: Appropriate permits for drilling will be obtained from Alameda County Public Works Agency.

Site Safety Plan: A site safety plan will be prepared for field work.

Utility Clearance: Proposed drilling locations will be marked and their locations cleared through Underground Service Alert prior to drilling. A private utility locator may be hired to clear on-site

utilities. The top 5 feet of each location will be advanced with hand auger equipment or an air knife, to further minimize the potential for damaging any utilities not identified by USA.

Site Investigation: Five soil borings are proposed as shown on Figure 3. Four of the borings (SB-4 through SB-7) are positioned in the south-southwest corner of the site downgradient of the USTs. The fifth boring (SB-8) is located in the north-northwest corner of the site. Cambria's Standard Field Procedures for Soil Borings is included in Attachment F.

Site Investigation: Five exploratory cone penetrometer test (CPT) soil borings (SB-4 through SB-8) are proposed at the locations shown on Figure 3. All the borings will be drilled using direct push CPT equipment. Cambria's Stand Field Procedures for Cone Penetrometer Testing and Sampling are presented as Attachment F. Borings SB-4 through SB-8 will be drilled to an approximate depth of 25 fbg to assess the lateral and vertical extent of SPH in soil beneath the sites.

Sediments will be electronically logged by CPT logging equipment. Borings SB-4 through SB-8 will also be logged using an ultraviolet induced fluorescence (UVIF) probe. The UVIF probe works on the principle that polyaromatic hydrocarbons mixed with soil and groundwater fluoresce when irradiated by ultraviolet light. By measuring the UVIF intensity of the soil and groundwater, the relative lateral and vertical extent of SPH can be determined. Soil samples will be collected at selected locations and depths from borings SB-4 through SB-8 for chemical analysis to compare laboratory analytical data with UVIF readings. Based on the CPT logging results, groundwater samples will be collected from borings SB-4 through SB-8.

Soil samples designated for chemical analysis will be retained in stainless steel, brass, or plastic sample tubes, and covered on both ends with Teflon sheets and plastic end caps. Groundwater samples will be collected from borings using Hydropunch or equivalent sampling equipment, and placed into appropriate containers. 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.

Chemical Analyses: Groundwater samples and selected soil samples will be analyzed for TPHg, BTEX, and fuel oxygenates by EPA Method 8260.

Physical Parameter Testing: In order to use site-specific data to perform the risk assessment, select soil samples will be submitted for additional analyses to determine physical characteristics. Cambria proposes submitting samples from the 5-foot and 10-foot intervals from all borings for analysis of moisture content, total porosity, and soil bulk density. This data will be used to perform a Tier II risk based corrective action (RBCA) evaluation.

Soil-Vapor Assessment Activities

Soil-Vapor Investigation: Based on the document *Guidance on Use of Soil-Gas Surveys to Assess Vapor Transport to Indoor Air* prepared by Shell (Attachment G), Cambria proposes to perform active sampling from fixed soil-gas probe locations. As shown on Figure 3, five soil-vapor probes (SV-A through SV-E) are proposed to be installed on site along the western property boundary.

Soil-Gas Probe Installation: The soil-vapor probe nests will be installed using hand-auger equipment. Two intervals will be screened at each location, one at approximately 5 fbg and one at approximately 10 fbg. Adjustments to the screen depths will be made based on the observed lithology. Zones of higher permeability will be targeted for screening.

Each probe will consist of 0.25-inch inside diameter Teflon tubing, with no greater than 3-inch lengths of screen (perforated in the field using a drill and very small bit). The bottom of the tubing and the screened interval will be wrapped with stainless steel screen to avoid potential clogging with soil. Teflon tape will be used to secure the screen on the tubing. A clean, fine-grained silica sand filter pack will be installed approximately 3 to 6 inches below and above the screened interval. The annulus between probe intervals will be sealed using a bentonite slurry, set atop a 2-inch base of bentonite pellets. Each nest of soil-probes will be sealed by grout from the surface. The wellhead will be protected by a traffic-rated well box.

Soil-Vapor Sampling: To allow adequate time for soil-vapor equilibration within the disturbed soils, the initial vapor sampling event will occur no earlier than 3 weeks following probe installation. Further, soil-gas sampling will occur no sooner than 3 days following a precipitation event. Cambria will discuss the sampling schedule with the property owners and request that they do not perform any irrigation within 3 days prior to the proposed sampling date. Sample collection procedures are detailed in Attachment F.

A schematic of the aboveground soil-vapor sampling apparatus is shown on Figure 4. A flow meter/controller will regulate the flow of air extracted from the tubing by the purge pump. Approximately three tubing volumes will be purged from each vapor point over a period of approximately 10 minutes prior to sample collection. Immediately after purging, soil-vapor samples will be collected over an approximate 30-minute period using 1-liter Summa canisters provided by the laboratory.

Chemical Analyses: The vapor samples will be kept at ambient temperature and submitted under chain-of-custody to Air Toxics LTD of Folsom, California for analysis. The samples will be analyzed for TPHg using EPA Method TO-3, BTEX using TO-14A GC/MS full scan, and propane using Air Toxics Limited Method @82.

Analysis of oxygen, carbon dioxide, and methane will be used to evaluate potential dilution of the soil vapor samples with ambient air. Standard publicized levels of ambient air are: oxygen 21%, carbon dioxide 0.033%, and 2.0-ppm methane. Because biodegradation of petroleum hydrocarbons is likely occurring in the subsurface, the soil-vapor concentration of oxygen is expected to be lower than general ambient concentrations. However, for the same reason, carbon dioxide and methane concentrations are expected to be higher. The concentration of oxygen, carbon dioxide, and methane in the subsurface is dependent on the amount and kind of biodegradation activity and will likely vary between the 5 and 10 fbg samples.

Report Preparation: Following the receipt of analytical and physical parameter results from the laboratory, Cambria will prepare a written report which will include field procedures, laboratory results, boring logs, the Tier II RBCA, conclusions and recommendations for further activities.

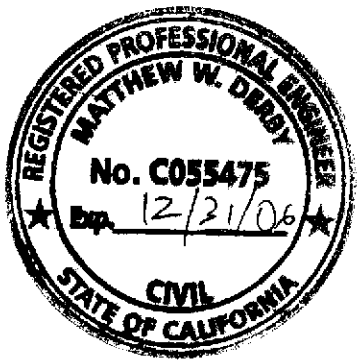
CLOSING

Cambria is prepared to begin permitting activities upon approval of this work plan by the ACHCSA. The on-site field activities will also be scheduled as soon as work plan approval is received. If you have any questions regarding the contents of this document, please call Dan Lescure at (510) 420-3306.

Sincerely,
Cambria Environmental Technology, Inc.

Dan Lescure
Senior Project Engineer

Matthew W. Derby, P.E.
Senior Project Engineer



Figures:
1 - Vicinity/Area Well Survey Map
2 - Groundwater Elevation Contour Map
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Tables:
1 - Boring/Well Data
2 - Groundwater Extraction – System Analytical Data
3 - Groundwater Extraction – Operation and Mass Removal Data
4 - Soil Vapor Extraction – Mass Removal Data
5 - Soil Vapor Extraction – Vacuum Radius of Influence Data

Attachments:
A - Historical Soil Data
B - Historical Groundwater Monitoring Data
C - Boring Logs
D - Field Data Sheets
E - Certified Laboratory Analytical Reports
F - Standard Field Procedures for Soil Borings
G - *Guidance on Use of Soil-Gas Surveys to Assess Vapor Transport to Indoor Air*

cc: Karen Petryna, Shell Oil Products US, 20945 S. Wilmington Avenue, Carson, CA 90810

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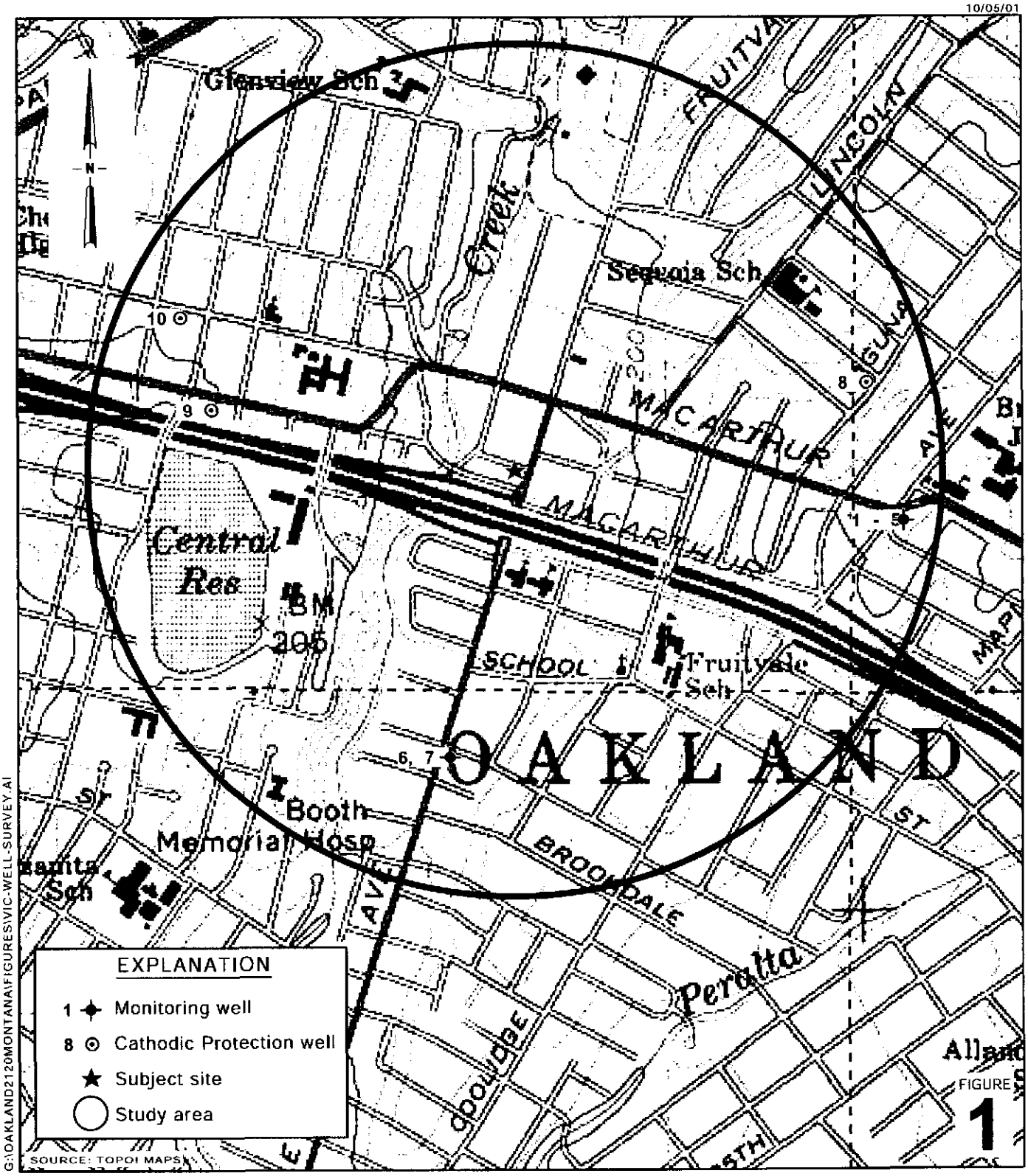
10/05/01



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0 1/6 1/3 1/2 1

SCALE : 1" = 1/6 MILE

FIGURE 1

Shell-branded Service Station
2120 Montana Street
Oakland, California
Incident #98995740

CAMBRIA

Vicinity / Area Well Survey Map

(1/2-Mile Radius)

12/06/04

EXPLANATION

MW-1 • Monitoring well location

TBW-N + Tank backfill well location

SB-1 ◉ Cambria soil boring location (10/99)

D-1 ● Cambria soil sampling location (11/97)

→ Groundwater flow direction

XX.XX Groundwater elevation contour, in feet above mean sea level (msl), dashed where inferred

Well — Well designation

ELEV — Groundwater elevation, in feet above msl

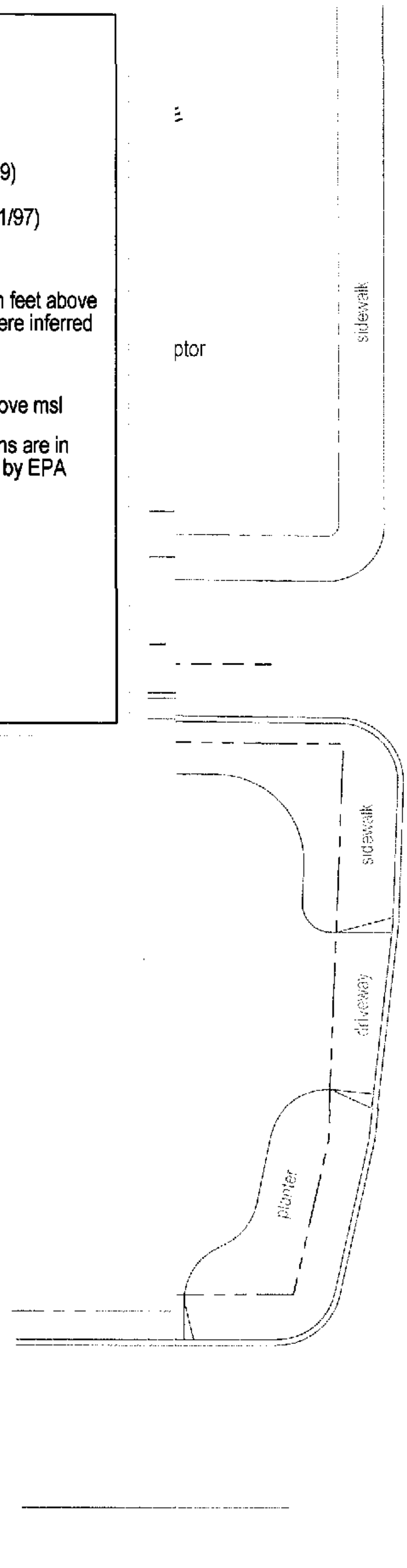
Benzene / MTBE — Benzene and MTBE concentrations are in parts per billion and are analyzed by EPA Method 8260.

---------------- Overhead electrical service

——···—— Remediation piping

— — — — Existing 10" Santiary sewer (SS)

—·—·—·— Discharge Pipe



0 15 30 60

Scale (ft)

FIGURE

2

Groundwater Elevation Contour Map

September 17, 2004

CAMBRIA

Shell-branded Service Station

2120 Montana Street

Oakland, California

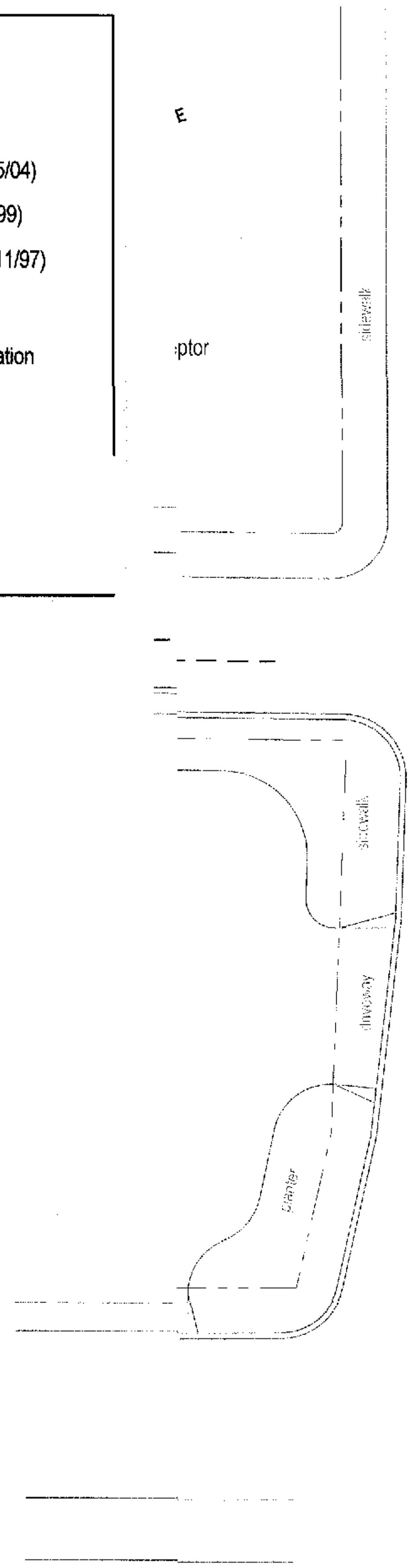
Incident #98995740

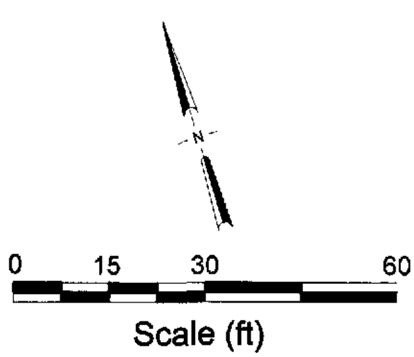
G:\OAKLAND 2120 MONTANA\FIGURES\3QM04.DWG

12/28/04

EXPLANATION

MW-1	Monitoring well location
TBW-N	Tank backfill well location
D-1-4.0	Soil sampling location (Cambria, 5/04)
SB-1	Soil boring location (Cambria, 10/99)
D-1	Soil sampling location (Cambria, 11/97)
SB-4	Proposed soil boring location
SV-A	Proposed soil vapor sampling location
	Overhead electrical service
	Remediation piping
	Existing 10" Santiary sewer (SS)
	Discharge Pipe





Proposed Soil Boring Location Map

December 28, 2004

CAMBRIA

FIGURE

3

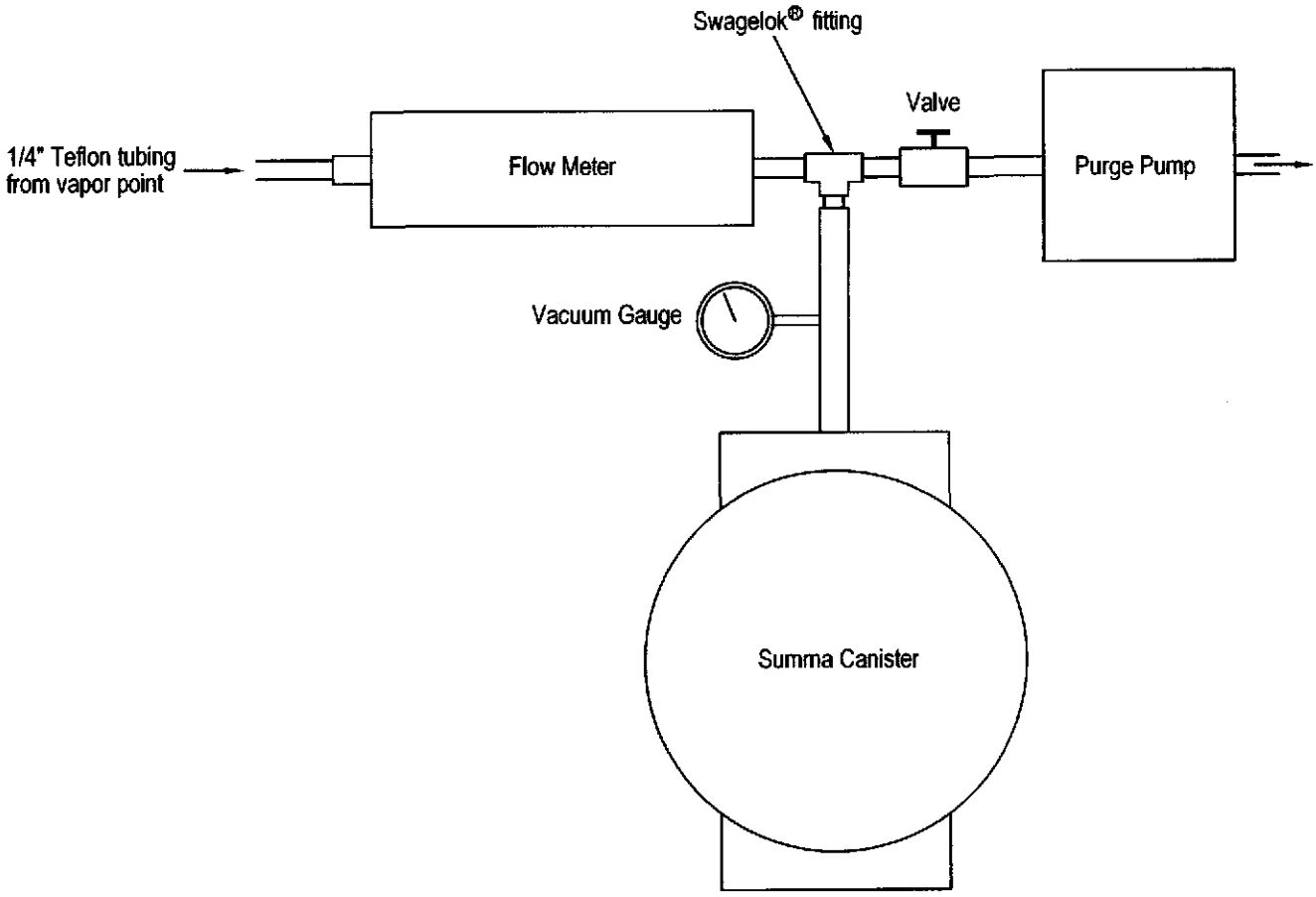
Shell-branded Service Station

2120 Montana Street

Oakland, California

Incident #98995740

G:\OAKLAND2120MONTANA\FIGURES\PROPOSED BORINGS DEC04.DWG



G:\OAKLAND 2120 MONTANA\FIGURES\VAPOR SAMLING DIAGRAM.DWG

FIGURE
4

Schematic Not to Scale

Shell-branded Service Station
2120 Montana Street
Oakland, California

CAMBRIA

Soil Vapor Sampling Apparatus Diagram

Table 1. Boring/Well Data - Shell-branded Service Station, Incident #98995740, 2120 Montana St, Oakland, CA

Well No.	Date Installed	Elevation TOC (ft)	Casing Material	Total Depth (ft bgs)	Well Depth (ft bgs)	Borehole Diameter (inches)	Casing Diameter (inches)	Screened Interval Top (ft bgs)	Screened Interval Bottom (ft bgs)	Slot Size (inches)	Filter Pack Interval (ft bgs)
SB-1	10/27/1999			16		2					
SB-2	10/27/1999			20		2					
SB-3	10/27/1999			16		2					
MW-1	2/20/2001	159.08	PVC	28	28	8	2	13	28	0.010	11-28
MW-2	2/20/2001	158.01	PVC	21.5	21.5	8	2	5	20	0.010	4-20
MW-3	2/21/2001	161.11	PVC	21.5	21.5	8	2	5	20	0.010	4-20
MW-4	6/21/2004	160.09	PVC	20	20	10	4	5	20	0.010	4-20
MW-5	6/21/2004	158.25	PVC	20	20	10	2	5	20	0.010	4-20
TBW-N	unknown	159.95	PVC	12.5	12.5	NA	4	0	13	unknown	NA
TBW-W*	unknown	160.78	PVC	12.5	12.5	NA	4	0	13	unknown	NA
TBW-S*	unknown	160.71	PVC	12.5	12.5	NA	4	0	13	unknown	NA
TBW-E*	unknown	160.95	PVC	12.5	12.5	NA	4	0	13	unknown	NA

TOC Top of casing
fbg Feet below grade
* Tank Backfill well info is only known for TBW-N; it is assumed that the other backfill wells were installed similarly

Table 2: Groundwater Extraction - System Analytical Data
Shell-branded Service Station, Incident #98995740, 2120 Montana St, Oakland, California

Sample Date (mm/dd/yy)	Influent			Midfluent 1			Midfluent 2			Effluent		
	TPHg Conc. (ppb)	Benzene Conc. (ppb)	MTBE Conc (ppb)	TPHg Conc. (ppb)	Benzene Conc (ppb)	MTBE Conc. (ppb)	TPHg Conc. (ppb)	Benzene Conc (ppb)	MTBE Conc. (ppb)	TPHg Conc. (ppb)	Benzene Conc. (ppb)	MTBE Conc (ppb)
04/02/2003	51,000	1,300	7,100	<50	<0.50	<0.50	<50	<0.50	<0.50	<50	<0.50	<0.50
04/08/2003	45,000	1,200	8,600	1,600	5.3	3.2	220	<0.50	<0.50	<50	<0.50	<0.50
04/22/2003	<50	<25	1,700	<50	<0.50	<0.50	<50	<0.50	<0.50	<50	<0.50	<0.50
05/01/2003	45,000	1,600	8,300	<50	<0.50	<0.50	<50	<0.50	<0.50	<50	<0.50	<0.50
05/21/2003	12,000	370	1,500	<50	<0.50	<0.50	<50	<0.50	<0.50	<50	<0.50	<0.50
06/03/2003	10,000	470	1,900	<50	<0.50	<0.50	<50	<0.50	<0.50	<50	<0.50	<0.50
06/17/2003	1,200	42	29	<50	<0.50	<0.50	<50	<0.50	<0.50	<50	<0.50	<0.50
04/21/2004	10,000	540	950	<50	<0.50	<0.50	<50	<0.50	<0.50	<50	<0.50	<0.50
06/08/2004	970	26	290	<50	<0.50	<0.50	<50	<0.50	<0.50	94	<0.50	<0.50
06/30/2004	NS	NS	NS	NS	NS	NS	NS	NS	NS	<50	<0.50	<0.50
07/07/2004	1,700	71	500	<50	<0.50	<0.50	<50	<0.50	<0.50	<50	<0.50	<0.50
08/03/2004	1,000	52	390	<50	<0.50	<0.50	<50	<0.50	<0.50	<50	<0.50	<0.50
09/14/2004	4,100	230	1,100	<50	<0.50	<0.50	<50	<0.50	<0.50	<50	<0.50	<0.50
10/12/2004	140	3.9	140	<50	<0.50	<0.50	<50	<0.50	<0.50	<50	<0.50	<0.50
11/12/2004	2,600	180	680	<50	<0.50	<0.50	<50	<0.50	<0.50	<50	<0.50	<0.50

Abbreviations & Notes:

TPHg = Total purgeable hydrocarbons as gasoline
MTBE = Methyl tert-butyl ether
Conc. = Concentration
ppb = parts per billion, equivalent to µg/l
TPHg, benzene, and MTBE analyzed by EPA Method 8260B

Table 2: **Groundwater Extraction - Operation and Mass Removal Data**
Shell-branded Service Station, Incident #98995740, 2120 Montana Street, Oakland, California

		Period				TPHg			Benzene			MTBE		
Site Visit (mm/dd/yy)	Hour Meter hours	Flow Meter Reading (gal)	Period Volume (gal)	Operational Flow Rate (gpm)	Cumulative Volume (gal)	TPHg Conc. (ppb)	Period Removal (pounds)	Cumulative Removal (pounds)	Benzene Conc. (ppb)	Period Removal (pounds)	Cumulative Removal (pounds)	MTBE Conc. (ppb)	Period Removal (pounds)	Cumulative Removal (pounds)
04/02/2003	0.0	393	0	0	0		0.000	0.000		0.000	0.000		0.000	0.000
04/02/2003	5.3	1,006	613	1.93	613	51,000	0.261	0.261	1,300	0.007	0.007	7,100	0.036	0.036
04/08/2003	11.4	2,010	1,004	2.74	1,617	45,000	0.377	0.638	1,200	0.010	0.017	8,600	0.072	0.108
04/22/2003	303.0	15,640	13,630	0.78	15,247	<50	0.003	0.641	<25	0.001	0.018	1,700	0.193	0.302
05/01/2003	399.0	17,840	2,200	0.38	17,447	45,000	0.826	1.47	1,600	0.029	0.047	8,300	0.152	0.454
05/20/2003	784.0	43,320	25,480	1.10	42,927		9.568	11.0		0.340	0.388		1.765	2.22
05/21/2003	808.5	44,639	1,319	0.90	44,246	12,000	0.132	11.2	370	0.004	0.392	1,500	0.017	2.24
06/03/2003	1116.9	59,813	15,174	0.82	59,420	10,000	1.266	12.4	470	0.060	0.451	1,900	0.241	2.48
06/17/2003	1455.5	64,741	4,928	0.24	64,348	1,200	0.049	12.5	42	0.002	0.453	29	0.001	2.48
07/01/2003	1697.4	68,668	3,927	0.27	68,275		0.039	12.5		0.001	0.454		0.001	2.48
07/18/2003	1867.0	69,099	431	0.04	68,706		0.004	12.5		0.000	0.455		0.000	2.48
System Shutdown due to presence of SPH														
04/21/2004	1984.4	1,516.3	0	0.00	68,706	10,000	0.000	12.5	540	0.000	0.455	950	0.000	2.48
05/25/2004	1984.4	1,516.3	0	0.00	68,706		0.000	12.5		0.000	0.455		0.000	2.48
06/08/2004	2,107.5	4,798.2	3,282	0.44	71,988	970	0.027	12.6	26	0.001	0.455	290	0.008	2.49
06/22/2004	2280.6	10,108	5,310	0.51	77,298		0.043	12.6		0.001	0.456		0.013	2.50
06/30/2004	2475.2	18,527.5	8,420	0.72	85,717		0.068	12.7		0.002	0.458		0.020	2.52
07/07/2004	2494.5	19,377	850	0.73	86,567	1,700	0.012	12.7	71	0.001	0.459	500	0.004	2.52
07/22/2004	2861.5	34,214	14,837	0.67	101,404		0.210	12.9		0.009	0.468		0.062	2.58
08/03/2004	3142.1	59,767	25,553	1.52	126,957	1,000	0.213	13.1	52	0.011	0.479	390	0.083	2.67
08/17/2004	3501.3	81,350	21,583	1.00	148,540		0.180	13.3		0.009	0.488		0.070	2.74
08/31/2004	3813.2	81,571	221	0.01	148,761		0.002	13.3		0.000	0.488		0.001	2.74
09/14/2004	4153.4	101,123	19,552	0.96	168,313	4,100	0.669	13.9	230	0.038	0.526	1,100	0.179	2.92
09/29/2004	4513.1	120,885	19,762	0.92	188,075		0.676	14.6		0.038	0.564		0.181	3.10
10/12/2004	4824.1	134,612	13,727	0.74	201,802	140	0.016	14.6	3.9	0.000	0.564	140	0.016	3.12
10/22/2004	4990.6	145,220	10,608	1.06	212,410		0.012	14.7		0.000	0.564		0.012	3.13
11/02/2004	5021.0	147,500	2,280	1.25	214,690		0.003	14.7		0.000	0.564		0.003	3.13
11/12/2004	5263.0	163,212	15,712	1.08	230,402	2,600	0.341	15.0	180	0.024	0.588	680	0.089	3.22
11/22/2004	5498.2	164,899	1,687	0.12	232,089		0.037	15.0		0.003	0.590		0.010	3.23
		Total Extracted Volume =			**232,089**	**Total Pounds Removed:**		**15.0**	**Total Pounds Removed:**		**0.590**	**Total Pounds Removed:**		**3.23**
		Average Operational Flow Rate =			**0.704**	**Total Gallons Removed:**		**2.47**	**Total Gallons Removed:**		**0.081**	**Total Gallons Removed:**		**0.523**

Table 2: **Groundwater Extraction - Operation and Mass Removal Data**
Shell-branded Service Station, Incident #98995740, 2120 Montana Street, Oakland, California

		Period				TPHg			Benzene			MTBE		
Site Visit (mm/dd/yy)	Hour Meter hours	Flow Meter Reading (gal)	Period Volume (gal)	Operational Flow Rate (gpm)	Cumulative Volume (gal)	TPHg Conc. (ppb)	Period Removal (pounds)	Cumulative Removal (pounds)	Benzene Conc. (ppb)	Period Removal (pounds)	Cumulative Removal (pounds)	MTBE Conc. (ppb)	Period Removal (pounds)	Cumulative Removal (pounds)

Abbreviations & Notes:

TPHg = Total purgeable hydrocarbons as gasoline
MTBE = Methyl tert-butyl ether
Conc. = Concentration
ppb = Parts per billion, equivalent to µg/L
µg/L = Micrograms per liter
L = Liter gal = Gallon g = Gram
Mass removed based on the formula: volume extracted (gal) x Concentration (µg/L) x ($g/10^6 \mu g$) x (pound/453.6g) x (3.785 L/gal)
When constituents are not detected, the concentration is assumed to be equal to half the detection limit in subsequent calculations.
Volume removal data based on the formula: mass (pounds) x $(density)^{-1}$ (cc/g) x 453.6 (g/pound) x (L/1000 cc) * (gal/3.785 L)
Density inputs: TPHg = 0.73 g/cc, benzene = 0.88 g/cc, MTBE = 0.74 g/cc
TPHg, BTEX, and MTBE analyzed by EPA Method 8260B

Table 4. Soil Vapor Extraction - Mass Removal Data - Shell-branded Service Station, Incident #98995740, 2120 Montana Street, Oakland, CA

										TPHg		Benzene		MTBE	
	Hour	Cumulative	Well Head				Hydrocarbon Concentrations			Removal	Cumulative	Removal	Cumulative	Removal	Cumulative
	Meter	Operation	Vacuum		Flow Rate		TPHg	Benzene	MTBE	Rate	Removed	Rate	Removed	Rate	Removed
Date/Time	(hours)	(hours)	Gage(in WC)	Abs(in WC)	(ACFM)	(SCFM)	(Concentrations in ppmv)			(#/hour)	(#)	(#/hour)	(#)	(#/hour)	(#)
MW-1 SVE Test															
7/26/2004 13:15	2351.9	0.0	24.4	382.4	12.4	11.7	*8,870*			0.732	0.00	0.000	0.000	0.001	0.000
13:30	2352.1	0.2	25.0	381.8	12.3	11.5	**4,700**	**<1.6**	**6.8**	0.725	0.15	0.000	0.000	0.001	0.000
13:40	2352.3	0.4	23.9	382.9	11.0	10.4	*7,130*			0.651	0.28	0.000	0.000	0.001	0.000
13:50	2352.4	0.5	42.5	364.3	15.9	14.2	*8,100*			0.895	0.36	0.000	0.000	0.001	0.001
14:00	2352.6	0.7	41.1	365.7	13.5	12.1	*8,540*			0.762	0.52	0.000	0.000	0.001	0.001
14:10	2352.7	0.8	41.8	365.0	14.7	13.2	*8,740*			0.829	0.60	0.000	0.000	0.001	0.001
14:20	2352.9	1.0	76.7	330.1	24.5	19.9	*9,920*			1.249	0.85	0.000	0.000	0.002	0.001
14:30	2353.1	1.2	76.4	330.4	25.0	20.3	*10,190*			1.276	1.10	0.000	0.000	0.002	0.002
14:40	2353.2	1.3	75.2	331.6	25.1	20.5	*10,240*			1.285	1.23	0.000	0.000	0.002	0.002
14:50	2353.4	1.5	105.1	301.7	34.1	25.3	*3,700*			3.719	1.98	0.007	0.002	0.010	0.004
15:30	2354.1	2.2	50.2	356.6	23.1	20.2	*5,250*			2.978	4.06	0.006	0.006	0.008	0.010
15:45	2354.3	2.4	51.4	355.4	22.1	19.3	*5,300*			2.839	4.63	0.006	0.007	0.008	0.011
16:00	2354.6	2.7	50.0	356.8	24.2	21.2	**11,000**	**24**	**30**	3.121	5.57	0.006	0.009	0.009	0.014
7/27/2004 8:00	2371.1	19.2	50.2	356.6	34.0	29.8	**2,300**	**9.7**	**12**	2.649	49.3	0.006	0.109	0.009	0.155
8:30	2371.6	19.7	51.1	355.7	34.4	30.1	*7,800*			0.925	49.7	0.004	0.111	0.005	0.158
9:00	2372.1	20.2	50.4	356.4	33.9	29.7	*7,860*			0.913	50.2	0.003	0.113	0.005	0.160
9:30	2372.5	20.6	64.0	342.8	37.0	31.2	*7,400*			0.959	50.6	0.004	0.114	0.005	0.162
10:00	2373.0	21.1	65.0	341.8	38.0	31.9	*7,460*			0.982	51.1	0.004	0.116	0.005	0.165
10:30	2373.5	21.6	63.3	343.5	35.0	29.6	*7,250*			0.909	51.5	0.003	0.118	0.005	0.167
11:00	2374.0	22.1	62.6	344.2	31.0	26.2	*7,270*			0.806	51.9	0.003	0.119	0.004	0.169
11:30	2374.5	22.6	63.6	343.2	29.0	24.5	*8,440*			0.752	52.3	0.003	0.121	0.004	0.171
12:00	2375.5	23.6	64.0	342.8	29.0	24.4	*8,560*			0.523	52.8	0.002	0.123	0.003	0.174
12:30	2376.0	24.1	64.1	342.7	29.0	24.4	*8,570*			0.523	53.1	0.002	0.124	0.003	0.176
13:00	2376.5	24.6	64.7	342.1	29.0	24.4	*8,740*			0.522	53.4	0.002	0.125	0.003	0.177
13:30	2377.0	25.1	65.3	341.5	29.0	24.3	*8,560*			0.521	53.6	0.002	0.126	0.003	0.179
14:00	2377.5	25.6	65.1	341.7	29.5	24.8	**1,600**	**6.5**	**8.9**	0.530	53.9	0.002	0.127	0.003	0.180
7/28/2004 7:00	2394.6	42.7	58.4	348.4	45.0	38.5	**4,300**	**18**	**24**	1.520	79.9	0.006	0.224	0.009	0.329
8:00	2395.5	43.6	62.5	344.3	41.5	35.1	*6,640*			2.019	81.7	0.008	0.231	0.012	0.339
8:30	2396.0	44.1	63.0	343.8	41.7	35.2	*6,920*			2.026	82.7	0.008	0.235	0.012	0.345
9:00	2396.4	44.5	63.0	343.8	42.0	35.5	*7,210*			2.040	83.5	0.008	0.238	0.012	0.349
9:30	2397.0	45.1	63.1	343.7	40.5	34.2	*7,300*			1.967	84.7	0.007	0.243	0.011	0.356
10:00	2397.5	45.6	63.2	343.6	40.5	34.2	*7,150*			1.966	85.7	0.007	0.247	0.011	0.362
10:30	2398.0	46.1	63.0	343.8	39.0	33.0	*7,740*			5.287	88.3	0.017	0.255	0.023	0.373
11:00	2398.5	46.6	62.6	344.2	38.4	32.5	*7,910*			5.212	90.9	0.017	0.263	0.023	0.385
11:30	2399.0	47.1	62.0	344.8	38.0	32.2	*8,200*			5.167	93.5	0.016	0.271	0.023	0.396
12:00	2399.5	47.6	62.0	344.8	35.7	30.3	*7,700*			4.854	95.9	0.015	0.279	0.022	0.407
12:30	2400.0	48.1	61.4	345.4	33.4	28.4	*7,000*			4.549	98.2	0.014	0.286	0.020	0.417
13:00	2400.5	48.6	61.0	345.8	32.4	27.5	*7,460*			4.418	100	0.014	0.293	0.020	0.427
13:30	2401.0	49.1	61.0	345.8	31.0	26.4	**12,000**	**42**	**52**	4.227	103	0.013	0.300	0.019	0.436
7/29/2004 7:00	2418.9	67.0	55.3	351.5	35.2	30.4				3.192	160	0.011	0.495	0.019	0.768
7:30	2419.4	67.5	55.0	351.8	36.0	31.1	*3,200*			3.267	161	0.011	0.500	0.019	0.777
8:00	2419.9	68.0	56.1	350.7	36.2	31.2	*3,290*			3.275	163	0.011	0.506	0.019	0.787
8:30	2420.4	68.5	56.3	350.5	36.9	31.8	*3,410*			3.336	165	0.011	0.512	0.019	0.797
9:00	2420.9	69.0	56.4	350.4	37.7	32.5	*3,330*			3.408	166	0.012	0.517	0.020	0.806

Table 4. Soil Vapor Extraction - Mass Removal Data - Shell-branded Service Station, Incident #98995740, 2120 Montana Street, Oakland, CA

			Well Head				Hydrocarbon Concentrations			TPHg		Benzene		MTBE	
	Hour Meter	Cumulative Operation	Vacuum		Flow Rate		TPHg	Benzene	MTBE	Removal Rate	Cumulative Removed	Removal Rate	Cumulative Removed	Removal Rate	Cumulative Removed
Date/Time	(hours)	(hours)	Gage(in WC)	Abs(in WC)	(ACFM)	(SCFM)	(Concentrations in ppmv)			(#/hour)	(#)	(#/hour)	(#)	(#/hour)	(#)
9:30	*2421.3*	69.4	69.0	337.8	*37.0*	30.7	*2,170*			3.224	168	0.011	0.522	0.019	0.814
10:00	2421.7	69.8	57.0	349.8	40.0	34.4	**3,700**	**17**	**37**	3.609	169	0.012	0.527	0.021	0.822
10:30	2422.1	70.2	61.8	345.0	38.1	32.3	*4,080*			1.598	170	0.007	0.529	0.016	0.829
11:00	2422.6	70.7	63.1	343.7	38.0	32.1	*4,100*			1.588	170	0.007	0.533	0.016	0.837
11:30	2423.1	71.2	64.4	342.4	37.9	31.9	*4,140*			1.578	171	0.007	0.536	0.016	0.845
12:00	2423.7	71.8	66.7	340.1	37.7	31.5	*4,170*			1.559	172	0.006	0.540	0.016	0.855
12:30	2424.2	72.3	67.1	339.7	37.0	30.9	*4,420*			1.941	173	0.007	0.543	0.014	0.862
13:00	2424.7	72.8	67.2	339.6	37.0	30.9	*4,540*			1.941	174	0.007	0.547	0.014	0.869
13:30	2425.3	73.4	67.2	339.6	37.0	30.9	*4,570*			1.941	175	0.007	0.551	0.014	0.877
14:00	2425.8	73.9	67.2	339.6	36.8	30.7	**4,700**	**18**	**33**	1.930	176	0.007	0.554	0.014	0.884
7/30/2004 7:00	2443.0	91.1	62.1	344.7	44.3	37.5	**6,900**	**26**	**23**	2.910	226	0.010	0.726	0.014	1.13
7:30	2443.5	91.6	62.0	344.8	43.7	37.0	*5,890*			3.416	228	0.012	0.732	0.012	1.14
8:00	2444.0	92.1	62.0	344.8	44.0	37.3	*5,900*			3.440	230	0.012	0.738	0.012	1.14
8:30	2444.5	92.6	61.1	345.7	43.5	37.0	*5,900*			3.410	231	0.012	0.744	0.012	1.15
10:30	2446.6	94.7	60.4	346.4	41.1	35.0	*5,870*			3.228	238	0.011	0.767	0.011	1.17
11:00	2447.1	95.2	67.3	339.5	41.0	34.2	*5,710*			3.156	240	0.011	0.772	0.011	1.18
11:30	*2447.7*	95.8	69.1	337.7	42.0	34.9	*6,220*			3.962	242	0.011	0.779	0.010	1.18
12:00	2448.2	96.3	74.7	332.1	48.7	39.8	*6,400*			4.518	244	0.013	0.786	0.011	1.19
12:30	2448.6	96.7	74.4	332.4	49.1	40.1	*6,310*			4.559	246	0.013	0.791	0.012	1.19
13:00	2449.0	97.1	74.1	332.7	49.3	40.3	*6,240*			4.581	248	0.013	0.796	0.012	1.20
13:30	2449.5	97.6	77.1	329.7	50.0	40.5	*6,200*			4.605	250	0.013	0.803	0.012	1.20
14:00	2450.0	98.1	75.0	331.8	49.0	40.0	**8,500**	**27**	**21**	4.541	253	0.013	0.809	0.011	1.21
14:25	*2450.4*	98.5	105.0	301.8	83.5	61.9	*4,560*			7.039	256	0.020	0.818	0.018	1.22
14:30	*2450.5*	98.6	128.0	278.8	71.5	49.0	*4,370*			5.568	256	0.016	0.819	0.014	1.22
14:35	*2450.6*	98.7	131.0	275.8	58.0	39.3	*4,160*			4.468	257	0.013	0.820	0.011	1.22
14:40	*2450.7*	98.8	157.0	249.8	64.5	39.6	*3,170*			4.500	257	0.013	0.822	0.011	1.22
14:45	*2450.7*	98.8	156.0	250.8	59.0	36.4	*2,950*			4.133	257	0.012	0.822	0.010	1.22
Total Pounds Removed:										**TPHg =**	**257**	**Benzene =**	**0.822**	**MTBE =**	**1.22**

Abbreviations and Notes:

in WC = inches of water column

ACFM = Actual cubic feet per minute

SCFM = Standard cubic feet per minute.

SCFM = (ACFM) (Applied Absolute Vacuum / Atmospheric Absolute Vacuum)

ppmv = Parts per million by volume # = Pounds

TPHG, Benzene, and MTBE analyzed by EPA Method 8260 respectively from 1 liter tedlar bag samples

(Rate = Laboratory analytical concentration (ppmv) x wellhead flow rate (scfm) x (1lb-mole/386ft3) x molecular weight (86 lb/lb-mole for TPHg, 78 lb/lb-mole for benzene, 88 lb/lb-mole for MTBE) x 60 min/hour x 1/1,000,000)

Cumulative TPHg / Benzene / MTBE removal = Previous removal rate multiplied by the hour-interval of operation plus the previous total

Italicized Hour Meter Data calculated based on Date/Time data

Italicized TPHg Concentrations are field measured values

Italicized Flow Rates (ACFM)- stream too wet to measure

Table 5: Soil Vapor Extraction - Vacuum Radius of Influence Data - Shell-branded Service Station, Incident #98995740, 2120 Montana Street, Oakland, CA

Extraction Well	Monitoring Wells	Rw (ft)	r (ft)	Pw (in WC gauge)	Pw(abs) (in WC absolute)	P(r) (inWC gauge)	P(r) (inWC absolute)	Ri [1] (ft)	P(r)/P(w) (%)
MW-1									
7/30/04 10:30 AM	MW-3	0.083	115.5	48.7	358.1	0.01	406.8	115.7	0.02%
7/30/04 2:40 PM	MW-4	0.167	47	157.0	249.8	0.70	406.1	48.5	0.45%
7/30/04 10:30 AM	TBW-W	0.167	26	48.7	358.1	0.01	406.8	26.0	0.02%
7/30/04 10:30 AM	TBW-N	0.167	52	48.7	358.1	0.01	406.8	52.1	0.02%
7/30/04 10:30 AM	TBW-E	0.167	59	48.7	358.1	0.01	406.8	59.1	0.02%

[1] Based on the steady-state radial pressure distribution equation from "A Practical Approach to the Design, Operation, and Monitoring of In Situ Soil Venting Systems", P.C. Johnson, C.C. Stanley, M.W. Kemblowski, D.L. Byers, and J.D. Cothart, Groundwater Monitoring and Review, Spring 1990:

$$Ri = [Rw] / [r/Rw]^{(1-(Patm/Pw)^2)/(((P(r)/Pw)^2)-1)}$$

[2] Ratio of monitoring well gauge pressure to extraction well gauge pressure.

Rw = Radius of Extraction Well (feet)

r = Distance of monitoring well from extraction well (feet)

Pw = Absolute pressure applied at extraction well (inches of water column)

P(r) = Absolute pressure at monitoring well (inches of water column)

Ri = Radius of Influence (feet)

Ri = Radius of Influence (feet)

ft = feet

inWC = vacuum in inches of water column

ATTACHMENT A

Historical Soil Data

Table 1. Soil Analytical Results - Soil Borings - Shell-branded Service Station

2120 Montana Ave, Oakland, CA

Sample	Depth (fbg)	Date Sampled	TPHg (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Xylenes (mg/kg)	MTBE (mg/kg)
SB-1-10	10	10/27/99	**12**	<0.0050	<0.0050	**0.0093**	**0.030**	<0.05
SB-1-5	5	10/27/99	**54**	<0.050	<0.050	**0.091**	**0.099**	<0.50
SB-2-5	5	10/27/99	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.05
SB-2-10	10	10/27/99	**2.0**	**0.0050**	**0.0063**	<0.0050	*<0.0050*	**0.27 (0.24)**
SB-2-15	15	10/27/99	**14**	**0.019**	**0.032**	**0.064**	**0.072**	<0.05
SB-2-20	20	10/27/99	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.05
SB-3-5	5	10/27/99	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.05
SB-3-10	10	10/27/99	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	**0.11**
SB-3-15	15	10/27/99	**17**	**0.013**	**0.018**	**0.054**	**0.16**	**0.19**
D-1-4.0	4.0	5/6/2004	<4.8	<0.024	<0.024	<0.024	**0.17**	**0.77**
D-2-4.0	4.0	5/6/2004	**1900**	**1.7**	<1.0	**21**	**57**	**5.80**
D-3-4.0	4.0	5/6/2004	**110**	<0.50	<0.50	**3.1**	<0.50	**0.65**

Abbreviations and Notes:

fbg = Feet below grade

mg/kg = milligrams per kilogram (parts per million)

<x = Not detected at detection limit x

TPHg = Total petroleum hydrocarbons as gasoline analyzed by EPA Method 8260b

Benzene, toluene, ethylbenzene, and xylenes analyzed by EPA Method 8260B

MTBE = methyl tertiary butyl ether analyzed by EPA Method 8260B

CAMBRIA

Table 1. Soil Analytical Results - Monitoring Well Borings - Shell-branded Service Station

2120 Montana Ave, Oakland, CA

Sample ID	Depth (fbg)	Date	TPHg (ppm)	Benzene (ppm)	Toluene (ppm)	Ethylbenzene (ppm)	Xylenes (ppm)	MTBE (ppm)
MW-1-5.5	5.5	2/20/01	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	**0.12**
MW-1-10.0	10	2/20/01	**4.7**	**0.066**	<0.0050	**0.12**	**0.14**	**2.4**
MW-1-15.5	15.5	2/20/01	**1.0**	**0.014**	**0.041**	**0.024**	**0.098**	**5.0**
MW-1-20.5	20.5	2/20/01	**1.5**	**0.023**	**0.16**	**0.037**	**0.17**	**2.0**
MW-1-24.0	24	2/20/01	**4.4**	**0.024**	**0.14**	**0.050**	**0.27**	**0.51**
MW-2-5.5	5.5	2/21/01	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
MW-2-10.5	10.5	2/21/01	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
MW-2-15.5	15.5	2/21/01	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	**5.2**
MW-2-21.0	21	2/21/01	**10**	**0.028**	**0.012**	**0.080**	**0.021**	**1.3**
MW-3-5.5	5.5	2/21/01	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
MW-3-10.5	10.5	2/21/01	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
MW-3-15.5	15.5	2/21/01	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
MW-3-20.5	20.5	2/21/01	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
MW-4-5.5	5.5	06/21/02	<1.0	<0.005	<0.005	<0.005	<0.005	<0.5
MW-4-9.0	9.0	06/21/02	<1.0	<0.005	<0.005	<0.005	<0.005	<0.5
MW-4-13.5	13.5	06/21/02	<1.0	<0.005	<0.005	<0.005	<0.005	<0.5
MW-5-5.5	5.5	06/21/02	<1.0	<0.005	<0.005	<0.005	<0.005	<0.5
MW-5-9.0	9.0	06/21/02	**1.3**	**0.0083**	<0.005	<0.005	<0.005	<0.5
MW-5-19.0	19.0	06/21/02	**18**	**0.0071**	<0.005	**0.014**	**0.019**	<0.5

Notes and Abbreviations:

TPHg = Total petroleum hydrocarbons as gasoline, analyzed by EPA Method 8260B

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

Benzene, ethylbenzene, toluene, xylenes, analyzed by EPA Method 8260B

ppm = parts per million fbg = feet below grade

<X = Below laboratory detection limit of X

ATTACHMENT B

Historical Groundwater Monitoring Data

WELL CONCENTRATIONS
Shell-branded Service Station
2120 Montana Street
Oakland, CA

Well ID	Date	TPPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	DIPE (ug/L)	ETBE (ug/L)	TAME (ug/L)	TBA (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
MW-2	06/06/2002	<5,000	210	<50	<50	<50	NA	23,000	NA	NA	NA	NA	158.03	12.15	145.88	ND
MW-2	07/16/2002	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	158.03	12.25	145.78	ND
MW-2	09/06/2002	<2,000	56	<20	<20	<20	NA	11,000	NA	NA	NA	NA	158.01	12.44	145.57	ND
MW-2	12/12/2002	<2,500	80	<25	<25	<25	NA	13,000	NA	NA	NA	NA	158.01	12.53	145.48	ND
MW-2	03/31/2003	<5,000	230	1,200	95	150	NA	13,000	NA	NA	NA	NA	158.01	11.98	146.03	ND
MW-2	06/30/2003	<12,000	780	<120	170	250	NA	9,000	NA	NA	NA	NA	158.01	12.10	145.91	ND
MW-2	09/09/2003	140,000	4,600	40,000	4,800	32,000	NA	11,000	NA	NA	NA	NA	158.01	12.94	145.07	ND
MW-2	12/29/2003	220,000	240	4,800	2,900	19,000	NA	1,000	NA	NA	NA	NA	158.01	11.20	146.81	ND
MW-2	03/17/2004	25,000	170	390	280	1,400	NA	1,500	NA	NA	NA	NA	158.01	11.40	146.61	ND
MW-2	05/24/2004	140,000	<25	220	1,200	6,800	NA	320	NA	NA	NA	NA	158.01	12.28	145.73	ND
MW-2	**09/17/2004**	**64,000**	**2,900**	**230**	**2,300**	**9,700**	**NA**	**6,300**	**<100**	**<100**	**<100**	**4,100**	**158.01**	**12.90**	**145.11**	**ND**
MW-3	03/19/3001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	161.13	11.42	149.71	ND
MW-3	03/23/2001	<50.0	<0.500	<0.500	<0.500	<0.500	NA	1.26	NA	NA	NA	NA	161.13	11.42	149.71	ND
MW-3	05/31/2001	<50e	<0.50e	<0.50e	<0.50e	<0.50e	NA	<5.0e	NA	NA	NA	NA	159.59	13.00	146.59	ND
MW-3	06/27/2001	<50	<0.50	<0.50	<0.50	<0.50	NA	<0.50	NA	NA	NA	NA	161.13	12.32	148.81	ND
MW-3	09/25/2001	<50	<0.50	<0.50	<0.50	<0.50	NA	<0.50	NA	NA	NA	NA	161.13	12.50	148.63	ND
MW-3	12/05/2001	<50	<0.50	<0.50	<0.50	<0.50	NA	<5.0	NA	NA	NA	NA	161.13	10.13	151.00	ND
MW-3	03/01/2002	<50	<0.50	<0.50	<0.50	0.73	NA	<5.0	NA	NA	NA	NA	161.13	11.63	149.50	ND
MW-3	06/06/2002	<50	<0.50	<0.50	<0.50	<0.50	NA	<5.0	NA	NA	NA	NA	161.13	11.55	149.58	ND
MW-3	07/16/2002	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	161.13	11.72	149.41	ND
MW-3	09/06/2002	<50	<0.50	<0.50	<0.50	<0.50	NA	<5.0	NA	NA	NA	NA	161.11	12.24	148.87	ND
MW-3	12/12/2002	<50	<0.50	<0.50	<0.50	<0.50	NA	<5.0	NA	NA	NA	NA	161.11	12.18	148.93	ND
MW-3	03/31/2003	<50	<0.50	<0.50	<0.50	<1.0	NA	0.78	NA	NA	NA	NA	161.11	11.94	149.17	ND
MW-3	06/30/2003	<50	<0.50	<0.50	<0.50	<1.0	NA	<0.50	NA	NA	NA	NA	161.11	12.50	148.61	ND
MW-3	09/09/2003	<50	<0.50	<0.50	<0.50	<1.0	NA	<0.50	NA	NA	NA	NA	161.11	12.55	148.56	ND
MW-3	12/29/2003	<50	<0.50	<0.50	<0.50	<1.0	NA	0.70	NA	NA	NA	NA	161.11	10.90	150.21	ND
MW-3	03/17/2004	<50	<0.50	<0.50	<0.50	<1.0	NA	2.1	NA	NA	NA	NA	161.11	11.63	149.48	ND
MW-3	05/24/2004	<50	<0.50	<0.50	<0.50	1.0	NA	0.96	NA	NA	NA	NA	161.11	11.32	149.79	ND

WELL CONCENTRATIONS
Shell-branded Service Station
2120 Montana Street
Oakland, CA

Well ID	Date	TPPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	DIPE (ug/L)	ETBE (ug/L)	TAME (ug/L)	TBA (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
MW-1	03/19/3001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	159.59	12.14	147.45	ND
MW-1	03/23/2001	16,600	753	1,720	407	2,330	NA	27,500	NA	NA	NA	NA	159.59	12.25	147.34	ND
MW-1	05/31/2001	<20,000d	1,000d	920d	490d	2,000d	NA	54,000d	NA	NA	NA	NA	161.13	12.22	148.91	ND
MW-1	06/27/2001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	159.59	13.00b	NA	ND
MW-1	07/09/2001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	159.59	13.17	146.67	0.31
MW-1	09/25/2001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	159.59	14.27	145.66	0.43
MW-1	11/20/2001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	159.59	13.49	146.14	0.05
MW-1	12/05/2001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	159.59	11.32	148.31	0.05
MW-1	03/01/2002	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	159.59	13.22	146.56	0.24
MW-1	06/06/2002	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	159.59	12.99	147.00	0.50
MW-1	07/16/2002	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	159.59	13.37	146.22	ND
MW-1	09/06/2002	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	159.57	13.30	146.70	0.54
MW-1	12/12/2002	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	159.57	13.78	146.61	1.03
MW-1	03/31/2003	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	159.57	11.21	148.38	0.03
MW-1	06/30/2003	7,800	<25	37	<25	380	NA	2,000	NA	NA	NA	NA	159.57	12.20	147.37	ND
MW-1	09/09/2003	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	159.08	15.70	145.28	2.38
MW-1	12/29/2003	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	159.08	11.25	147.89	0.07
MW-1	03/17/2004	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	159.08	11.80	147.40	0.15
MW-1	05/24/2004	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	159.08	12.42	146.71	0.06
MW-1	**09/17/2004**	**8,000**	**530**	**380**	**330**	**960**	**NA**	**1,100**	**<20**	**<20**	**<20**	**4,100**	**159.08**	**15.95**	**143.13**	**NA**
MW-2	03/19/3001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	158.03	11.60	146.43	ND
MW-2	03/23/2001	4,450	280	41.0	62.1	63.0	NA	16,600	NA	NA	NA	NA	158.03	11.76	146.27	ND
MW-2	05/31/2001	<20,000a	820a	<200a	<200a	<200a	NA	63,000a	NA	NA	NA	NA	158.03	11.40	146.63	ND
MW-2	06/27/2001	<50,000	610	4.0	13	9.2	NA	47,000	NA	NA	NA	NA	158.03	12.65	145.38	ND
MW-2	09/25/2001	<2,000	41	<20	<20	<20	NA	6,400	NA	NA	NA	NA	158.03	12.89	145.14	ND
MW-2	12/05/2001	<2,000	74	<20	<20	<20	NA	8,400	NA	NA	NA	NA	158.03	10.40	147.63	ND
MW-2	03/01/2002	<1,000	<10	<10	<10	<10	NA	2,900	NA	NA	NA	NA	158.03	11.52	146.51	ND

WELL CONCENTRATIONS
Shell-branded Service Station
2120 Montana Street
Oakland, CA

Well ID	Date	TPPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	DIPE (ug/L)	ETBE (ug/L)	TAME (ug/L)	TBA (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
MW-3	**09/17/2004**	**<50**	**<0.50**	**<0.50**	**<0.50**	**1.0**	**NA**	**2.6**	**<2.0**	**<2.0**	**<2.0**	**<5.0**	**161.11**	**12.13**	**148.98**	**ND**
MW-4	07/10/2002	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NM	13.19	NA	ND
MW-4	07/16/2002	800	1.1	1.1	2.6	2.4	NA	450	NA	NA	NA	NA	NM	13.56	NA	ND
MW-4	09/06/2002	1,100	3.0	1.8	8.0	4.6	NA	110	NA	NA	NA	NA	160.09	13.67	146.42	ND
MW-4	12/12/2002	130	<0.50	<0.50	<0.50	<0.50	NA	940	NA	NA	NA	NA	160.09	14.06	146.03	ND
MW-4	03/31/2003	<250	<2.5	<2.5	<2.5	<5.0	NA	500	NA	NA	NA	NA	160.09	13.69	146.40	ND
MW-4	06/30/2003	3,100	5.3	<5.0	7.1	<10	NA	420	NA	NA	NA	NA	160.09	14.12	145.97	ND
MW-4	09/09/2003	1,400	2.4	2.0	2.6	3.2	NA	140	NA	NA	NA	NA	160.09	14.92	145.17	ND
MW-4	12/29/2003	2,700	10	6.2	20	11	NA	420	NA	NA	NA	NA	160.09	12.71	147.38	ND
MW-4	03/17/2004	1,900	6.9	3.0	33	22	NA	290	NA	NA	NA	NA	160.09	13.24	146.85	ND
MW-4	05/24/2004	1,800	<2.5	<2.5	<2.5	11	NA	44	NA	NA	NA	NA	160.09	14.03	146.06	ND
MW-4	**09/17/2004**	**3,300**	**57**	**10**	**47**	**32**	**NA**	**310**	**<10**	**<10**	**<10**	**700**	**160.09**	**13.58**	**146.51**	**ND**
MW-5	07/10/2002	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NM	12.22	NA	ND
MW-5	07/16/2002	6,100	65	7.2	100	130	NA	410	NA	NA	NA	NA	NM	12.50	NA	ND
MW-5	09/06/2002	5,900	100	8.1	41	32	NA	230	NA	NA	NA	NA	158.25	12.77	145.48	ND
MW-5	12/12/2002	4,900	70	5.7	25	17	NA	280	NA	NA	NA	NA	158.25	12.71	145.54	ND
MW-5	03/31/2003	6,400	61	4.9	23	13	NA	330	NA	NA	NA	NA	158.25	11.93	146.32	ND
MW-5	06/30/2003	3,400	18	<2.5	17	5.5	NA	47	NA	NA	NA	NA	158.25	11.97	146.28	ND
MW-5	09/09/2003	6,800	46	23	39	42	NA	67	NA	NA	NA	NA	158.25	12.44	145.81	ND
MW-5	12/29/2003	8,400	44	6.2	36	16	NA	60	NA	NA	NA	NA	158.25	11.38	146.87	ND
MW-5	03/17/2004	7,100	120	22	42	27	NA	300	NA	NA	NA	NA	158.25	11.68	146.57	ND
MW-5	05/24/2004	6,100	72	17	34	23	NA	110	NA	NA	NA	NA	158.25	12.30	145.95	ND
MW-5	**09/17/2004**	**5,700**	**27**	**5.3**	**35**	**<10**	**NA**	**28**	**<20**	**<20**	**<20**	**<50**	**158.25**	**12.15**	**146.10**	**ND**
TBW-N	09/25/2001 c	120,000	3,200	2,800	4,000	18,000	NA	31,000	NA	NA	NA	NA	NM	12.25	NM	ND
TBW-N	11/20/2001	72,000	2,200	3,600	2,600	14,000	NA	35,000	NA	NA	NA	NA	NM	12.13	NM	ND
TBW-N	12/05/2001	76,000	1,600	3,200	2,900	15,000	NA	30,000	NA	NA	NA	NA	NM	11.51	NM	ND

WELL CONCENTRATIONS
Shell-branded Service Station
2120 Montana Street
Oakland, CA

Well ID	Date	TPPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	DIPE (ug/L)	ETBE (ug/L)	TAME (ug/L)	TBA (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)
TBW-N	03/01/2002	91,000	1,200	4,200	2,800	14,000	NA	29,000	NA	NA	NA	NA	NM	11.88	NM	ND
TBW-N	06/06/2002	100,000	2,100	8,200	3,400	17,000	NA	18,000	NA	NA	NA	NA	NM	12.48	NM	ND
TBW-N	07/16/2002	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NM	12.39	NM	ND
TBW-N	09/06/2002	69,000	870	4,800	2,300	11,000	NA	17,000	NA	NA	NA	NA	161.26	12.36	148.90	ND
TBW-N	12/12/2002	Well inaccessible		NA	NA	NA	NA	NA	NA	NA	NA	NA	161.26	NA	NA	NA
TBW-N	12/19/2002	110,000	1,900	13,000	3,100	18,000	NA	19,000	NA	NA	NA	NA	161.26	10.82	150.44	ND
TBW-N	03/31/2003	62,000	1,600	6,500	2,200	11,000	NA	11,000	NA	NA	NA	NA	161.26	10.63	150.63	ND
TBW-N	06/30/2003	260,000	7,700	<120	5,800	40,000	NA	8,400	NA	NA	NA	NA	161.26	11.51	149.75	ND
TBW-N	09/09/2003	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	159.92	11.37	148.64	0.11
TBW-N	12/29/2003	130,000	840	8,200	2,400	18,000	NA	5,400	NA	NA	NA	NA	159.92	10.40	149.52	ND
TBW-N	03/17/2004	32,000	440	1,500	580	4,500	NA	3,700	NA	NA	NA	NA	159.92	10.49	149.44	0.01
TBW-N	05/24/2004	110,000	380	2,600	1,600	11,000	NA	3,100	NA	NA	NA	NA	159.92	10.72	149.20	ND
TBW-N	**09/17/2004**	**25,000**	**120**	**490**	**570**	**3,900**	**NA**	**490**	**<200**	**<200**	**<200**	**4,500**	**159.92**	**10.80**	**149.12**	**ND**

WELL CONCENTRATIONS
Shell-branded Service Station
2120 Montana Street
Oakland, CA

Well ID	Date	TPPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	DIPE (ug/L)	ETBE (ug/L)	TAME (ug/L)	TBA (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)

Abbreviations:

TPPH = Total petroleum hydrocarbons as gasoline by EPA Method 8260B; prior to May 31, 2001, analyzed by EPA Method 8015.

BTEX = Benzene, toluene, ethylbenzene, xylenes by EPA Method 8260B; prior to May 31, 2001, analyzed by EPA Method 8020.

MTBE = Methyl tertiary butyl ether

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

ETBE = Ethyl tertiary butyl ether, analyzed by EPA Method 8260B

TAME = Tertiary amyl methyl ether, analyzed by EPA Method 8260B

TBA = Tertiary butyl alcohol, analyzed by EPA Method 8260B

TOC = Top of Casing Elevation

GW = Groundwater

TBW-N = tank backfill well-north

NA = Not analyzed

ND = Not detected

NM = Not measured

ug/L = parts per billion

MSL = Mean sea level

ft. = Feet

<n = Below detection limit

WELL CONCENTRATIONS
Shell-branded Service Station
2120 Montana Street
Oakland, CA

Well ID	Date	TPPH (ug/L)	B (ug/L)	T (ug/L)	E (ug/L)	X (ug/L)	MTBE 8020 (ug/L)	MTBE 8260 (ug/L)	DIPE (ug/L)	ETBE (ug/L)	TAME (ug/L)	TBA (ug/L)	TOC (MSL)	Depth to Water (ft.)	GW Elevation (MSL)	SPH Thickness (ft.)

Notes:

a = Resampled on June 27, 2001, due to possible mislabeling.

b = Separate phase hydrocarbons encountered during purge; groundwater elevation may not be accurate.

c = Sample TBW-N was analyzed once within hold time, but the analyte concentrations all exceeded the instrument working ranges. The sample was diluted and re-analyzed out of hold time. The diluted analysis is reported because it more accurately reflects the concentrations present.

d = These results are listed as MW-3 on analytical report due to possible mislabeling in field or laboratory. Resampled on June 27, 2001, to confirm mislabeling.

e = These results are listed as MW-1 on analytical report due to possible mislabeling in field or laboratory. Resampled on June 27, 2001, to confirm mislabeling.

Survey data provided by Cambria Environmental Technology, May 2001.

Site surveyed February 12, 2002 and June 26, 2002 by Virgil Chavez Land Surveying of Vallejo, CA.

Wells MW-1 and TBW-N surveyed September 23, 2003 by Virgil Chavez Land Surveying of Vallejo, CA.

When separate phase hydrocarbons are present, ground water elevation is adjusted using the relation:

Corrected groundwater elevation = Top-of-casing elevation - Depth to water + (0.8 x Hydrocarbon thickness).

ATTACHMENT C

Boring Logs

Cambria Environmental Technology, Inc.
1144 - 65th St.
Oakland, CA 94608
Telephone: (510) 420-0700
Fax: (510) 420-9170

BORING/WELL LOG

CLIENT NAME	Equiva Services LLC	**BORING/WELL NAME**	SB-1
JOB/SITE NAME	2120 Montana Street, Oakland	**DRILLING STARTED**	27-Oct-99
LOCATION	2120 Montana Street, Oakland	**DRILLING COMPLETED**	27-Oct-99
PROJECT NUMBER	242-0733	**WELL DEVELOPMENT DATE (YIELD)**	NA
DRILLER	Gregg Drilling	**GROUND SURFACE ELEVATION**	Not Surveyed
DRILLING METHOD	Hydraulic push	**TOP OF CASING ELEVATION**	NA
BORING DIAMETER	2"	**SCREENED INTERVAL**	NA
LOGGED BY	M. Gaffney	**DEPTH TO WATER (First Encountered)**	12.5 ft (27-Oct-99)
REVIEWED BY	A. Le May, RG	**DEPTH TO WATER (Static)**	NA
REMARKS	Hand Augered to 5 feet		

TPHg (mg/kg)	BLOW COUNTS	SAMPLE ID	EXTENT	DEPTH (ft bgs)	U.S.C.S.	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH (ft bgs)	WELL DIAGRAM
							CONCRETE	0.5	Portland Type I/II
							Silty SAND: (SM); brown; dry; 5% clay, 25% silt, 65% sand, 5% gravel; high estimated permeability.		
		SB-1 5.0		5	SM		@ 5'-gray; dry; 10% silt 80% sand, 10% gravel; low plasticity.		
		SB-1 10.0		10			**SAND:** Gray; dry; 10% silt, 80% sand, 10% gravel; high estimated permeability.	10.0	
					SP				
				15			@ 15'- orange; 10% silt, 90% solidified coarse grained sand; medium estimated permeability.	16.0	Bottom of Boring @ 16 ft

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BORING/WELL LOG

CLIENT NAME	Equiva Services LLC	BORING/WELL NAME	SB-2
JOB/SITE NAME	2120 Montana Street, Oakland	DRILLING STARTED	27-Oct-99
LOCATION	2120 Montana Street, Oakland	DRILLING COMPLETED	27-Oct-99
PROJECT NUMBER	242-0733	WELL DEVELOPMENT DATE (YIELD)	NA
DRILLER	Gregg Drilling	GROUND SURFACE ELEVATION	Not Surveyed
DRILLING METHOD	Hydraulic push	TOP OF CASING ELEVATION	NA
BORING DIAMETER	2"	SCREENED INTERVAL	NA
LOGGED BY	M. Gaffney	DEPTH TO WATER (First Encountered)	16.5 ft (27-Oct-99)
REVIEWED BY	A. Le May, RG	DEPTH TO WATER (Static)	NA
REMARKS	Hand Augered to 5 feet		

TPHg (mg/kg)	BLOW COUNTS	SAMPLE ID	EXTENT	DEPTH (ft bgs)	U.S.C.S.	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH (ft bgs)	WELL DIAGRAM
							CONCRETE	0.5	Portland Type I/II
							Silty SAND: gray green; dry; 5% clay, 25% silt, 65% sand, 5% gravel; medium plasticity; high estimated permeability.		
		SB-2 5.0		5			● 5'-gray; 30% silt, 65% sand, 5% gravel; high estimated permeability.		
		SB-2 8.0							
				10	SM		● 12'-gray green; moist; 30% silt, 70% sand; medium estimated permeability.		
				15			● 15'-brown; medium estimated permeability.		
		SB-2 16					● 16.5'-wet; medium estimated permeability. ▽		
		SB-2 20		20				20.0	Bottom of Boring @ 20 ft

WELL LOG (TPH-G) \OAK5000-1\GINT\GINT.GPJ DEFAULT.GDT 3/30/00

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BORING/WELL LOG

CLIENT NAME	Equiva Services LLC	**BORING/WELL NAME**	SB-3
JOB/SITE NAME	2120 Montana Street, Oakland	**DRILLING STARTED**	27-Oct-99
LOCATION	2120 Montana Street, Oakland	**DRILLING COMPLETED**	27-Oct-99
PROJECT NUMBER	242-0733	**WELL DEVELOPMENT DATE (YIELD)**	NA
DRILLER	Gregg Drilling	**GROUND SURFACE ELEVATION**	Not Surveyed
DRILLING METHOD	Hydraulic push	**TOP OF CASING ELEVATION**	NA
BORING DIAMETER	2"	**SCREENED INTERVAL**	NA
LOGGED BY	M. Gaffney	**DEPTH TO WATER (First Encountered)**	16.0 ft (27-Oct-99)
REVIEWED BY	A. Le May, RG	**DEPTH TO WATER (Static)**	NA
REMARKS	Hand Augered to 5 feet		

TPHg (mg/kg)	BLOW COUNTS	SAMPLE ID	EXTENT	DEPTH (ft bgs)	U.S.C.S.	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH (ft bgs)	WELL DIAGRAM
							CONCRETE	0.5	
							Silty SAND: gray brown; dry; 5% clay, 15% silt, 65% sand, 10% gravel; high estimated permeability.	0.5	
		SB-3 5.0		5	SM		@ 5'-brown; 5% clay, 30% silt, 60% sand, 5% gravel; medium estimated permeability.	0.5	
		SB-3 10.0		10			@ 9'- gray; dry; 20% silt, 80% sand; low estimated permeability.		Portland Type I/II
		SB-3 15.0		15	SP		Gravelly SAND: (ML); brown; dry; 10% silt, 60% sand, 30% gravel; medium estimated permeability. ▽	15.0	
				20				20.0	Bottom of Boring @ 20 ft

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BORING/WELL

CLIENT NAME	Equiva Services LLC	**BORING/WELL NAME**	MW-1
JOB/SITE NAME	2120 Montana Street, Oakland	**DRILLING STARTED**	20-Feb-01
LOCATION	2120 Montana Street, Oakland	**DRILLING COMPLETED**	20-Feb-01
PROJECT NUMBER	242-0733	**WELL DEVELOPMENT DATE (YIELD)**	NA
DRILLER	Gregg Drilling	**GROUND SURFACE ELEVATION**	160.16
DRILLING METHOD	Hollow-stem auger	**TOP OF CASING ELEVATION**	159.59 ft
BORING DIAMETER	8"	**SCREENED INTERVAL**	13 to 28 ft bgs
LOGGED BY	J. Loetterle	**DEPTH TO WATER (First Encountered)**	19.0 ft (20-Feb-01)
REVIEWED BY	S. Bork, RG# 5626	**DEPTH TO WATER (Static)**	11.5 ft (20-Feb-01)

REMARKS Hand augered to 5'. Located at north end of station, 45' from the curb, and 10' from fence.

PID (ppm)	TPHd (ppm)	BLOW COUNTS	SAMPLE ID	EXTENT	DEPTH (ft bgs)	U.S.C.S.	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH (ft bgs)	WELL DIAGRAM
								CONCRETE	0.7	
								FILL; dark brown; damp; 5% clay, 10% silt, 80% fine to coarse sand; no plasticity.		
			MW-1 5.5		5	ML		**Sandy SILT** (ML); reddish brown; medium stiffness; damp; 10% clay, 50% silt, 40% fine sand; low plasticity; contains rootlets.	5.0	
			MW-1 10.0		10	SM		**Silty SAND** (SM); grey/reddish brown; loose; damp; 10% clay, 30% silt, 60% fine sand; low plasticity; contains organic fragments. ▼	10.0	Bentonite Seal Monterey Sand #2/12
			MW-1 15.5		15	SP		**SAND** (SP); reddish brown; very loose; wet; 10% clay, 10% silt, 80% fine sand; low plasticity. ▼	15.0	
			MW-1 20.5		20	SC		**Clayey SAND** (SC); grey; very loose; wet; 15% clay, 5% silt, 80% fine to medium sand; medium plasticity.	20.0	2"-diam., 0.010" Slotted Schedule 40 PVC
			MW-1 24.0		25			@ 25 fbg - grey/brown; contains faint petroleum odor.	28.0	Bottom of Boring @ 28 ft

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BORING/WELL LOG

CLIENT NAME	Equiva Services LLC	BORING/WELL NAME	MW-2
JOB/SITE NAME	2120 Montana Street, Oakland	DRILLING STARTED	21-Feb-01
LOCATION	2120 Montana Street, Oakland	DRILLING COMPLETED	21-Feb-01
PROJECT NUMBER	242-0733	WELL DEVELOPMENT DATE (YIELD)	NA
DRILLER	Gregg Drilling	GROUND SURFACE ELEVATION	158.29
DRILLING METHOD	Hollow-stem auger	TOP OF CASING ELEVATION	158.03 ft
BORING DIAMETER	8"	SCREENED INTERVAL	5 to 20 ft bgs
LOGGED BY	J. Loetterle	DEPTH TO WATER (First Encountered)	10.0 ft (21-Feb-01) ▽
REVIEWED BY	S. Bork, RG# 5626	DEPTH TO WATER (Static)	NA ▼

REMARKS: Hand augered to 5'. Located in the middle of the west bound lane of Montana Street, approximately 5' east of the property line.

PID (ppm)	TPHd (ppm)	BLOW COUNTS	SAMPLE ID	EXTENT	DEPTH (ft bgs)	U.S.C.S.	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH (ft bgs)
								CONCRETE	0.7
								FILL; dark brown; damp; 5% clay, 10% silt, 80% fine to coarse sand; no plasticity.	4.0
			MW-2-5.5		5	SM		**Silty SAND** (SM); light brown; damp; 5% clay 20% silt, 75% fine to medium sand; no plasticity.	10.0 ▽
			MW-2-10.5		10	ML		**Sandy SILT** (ML); reddish brown; medium stiffness; damp; 10% clay, 50% silt, 40% fine sand; low plasticity; contains rootlets.	15.0
			MW-2-15.5		15	SM		**Silty SAND** (SM); grey/reddish brown; loose; damp; 10% clay, 30% silt, 60% fine sand; low plasticity; contains organic fragments.	20.0
			MW-2-21.0		20	SC		**Clayey SAND** (SC); grey; very loose; wet; 15% clay, 5% silt, 80% fine to medium sand; medium plasticity.	21.5

WELL DIAGRAM: Portland Type I/II; Bentonite Seal; Monterey Sand #2/12; 2"-diam., 0.010" Slotted Schedule 40 PVC; Bottom of Boring @ 21.5 ft

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BORING/WELL

CLIENT NAME	Equiva Services LLC	**BORING/WELL NAME**	MW-3
JOB/SITE NAME	2120 Montana Street, Oakland	**DRILLING STARTED**	21-Feb-01
LOCATION	2120 Montana Street, Oakland	**DRILLING COMPLETED**	21-Feb-01
PROJECT NUMBER	242-0733	**WELL DEVELOPMENT DATE (YIELD)**	NA
DRILLER	Gregg Drilling	**GROUND SURFACE ELEVATION**	161.61
DRILLING METHOD	Hollow-stem auger	**TOP OF CASING ELEVATION**	161.13 ft
BORING DIAMETER	8"	**SCREENED INTERVAL**	5 to 20 ft bgs
LOGGED BY	J. Loetterle	**DEPTH TO WATER (First Encountered)**	16.6 ft (21-Feb-01)
REVIEWED BY	S. Bork, RG# 5626	**DEPTH TO WATER (Static)**	NA

REMARKS Hand augered to 5'. Located at the east end of the station, approximately 18' north of the eastern dispenser.

PID (ppm)	TPHd (ppm)	BLOW COUNTS	SAMPLE ID	EXTENT	DEPTH (ft bgs)	U.S.C.S.	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH (ft bgs)
								CONCRETE	0.7
								FILL; dark brown; damp; 20% clay, 30% silt, 50% sand; medium plasticity.	2.0
						SC		**Clayey SAND** (SC); light brown; damp; loose; 15% clay, 15% silt, 60% fine sand, 10% fine to coarse gravel. @ 3 fbg - brown; 20% clay, 10% silt, 60% fine sand, 10% fine to coarse gravel.	4.0
			MW-3 5.5		5	SM		**Silty SAND** (SM); brown; damp; loose; 10% clay, 30% silt, 60% fine sand; medium plasticity; contains organic fragments.	
			MW-3 10.5		10	SC		**Clayey SAND** (SC); olive brown; damp; medium dense; 20% clay, 15% silt, 65% fine to coarse, subrounded sand; medium plasticity.	10.0
			MW-3 15.5		15			@ 15 fbg - reddish brown; loose; moist; 20% clay, 10% silt, 70% fine to medium, subrounded sand; medium plasticity. ▽	
			MW-3 20.5		20			@ 20 fbg - grey; wet.	21.5

WELL DIAGRAM

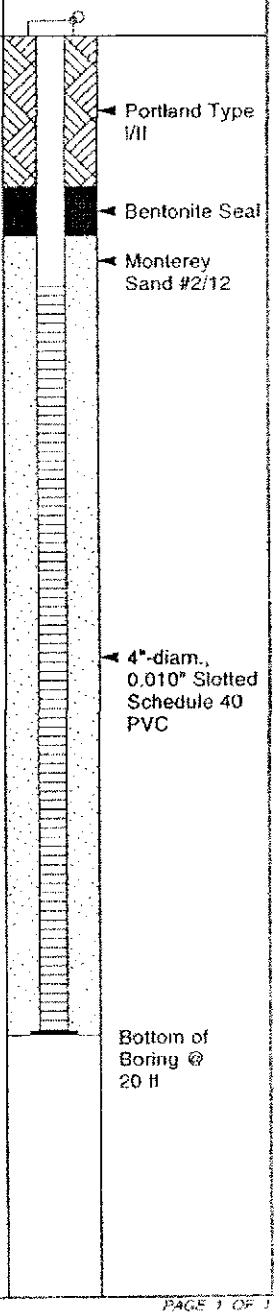
- Portland Type I/II
- Bentonite Seal
- Monterey Sand #2/12
- 2"-diam., 0.010" Slotted Schedule 40 PVC
- Bottom of Boring @ 21.5 ft

Cambria Environmental Technology, Inc.
1144 - 65th St.
Oakland, CA 94608
Telephone: (510) 420-0700
Fax: (510) 420-9170

BORING/WELL LOG

CLIENT NAME	Shell Oil Products US	**BORING/WELL NAME**	MW-4
JOB/SITE NAME	2120 Montana Street, Oakland	**DRILLING STARTED**	21-Jun-02
LOCATION	2120 Montana Street, Oakland	**DRILLING COMPLETED**	21-Jun-02
PROJECT NUMBER	244-0733	**WELL DEVELOPMENT DATE (YIELD)**	NA
DRILLER	Gregg Drilling	**GROUND SURFACE ELEVATION**	160.38 ft above msl
DRILLING METHOD	Hollow-stem auger	**TOP OF CASING ELEVATION**	160.09 ft above msl
BORING DIAMETER	10"	**SCREENED INTERVAL**	5 to 20 ft bgs
LOGGED BY	J. Gerke	**DEPTH TO WATER (First Encountered)**	12.0 ft (21-Jun-02)
REVIEWED BY	M. Derby, PE# 55475	**DEPTH TO WATER (Static)**	NA
REMARKS	Hand augered to 5'. Located in the west end of the planter along Montana Street.		

Soil TPHg (mg/kg)	Soil Vapor TPHg (ug/L)	SAMPLE ID	DEPTH (ft bgs)	U.S.C.S.	LITHOLOGIC DESCRIPTION	CONTACT DEPTH (ft bgs)
					Fill; brown; damp; 55% clay, 15% silt, 30% sand; medium plasticity; located in a planter.	
						1.5
				CL	**Silty CLAY** (CL); reddish brown; damp; 50% clay 35% silt, 15% sand; medium plasticity.	
<1.0		MW-4-5.5	5		@ 5 fbg - 40% clay, 35% silt, 25% sand.	
						7.5
<1.0		MW-4-9.0	10	ML	**Sandy SILT** (ML); bluish gray; moist; 5% clay, 40% silt, 30% fine to coarse sand; 25% fine subangular gravel; low plasticity.	
						11.8
<1.0		MW-4-13.5	15	SM	**Silty SAND** (SM); light brown; wet; 5% clay 20% silt, 55% fine to medium sand, 20% fine subangular gravel; no plasticity.	
						16.8
			20	ML	**Sandy SILT** (ML); bluish gray; wet; 5% clay, 50% silt, 40% fine sand; 5% fine subangular gravel; low plasticity.	
						20.0



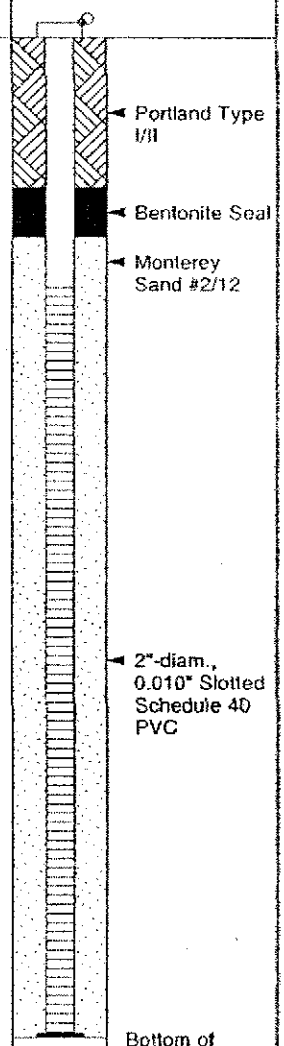
Cambria Environmental Technology, Inc.
1144 - 65th St.
Oakland, CA 94608
Telephone: (510) 420-0700
Fax: (510) 420-9170

BORING/WELL LOG

CLIENT NAME	Shell Oil Products US	**BORING/WELL NAME**	MW-5
JOB/SITE NAME	2120 Montana Street, Oakland	**DRILLING STARTED**	21-Jun-02
LOCATION	2120 Montana Street, Oakland	**DRILLING COMPLETED**	21-Jun-02
PROJECT NUMBER	244-0733	**WELL DEVELOPMENT DATE (YIELD)**	NA
DRILLER	Gregg Drilling	**GROUND SURFACE ELEVATION**	158.42 ft above msl
DRILLING METHOD	Hollow-stem auger	**TOP OF CASING ELEVATION**	158.25 ft above msl
BORING DIAMETER	8"	**SCREENED INTERVAL**	5 to 20 ft bgs
LOGGED BY	J. Gerke	**DEPTH TO WATER (First Encountered)**	12.0 ft (21-Jun-02)
REVIEWED BY	M. Derby, PE# 55475	**DEPTH TO WATER (Static)**	NA
REMARKS	Hand augered to 5'. Located in west bound lane of Montana Street, 45 west of site property line.		

Soil TPHg (mg/kg)	Soil Vapor TPHg (ug/L)	SAMPLE ID	DEPTH (ft bgs)	U.S.C.S.	LITHOLOGIC DESCRIPTION	CONTACT DEPTH (ft bgs)
					Asphalt	0.6
					Fill; dark brown; damp; 55% clay, 15% silt, 30% sand; medium plasticity.	2.5
					Silty SAND (SM); dark brown; damp; 10% clay 25% silt, 45% fine to coarse sand, 20% fine subangular gravel; no plasticity.	
			5		@ 5 fbg - brown.	
<1.0		MW-5-5.5				
1.3		MW-5-9.0	10	SM	@ 9.6 fbg - **Gravely SAND**; brown with bluish gray mottling; moist; 5% clay 20% silt, 40% fine to medium sand, 35% fine subangular gravel; no plasticity; trace roots.	
			15			
18		MW-5-19.0	20		@ 18.5 fbg - brown with bluish gray mottling; wet; 5% clay 15% silt, 50% medium to coarse sand, 30% fine subangular gravel; no plasticity.	20.0

WELL DIAGRAM



WELL LOG (TPHG PPM/PPB) G:\OA\SF2-1\GINT\GINT.GPJ DEFAULT.GDT 8/14/02

ATTACHMENT D

Field Data Sheets

CAMBRIA

DAILY FIELD REPORT

Project Name: 2120 Montana SVE	Cambria Mgr: Dan Lescure	Field Person: Dayton DB
Project Number: 246-0733	Date: 7/26/04	Site Address: 2120 Montana, Oakland – SVE Interim Remediation
General Tasks: Interim Remediation		

Time	Activity/Comments	Hours
0530	Depart	
0745	Arrive site	
	Generator site, do atest run on Generator	
	Note: The 2 inch QED pump that was dropped to bottom of well, on Thurs. Day has not pumped down DTW as much as needed.	
	Trey call Mark so he can drop off 2" Redi-Flow pump to Forus to use.	
1157	Hour almost dewatered to point Trey wants to stop - Running 4.5 cfm.	
1500	Temp out, collect final step test - data point, stop test... check water level in mw-1 ok, pump will not run Dry.	
1600	All is well Depart for ~~Sacramento~~, office	
	Drop off sample, mart w/ Trey.	
	Day over	

CAMBRIA

SVE TEST DATA FORM

Site Address: 2120 Montana, Oakland
Project No. 246-0733
Incident No. 98995740

Date: 7/26/04
Technician: Dayton Busch
Project Mgr: Matt Derby

Time (hh:mm)	Hour Meter (hrs)	LR Pump Vac (In Hg)	System Vac (in Hg)	System Flow (cfm)	Dilution Flow (cfm)	Well Flow (cfm) MW-1	Well Vac (InWC) MW-1	Well Vapor (ppmv) MW-1	Effluent Vapor (ppmv)	MW-1 Totalizer	Sample	Radius of Influence (DTW or Vacuum. Note units.) MW-4 (InWC)	TBW-S (InWC)	TBW-W (InWC)	TBW-N (InWC)	TBW-E (InWC)	MW-3 (InWC)
										INITIAL		0.0	0.0	0.0	0.0	0.0	14.11
										95500			NOT AVAILABLE Broken	DON'T TAPPED			
														DTW=	DTW		DTW
										DTW		DTW=	dry @	~~10.94~~	10.94'	dry@	
1:15	2351.9	3.5	~~3.0~~ 3.5	330	O/R	12.4	24.4	8870		24.87		14.73'	10.3'	dry@8		9.7'	12.22'
1:30	2352.1	3.5	3.5	327	O/R	12.3	25.0	7260		MW-1-A	X						
1:40	2352.3	3.5	2	331	O/R	11.0	23.9	7130									
1:50	2352.4	5	3	317	O/R	15.9	42.5	8100									
2:00	2352.6	5	3	316	O/R	13.5	41.1	8540	234								
2:10	2352.7	5	3	316	O/R	14.7	41.8	8740	250								
2:20	2352.9	7.5	5.5	279	O/R	24.5	76.7	9920	190								
2:30	2353.1	7.5	5.5	278	O/R	25.0	76.4	10,190	200								
2:40	2353.2	7.5	5.5	278	O/R	25.1	75.2	10,240	182	DTW=							
2:50	2353.4	10.0	8	251	O/R	34.1	105.1	3,700		26.0'							
~~3:00~~		Overheated - shutdown - full dilution to cool off															
3:15	2353.8	7	5.5	288	O/R	26.7		10,600									
3:30	2354.1	6	4.5	305	O/R	23.1	50.2	5,250				0	—	0	0.1	0	0
3:45	2354.3	6	4.5	305	O/R	22.1	51.4	5,300									
4:00	2354.6	6	4.5	303	O/R	24.2	50.0	5,300		MW-1-B	X						

NOTES: MW-1's DTW measurements are made from 1.2' above normal TOC due to temporary change in configuration
groundwater extracted @ 4.4 gpm start-up; @ 2:00 pm - 4.15 gpm
O/R = Greater than 130 cfm. Cannot be measured by TSI Velocicalc.
@ 3:15 pm — 3.8 gpm @ 380 Hz

CAMBR

DAILY FIELD REPORT

Project Name: 2120 Montana SVE	Cambria Mgr: Dan Lescure	Field Person: Dayton DJ
Project Number: 246-0733	Date: 7/27/04	Site Address: 2120 Montana, Oakland – SVE Interim Remediation
General Tasks: Interim Remediation		

Time	Activity/Comments	Hours
0630	Depart office / holding; from overnight stay.	
0700		
0800	Call into Tracy with status information. MW-1, pumping at 3.8 GPM, has produced 5060 Gallons 100560 - 95500 = 5060 current - start = total (See sub sheet) Request that she let me increase Recovery up to limits of Solinco. Continue w/test and Data Recording.	
0930	Tracy OK's increasing Recovery via increasing Vacuum on W/R to approx 7in Hg.	
1100	Increase MW-1 H^2O pump rate from 3.7 to 4.2 GPM, to expose a little more screen.	
1130	Extra Dewatering is wonking, concentration up, 1,100ppm Talk w/Tracy, suggest we modify S.O.W. to include DTW's. MW-2, MW-5, were not initial collected. We will begin collecting DTW's, all wells, 3 times a day to improve Data collection. starting at 1200 Hrs.	
1400	Secure Site, Sample Demob to office To Drop Samples, Brief Tracy.	
	Totalizer = 101890 95500 = 6390 Gallons	

F:\TEMPLATE\FORMS\FIELD\FIELDRPT.WPD
NSM 8/16/94

CAMBRIA

SVE TEST DATA FORM

Site Address: 2120 Montana, Oakland
Project No. 246-0733
Incident No. 98995740

Date: 7/27/04
Technician: Dayton Busch
Project Mgr: Matt Derby

MW-1

Time (hh:mm)	Hour Meter (hrs)	LR Pump Vac (in Hg)	System Vac (in Hg)	System Flow (cfm)	Dilution Flow (cfm)	Well Flow (cfm)	Well Vac (inWC)	Well Vapor (ppmv)	Effluent Vapor (ppmv)	MW-1	Sample	Radius of Influence (DTW or Vacuum. Note units.) MW-4 (inWC)	TBW-S (inWC)	TBW-W (inWC)	TBW-N (inWC)	TBW-E (inWC)	MW-3 (inWC)
									~~0230~~	DTW:							
0230										25.5							
0800	2371.1	6.0	3.0	309	O/R	34.0	50.2	7500	270	mw-1 C	X	.01	Dry	.01	.01	.01	.01
0830	2371.6	6.0	3.5	310	O/R	34.4	51.1	7800	101			.01		.01	.01	.01	.01
0900	2372.1	6.0	3.4	310	O/R	33.9	50.4	7960	140			.01		.01	.01	.01	.01
			INCREASE RECOVERY EFFORT							TEMP							
0930	2372.5	7.0	3.5	296	O/R	37.0	64.0	7400	129	985		.01		.01	.01	.01	.01
1000	2373.0	7.0	3.5	296	O/R	38.0	65.0	7460	131	975		.01		.01	.01	.01	.01
1030	2373.5	7.0	3.5	295	O/R	35.0	63.3	7250	100	995		.01		.01	.01	.01	.01
1100	2374.0	7.0	4.9	294	O/R	31.0	62.6	7220	96	992		.01		.01	.01	.01	.01
1130	2374.5	7.0	5.0	292	O/R	29.0	63.6	8440	157	995		.01		.01	.01	.01	.01
1200	2375.5	7.0	5.0	291	O/R	29.0	64.0	8560	71	995		17.67	Dry	Dry	Dry	Dry	12.67
1230	2376.0	7.0	5.5	290	O/R	29.0	64.1	8570	65	1004		~~17.67~~		.01	.01	.01	.01
1300	2376.5	7.0	5.0	291	O/R	29.	64.7	8740	69	1005				.01	.01	.01	.01
1330	2377.0	7	5.0	291	O/R	29	65.3	8560	71	1001				.01	.01	.01	.01
1400	2379.5	7	5	291	O/R	29.5	65.1	8700	71	1002	X	17.70	Dry	Dry	Dry	Dry	12.69
										mw-1 O							
		TOTALIZER 101890								DTW							
				95500 =	6390					26.5							

NOTES: O/R = OVER RANGE FOR TSI. VELOCICALC
* = INCREASE MW-1 PUMP RATE TO EXPOSE MOORE SCREEN.

12:00 MW-5 = 12.25, MW-2 = 18.52 (inverted)
14:00 " 12.29, " 18.60

CAMBRIA

DAILY FIELD REPORT

Project Name: 2120 Montana SVE	Cambria Mgr: Dan Lescure	Field Person: Dayton DJ
Project Number: 246-0733	Date: 7/28/04	Site Address: 2120 Montana, Oakland – SVE Interim Remediation
General Tasks: INTERIM REMEDIATION		

Time	Activity/Comments	Hours
0640	DEPART ~~HOME~~ HOTEL FOR SITE.	
0700	ONSITE, SYSTEM HAS RUNOVER NIGHT. 100% up Time. TAKE MORNING READINGS, GO TO OFFICE, CHECK IN W/ DAN AND TRAY. ANSWER SOME QUESTIONS FOR KAREN. ~~RUN~~ RETURN TO SITE	
1150	FORK TRUCK ARRIVES. FUEL UP GENERATOR SYSTEM IS RUNNING WELL. CONTINUE W/ DATA COLLECTION	
1330	COLLECT LAST DATA AND SAMPLE OF THE DAY. SECURE SITE, TAKE SAMPLES TO OFFICE FOR PICKUP. DJ	

CAMBRIA

SVE TEST DATA FORM

Site Address: 2120 Montana, Oakland
Project No. 246-0733
Incident No. 98995740

Date: 7/25/04
Technician: Dayton Busch
Project Mgr: Matt Derby

MW-1

Time (hh:mm)	Hour Meter (hrs)	LR Pump Vac (in Hg)	System Vac (in Hg)	System Flow (cfm)	Dilution Flow (cfm)	Well Flow (cfm)	Well Vac (inWC)	Well Vapor (ppmv)	Effluent Vapor (ppmv)			MW-4 (inWC)	Radius of Influence (DTW or Vacuum. Note units.) TBW-S (inWC)	TBW-W (inWC)	TBW-N (inWC)	TBW-E (inWC)	MW-3 (inWC)
						~~95.0~~				TOTALIZER							
0700	2394.6	7.0	3.0	297	O/R	~~54~~	58.4	7010	65	105880	X	18.15 MW-1-E	Dry	Dry	Dry	Dry	12.87
	LEAVE SITE TO RUN TO OFFICE									TEMP							
~~0800~~	2395.5	7.0	3.0	295	O/R	41.5	62.5	6640	64	987		.01	~~.01~~	.01	.01	.01	.01
830	2396.0	7.0	3.0	294	O/R	41.7	63	6920	69	988		.01		.01	.01	.01	.01
900	2396.4	7.0	3.2	293	O/R	42.0	63.0	7210	77	988		.01		.01	.01	.01	.01
930	2397.0	7	3.2	293	O/R	40.5	63.1	7300	79	985		.01		.01	.01	.01	.01
1000	2397.5	7	3.2	290	O/R	40.5	63.2	7150	74	989		.01		.01	.01	.01	.01
1030	2398.0	7	3.4	294	O/R	39	63.	7740	71	991		.01		.01	.01	.01	.01
1100	2398.5	7	3.6	295	O/R	38.4	62.6	7910	81	997		18.17	CANNOT MEASURE	DRY	DRY	DRY	12.90
1130	2399.0	7	4.0	295	O/R	36.0	62.0	8200	84	1001		.01		.01	.01	.01	.01
1200	2399.5	7	4.5	293	O/R	35.2	62.0	7700	66	1004		.01		.01	.01	.01	.01
1230	2400	7	5.1	291	O/R	33.4	61.4	7000	68	1010		.01		.01	.01	.01	.01
1300	2400.5	7	5.0	292	O/R	32.4	61	7460	71	997		.01		.01	.01	.01	.01
1330	2401.0	7	5.0	291	O/R	31.0	61	~~8250~~ 6880	24	997	X	.01 MW-1-F 15.20	DAMAGED CASE TOP	.01	.01	.01	.01
										TOTALIZER 107400							

NOTES:

0700 – MW-2 = 19.20 MW-5 = 12.56 MW-1 = 26.0 DTW
1100 – 19.25 = 12.57 = 26.2 DTW
~~1400~~ 1330 – 19.29 = 12.58

CAMBRIA

DAILY FIELD REPORT

Project Name: 2120 Montana SVE	Cambria Mgr: Dan Lescure	Field Person: Dayton DJ
Project Number: 246-0733	Date: 7/29/04	Site Address: 2120 Montana, Oakland – SVE Interim Remediation
General Tasks: Interim Remediation		

Time	Activity/Comments	Hours
0630	Depart motel For Site	
0650	Arrive site, Begin Setup, SVE has Run all night However, pump in MW-1 stopped. No fault lights, problem is that there is no power to sump pump out hut: Have to wire a pig tail to main power.	
0800	Pump is back up, and running, @ 5.0 Gpm Continue running, SVE, no other problems. check in w/ Trey, and Dan.	
1100	Office calls, samples where picked up.	
1200	Discover product in MW-2 call Trey to Bring Product probe	
1300	Well MW-2: free product @ 11e.96 fbg Water at 17.09 fbg Almost 1.5 inches. It just showed up at second water level.	
1400	Secure site, Take samples to Office DJ	

CAMBRIA

SVE TEST DATA FORM

Site Address: 2120 Montana, Oakland
Project No. 246-0733
Incidient No. 98995740

Date: 7/29/04
Technician: Dayton Busch DO
Project Mgr: Matt Derby

MW-1

Time (hh:mm)	Hour Meter (hrs)	LR Pump Vac (in Hg)	System Vac (In Hg)	System Flow (cfm)	Dilution Flow (cfm)	Well Flow (cfm)	Well Vac (InWC)	Well Vapor (ppmv)	Effluent Vapor (ppmv)	MW-1	Sample	Radius of Influence (DTW or Vacuum. Note units.) MW-4 (InWC)	TBW-S (InWC)	TBW-W (InWC)	TBW-N (InWC)	TBW-E (InWC)	MW-3 (InWC)
										TOTALIZER							
			MW-1 Pump OFF line upon arrival							108540							12.92
								Restart @ 4.5		cfm							
0700	2417.9	7	3.5	294	O/R	35.2	55.3	N/C	N/C			16.38	Dry	Dry	Dry	Dry	
730	2419.4	7	3.5	294	O/R	36.0	55.0	3200	N/C			.01	~~.01~~	.01	.01	.01	.01
800	2419.9	7	3.5	294	O/R	36.2	56.1	3240	N/C			.01		.01	.01	.01	.01
830	2420.4	7	3.5	294	O/R	36.9	56.3	3410	78	TEMP		.01		.01	.01	.01	.01
900	2420.9	7	3.6	295	O/R	37.7	56.4	3330	77	845		.01		.01	.01	.01	.01
930	*	9	5	268	O/R	T/W	69.0	2470	104	870		.01		.01	.01	.01	.01
1000	2421.7	7	4	294	O/R	40.0	57.0	3940	99	MW-1 G	X	.01		.01	.01	.01	.01
1030	2422.1	7	4	291	O/R	38.1	61.8	4080	90	875		.01		.01	.01	.01	.01
1100	2422.6	7	4	291	O/R	38	63.1	4100	107			.01		.01	.01	.01	.01
1130	2423.1	7	4	291	O/R	37.9	64.4	4040	99	TOTALIZER		.01		.01	.01	.01	.01
1200	2423.7	7	4.5	291	O/R	37.7	66.7	4170	98	109700		~~.01~~	Dry	Dry	Dry	Dry	12.90
1230	2424.2	7	5.0	291	O/R	37.0	67.1	4420	98	5046 cfm		16.88		.01	.01	.01	.01
1300	2424.7	7	5	290	O/R	37	67.2	4540	99	<94°F		.01		.01	.01	.01	.01
1330	2425.3	7	5	289	O/R	37	67.2	4570	99	TOTALIZER		.01		.01	.01	.01	.01
1400	2425.8	7	5	287	O/R	36.8	67.2	4700	101	110160	X	16.90	Dry	Dry	Dry	Dry	12.91
										4.16 cfm							
												MW-1-H					

NOTES:

O/R = OVER RANGE FOR TSI
N/C = NOT COLLECTED
* : CONDITIONS VERY WET VAPOR STREAM TOO WET TO MEASURE.

	DTW		DTW		DTW
0700 - MW-1	17.0	MW-5	12.57	MW-2	15.22
1200 "	25.1		12.56	MW-2	16.75
~~1300~~ 1400	25.7		12.57		SEE DPE PRODUCT IN WELL

CAMBRIA

DAILY FIELD REPORT

Project Name: 2120 Montana SVE	Cambria Mgr: Dan Lescure	Field Person: Dayton DD
Project Number: 246-0733	Date: 7/30/04	Site Address: 2120 Montana, Oakland – SVE Interim Remediation
General Tasks: Interim Remediation O&E		

Time	Activity/Comments	Hours
0620	Depart motel for site.	
0650	Arrive, system (both air, H_2O) have run all night. Set up to collect data	
0840	Depart for office, Fuel, Admin, etc.	
1020	Arrive back on site. Collect data, optimize recovery.	
1400	Complete F&Rs. Collect last samples, they take to office from site.	
	* Set up to perform additional vacuum steps, turn of thermal, perform rapid steps prior to system overheat.	
1505	Complete breakdown, set remediation back to baseline run condition (new filters, adjust, on-check operation.	
1730	Park trailer at corp. yard, store marks Honda and rad. flow, pump, and VFD in O_2 trailer and lock.	
1800	Arrive SAC office DD	

SWE SYSTEM TOTALIZER = 17,870 GALLON
START - 37,580
END - 55,450 T

CAMBRIA

SVE TEST DATA FORM

Site Address: 2120 Montana, Oakland
Project No. 246-0733
Incident No. 98995740

Date: 7/30/04
Technician: Dayton Busch DB
Project Mgr: Matt Derby

MW-1

Time (hh:mm)	Hour Meter (hrs)	LR Pump Vac (in Hg)	System Vac (in Hg)	System Flow (cfm)	Dilution Flow (cfm)	Well Flow (cfm)	Well Vac (inWC)	Well Vapor (ppmv)	Effluent Vapor (ppmv)		SAMPLE	Radius of Influence (DTW or Vacuum. Note units.) MW-4 (inWC)	TBW-S (inWC)	TBW-W (inWC)	TBW-N (inWC)	TBW-E (inWC)	MW-3 (inWC)
										TOTALIZER		MW-1-I					
0700	→									114000							13.50
										H₂O GAL		18.20					
0700	2443.0	7	3	292	O/R	44.3	62.1	~~45850~~	200	TEMP	X	~~.01~~	DRY	DRY	DRY	DRY	
730	2443.5	7	3	291	O/R	43.7	62	5840	171	950		~~.01~~ .1	UNABLE	.01	.01	.01	.01
800	2444	7	3	292	O/R	44.0	62	5900	165	950		.1	TO	.01	.01	.01	.01
0830	2444.5	7	3.5	292	O/R	43.5	61.1	5900	145	965		.1	COLLECT	.01	.01	.01	.01
GO TO AMMENVILLE OFFICE																	
1030	2446.6	7	4	293	O/R	41.1	60.4	5810	142	960		0.15	VACUUM.	.01	.01	.01	.01
1100	2447.1	~~8~~ 7	5	293	O/R	41.0	67.3	5710	141	TEMP °F		18.25	DAMAGING	DRY	DRY	DRY	13.52
1130	~~2448~~	7	5	291	O/R	42.0	69.1	6220	131	1040°		0.1	WELL	.01	.01	.01	.01
1200	2448.2	8	6	273	O/R	48.7	74.7	6400	210	1040		0.11	TOP.	.01	.01	.01	.01
1230	2448.6	8	6	274	O/R	49.1	74.4	6310	190	1040		0.1		.01	.01	.01	.01
1300	2449.0	8	6	275	O/R	49.3	74.1	6240	191	1042		.1		.01	.01	.01	.01
1330	2449.5	8	6	274	O/R	50	74.1	6200	180	1060		.1		.01	.01	.01	.01
1400	2450	8	6	273	O/R	49	75	5310	180	1060	X	.1		.01	.01	.01	13.12
											MW-1-J						
MINI STRIP																	
		10	7	244	O/R	~~110~~	105	4560	N/C			"H₂O					
			10			83.5		~~4~~									
1430		12.5	~~12.5~~	~~10~~ 211	N/C	71.5	128	4370	N/C			0.1					
1435		12.5	10	211	N/C	58.0	131	4160	N/C			0.5					
1440		15	12.5	165	N/C	64.5	157	3170	N/C			0.7	FINAL DTW				
1445		15	12.5	166	N/C	59.0	156	2950	N/C			0.6					
1450		COOL UNIT								1310°F		.01					
					STOP					TOTALIZER = 115660 GAL		18.37					

NOTES:

115660
-95500
20,160 GALLONS REMOVED
100% SVE

	MW-2	PRODUCT	MW-5	MW-1	
0700 -	19.20	19.18	12.78	25.2	DTW
1100 -	19.23	19.20	12.80	26.1	DTW
1500 -	19.70	18.90	12.72	26.0	DTW

ATTACHMENT E

Certified Laboratory Analytical Reports

SEVERN TRENT STL

Submission#: 2004-07-0787

Cambria Environmental Emeryville

August 04, 2004

5900 Hollis Street, Ste. A
Emeryville, CA 94608

Attn.: Trey Jackson

Project#: 246-0733
Project: 98995740
Site: 2120 Montana St., Oakland

Attached is our report for your samples received on 07/27/2004 15:20
This report has been reviewed and approved for release. Reproduction of this report is permitted only in its entirety.

Please note that any unused portion of the samples will be discarded after 09/10/2004 unless you have requested otherwise.
We appreciate the opportunity to be of service to you. If you have any questions,

You can also contact me via email. My email address is: mbrewer@stl-inc.com

Sincerely,

Melissa Brewer

Melissa Brewer
Project Manager

SEVERN TRENT STL

Submission: 2004-07-0787

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville

Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/27/2004 15:20

Site: 2120 Montana St., Oakland

Samples Reported

Sample Name	Date Sampled	Matrix	Lab #
MW-1-A	07/26/2004 13:30	Air	1
MW-1-B	07/26/2004 16:00	Air	2

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville

Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/27/2004 15:20

Site: 2120 Montana St., Oakland

Prep(s): 5030B
Test(s): 8260B
Sample ID: **MW-1-A**
Lab ID: 2004-07-0787 - 1
Sampled: 07/26/2004 13:30
Extracted: 7/28/2004 15:00
Matrix: Air
QC Batch#: 2004/07/28-1A.69
Analysis Flag: o (See Legend and Note Section)

Compound	Conc.	RL	Unit	Dilution	Analyzed	Flag
Gasoline	4700	70	ppmv	5.00	07/28/2004 15:00	
Benzene	ND	1.6	ppmv	5.00	07/28/2004 15:00	
Toluene	11	1.3	ppmv	5.00	07/28/2004 15:00	
Ethylbenzene	1.6	1.2	ppmv	5.00	07/28/2004 15:00	
Total xylenes	74	1.2	ppmv	5.00	07/28/2004 15:00	
Methyl tert-butyl ether (MTBE)	6.8	0.70	ppmv	5.00	07/28/2004 15:00	
Surrogate(s)						
1,2-Dichloroethane-d4	110.4	76-130	%	5.00	07/28/2004 15:00	
Toluene-d8	94.8	78-115	%	5.00	07/28/2004 15:00	

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville

Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/27/2004 15:20

Site: 2120 Montana St., Oakland

Prep(s):	5030B	Test(s):	8260B
Sample ID:	**MW-1-B**	Lab ID:	2004-07-0787 - 2
Sampled:	07/26/2004 16:00	Extracted:	7/29/2004 12:09
Matrix:	Air	QC Batch#:	2004/07/29-1E.64

Analysis Flag: o (See Legend and Note Section)

Compound	Conc.	RL	Unit	Dilution	Analyzed	Flag
Gasoline	11000	140	ppmv	10.00	07/29/2004 12:09	
Benzene	24	3.1	ppmv	10.00	07/29/2004 12:09	
Toluene	71	2.6	ppmv	10.00	07/29/2004 12:09	
Ethylbenzene	2.8	2.3	ppmv	10.00	07/29/2004 12:09	
Total xylenes	210	2.3	ppmv	10.00	07/29/2004 12:09	
Methyl tert-butyl ether (MTBE)	30	1.4	ppmv	10.00	07/29/2004 12:09	
Surrogate(s)						
1,2-Dichloroethane-d4	106.2	76-130	%	10.00	07/29/2004 12:09	
Toluene-d8	108.5	78-115	%	10.00	07/29/2004 12:09	

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville

Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/27/2004 15:20

Site: 2120 Montana St., Oakland

Batch QC Report

Prep(s): 5030B — Test(s): 8260B

Method Blank — **Water** — **QC Batch # 2004/07/28-1A.69**

MB: 2004/07/28-1A.69-030 — Date Extracted: 07/28/2004 07:30

Compound	Conc.	RL	Unit	Analyzed	Flag
Gasoline	ND	50	ug/L	07/28/2004 07:30	
Methyl tert-butyl ether (MTBE)	ND	0.5	ug/L	07/28/2004 07:30	
Benzene	ND	0.5	ug/L	07/28/2004 07:30	
Toluene	ND	0.5	ug/L	07/28/2004 07:30	
Ethylbenzene	ND	0.5	ug/L	07/28/2004 07:30	
Total xylenes	ND	1.0	ug/L	07/28/2004 07:30	
Surrogates(s)					
1,2-Dichloroethane-d4	106.2	76-130	%	07/28/2004 07:30	
Toluene-d8	110.6	78-115	%	07/28/2004 07:30	

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville

Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/27/2004 15:20

Site: 2120 Montana St., Oakland

Batch QC Report

Prep(s): 5030B — Test(s): 8260B

Method Blank — **Water** — **QC Batch # 2004/07/29-1E.64**

MB: 2004/07/29-1E.64-025 — Date Extracted: 07/29/2004 08:25

Compound	Conc.	RL	Unit	Analyzed	Flag
Gasoline	ND	50	ug/L	07/29/2004 08:25	
Methyl tert-butyl ether (MTBE)	ND	0.5	ug/L	07/29/2004 08:25	
Benzene	ND	0.5	ug/L	07/29/2004 08:25	
Toluene	ND	0.5	ug/L	07/29/2004 08:25	
Ethylbenzene	ND	0.5	ug/L	07/29/2004 08:25	
Total xylenes	ND	1.0	ug/L	07/29/2004 08:25	
Surrogates(s)					
1,2-Dichloroethane-d4	104.4	76-130	%	07/29/2004 08:25	
Toluene-d8	112.2	78-115	%	07/29/2004 08:25	

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville

Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/27/2004 15:20

Site: 2120 Montana St., Oakland

Batch QC Report

Prep(s): 5030B

Test(s): 8260B

Laboratory Control Spike **Water** **QC Batch # 2004/07/28-1A.69**

LCS 2004/07/28-1A.69-054 Extracted: 07/28/2004 Analyzed: 07/28/2004 06:54

LCSD 2004/07/28-1A.69-049 Extracted: 07/28/2004 Analyzed: 07/28/2004 07:49

Compound	Conc. ug/L		Exp.Conc.	Recovery %		RPD	Ctrl.Limits %		Flags	
	LCS	LCSD		LCS	LCSD	%	Rec.	RPD	LCS	LCSD
Methyl tert-butyl ether (MTBE)	28.8	30.1	25	115.2	120.4	4.4	65-165	20		
Benzene	28.8	29.8	25	115.2	119.2	3.4	69-129	20		
Toluene	25.9	26.4	25	103.6	105.6	1.9	70-130	20		
Surrogates(s)										
1,2-Dichloroethane-d4	481	498	500	96.2	99.6		76-130			
Toluene-d8	552	559	500	110.4	111.8		78-115			

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville

Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/27/2004 15:20

Site: 2120 Montana St., Oakland

Batch QC Report

Prep(s): 5030B

Test(s): 8260B

Laboratory Control Spike **Water** **QC Batch # 2004/07/29-1E.64**

LCS 2004/07/29-1E.64-040 Extracted: 07/29/2004 Analyzed: 07/29/2004 07:40

LCSD 2004/07/29-1E.64-059 Extracted: 07/29/2004 Analyzed: 07/29/2004 08:59

Compound	Conc. ug/L		Exp.Conc.	Recovery %		RPD	Ctrl.Limits %		Flags	
	LCS	LCSD		LCS	LCSD	%	Rec.	RPD	LCS	LCSD
Methyl tert-butyl ether (MTBE)	29.7	29.8	25	118.8	119.2	0.3	65-165	20		
Benzene	25.1	25.9	25	100.4	103.6	3.1	69-129	20		
Toluene	25.9	25.1	25	103.6	100.4	3.1	70-130	20		
Surrogates(s)										
1,2-Dichloroethane-d4	594	571	500	118.8	114.2		76-130			
Toluene-d8	507	494	500	101.4	98.8		78-115			

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville

Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/27/2004 15:20

Site: 2120 Montana St., Oakland

Legend and Notes

Analysis Flag

o

Reporting limits were raised due to high level of analyte present in the sample.

STL San Francisco

1220 Quarry Lane
Pleasanton, CA 94566
(925) 484-1919 (925) 484-1096 fax

SHELL Chain Of Custody Record

88159

Shell Project Manager to be Invoiced:
☑ SCIENCE & ENGINEERING
☐ TECHNICAL SERVICES
☐ CRMT HOUSTON

Karen Petrina

INCIDENT NUMBER (S&E ONLY): 9 8 9 9 5 7 4 0

SAP or CRMT NUMBER (TS/CRMT): 1 3 5 6 7 5

DATE: 7/26/04

PAGE: 1 of 1

SAMPLING COMPANY: Cambria Environmental Technology, Inc.
LOG CODE: CETS
SITE ADDRESS (Street and City): 2120 Montana St, Oakland
GLOBAL ID NO.: N/A

ADDRESS: 5900 Hollis Street, Suite A, Emeryville, CA 94608
EDF DELIVERABLE TO (Responsible Party or Designee): N/A
PHONE NO.: N/A
E-MAIL: N/A
CONSULTANT PROJECT NO.: 246-0733

PROJECT CONTACT (Hardcopy or PDF Report to): Trey Jackson
SAMPLER NAME(S) (Print): Dayton Busch.

LAB USE ONLY

TELEPHONE: 510-420-3341
FAX: 510-420-9170
E-MAIL: tjackson@cambria-env.com

TURNAROUND TIME (BUSINESS DAYS):
☑ 10 DAYS ☐ 5 DAYS ☐ 72 HOURS ☐ 48 HOURS ☐ 24 HOURS ☐ LESS THAN 24 HOURS

☐ LA - RWQCB REPORT FORMAT ☐ UST AGENCY: ____

GC/MS MTBE CONFIRMATION: HIGHEST ____ HIGHEST per BORING ____ ALL ____

SPECIAL INSTRUCTIONS OR NOTES: CHECK BOX IF EDD IS NOT NEEDED ☑

Please report in ppmv

REQUESTED ANALYSIS

LAB USE ONLY	Field Sample Identification	SAMPLING DATE	SAMPLING TIME	MATRIX	NO. OF CONT.	TPH - Purgeable	TPH - Extractable (8015m)	BTEX	MTBE (EPA 8260B)	TBA	5 Oxygenates	1,2 DCA and EDB	Ethanol	Methanol	VOCs by 8260B	Semi-Volatiles by 8270C	Lead ☐ Total ☐ STLC ☐ TCLP	LUFTS ☐ Total ☐ STLC ☐ TCLP	CAM17 ☐ Total ☐ STLC ☐ TCLP	Test for Disposal (see attached)					FIELD NOTES: Container/Preservative or PID Readings or Laboratory Notes
	MW-1-A	7/26/04	1530	Air	1	X		X	X																tedlar bag
	MW-1-B	7/26/04	1600	Air	1	X		X	X																Tedlar bag.

TEMPERATURE ON RECEIPT C°: 26°

Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:
[signature]	Secure Location	7/26/04	1624
[signature]	[signature]	7/27/04	1520
[signature]	[signature]	7/27/04	17:00

DISTRIBUTION: White with final report, Green to File, Yellow and Pink to Client.

G:\Oakland 2120 Montana\Remediation\SVE Interim Remediation July04\SVE Test COC July04.xls]STL

10/16/00 Shell Revision
10/28/03 Cambria Revision

SEVERN TRENT STL

Submission#: 2004-07-0786

Cambria Environmental Emeryville

August 04, 2004

5900 Hollis Street, Ste. A
Emeryville, CA 94608

Attn.: Trey Jackson

Project#: 246-0733
Project: 98995740
Site: 2120 Montana St., Oakland

Attached is our report for your samples received on 07/27/2004 15:20
This report has been reviewed and approved for release. Reproduction of this report is permitted only in its entirety.

Please note that any unused portion of the samples will be discarded after 09/10/2004 unless you have requested otherwise.
We appreciate the opportunity to be of service to you. If you have any questions,

You can also contact me via email. My email address is: mbrewer@stl-inc.com

Sincerely,

Melissa Brewer

Melissa Brewer
Project Manager

SEVERN TRENT STL

Submission: 2004-07-0786

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville
Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/27/2004 15:20

Site: 2120 Montana St., Oakland

Samples Reported

Sample Name	Date Sampled	Matrix	Lab #
MW-1-C	07/27/2004 08:00	Air	1
MW-1-D	07/27/2004 14:00	Air	2

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville

Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/27/2004 15:20

Site: 2120 Montana St., Oakland

Prep(s): 5030B
Test(s): 8260B
Sample ID: **MW-1-C**
Lab ID: 2004-07-0786 - 1
Sampled: 07/27/2004 08:00
Extracted: 7/28/2004 14:05
Matrix: Air
QC Batch#: 2004/07/28-1A.69
Analysis Flag: o (See Legend and Note Section)

Compound	Conc.	RL	Unit	Dilution	Analyzed	Flag
Gasoline	2300	280	ppmv	20.00	07/28/2004 14:05	
Benzene	9.7	6.2	ppmv	20.00	07/28/2004 14:05	
Toluene	29	5.2	ppmv	20.00	07/28/2004 14:05	
Ethylbenzene	ND	4.6	ppmv	20.00	07/28/2004 14:05	
Total xylenes	62	4.6	ppmv	20.00	07/28/2004 14:05	
Methyl tert-butyl ether (MTBE)	12	2.8	ppmv	20.00	07/28/2004 14:05	
Surrogate(s)						
1,2-Dichloroethane-d4	108.1	76-130	%	20.00	07/28/2004 14:05	
Toluene-d8	102.5	78-115	%	20.00	07/28/2004 14:05	

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville
Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/27/2004 15:20

Site: 2120 Montana St., Oakland

Prep(s):	5030B	Test(s):	8260B
Sample ID:	**MW-1-D**	Lab ID:	2004-07-0786 - 2
Sampled:	07/27/2004 14:00	Extracted:	7/28/2004 14:23
Matrix:	Air	QC Batch#:	2004/07/28-1A.69

Analysis Flag: o (See Legend and Note Section)

Compound	Conc.	RL	Unit	Dilution	Analyzed	Flag
Gasoline	1600	140	ppmv	10.00	07/28/2004 14:23	
Benzene	6.5	3.1	ppmv	10.00	07/28/2004 14:23	
Toluene	22	2.6	ppmv	10.00	07/28/2004 14:23	
Ethylbenzene	2.7	2.3	ppmv	10.00	07/28/2004 14:23	
Total xylenes	47	2.3	ppmv	10.00	07/28/2004 14:23	
Methyl tert-butyl ether (MTBE)	8.9	1.4	ppmv	10.00	07/28/2004 14:23	
Surrogate(s)						
1,2-Dichloroethane-d4	112.2	76-130	%	10.00	07/28/2004 14:23	
Toluene-d8	105.5	78-115	%	10.00	07/28/2004 14:23	

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville

Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/27/2004 15:20

Site: 2120 Montana St., Oakland

Batch QC Report

Prep(s): 5030B — Test(s): 8260B

Method Blank — **Water** — **QC Batch # 2004/07/28-1A.69**

MB: 2004/07/28-1A.69-030 — Date Extracted: 07/28/2004 07:30

Compound	Conc.	RL	Unit	Analyzed	Flag
Gasoline	ND	50	ug/L	07/28/2004 07:30	
Methyl tert-butyl ether (MTBE)	ND	0.5	ug/L	07/28/2004 07:30	
Benzene	ND	0.5	ug/L	07/28/2004 07:30	
Toluene	ND	0.5	ug/L	07/28/2004 07:30	
Ethylbenzene	ND	0.5	ug/L	07/28/2004 07:30	
Total xylenes	ND	1.0	ug/L	07/28/2004 07:30	
Surrogates(s)					
1,2-Dichloroethane-d4	106.2	76-130	%	07/28/2004 07:30	
Toluene-d8	110.6	78-115	%	07/28/2004 07:30	

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville

Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/27/2004 15:20

Site: 2120 Montana St., Oakland

Batch QC Report

Prep(s): 5030B

Test(s): 8260B

Laboratory Control Spike **Water** **QC Batch # 2004/07/28-1A.69**

LCS 2004/07/28-1A.69-054 Extracted: 07/28/2004 Analyzed: 07/28/2004 06:54

LCSD 2004/07/28-1A.69-049 Extracted: 07/28/2004 Analyzed: 07/28/2004 07:49

Compound	Conc. ug/L		Exp.Conc.	Recovery %		RPD	Ctrl.Limits %		Flags	
	LCS	LCSD		LCS	LCSD	%	Rec.	RPD	LCS	LCSD
Methyl tert-butyl ether (MTBE)	28.8	30.1	25	115.2	120.4	4.4	65-165	20		
Benzene	28.8	29.8	25	115.2	119.2	3.4	69-129	20		
Toluene	25.9	26.4	25	103.6	105.6	1.9	70-130	20		
Surrogates(s)										
1,2-Dichloroethane-d4	481	498	500	96.2	99.6		76-130			
Toluene-d8	552	559	500	110.4	111.8		78-115			

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville

Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/27/2004 15:20

Site: 2120 Montana St., Oakland

Legend and Notes

Analysis Flag

o

Reporting limits were raised due to high level of analyte present in the sample.

STL-San Francisco 0801-01-0786

1220 Quarry Lane
Pleasanton, CA 94566
(925) 484-1919 (925) 484-1096 fax

SHELL Chain Of Custody Record

88158

Shell Project Manager to be Invoiced:

- ☑ SCIENCE & ENGINEERING
- ☐ TECHNICAL SERVICES
- ☐ CRMT HOUSTON

Karen Petrina

INCIDENT NUMBER (S&E ONLY): 9 8 9 9 5 7 4 0

SAP or CRMT NUMBER (TS/CRMT): 1 3 5 6 7 5

DATE: 7/27/04

PAGE: 1 of 1

SAMPLING COMPANY:	Cambria Environmental Technology, Inc.
LOG CODE:	CETS
SITE ADDRESS (Street and City):	2120 Montana St, Oakland
GLOBAL ID NO.:	N/A
ADDRESS:	5900 Hollis Street, Suite A, Emeryville, CA 94608
EDF DELIVERABLE TO (Responsible Party or Designee):	N/A
PHONE NO.:	N/A
E-MAIL:	N/A
CONSULTANT PROJECT NO.:	246-0733
PROJECT CONTACT (Hardcopy or PDF Report to):	Trey Jackson
SAMPLER NAME(S) (Print):	DAYTON BUSCH
TELEPHONE:	510-420-3341
FAX:	510-420-9170
E-MAIL:	tjackson@cambria-env.com
LAB USE ONLY	

TURNAROUND TIME (BUSINESS DAYS): ☑ 10 DAYS ☐ 5 DAYS ☐ 72 HOURS ☐ 48 HOURS ☐ 24 HOURS ☐ LESS THAN 24 HOURS

☐ LA - RWQCB REPORT FORMAT ☐ UST AGENCY: ______

GC/MS MTBE CONFIRMATION: HIGHEST ______ HIGHEST per BORING ______ ALL ______

SPECIAL INSTRUCTIONS OR NOTES: CHECK BOX IF EDD IS NOT NEEDED ☑

Please report in ppmv

REQUESTED ANALYSIS

LAB USE ONLY	Field Sample Identification	Sampling Date	Sampling Time	Matrix	No. of Cont.	TPH - Purgeable	TPH - Extractable (8015m)	BTEX	MTBE (EPA 8260B)	TBA	5 Oxygenates	1,2 DCA and EDB	Ethanol	Methanol	VOCs by 8260B	Semi-Volatiles by 8270C	Lead ☒ Total ☐ STLC ☐ TCLP	LUFTS ☐ Total ☐ STLC ☐ TCLP	CAM17 ☐ Total ☐ STLC ☐ TCLP	Test for Disposal (see attached)						FIELD NOTES: Container/Preservative or PID Readings or Laboratory Notes
	mw-1-C	7/27/04	0500	Air	1	X		X	X																	7K tedlar bag
	mw-1-O	7/27/04	1400	Air	1	X		X	X																	8K T2 OLMOALS

TEMPERATURE ON RECEIPT C°: 26°

Relinquished by: (Signature)	Received by: (Signature)	Date	Time
Dayton Busch	Secure Location	7/27/04	1430
[signature]	Rodney [signature]	7/27/04	15:20
Rodney [signature]	[signature]	7/27/04	17:00

DISTRIBUTION: White with final report, Green to File, Yellow and Pink to Client.

G:\Oakland 2120 Montana\Remediation\SVE Interim Remediation July04\[SVE Test COC July04.xls]STL

10/16/00 Shell Revision
10/20/03 Cambria Revision

SEVERN TRENT STL

Submission#: 2004-07-0824

Cambria Environmental Emeryville

August 02, 2004

5900 Hollis Street, Ste. A
Emeryville, CA 94608

Attn.: Trey Jackson

Project#: 246-0733
Project: 98995740
Site: 2120 Montana St, Oakland

Attached is our report for your samples received on 07/28/2004 14:30
This report has been reviewed and approved for release. Reproduction of this report is permitted only in its entirety.

Please note that any unused portion of the samples will be discarded after 09/11/2004 unless you have requested otherwise.
We appreciate the opportunity to be of service to you. If you have any questions,

You can also contact me via email. My email address is: mbrewer@stl-inc.com

Sincerely,

Melissa Brewer

Melissa Brewer
Project Manager

SEVERN TRENT STL

Submission: 2004-07-0824

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville

Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/28/2004 14:30

Site: 2120 Montana St, Oakland

Samples Reported

Sample Name	Date Sampled	Matrix	Lab #
MW-1-E	07/28/2004 07:00	Air	1
MW-1-F	07/28/2004 13:30	Air	2

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville

Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/28/2004 14:30

Site: 2120 Montana St, Oakland

Prep(s):	5030B	*Test(s):*	8260B
Sample ID:	**MW-1-E**	Lab ID:	2004-07-0824 - 1
Sampled:	07/28/2004 07:00	Extracted:	7/30/2004 11:55
Matrix:	Air	QC Batch#:	2004/07/30-1D.64

Analysis Flag: o (See Legend and Note Section)

Compound	Conc.	RL	Unit	Dilution	Analyzed	Flag
Gasoline	4300	70	ppmv	5.00	07/30/2004 11:55	
Benzene	18	1.6	ppmv	5.00	07/30/2004 11:55	
Toluene	64	1.3	ppmv	5.00	07/30/2004 11:55	
Ethylbenzene	7.8	1.2	ppmv	5.00	07/30/2004 11:55	
Total xylenes	100	1.2	ppmv	5.00	07/30/2004 11:55	
Methyl tert-butyl ether (MTBE)	24	0.70	ppmv	5.00	07/30/2004 11:55	
Surrogate(s)						
1,2-Dichloroethane-d4	106.0	76-130	%	5.00	07/30/2004 11:55	
Toluene-d8	105.3	78-115	%	5.00	07/30/2004 11:55	

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville

Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/28/2004 14:30

Site: 2120 Montana St, Oakland

Prep(s):	5030B	Test(s):	8260B
Sample ID:	**MW-1-F**	Lab ID:	2004-07-0824 - 2
Sampled:	07/28/2004 13:30	Extracted:	7/30/2004 14:41
Matrix:	Air	QC Batch#:	2004/07/30-1B.62

Analysis Flag: o (See Legend and Note Section)

Compound	Conc.	RL	Unit	Dilution	Analyzed	Flag
Gasoline	12000	140	ppmv	10.00	07/30/2004 14:41	
Benzene	42	3.1	ppmv	10.00	07/30/2004 14:41	
Toluene	130	2.6	ppmv	10.00	07/30/2004 14:41	
Ethylbenzene	19	2.3	ppmv	10.00	07/30/2004 14:41	
Total xylenes	240	2.3	ppmv	10.00	07/30/2004 14:41	
Methyl tert-butyl ether (MTBE)	52	1.4	ppmv	10.00	07/30/2004 14:41	
Surrogate(s)						
1,2-Dichloroethane-d4	108.6	76-130	%	10.00	07/30/2004 14:41	
Toluene-d8	91.9	78-115	%	10.00	07/30/2004 14:41	

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville

Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/28/2004 14:30

Site: 2120 Montana St, Oakland

Batch QC Report

Prep(s): 5030B — Test(s): 8260B

Method Blank — **Water** — **QC Batch # 2004/07/30-1B.62**

MB: 2004/07/30-1B.62-009 — Date Extracted: 07/30/2004 13:08

Compound	Conc.	RL	Unit	Analyzed	Flag
Gasoline	ND	50	ug/L	07/30/2004 13:08	
Methyl tert-butyl ether (MTBE)	ND	0.5	ug/L	07/30/2004 13:08	
Benzene	ND	0.5	ug/L	07/30/2004 13:08	
Toluene	ND	0.5	ug/L	07/30/2004 13:08	
Ethylbenzene	ND	0.5	ug/L	07/30/2004 13:08	
Total xylenes	ND	1.0	ug/L	07/30/2004 13:08	
Surrogates(s)					
1,2-Dichloroethane-d4	107.4	76-130	%	07/30/2004 13:08	
Toluene-d8	102.6	78-115	%	07/30/2004 13:08	

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville

Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/28/2004 14:30

Site: 2120 Montana St, Oakland

Batch QC Report

Prep(s): 5030B — Test(s): 8260B

Method Blank — **Water** — **QC Batch # 2004/07/30-1D.64**

MB: 2004/07/30-1D.64-040 — Date Extracted: 07/30/2004 08:40

Compound	Conc.	RL	Unit	Analyzed	Flag
Gasoline	ND	50	ug/L	07/30/2004 08:40	
Methyl tert-butyl ether (MTBE)	ND	0.5	ug/L	07/30/2004 08:40	
Benzene	ND	0.5	ug/L	07/30/2004 08:40	
Toluene	ND	0.5	ug/L	07/30/2004 08:40	
Ethylbenzene	ND	0.5	ug/L	07/30/2004 08:40	
Total xylenes	ND	1.0	ug/L	07/30/2004 08:40	
Surrogates(s)					
1,2-Dichloroethane-d4	108.2	76-130	%	07/30/2004 08:40	
Toluene-d8	104.2	78-115	%	07/30/2004 08:40	

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville

Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/28/2004 14:30

Site: 2120 Montana St, Oakland

Batch QC Report

Prep(s): 5030B

Test(s): 8260B

Laboratory Control Spike **Water** **QC Batch # 2004/07/30-1B.62**

LCS 2004/07/30-1B.62-008 Extracted: 07/30/2004 Analyzed: 07/30/2004 12:08

LCSD 2004/07/30-1B.62-030 Extracted: 07/30/2004 Analyzed: 07/30/2004 12:30

Compound	Conc. ug/L		Exp.Conc.	Recovery %		RPD	Ctrl.Limits %		Flags	
	LCS	LCSD		LCS	LCSD	%	Rec.	RPD	LCS	LCSD
Methyl tert-butyl ether (MTBE)	28.2	28.1	25	112.8	112.4	0.4	65-165	20		
Benzene	28.8	28.0	25	115.2	112.0	2.8	69-129	20		
Toluene	29.0	29.4	25	116.0	117.6	1.4	70-130	20		
Surrogates(s)										
1,2-Dichloroethane-d4	532	525	500	106.4	105.0		76-130			
Toluene-d8	517	516	500	103.4	103.2		78-115			

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville

Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/28/2004 14:30

Site: 2120 Montana St, Oakland

Batch QC Report

Prep(s): 5030B

Test(s): 8260B

Laboratory Control Spike **Water** **QC Batch # 2004/07/30-1D.64**

LCS 2004/07/30-1D.64-055 Extracted: 07/30/2004 Analyzed: 07/30/2004 07:55

LCSD 2004/07/30-1D.64-018 Extracted: 07/30/2004 Analyzed: 07/30/2004 08:18

Compound	Conc. ug/L		Exp.Conc.	Recovery %		RPD	Ctrl.Limits %		Flags	
	LCS	LCSD		LCS	LCSD	%	Rec.	RPD	LCS	LCSD
Methyl tert-butyl ether (MTBE)	24.9	27.7	25	99.6	110.8	10.6	65-165	20		
Benzene	24.7	24.7	25	98.8	98.8	0.0	69-129	20		
Toluene	27.9	28.8	25	111.6	115.2	3.2	70-130	20		
Surrogates(s)										
1,2-Dichloroethane-d4	501	513	500	100.2	102.6		76-130			
Toluene-d8	541	535	500	108.2	107.0		78-115			

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville

Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/28/2004 14:30

Site: 2120 Montana St, Oakland

Legend and Notes

Analysis Flag

o

Reporting limits were raised due to high level of analyte present in the sample.

STL-San Francisco

1220 Quarry Lane

Pleasanton, CA 94566

(925) 484-1919 (925) 484-1096 fax

SHELL Chain Of Custody Record

88181

Shell Project Manager to be Invoiced:

☑ SCIENCE & ENGINEERING

☐ TECHNICAL SERVICES

☐ CRMT HOUSTON

Karen Petrina

2004-07-0824

INCIDENT NUMBER (S&E ONLY): 9 8 9 9 5 7 4 0

SAP or CRMT NUMBER (TS/CRMT): 1 3 5 6 7 5

DATE: 7/27/04

PAGE: 1 of 1

SAMPLING COMPANY: Cambria Environmental Technology, Inc.

LOG CODE: CETS

ADDRESS: 5900 Hollis Street, Suite A, Emeryville, CA 94608

PROJECT CONTACT (Hardcopy or PDF Report to): Trey Jackson

TELEPHONE: 510-420-3341

FAX: 510-420-9170

E-MAIL: tjackson@cambria-env.com

SITE ADDRESS (Street and City): 2120 Montana St, Oakland

GLOBAL ID NO.: N/A

EDF DELIVERABLE TO (Responsible Party or Designee): N/A

PHONE NO.: N/A

E-MAIL: N/A

CONSULTANT PROJECT NO.: 246-0733

SAMPLER NAME(S) (Print): DAYTON BUSCH

LAB USE ONLY

TURNAROUND TIME (BUSINESS DAYS): ☑ 10 DAYS ☐ 5 DAYS ☐ 72 HOURS ☐ 48 HOURS ☐ 24 HOURS ☐ LESS THAN 24 HOURS

☐ LA - RWQCB REPORT FORMAT ☐ UST AGENCY:

GC/MS MTBE CONFIRMATION: HIGHEST ____ HIGHEST per BORING ____ ALL ____

SPECIAL INSTRUCTIONS OR NOTES: CHECK BOX IF EDD IS NOT NEEDED ☑

Please report in ppmv

REQUESTED ANALYSIS

LAB USE ONLY	Field Sample Identification	SAMPLING DATE	SAMPLING TIME	MATRIX	NO. OF CONT.	TPH - Purgeable	TPH - Extractable (8015m)	BTEX	MTBE (EPA 8260B)	TBA	5 Oxygenates	1,2 DCA and EDB	Ethanol	Methanol	VOCs by 8260B	Semi-Volatiles by 8270C	Lead ☐ Total ☐ STLC ☐ TCLP	LUFTS ☐ Total ☐ STLC ☐ TCLP	CAM17 ☐ Total ☐ STLC ☐ TCLP	Test for Disposal (see attached)						FIELD NOTES: Container/Preservative or PID Readings or Laboratory Notes
	MW-1-E	7/27/04	0700	Air	1	X		X	X																	
	MW-1-F	7/27/04	1030	Air	1	X		X	X																	7K tedlar bag ppmv

TEMPERATURE ON RECEIPT C°: 24°C

Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:
[signature]	SECURE LOCATION	7/27/04	1345
[signature]	[signature]	7/28/04	14:30
[signature]	[signature]	7/28/04	1650

DISTRIBUTION: White with final report, Green to File, Yellow and Pink to Client.

G:\Oakland 2120 Montana\Remediation\SVE Interim Remediation July04\SVE Test COC July04.xls]STL

10/16/00 Revision

10/28/03 Cambria Revision

OAO Graphic (714) 895-5102

SEVERN TRENT STL

Submission#: 2004-07-0856

Cambria Environmental Emeryville

August 05, 2004

5900 Hollis Street, Ste. A
Emeryville, CA 94608

Attn.: Trey Jackson

Project#: 246-0733
Project: 98995740
Site: 2120 Montana St., Oakland

Attached is our report for your samples received on 07/29/2004 15:35
This report has been reviewed and approved for release. Reproduction of this report is permitted only in its entirety.

Please note that any unused portion of the samples will be discarded after 09/12/2004 unless you have requested otherwise.
We appreciate the opportunity to be of service to you. If you have any questions,

You can also contact me via email. My email address is: mbrewer@stl-inc.com

Sincerely,

Melissa Brewer

Melissa Brewer
Project Manager

SEVERN TRENT STL

Submission: 2004-07-0856

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville
Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/29/2004 15:35

Site: 2120 Montana St., Oakland

Samples Reported

Sample Name	Date Sampled	Matrix	Lab #
MW-1-G	07/29/2004 10:00	Air	1
MW-1-H	07/29/2004 14:00	Air	2

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville

Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/29/2004 15:35

Site: 2120 Montana St., Oakland

Prep(s):	5030B	Test(s):	8260B
Sample ID:	**MW-1-G**	Lab ID:	2004-07-0856 - 1
Sampled:	07/29/2004 10:00	Extracted:	7/30/2004 17:38
Matrix:	Air	QC Batch#:	2004/07/30-1D.68

Analysis Flag: o (See Legend and Note Section)

Compound	Conc.	RL	Unit	Dilution	Analyzed	Flag
Gasoline	3700	70	ppmv	5.00	07/30/2004 17:38	
Benzene	17	1.6	ppmv	5.00	07/30/2004 17:38	
Toluene	81	1.3	ppmv	5.00	07/30/2004 17:38	
Ethylbenzene	10	1.2	ppmv	5.00	07/30/2004 17:38	
Total xylenes	130	1.2	ppmv	5.00	07/30/2004 17:38	
Methyl tert-butyl ether (MTBE)	37	0.70	ppmv	5.00	07/30/2004 17:38	
Surrogate(s)						
1,2-Dichloroethane-d4	111.7	76-130	%	5.00	07/30/2004 17:38	
Toluene-d8	97.0	78-115	%	5.00	07/30/2004 17:38	

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville

Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/29/2004 15:35

Site: 2120 Montana St., Oakland

Prep(s): 5030B
Test(s): 8260B
Sample ID: **MW-1-H**
Lab ID: 2004-07-0856 - 2
Sampled: 07/29/2004 14:00
Extracted: 7/30/2004 17:57
Matrix: Air
QC Batch#: 2004/07/30-1D.68
Analysis Flag: o (See Legend and Note Section)

Compound	Conc.	RL	Unit	Dilution	Analyzed	Flag
Gasoline	4700	70	ppmv	5.00	07/30/2004 17:57	
Benzene	18	1.6	ppmv	5.00	07/30/2004 17:57	
Toluene	91	1.3	ppmv	5.00	07/30/2004 17:57	
Ethylbenzene	15	1.2	ppmv	5.00	07/30/2004 17:57	
Total xylenes	180	1.2	ppmv	5.00	07/30/2004 17:57	
Methyl tert-butyl ether (MTBE)	33	0.70	ppmv	5.00	07/30/2004 17:57	
Surrogate(s)						
1,2-Dichloroethane-d4	104.8	76-130	%	5.00	07/30/2004 17:57	
Toluene-d8	95.5	78-115	%	5.00	07/30/2004 17:57	

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville

Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/29/2004 15:35

Site: 2120 Montana St., Oakland

Batch QC Report

Prep(s): 5030B — Test(s): 8260B

Method Blank — **Water** — **QC Batch # 2004/07/30-1D.68**

MB: 2004/07/30-1D.68-054 — Date Extracted: 07/30/2004 13:54

Compound	Conc.	RL	Unit	Analyzed	Flag
Gasoline	ND	50	ug/L	07/30/2004 13:54	
Methyl tert-butyl ether (MTBE)	ND	0.5	ug/L	07/30/2004 13:54	
Benzene	ND	0.5	ug/L	07/30/2004 13:54	
Toluene	ND	0.5	ug/L	07/30/2004 13:54	
Ethylbenzene	ND	0.5	ug/L	07/30/2004 13:54	
Total xylenes	ND	1.0	ug/L	07/30/2004 13:54	
Surrogates(s)					
1,2-Dichloroethane-d4	100.6	76-130	%	07/30/2004 13:54	
Toluene-d8	100.4	78-115	%	07/30/2004 13:54	

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville

Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/29/2004 15:35

Site: 2120 Montana St., Oakland

Batch QC Report

Prep(s): 5030B

Test(s): 8260B

Laboratory Control Spike **Water** **QC Batch # 2004/07/30-1D.68**

LCS 2004/07/30-1D.68-016 Extracted: 07/30/2004 Analyzed: 07/30/2004 13:16

LCSD 2004/07/30-1D.68-035 Extracted: 07/30/2004 Analyzed: 07/30/2004 13:35

Compound	Conc. ug/L		Exp.Conc.	Recovery %		RPD	Ctrl.Limits %		Flags	
	LCS	LCSD		LCS	LCSD	%	Rec.	RPD	LCS	LCSD
Methyl tert-butyl ether (MTBE)	29.9	29.2	25	119.6	116.8	2.4	65-165	20		
Benzene	30.7	27.3	25	122.8	109.2	11.7	69-129	20		
Toluene	32.3	28.4	25	129.2	113.6	12.9	70-130	20		
Surrogates(s)										
1,2-Dichloroethane-d4	434	475	500	86.8	95.0		76-130			
Toluene-d8	493	487	500	98.6	97.4		78-115			

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville

Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/29/2004 15:35

Site: 2120 Montana St., Oakland

Legend and Notes

Analysis Flag

o

Reporting limits were raised due to high level of analyte present in the sample.

STL-San Francisco

SHELL Chain Of Custody Record

98221

1220 Quarry Lane
Pleasanton, CA 94566
(925) 484-1919 (925) 484-1096 fax

Shell Project Manager to be Invoiced:
☑ SCIENCE & ENGINEERING ☐ TECHNICAL SERVICES ☐ GRMT HOUSTON
Karen Petrina

INCIDENT NUMBER (S&E ONLY): 98099574 0
RAP or GRMT NUMBER (TS/GRMT): [redacted] 1357

DATE: 7/29/04
PAGE: 1 of 1

SAMPLING COMPANY: Cambria Environmental Technology, Inc.	LOG CODE: CETS
ADDRESS: 5900 Hollis Street, Suite A, Emeryville, CA 94608	
PROJECT CONTACT (Hardcopy or PDF Report to): Trey Jackson	
TELEPHONE: 510-420-3341	FAX: 510-420-9170
E-MAIL: tjackson@cambria-env.com	
SITE ADDRESS (Street and City): 2120 Montana St, Oakland	GLOBAL ID NO.: N/A
EDF DELIVERABLE TO (Hardcopy or Diskette): N/A	PHONE NO.: N/A
E-MAIL: N/A	CONSULTANT PROJECT NO.: 246-0733
SAMPLER NAME(S) (Print): D. Dayton Dusch	LAB USE ONLY

TURNAROUND TIME (BUSINESS DAYS): ☑ 10 DAYS ☑ 5 DAYS ☐ 72 HOURS ☐ 48 HOURS ☐ 24 HOURS ☐ LESS THAN 24 HOURS

☐ LA - RWQCB REPORT FORMAT ☐ UST AGENCY: _____

GCMS MTBE CONFIRMATION: HIGHEST _____ HIGHEST per BORING _____ ALL _____

SPECIAL INSTRUCTIONS OR NOTES: CHECK BOX IF EDD IS NOT NEEDED ☑

Please report in ppmv

REQUESTED ANALYSIS

LAB USE ONLY	Field Sample Identification	SAMPLING DATE	SAMPLING TIME	MATRIX	NO. OF CONT.	TPH - Purgeable	TPH - Extractable (SD15m)	BTEX	MTBE (EPA 8260B)	TBA	5 Oxygenates	1,2 DCA and EDB	Ethanol	Methanol	VOCs by 8260B	Semi-Volatiles by 8270C	Lead ☐ 1 ☐ 5 ☐ 7DLA	LUFT5 ☐ Total ☐ 5 ☐ 7DLA	CAM17 ☐ Total ☐ 5 ☐ 7DLA	Test for Disposal (see attached)	FIELD NOTES: Container/Preservative or PID Readings or Laboratory Notes
01	MW-1-G	7/29/04	1000	Vapor	1	X		X	X												tedlar bag
02	MW-1-H	7/29/04	1400	Vapor	1	X		X	X												

TEMPERATURE ON RECEIPT C°: 26°

Relinquished by: (Signature)	Through Location.	Date: 7/29/04	Time: 1415
Relinquished by: (Signature)	Received by: (Signature)	Date: 7/29/04	Time: 15:35
Relinquished by: (Signature)	Received by: (Signature)	Date: 7/29/04	Time: 18:00

DISTRIBUTION: White with final report, Green to File, Yellow and Pink to Client.

G:\Oakland\2120 Montana\Remediation\SVE Interim Remediation July04\[SVE Test COC July04.xls]STL

Rev. 6/03: Shell Revision
10/2003 Cambria Revision

OES Graphics (714) 895-5702

SEVERN TRENT STL

Submission#: 2004-07-0910

Cambria Environmental Emeryville

August 13, 2004

5900 Hollis Street, Ste. A
Emeryville, CA 94608

Attn.: Trey Jackson

Project#: 246-0733
Project: 98995740
Site: 2120 Montana St., Oakland

Attached is our report for your samples received on 07/30/2004 14:45
This report has been reviewed and approved for release. Reproduction of this report is permitted only in its entirety.

Please note that any unused portion of the samples will be discarded after 09/13/2004 unless you have requested otherwise.
We appreciate the opportunity to be of service to you. If you have any questions,

You can also contact me via email. My email address is: mbrewer@stl-inc.com

Sincerely,

Melissa Brewer

Melissa Brewer
Project Manager

SEVERN TRENT STL

Submission: 2004-07-0910

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville

Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/30/2004 14:45

Site: 2120 Montana St., Oakland

Samples Reported

Sample Name	Date Sampled	Matrix	Lab #
MW-1-I	07/30/2004 07:00	Air	1
MW-1-J	07/30/2004 14:00	Air	2

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville

Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/30/2004 14:45

Site: 2120 Montana St., Oakland

Prep(s): 5030B
Sample ID: **MW-1-I**
Sampled: 07/30/2004 07:00
Matrix: Air
Analysis Flag: o (See Legend and Note Section)

Test(s): 8260B
Lab ID: 2004-07-0910 - 1
Extracted: 7/30/2004 20:13
QC Batch#: 2004/07/30-1B.62

Compound	Conc.	RL	Unit	Dilution	Analyzed	Flag
Gasoline	6900	140	ppmv	10.00	07/30/2004 20:13	
Benzene	26	3.1	ppmv	10.00	07/30/2004 20:13	
Toluene	92	2.6	ppmv	10.00	07/30/2004 20:13	
Ethylbenzene	18	2.3	ppmv	10.00	07/30/2004 20:13	
Total xylenes	180	2.3	ppmv	10.00	07/30/2004 20:13	
Methyl tert-butyl ether (MTBE)	23	1.4	ppmv	10.00	07/30/2004 20:13	
Surrogate(s)						
1,2-Dichloroethane-d4	105.8	76-130	%	10.00	07/30/2004 20:13	
Toluene-d8	99.8	78-115	%	10.00	07/30/2004 20:13	

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville

Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/30/2004 14:45

Site: 2120 Montana St., Oakland

Prep(s):	5030B	Test(s):	8260B
Sample ID:	**MW-1-J**	Lab ID:	2004-07-0910 - 2
Sampled:	07/30/2004 14:00	Extracted:	7/30/2004 20:35
Matrix:	Air	QC Batch#:	2004/07/30-1B.62

Analysis Flag: o (See Legend and Note Section)

Compound	Conc.	RL	Unit	Dilution	Analyzed	Flag
Gasoline	8500	140	ppmv	10.00	07/30/2004 20:35	
Benzene	27	3.1	ppmv	10.00	07/30/2004 20:35	
Toluene	90	2.6	ppmv	10.00	07/30/2004 20:35	
Ethylbenzene	19	2.3	ppmv	10.00	07/30/2004 20:35	
Total xylenes	170	2.3	ppmv	10.00	07/30/2004 20:35	
Methyl tert-butyl ether (MTBE)	21	1.4	ppmv	10.00	07/30/2004 20:35	
Surrogate(s)						
1,2-Dichloroethane-d4	105.4	76-130	%	10.00	07/30/2004 20:35	
Toluene-d8	94.9	78-115	%	10.00	07/30/2004 20:35	

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville

Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/30/2004 14:45

Site: 2120 Montana St., Oakland

Batch QC Report

Prep(s): 5030B — Test(s): 8260B

Method Blank — **Water** — **QC Batch # 2004/07/30-1B.62**

MB: 2004/07/30-1B.62-009 — Date Extracted: 07/30/2004 13:08

Compound	Conc.	RL	Unit	Analyzed	Flag
Gasoline	ND	50	ug/L	07/30/2004 13:08	
Methyl tert-butyl ether (MTBE)	ND	0.5	ug/L	07/30/2004 13:08	
Benzene	ND	0.5	ug/L	07/30/2004 13:08	
Toluene	ND	0.5	ug/L	07/30/2004 13:08	
Ethylbenzene	ND	0.5	ug/L	07/30/2004 13:08	
Total xylenes	ND	1.0	ug/L	07/30/2004 13:08	
Surrogates(s)					
1,2-Dichloroethane-d4	107.4	76-130	%	07/30/2004 13:08	
Toluene-d8	102.6	78-115	%	07/30/2004 13:08	

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville

Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/30/2004 14:45

Site: 2120 Montana St., Oakland

Batch QC Report

Prep(s): 5030B

Test(s): 8260B

Laboratory Control Spike **Water** **QC Batch # 2004/07/30-1B.62**

LCS 2004/07/30-1B.62-008 Extracted: 07/30/2004 Analyzed: 07/30/2004 12:08

LCSD 2004/07/30-1B.62-030 Extracted: 07/30/2004 Analyzed: 07/30/2004 12:30

Compound	Conc. ug/L		Exp.Conc.	Recovery %		RPD	Ctrl.Limits %		Flags	
	LCS	LCSD		LCS	LCSD	%	Rec.	RPD	LCS	LCSD
Methyl tert-butyl ether (MTBE)	28.2	28.1	25	112.8	112.4	0.4	65-165	20		
Benzene	28.8	28.0	25	115.2	112.0	2.8	69-129	20		
Toluene	29.0	29.4	25	116.0	117.6	1.4	70-130	20		
Surrogates(s)										
1,2-Dichloroethane-d4	532	525	500	106.4	105.0		76-130			
Toluene-d8	517	516	500	103.4	103.2		78-115			

Gas/BTEX/MTBE by 8260B (C6-C12)

Cambria Environmental Emeryville

Attn.: Trey Jackson

5900 Hollis Street, Ste. A
Emeryville, CA 94608
Phone: (510) 420-3341 Fax: (510) 420-9170

Project: 246-0733
98995740

Received: 07/30/2004 14:45

Site: 2120 Montana St., Oakland

Legend and Notes

Analysis Flag

o

Reporting limits were raised due to high level of analyte present in the sample.

STL-San Francisco

1220 Quarry Lane
Pleasanton, CA 94566
(925) 484-1919 (925) 484-1096 fax

SHELL Chain Of Custody Record

8829

Shell Project Manager to be Invoiced:

- ☑ SCIENCE & ENGINEERING
- ☐ TECHNICAL SERVICES
- ☐ CRMT HOUSTON

Karen Petrina

INCIDENT NUMBER (S&E ONLY): 9 8 9 9 5 7 4 0

SAP or CRMT NUMBER (TS/CRMT): 1 3 5 6 7 5

DATE: 7/30/04

PAGE: 1 of 1

SAMPLING COMPANY: Cambria Environmental Technology, Inc.	LOG CODE: CETS	SITE ADDRESS (Street and City): 2120 Montana St, Oakland
GLOBAL ID NO.: N/A		
ADDRESS: 5900 Hollis Street, Suite A, Emeryville, CA 94608	EDF DELIVERABLE TO (Responsible Party or Designee): N/A	PHONE NO.: N/A
E-MAIL: N/A	CONSULTANT PROJECT NO.: 246-0733	
PROJECT CONTACT (Hardcopy or PDF Report to): Trey Jackson	SAMPLER NAME(S) (Print): Dayton Busch	LAB USE ONLY
TELEPHONE: 510-420-3341	FAX: 510-420-9170	E-MAIL: tjackson@cambria-env.com

TURNAROUND TIME (BUSINESS DAYS): ☑ 10 DAYS ☐ 5 DAYS ☐ 72 HOURS ☐ 48 HOURS ☐ 24 HOURS ☐ LESS THAN 24 HOURS

☐ LA - RWQCB REPORT FORMAT ☐ UST AGENCY: ____

GC/MS MTBE CONFIRMATION: HIGHEST ____ HIGHEST per BORING ____ ALL ____

SPECIAL INSTRUCTIONS OR NOTES: CHECK BOX IF EDD IS NOT NEEDED ☑

Please report in ppmv

REQUESTED ANALYSIS

LAB USE ONLY	Field Sample Identification	SAMPLING DATE	SAMPLING TIME	MATRIX	NO. OF CONT.	TPH - Purgeable	TPH - Extractable (8015m)	BTEX	MTBE (EPA 8260B)	TBA	5 Oxygenates	1,2 DCA and EDB	Ethanol	Methanol	VOCs by 8260B	Semi-Volatiles by 8270C	Lead ☐ Total ☐ STLC ☐ TCLP	LUFTS ☐ Total ☐ STLC ☐ TCLP	CAM17 ☐ Total ☐ STLC ☐ TCLP	Test for Disposal (see attached)						FIELD NOTES: Container/Preservative or PID Readings or Laboratory Notes
																										TEMPERATURE ON RECEIPT C° 25
	mw-1-I	7/30	0700	Vapor	1	X		X	X																	BK tedlar bag
	mw-1 5	7/30	1400	Vapor	1	X		X	X																	4K " "

Relinquished by: (Signature)	Received by: (Signature)	Date	Time
Dayton Busch	Secure Location	7/30/04	1410
[signature]	[signature]	7/30/04	1445
[signature]	[signature]	7/30/04	1710

DISTRIBUTION: White with final report, Green to File, Yellow and Pink to Client.

G:\Oakland 2120 Montana\Remediation\SVE\Interim Remediation July04\[SVE Test COC July04.xls]STL

10/16/00 Shell Revision
10/2/03 Cambria Revision

O&D GraphiC (713) 688-9702

ATTACHMENT F

Standard Procedures for Soil Borings

CAMBRIA

STANDARD FIELD PROCEDURES FOR SOIL BORINGS

This document describes Cambria Environmental Technology's standard field methods for drilling and sampling soil borings. 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 Registered Geologist (RG) 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 product saturation percentage,
- Observed odor and/or discoloration,
- Other significant observations (i.e. cementation, presence of marker horizons, mineralogy), and
- Estimated permeability.

Soil Boring and Sampling

Soil borings are typically drilled using hollow-stem augers or hydraulic push technologies. In addition, borings are also advanced by hand auger. In most cases, at least one and one half feet of the soil column is collected for every five feet of drilled depth. However, variances in sampling intervals are approved by the lead regulatory agencies to accommodate project objectives. A soil sample is collected at the soil-ground water interface and at significant lithologic changes. Samples are collected using lined split-barrel or equivalent samplers driven into undisturbed sediments beyond the bottom of the borehole. The vertical location of each soil sample is determined by measuring the distance from the middle of the soil sample tube to the end of the drive rod used to advance the sampler. 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.

Augering 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 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® detector measures volatile hydrocarbon vapor concentrations in the bag's headspace, extracting the vapor through a slit in the plastic bag. GasTech® measurements are used along with the field observations, odors, stratigraphy and ground water 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 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 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.

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. Soil cuttings are transported by licenced waste haulers and disposed in secure, licenced facilities based on the composite analytic results.

Ground water removed during sampling and rinseates are 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 licenced 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.

ATTACHMENT G

Guidance on Use of Soil-Gas Surveys to Assess Vapor Transport to Indoor Air

GUIDANCE ON USE OF SOIL-GAS SURVEYS TO ASSESS VAPOR TRANSPORT TO INDOOR AIR

Soil & Groundwater

EQUILON ENTERPRISES LLC
Shell & Texaco Working Together

INTRODUCTION

Risk-Based Corrective Action (RBCA) has become commonplace in evaluating remediation at leaking underground storage tank (LUST) sites. At many LUST sites, migration of volatile organic compounds (VOCs) from ground water or soil into buildings or other enclosed spaces is a potential exposure pathway (see Figure 1). Soil-gas surveys can provide fundamental data needed to evaluate this pathway and should be included as part of any risk assessment. For example, soil-gas surveys can be used for:

- Tier 1 (screening-level) applications
  - to help identify chemicals of concern and maximum concentrations,
  - to delineate sources and exposure pathways,
  - to detect immediate risks for combustion and human health, and
  - to verify biodegradation hypotheses.
- Tier 2 and Tier 3 (site-specific) evaluations
  - to verify and predict indoor-air concentrations,
  - to quantify rates of vapor intrusion and
  - to establish site-specific target levels (SSTLs) for clean up.

The purpose of this report is to provide technical guidance on conducting soil-gas surveys at sites where long-term or chronic vapor intrusion is a concern. The reader is referred to the American Society of Testing and Materials *Standard Guide for Soil Gas Monitoring in the Vadose Zone (ASTM D 5314)* and the Environmental Protection Agency *Expedited Site Assessment Tools for Underground Storage Tank Sites: A Guide for Regulators – Chapter IV (EPA 510-B-97-*.

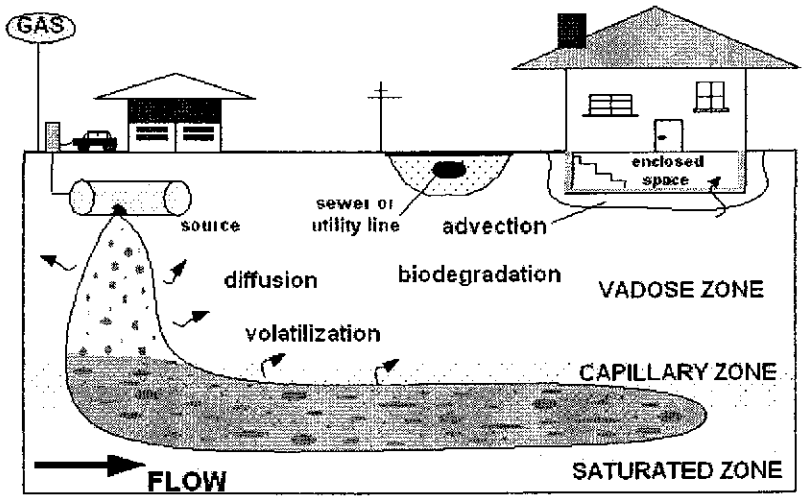


Figure 1. Conceptualization of vapor transport to indoor air at a petroleum-release site.

Table 1. Common ranges of soil-gas concentrations for compounds of environmental interest at 25°C

Compound	Saturated Vapor Concentration (g/L)[1]	Maximum Concentration in Soil Gas (g/L)[2]	Minimum (Screening-Level) Concentration in Soil Gas (Residential) (g/L)[3]	Minimum (Screening-Level) Concentration in Soil Gas (Industrial) (g/L)[3]
benzene	4.0E-01	5.2E-03	9.9E-07	9.9E-05
toluene	1.4E-02	2.8E-03	1.4E-03	1.4E-01
ethylbenzene	5.5E-02	1.2E-03	3.5E-03	3.5E-01
o-xylene	3.8E-02	3.8E-04	1.6E-02	1.6E+00
trichloroethylene	4.6E-01	4.6E-01	4.8E-06	4.8E-04
1,1 dichloroethylene	2.4E+00	2.4E+00	1.6E-07	1.6E-05
1,1,1 trichloroethane	9.4E-01	9.4E-01	3.5E-03	3.5E-01
tetrachloroethylene	1.5E-01	1.5E-01	1.4E-05	1.4E-03

[1]Calculated from ideal gas law.

[2]Calculated by assuming the following mole fraction composition for gasoline: benzene – 1.3%, toluene -- 20%, ethylbenzene --3%, and o-xylene – 1%.

[3]Calculated using the Johnson and Ettinger (1991) model assuming chemical, building, and soil parameters defined by the U.S. Environmental Protection Agency (1997).

001) for more detailed discussions of soil-gas surveys and various methodologies. This report does not evaluate cases where high concentrations of vapors are present in enclosed spaces (e.g., utility, sewer, and dry-well conduits) that pose flammability and/or acute health risks. These cases typically require immediate attention and response.

THEORETICAL PRINCIPLES

Transport of VOCs to indoor air is a complex phenomenon involving partitioning, migration, and biodegradation (see Figure 1).

- ***Partitioning:*** The potential for vapor migration to indoor air is greatest for compounds that strongly partition to the gaseous phase. Partitioning of a compound to the gaseous-phase is defined by Raoult's Law (gaseous/immiscible phase partitioning) and Henry's Law (gaseous/aqueous phase partitioning), which, in turn, is defined by the vapor pressure and solubility of a compound, which are temperature and pressure dependent. At LUST sites, benzene, trichloroethylene, 1,1 dichloroethylene, 1,1,1 trichloroethane, and tetrachloroethylene are potential chemicals of concern due to their high source concentrations, vapor pressures, Henry's Laws, and human toxicities (see Table 1).

- ***Migration:*** Migration of VOCs to indoor air is governed by gaseous-phase advection and gaseous-phase diffusion. Gaseous-phase advection, caused by pressure gradients near foundation walls, is the more dominant migration mechanism near the receptor. Gaseous-phase diffusion, caused by concentration gradients between the source and the receptor, is the more dominant migration mechanism away from the receptor. The magnitude of these mechanisms is dependent upon soil type, source concentration, and building characteristics. Seasonal effects, including the presence of a frost layer and variations in soil moisture content, water table elevation, barometric pressure, and biodegradation rate, can also affect rate of vapor intrusion. Vapors will tend to migrate toward areas of lower pressure and concentration and along paths of least resistance (e.g., backfill materials surrounding sewer and utility lines, tree roots, or drains and cracks in basement foundations).

- ***Biodegradation:*** Depending on substrate (VOC), electron acceptor (e.g., oxygen -- O_2), and nutrient conditions, biodegradation can also play a significant role in limiting transport to indoor air, especially for benzene and other biodegradable petroleum compounds. This mechanism, however, is not considered in most risk assessments.

APPROACH

The following approach is intended to serve as guidance for conducting soil-gas surveys at LUST sites where vapor transport to indoor air is a potential exposure pathway. The actual approach that is taken will depend on site-specific conditions, project confidence, and available resources.

The approach for conducting a soil-gas survey is divided into four phases:

- Phase I: Method Selection and Sampling Design,
- Phase II: Borehole Development and Soil Sampling,

- Phase III: Probe Construction and Installation
- Phase IV: Sample Collection, and
- Phase V: Analysis.

Phase I: Method Selection and Sampling Design

The two principal methods applied in soil-gas surveying are active and passive. Selection of an appropriate method depends on the site-assessment objectives.

- ***Active Sampling:*** Active sampling is a technique that involves collecting a whole air (grab) sample by induction of air flow either directly into an analytical instrument (detector) or into a gas-tight container for subsequent analysis. Active sampling is performed at fixed or temporary locations and generally is generally more costly than passive sampling. The active method provides quantitative real-time data and is recommended for risk assessment.

- ***Passive Sampling:*** Passive sampling is used primarily for qualitative (field screening) purposes. Soil-gas samples are collected in sorbent cartridges or flux chambers without induction of air flow. The sample is retrieved at a later date for analysis. Passive sampling is not recommended for risk assessment because soil-gas concentrations can not be directly measured.

The design of a soil-gas sampling system requires fundamental knowledge of source location, soil stratigraphy, and potential exposure pathways. These data can be determined through reconnaissance sampling using a Geoprobe® and on-site soil-gas analyses (see Table 2) or during soil sampling (see Phase II: Borehole Development and Soil Sampling). To characterize the soil-gas pathway, soil-gas probes are generally placed between the source (soil or ground-water plume) and the receptor (building foundation). It is often advantageous to maximize the number of soil-gas probes placed in this region because of the minimal cost and effort required for additional probe installation.

- ***Vertical Sampling***: Soil-gas probes should be placed in nests (clusters) approximately 2 to 3 ft apart in shallow vadose zone systems (< 10 ft) and 3 - 5 ft apart in deeper systems according to the configuration shown in Figure 2. Particular attention (closer spacing) should be given to regions near the source and near the receptor. If soil layers with significantly different permeabilities are present, probes should be placed within the higher permeability soil units without regard to depth. These units will act as preferential pathways for vapor migration. This practice requires greater effort and expense than fixed-interval installation because the presence, thickness, and depth of target soil horizons, needs to be known *apriori*. It is therefore important to examine boring logs and conduct soil sampling to identify soil strata, perched water and clay lenses, buried structures, and recently disturbed soils or backfills. At sites where the source is present in ground water, placement of 1 - 2 soil-gas probes below the water table is often beneficial. These probes can provide more accurate water-table concentration data than conventional monitoring wells, which are typically screened over greater lengths (2 – 20 ft). In addition, these probes can provide additional soil-gas data during periods of low water-table elevation.

- ***Areal Sampling:*** The areal distribution of soil-gas probe nests depends on the purpose of the soil-gas investigation. For general mapping purposes, probe nests should be positioned approximately 15 - 30 ft apart in a grid pattern. Probe nests should be spaced at closer intervals (3 – 6 ft) if targeting an exposure pathway, such as near a building foundation, storage tank, or transfer conduit (sewer lines, trenches, utility vaults, pipelines and other preferential pathways). Two or more probe nests are recommended for most site assessments, even if the vapor pathway is considered well defined.

- ***Repeated Sampling:*** Short-term effects, such as changes in barometric pressure, water table elevation, moisture content and long-term effects, such as biodegradation and changes in source strength, can result in the appearance or disappearance of certain compounds from soil-gas over time. Depending on compound and soil type, distance from the source, and relative age of the release, response times can range from hours to days for short-term effects and from months to years for long-term effects. Repeated sampling provides a means to assess these temporal variabilities.

- ***Sampling Following Precipitation Events and Probe Installation:*** Because the effect of recharge on soil-gas concentrations is still uncertain, soil-gas sampling is not recommended within 2 – 3 days of a precipitation event. In addition, soil-gas sampling should be conducted no earlier than 3 – 4 weeks following probe

Table 2. Comparison of commonly employed analytical methods

Instrument	Compounds Detected	Detection Limits	Data Quality Level	Advantages	Limitations
Detector tubes	Aliphatics and aromatics, alcohols, inorganics	0.1 – 8,000 ppm	1A/1B	Inexpensive Easy to use Provides immediate results Compound specific	Low sensitivity (mainly for screening purposes) Cross-contamination by other compounds Affected by humidity, sample flow rate, temperature extremes, storage conditions and shelf life
Portable Photoionization Detector (PID)	Aromatics (e.g., BTEX), some aliphatics, less methane	1 - < 300 ppm	1A/1B	Inexpensive Easy to use Provides immediate results	No inorganic analyses Low sensitivity (mainly for screening purposes) Inconsistent readings Can not detect methane (CH_4) and thus may produce false low readings when CH_4 concentrations exceed 1 % Instrument response can be affected by high relative humidity(> 90%), dust, temperature (< 0°C), and electrical currents (power lines)
Portable Flame Ionization Detector (FID)	Aliphatics (e.g., butane), less sensitive to aromatics (e.g., BTEX)	1 - > 1,000 ppm	1A/1B	Inexpensive Easy to use Provides immediate results	Low sensitivity (mainly for screening purposes) Inconsistent readings High CO_2, low O_2 (<15 %) Requires a hydrogen source and more training than PID High flow rates (~ 2L/min) needed for analysis Instrument response can be affected by wind and temperature (< 0°C) High CH_4 concentrations may be interpreted as contamination
Portable Explosivity Detector (ED)	Combustible gas mixture (gasoline, O_2, and CH_4)	> 100 ppm	1A/1B	Inexpensive Easy to use Provides immediate results Less sensitive to environmental effects than PIDs or FIDs	Low sensitivity (mainly for screening purposes)
Portable Gas Chromatograph (GC)	Aromatics and aliphatics, inorganics, and chlorinated compounds	1 ppb – >1,000 ppm	2	More quantitative than typical PIDs and FIDs More easily transported than transportable GCs (no carrier gas – hydrogen, helium) needed Relatively short analysis time (< 10 minutes)	Requires power supply Relatively long analysis time (10 – 60 minutes) Expensive Higher operator training than other portable detectors
Transportable Gas Chromatograph (GC)	Aromatics and aliphatics, inorganics, and chlorinated compounds	1 ppb – >1,000 ppm	2/3	Provides better quantification and identification of compounds than portable GCs High sensitivity Consistent measurements	Requires power supply Relatively long analysis time (10 – 60 minutes) Expensive Higher concentration samples generally require dilution Higher operator training than portable GC
Gas Chromotograph / Mass Spectometry (GC/MS)	Aromatics and aliphatics, total organic vapor, and chlorinated compounds	0.05 ppb - > 1,000 ppm	3	High sensitivity Consistent measurements Provides the highest quality of speciation	Requires power supply Relatively long analysis time (10 – 60 minutes) Expensive

1A – Qualitative (used to detect general presence of VOCs).

1B – Semi-quantitative (used to approximate total VOC contamination within an order of magnitude).

2 – Quantitative.

3 – Highly quantitative.

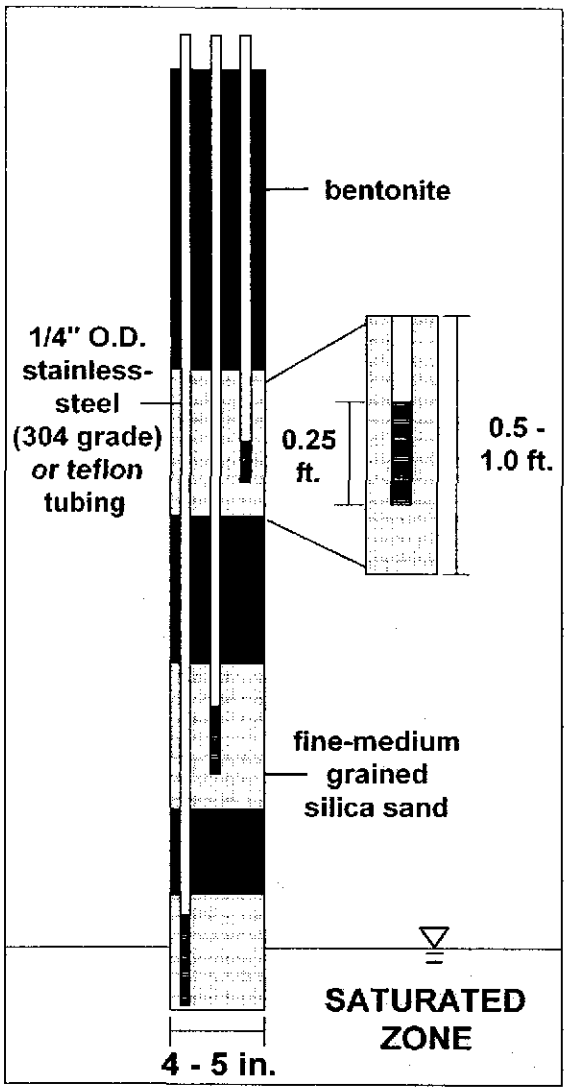


Figure 2. Schematic of vapor-probe nest in augered hole.

installation to allow conditions in the subsurface to reequilibrate.

Phase II: Borehole Development and Soil Sampling

Soil-gas sampling can be achieved from either temporary or fixed sampling locations. Temporary soil-gas sampling is practical for site reconnaissance and field screening, but is not recommended for risk assessment due to the potential for ingress of atmospheric air (dilution). In addition, temporary sampling can conceal temporal variabilities in soil-gas data that are commonly observed at field sites.

- ***Borehole Development:*** Soil-gas probes are can be installed manually by using hand augers or slam bars or mechanically by using rotary augers or direct-push rods (U.S. Environmental Protection Agency, 1997). Manual methods are recommended for probe installation in shallow, unconsolidated vadose zones (< 10 ft.). Mechanical methods are recommended for probe installation in deeper, more consolidated vadose zones or below perched or regional ground-water tables. Use of augers is recommended over direct-push rods for probe installation because augers can create larger diameter boreholes (4 – 5 in.) that can accommodate several additional soil-gas probes (5 - 7) as shown in Figure 2. Regardless of the technique, logging of the borehole (identification of soil layers – depth and thickness) is critical during probe installation so that sampling locations can be properly identified.

- ***Soil Sampling*:** Soil sampling is an essential part of the soil-gas survey. Soil samples should be collected from each distinct (mappable) stratigraphic unit using a stainless-steel soil sampler (barrel, split-spoon, or piston type) that is driven to discrete depths ahead of the auger or direct-push rod. The soil sampler may be driven into the subsurface manually (using a sledgehammer, pneumatic hammer, or slam bar) or mechanically (using a 140 lb. drop hammer attached to a drill rig or Geoprobe®) depending on the vadose-zone thickness, soil type, and degree of consolidation. Each soil sample should be analyzed for:

  - bulk density (American Society for Testing and Materials– ASTM D 2937)
  - specific gravity (American Society for Testing and Materials– ASTM D 854-92)
  - moisture content (American Society for Testing and Materials – ASTM D 2216-90)
  - grain size (American Society for Testing and Materials – ASTM D 422-63)
  - organic carbon content (American Society for Testing and Materials – ASTM E1195-87(1993))

  Bulk density measurements are needed to estimate total porosity, which is used in conjunction with moisture content, to estimate the effective diffusion coefficient, a critical transport parameter (American Petroleum Institute, 1998)[1]. Moisture content measurements and grain size measurements (see

[1]Effective diffusion coefficients can also be determined experimentally either *in situ* (Kreamer et al., 1988; Johnson et al., 1998) or in laboratory column experiments (Fischer et al., 1996; Batterman et al., 1996).

Table 3. Capillary rise in soils based on grain-size (from Lohman, 1972)

Soil Type	Grain Size (mm)	Capillary Rise (cm)
Fine gravel	5	1.5
Very coarse sand	2	4
Coarse sand	0.5	15
Medium sand	0.3	25
Fine sand	0.15	50
Very fine sand	0.075	100
Coarse silt	0.025	300
Fine silt	0.008	750

Table 3) are used for estimating the thickness of the capillary zone. An accurate estimate of the capillary-zone thickness is important because of the sensitivity of vapor transport to this parameter. Grain-size measurements can also be used to estimate air-phase permeabilities (U.S. Environmental Protection Agency, 1995). Likewise, in-situ techniques, such as Baehr and Hult (1988), can be used to estimate air-phase permeabilities. Organic-carbon content measurements are needed to quantify sorption to vadose-zone soils.

Further discussion of soil boring and sampling techniques is provided in the American Society for Testing and Materials *Standard Guide for Soil Sampling in the Vadose Zone (ASTM D 4700)*.

Phase III: Probe Construction (see Figure 2 and Appendix A)

Soil-gas probes can be constructed out of either 0.125 or 0.25 in. O.D. stainless-steel (grade 304) or teflon tubing that is cut to the desired length, slotted at the base (using a hack saw or power drill), and wrapped with stainless steel or fiberglass screening to avoid potential clogging with soil. Stainless steel or teflon are recommended because of their inert chemical properties. As shown in Figure 2, soil-gas probe nests are constructed by placing the probes in fine-medium grained (clean) silica sand layers separated by layers of bentonite. Bentonite layers (seals) can be prepared in the bore hole by pouring in 2 parts coarse-grained (Easy Seal®) bentonite to 1 part water or by injecting a pre-mixed slurry. Each bentonite seal should be pressure tested to avoid short-circuiting (air flow) between probes or the atmosphere. The minimum separation distance between probes is approximately 1 ft; thus, additional boreholes are needed to obtain more fine-scale resolution. Placement of probes below the water table requires pre-casing to maintain an open borehole during probe installation.

Phase IV: Sample Collection

Active soil-gas sampling is conducted by inducing air flow either manually (by using a gas-tight syringe or hand pump) or mechanically (by using a peristaltic pump or SUMMA® canister). Soil-gas samples are collected directly into a sampling container (see Table 4) or from the effluent air stream induced by the sampling pump. Standard operating procedures for SUMMA® canister, tedlar bag, and syringe sampling are provided in the Appendices B, C, and D, respectively.

- ***Purge and Sample Volumes:*** Prior to sample collection, soil-gas probes and auxiliary tubing should be purged with at least 1 system volume. The purge volume should remain consistent for the entire sampling event and should always be reported in field logs. Manual purging using a hand (suction) pump or syringe is preferred over mechanical purging using a vacuum or peristaltic pump because purge volumes can be more accurately controlled, which is especially important when sampling in low permeability soils.

- ***Flow Rates:*** Flow rates on peristaltic pumps and SUMMA® canisters should always be set at a minimum during sample collection to avoid development of significant vacuum pressures (> 10 in. water) which can affect the soil-gas concentration measurement. If vacuum pressures of this magnitude are encountered, sampling should be abandoned or performed periodically at lower flow rates (time integrated). Vacuum pressures should be continuously monitored using pressure gauges arranged in-line (see Appendices B, C, and D), especially in highly saturated or fine-grained, low-permeability soils where higher vacuum pressures can be expected. Vacuum pressures observed during sampling may indicate a clogged or water-saturated probe. Clogged probes can often be unplugged by inserting a small diameter (1/8 in. O.D.) wire down the inside of the probe. Care should be taken, however, to avoid displacing or piercing the screen attached to the base of the soil-gas probe.

- ***Sample Containers (see Table 4):*** Selection of an appropriate sampling container will depend on the holding time (time between sample collection and analysis) and detection limits. In

general, SUMMA® canister and syringe sampling provide more accurate quantification of soil gas concentrations than Tedlar bag sampling and should always be used at sites where low detection levels are desired.

Phase V: Analysis

Various soil-gas analyses are available depending on the survey objectives, budget constraints, and quality assurance/quality control (QA/QC) objectives.

- ***Analytes:*** At LUST sites, VOCs, nitrogen (N_2), O_2, carbon dioxide (CO_2), methane (CH_4), and in some cases, hydrogen sulfide (H_2S) may all be present in soil gas. Their distribution depends on the soil type, stratigraphy, presence of impermeable surface boundaries (e.g., building foundations, asphalt surfaces), and biodegradation. In most risk assessments, identification of the types of VOCs present and their concentration in soil gas is the primary concern. Total VOC concentration data, however, can also be useful for screening level applications. Although not required in most risk assessments, O_2, CO_2, CH_4 and H_2S concentration data can also provide fundamental biodegradation data to help assess vapor intrusion. In particular, these data can be used to verify biodegradation hypotheses, and estimate biodegradation rates (Lahvis and Baehr, 1996). O_2 and CO_2 concentration data can also be used to map VOC plumes (Kerfoot et al., 1988).

- ***Analyses:*** A comparison of commonly employed field analyses is provided in Table 2. In general, the cost associated with each analysis is proportional to the degree of quantification.

- ***Methods:*** Most soil-gas analyses are performed off-site. The following are approved U.S. Environmental Protection Agency methods for laboratory (off-site) soil-gas analyses:

Analytes	Sample Container	Analysis	EPA Method
organics	canister/tedlar bag	GC	TO-3, 12, 14, 14A
organics	canister	GC/MS	TO – 15
organics	sorbent tubes (cartridges)	GC	TO – 1, 2, 17
inorganics*	canister/tedlar bag	GC	Method 3C

*O_2, CO_2, N_2, CH_4, and H_2S

Table 4. Comparison of common soil-gas sampling containers (modified from Mayer, 1989)

Type	Application	Sample Volume	Advantages	Limitations
Glass syringe	Collection of samples for on-site GC analysis Suspected concentrations of COC must generally exceed 10 ppb	25-mL	Inert Allows quick, replicate analysis	Holding times are typically short (< 8 hours) Small sample volume Generally unable to detect VOCs at concentrations < 10 ppb
Sorbent trap	Allows for low-concentration measurements (< 10 ppb)	Variable—depends on VOC concentration	Ease of handling Relatively long holding times (days)	Requires precise sample volume (flow) measurements Requires thermal or solvent desorption Soil-gas moisture can affect analysis Provide only qualitative information if used for passive sampling
Tedlar® bag	Collection of samples for delayed analysis (see U.S. Environmental Protection Agency, 1994)	1 – 25 liters	Bulk loss of sample is readily apparent Sample volume measurement not required	Some container materials may contaminate sample Potential for adsorption to bag walls and leakage to atmosphere limits application for risk assessment Containers are not easily reused
Glass bulb	Collection of samples for delayed analysis	2 mL – 2 L	Inert Allows replicate samples	Easily breakable Expensive Leakage through stopcocks and septa possible Short holding times (< 4 hours)
Stainless-steel (SUMMA®) canisters	Collection of samples for delayed analysis(see U.S. Environmental Protection Agency, 1995)	2 mL – 6 L	Inert and durable Longer sample retention times	Expensive Containers not easily reused Can be difficult to decontaminate

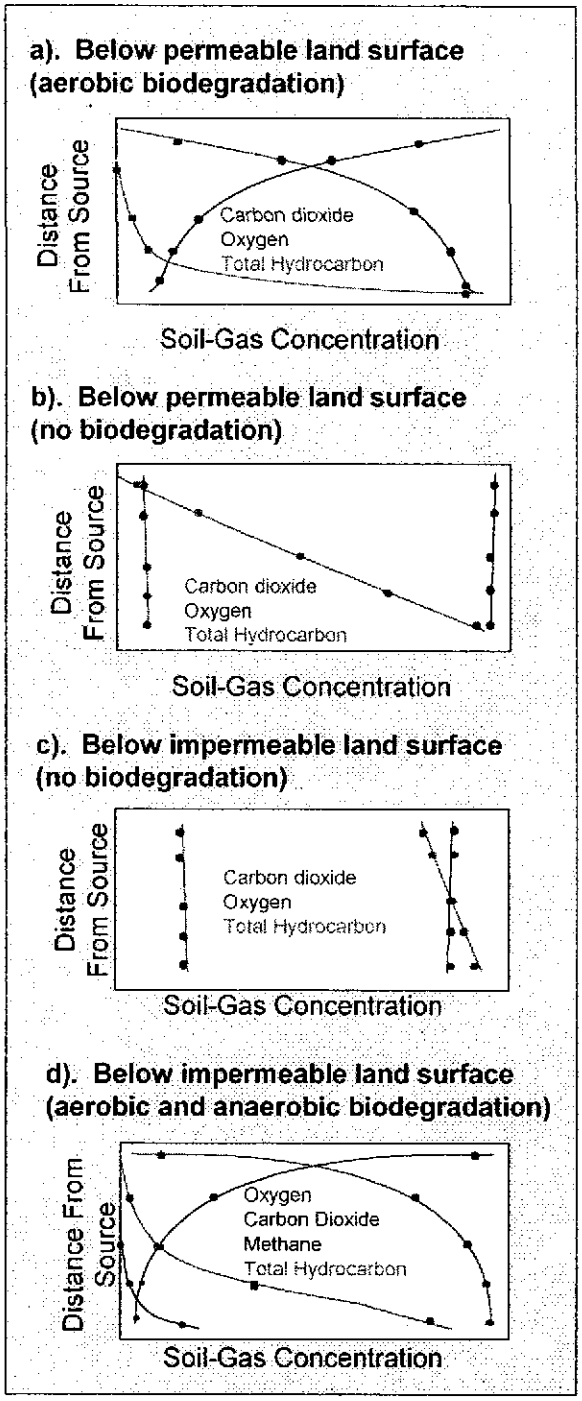


Figure 3. Conceptualization of soil-gas profiles at a petroleum-release site.

- *QA/QC:* QA/QC procedures are an integral part of any soil-gas survey and must be performed to ensure that soil-gas samples are representative of subsurface conditions. The following is a list of some important QA/QC procedures:
  - Sampling should be consistent and completed in a relatively short period of time (hours, days) to reduce effects of temperature, barometric pressure, and recharge on soil-gas transport. Holding times and exposure of sampling containers to direct sunlight should be minimized.
  - Sampling and drilling equipment should be decontaminated between boreholes to prevent cross contamination.
  - All bentonite seals constructed during vapor sampling or probe installation should be pressure tested.
  - Soil-gas samples should be collected outside the zone of contamination to assess background concentrations.
  - All connections and fittings in the sampling line should be leak checked.
  - Field and trip blanks should be used to ensure proper sampling and decontamination procedures. Approximately 1 out of every 10 soil-gas samples should be duplicated to ensure reproducibility of the data.
  - Analytical QA/QC should be routinely performed and include: a multi-point calibration curve generated over the range of anticipated soil-gas concentrations, periodic calibration checks, spike samples to determine percent recovery and aid retention time analysis, and sample blanks.

INTERPRETATION AND APPLICATION

Interpretation

The following are important factors to consider in the interpretation of a soil-gas survey:

- Soil gas-concentrations can be relied upon for risk assessment provided the concentration is approximately steady state. The time required to reach steady state increases as the square of the distance from the source. Soil-gas concentrations measured near the source will therefore reach steady state more quickly (hours-days) than concentrations several meters away (weeks to years).

- Regions where soil-gas concentrations increase or decrease sharply should be identified. Steep concentration gradients will exist in fine-grained or wet soils and in areas of significant (aerobic) biodegradation (see Figures 3a and 3d). VOC concentration gradients will be less steep in regions where O_2 is depleted (< 5%) and/or anaerobic biodegradation (as indicated by the presence of CH_4 or H_2S in soil gas) is occurring (Figures 3b, 3c, and 3d). Anaerobic biodegradation is likely to occur in regions, such as, near the source or beneath impermeable barriers, where O_2 concentrations are low (< 2%) and vapor transport is limited.

Table 5. Evaluation of commonly applied models to assess transport in the vadose zone

Model	Type		Processes Considered									
	Analytical	Numerical	Finite Source	NAPL Partitioning	Non-Equilibrium Partitioning	Gaseous-Phase Diffusion	Gaseous-Phase Advection	Ground-water Infiltration	Sorption	Biodegradation	Soil Layering	Variable Moisture
VLEACH (Ravi and Johnson, 1997)		X	X		X	X		X	X		X	X
R-UNSAT (Lahvis and Baehr, 1997)	X	X	X	X		X		X	X	X	X	X
Little et al. (1992)	X					X	X		X			
Farmer et al. (1980)	X					X			X			
Jury et al. (1983)	X		X			X		X	X	X		
Johnson and Ettinger (1991)	X		X			X	X		X		X	
Johnson et al. (1999)	X		X			X	X		X	X	X	

- VOC concentrations in soil gas can not exceed saturated vapor concentrations for sources present above the water table or the vapor-phase equivalent of the aqueous-phase solubility for sources present in ground water (see Table 1). VOC concentrations in soil gas that approach maximum concentrations likely indicate the presence of a non-aqueous phase liquid (NAPL). Note, however, that the maximum soil-gas concentrations can vary significantly depending on source composition, subsurface temperature, and pressure.

- Placing measured soil-gas concentration data along side vertical cross sections of the subsurface can often facilitate interpretation of the soil-gas concentration data.

Application

Although soil gas surveys are beneficial for initial site-assessment (Tier 1) purposes, soil-gas surveys are primarily used in site-specific (Tier 2) evaluations after risk based screening levels (RBSLs) have been exceeded. For example, soil-gas concentration data can be used to verify indoor-air concentrations, assess long-term vapor intrusion, and establish SSTLs. Transport conditions are assumed to be at or near steady state and biodegradation is typically not considered.

- ***Verifying Indoor-Air Concentrations:*** According to the American Petroleum Institute (American Petroleum Institute, 1998), indoor-air concentrations are approximately one thousandth of the soil-gas concentration immediately adjacent the building foundation. This relation is consistent with published data from field studies conducted by Nazaroff et al. (1987) on radon-gas intrusion and model results from Johnson and Ettinger (1991). However, there are limitations with this assumption. Near-surface soil-gas concentrations and sub-foundation conditions may differ substantially as a result of varying flow conditions around the building foundation and the potential for short-circuiting (atmospheric contamination) in soil-gas samples collected near land surface.

- ***Assessing Long-Term Vapor Intrusion:*** Several mathematical models are available for assessing long-term vapor intrusion (see Table 5). Analytical solutions developed by Farmer et al. (1980), Little et al. (1992), Johnson and Ettinger (1991), and Johnson et al. (1999) are most commonly used for this purpose. Transport models developed by Ravi and Johnson (1997), Lahvis and Baehr (1997), Farmer et al. (1980), and Jury et al (1983) can also be used to assess vapor transport, however, these models do not account for gaseous-phase advection, which may be significant at some field sites.

Reliance on near-surface and sub-foundation soil-gas concentrations to assess long-term impacts is not recommended because these concentrations are typically measured several meters away from the source and, consequently, may not have reached steady state. Soil-gas concentrations measured adjacent the source may be more appropriate for assessing long-term impacts, however, this application requires knowledge of the subsurface geology between the source and the receptor.

- ***Assessing Site-Specific Target Levels (SSTLs):*** Once conditions protective of indoor air (RBSL) have been established, SSTLs can be back-calculated by transport modeling. The SSTL concentration determined by modeling can be directly compared to concentrations in soil gas, or concentrations in soil or groundwater calculated from equilibrium partitioning relations (U.S. Environmental Protection Agency, 1996; American Society for Testing and Materials, 1995).

Other Applications: There are several other applications of soil-gas surveys that are not discussed in this report, which have practical implications for site assessment. These applications include, tracking contaminant plumes in groundwater (Kerfoot, 1988), estimating volatilization rates of hydrocarbon from ground water (Lahvis et al., 1999), predicting mass-loading rates to ground water from sources in the vadose zone (Lahvis and Rehmann, 1999), and quantifying the effectiveness of bioventing applications (Lahvis and Baehr, 1996).

SUMMARY

For soil-gas surveys to be an effective tool in RBCA decision making, care must be taken in the sampling design, sampling process, and, in particular, interpretation of results. Soil-gas survey data should always be supported with site-specific soil and groundwater data as part of a multimedia approach to risk assessment. Lastly, it is important to realize that soil-gas transport is dynamic by nature and may not always be representative of steady-state, long-term conditions.

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