



ENVIRONMENTAL
PROTECTION

98 JUN 23 AM 9: 53

June 22, 1998

Ms. Susan L. Hugo
Alameda County Department of Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502

Re: **Risk-Based Corrective Action**
Shell Service Station
3420 San Pablo Avenue
Oakland, California
WIC # 204-5508-5306
Cambria Project # 240-0554-11

Dear Ms. Hugo:

On behalf of Shell Oil Products Company (Shell), Cambria Environmental Technology, Inc., (Cambria) has reviewed the project files and prepared this risk-based corrective action (RBCA) analysis for the site referenced above. Specifically, the objective of this evaluation was to assess the potential risk that residual hydrocarbons in soil and ground water underlying the site may have on the health and safety of future occupants of the commercial building that is being constructed on site.

INTRODUCTION

This report documents a RBCA analysis performed by Cambria for the site referenced above. Cambria's analysis was based on RBCA guidelines for petroleum release sites set forth by the American Society for Testing and Materials (ASTM E-1739-95¹), and utilized the RBCA Spreadsheet System developed by Groundwater Services, Inc. (GSI, 1995²).

On January 27, 1998, Paul Waite, Peter McKereghan, and Sampath Rangarajan of Cambria met with Susan Hugo and Madhulla Logan of the Alameda County Department of Environmental Health (ACDEH) to discuss the site. At the meeting, it was agreed that Shell would conduct a modified risk-based corrective action (RBCA) analysis to evaluate the potential risk presented by residual hydrocarbons in soil and ground water to the future occupants of the building. Although the preliminary analysis indicated that there should be no significant risk to building occupants, it was also agreed that Shell would install the vapor extraction piping beneath the building to prevent hydrocarbon vapors from accumulating inside of the building if the situation changes. As part of the risk analysis, Cambria would develop ground water site-specific target levels (SSTLs) for site constituents of concern (COCs). If, in

CAMBRIA
ENVIRONMENTAL
TECHNOLOGY, INC.
1144 65TH STREET,
SUITE B
OAKLAND,
CA 94608

PH: (510) 420-0700
FAX: (510) 420-9170

1

ASTM Designation E 1739-95 (Revised December 1996): Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites, American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

2

Tier 2 RBCA: Spreadsheet System and Modeling Guidelines, 1995: Ground water Services, Inc., 2211 Norfolk, Suite 1000, Houston, TX 77098-4044.

the future, COC ground water concentrations in monitoring wells near the building exceed the SSTL concentrations, an assessment of the indoor air COC concentrations may be conducted, and, if necessary, the vapor extraction piping may be used to abate any COC vapors present.

SITE BACKGROUND

The site is a Shell service station undergoing renovation located at the southeast corner of the intersection of 35th Street and San Pablo Avenue in Oakland. Property use in the site vicinity is mixed residential/commercial. Primary surface water bodies in the vicinity of the site are the San Francisco Bay, which is located approximately 1.1 miles west of the site, the Oakland Inner Harbor approximately 2.0 miles south of the site, and Lake Merritt, a tidal lake, approximately 1.4 miles southeast of the site.

The station is currently not in operation. Site renovation activities include replacing product dispensers and piping, grading the site, installing a canopy, and constructing a commercial training center and a retail gasoline station on site (Attachment A). Currently, ground water quality beneath the site is monitored quarterly by nine monitoring wells (six on-site and three off-site wells). Monitoring wells MW-3 and MW-6 were abandoned due to construction activities in December 1997 and will be replaced, as described in Cambria's December 4, 1997, letter to Susan Hugo of ACDEH.

A brief summary of previous soil and ground water investigations at the site is presented below. This information has been compiled from reports by previous consultants, including Ensco Environmental Services, Inc. and Delta Environmental Consultants, Inc. Soil analytical data from previous investigations are presented as Attachment B. Boring logs and geologic cross-sections for the site are included as Attachment C. Ground water analytic data are included as Attachment D.

December 1984 Dispenser Leak: In December 1984, gasoline-saturated soil was discovered beneath the pump island area. A review of inventory records indicated a loss of approximately 2,500 gallons of super unleaded and 1,500 gallons of regular gasoline.

1985 Tanks Replacement: In January 1985, the steel underground storage tanks (USTs) and the product lines were replaced with double-walled fiberglass tanks and double-walled, fiberglass product lines.

1988 Soil Borings: In August 1988, Ensco Environmental Services, Inc., (Ensco) drilled five soil borings (B-1 through B-5) to a maximum depth of 20.5 feet (ft). Total petroleum hydrocarbons as gasoline (TPHg) was detected at a maximum concentration of 1,400 parts per million (ppm) at 5 ft depth in boring B-1, located at the north end of the UST pit. Benzene was also detected at a maximum concentration of 1.9 ppm in this sample (Attachment B).

1989 Monitoring Wells Installation: In April 1989, Delta Environmental Consultants (Delta) of Rancho Cordova, California, drilled and installed four on-site monitoring wells, MW-1 through MW-4. TPHg was

detected at a maximum concentration of 850 ppm at 5.5 ft depth in boring MW-1. The maximum benzene concentration of 1.2 ppm was also detected in this sample. Monitoring well MW-1 is located adjacent to the soil boring B-1, where the maximum TPHg and benzene in soil were previously detected (Attachment B).

1990 Monitoring Wells Installation: In January 1990, Delta drilled and installed five additional monitoring wells, MW-5 through MW-9. Monitoring well MW-5 was drilled to a depth of 26.5 ft below ground surface (bgs) and monitoring wells MW-6 through MW-9 were drilled to depths of 21.5 ft bgs. Monitoring wells MW-5 through MW-8 were located on site, and well MW-9 was located off site to the north, on 35th Street. TPHg was detected at a maximum concentration of 6.1 ppm in soil at 10.5 ft depth in well MW-9. Benzene was detected at a maximum concentration of 0.078 ppm in soil at 5.5 ft depth in well MW-7 (Attachment B).

1991 Monitoring Wells Installation: In October 1991, Delta drilled and installed monitoring wells MW-10 and MW-11 off site. TPHg was detected at a maximum concentration of 1.8 ppm in soil at 10 ft depth in boring MW-10. The maximum benzene concentration of 0.06 ppm was also detected in this soil sample (Attachment B).

1997 Station Renovation: Since mid-1997, the station has been undergoing renovations for subsequent development as a training center and as a retail station. As part of the site renovation, in June 1997, Armer-Norman and Associates of Walnut Creek, California (Armer-Norman), demolished the station building and removed one 550-gallon waste oil UST, and two gasoline dispensers and associated piping. The gasoline USTs were not uncovered during these activities. During the fall of 1997, two residential buildings, located immediately east of the site, were demolished and the entire lot was regraded in preparation for building construction.

1997 Soil Sampling: As presented in Cambria's report dated December 5, 1997, Cambria collected two soil samples from the sidewalls of the waste oil tank pit and ten soil samples from beneath the former dispensers and gasoline product piping on June 26, 1997 (Figure 1). TPHg was detected at a maximum concentration of 120 ppm in sample P-8 at 2.5 ft bgs, which was collected beneath the product piping. The maximum benzene concentration of 0.13 ppm was detected at 2.5 ft depth in piping sample P-1. Maximum concentrations of other constituents detected were: chromium at 38 ppm at 7 ft depth in the waste oil tank pit sample TP-S-7, lead at 2,000 ppm in piping sample P-7-2.0, nickel at 34 ppm in tank pit sample TP-S-7, and zinc at 33 ppm in tank pit sample TP-S-7 (Attachment B).

1998 Construction Activities: Shell is in the process of constructing a new commercial building at the site. During construction of the building, perforated plastic piping was installed beneath the foundation of the building. If necessary and appropriate the piping may be used to remove hydrocarbon vapors, should they accumulate beneath the building.

Soils removed from the lot during grading and footing excavation have been hauled to the Laidlaw facility in Buttonwillow, California, for disposal. These activities will be detailed in a future report to the ACDEH.

SITE CONDITIONS

A summary of site conditions, developed from information presented in previous investigation reports, is presented in the following paragraphs.

Regional Geology and Hydrogeology: The site lies within the East Bay Plain ground water basin. The East Bay Plain basin covers an area of about 114 square miles in Western Alameda County. Unconsolidated deposits consisting of older alluvium, "Merritt Sand", bay mud, interfluvial basin deposits, fluvial deposits, and younger alluvium comprise the ground water reservoir (Hickenbottom and Muir, 1988). Maximum aggregate thickness of these deposits is about 1,100 ft. Bedrock forms the bottom and eastern boundaries of the basin. The older alluvium unit is considered the principal water-bearing zone of the basin. Ground water in this zone is mostly under confined conditions due to the presence of clay and other fine-grained material overlying more permeable sand and gravel units.

Local Geology: The site is underlain by silty clay, sandy clay, and gravelly sand of low to high estimated permeability to the total explored depth of 31.5 ft (Attachment C).

Historic Depth to Ground Water: Ground water beneath the site has ranged from 4 to 13 ft depth and generally flows westward (Attachment D).

Area Well Survey

In December 1988, Delta conducted an area well survey within a 1-mile radius of the site by reviewing the files at the Department of Water Resources (DWR). Delta identified a total of 32 wells within this radius. The nearest municipal well is located about 2,500 northwest of the site. The nearest domestic well is located about 2,500 southwest of the site. Results of the area well survey are included as Attachment E. The City of Oakland receives its potable water supply from the East Bay Municipal Utility District (EBMUD).

RISK ASSESSMENT OBJECTIVES

The need for a RBCA analysis at this site is driven by the presence of residual petroleum hydrocarbon compounds beneath the site. Given the future commercial land use of the site, Cambria analyzed the risk associated with potential exposure of site occupants to the subsurface hydrocarbons under a commercial use scenario.

Accordingly, Cambria's specific objectives for this study were:

- To quantify the potential human health risks posed by chemicals detected beneath the site to future occupants of the new on-site building; and
- If necessary, to define risk-based soil and/or ground water cleanup levels protective of human health as set forth by the State of California and the U.S. Environmental Protection Agency (USEPA).

RISK ASSESSMENT

As previously indicated, Cambria's risk assessment followed RBCA guidelines set forth by ASTM for petroleum release sites. The ASTM RBCA process is summarized below, with specific details of this assessment.

Overview of RBCA Process

The RBCA process is the integration of site assessment, remedial action selection, and monitoring with USEPA-recommended risk and exposure assessment practices. This creates a process by which corrective action decisions are made in a consistent manner that is protective of human health and the environment. The RBCA process is implemented in a tiered approach, involving increasingly sophisticated levels of data collection and analysis. Upon completion of each tier, the results are evaluated and, if warranted, assumptions of the current tier are replaced with site-specific data and the analysis proceeds to the next tier.

In the first of the three tiers (Tier 1), a look-up table is used to develop numerical cleanup goals based on very conservative contaminant transport and exposure assumptions. If this initial conservative screening indicates acceptable risk, the site generally poses little danger to human health and no additional work is necessary. However, if the initial screening shows unacceptable risk levels, then the reviewer may proceed to a more site-specific, less-generalized Tier 2 evaluation to establish a more accurate set of site-specific cleanup guidelines. Similarly, if the Tier 2 evaluation shows unacceptable risk, the reviewer may proceed to a more sophisticated and specific Tier 3. The three tiers are described in detail below.

Tier 1 Evaluation: Cambria first reviews the risk associated with the chemicals of concern (COCs) observed beneath a site by comparing site-specific representative COC concentrations to highly conservative, generic, risk-based screening levels (RBSLs) that are developed from default parameters and equations and a generalized conceptual site model. The Tier 1 process uses simplified equilibria models for COCs, addresses both direct and indirect exposure pathways, and anticipates various potential property use categories (residential and commercial/industrial).

Tier 2 Evaluation: Site-specific target levels (SSTLs) for soil and ground water cleanup are based on site-specific physical soil conditions and points of exposure. Both RBSL and SSTL values represent concentration limits for constituents within the source zone. However, SSTLs differ from RBSLs in the following ways:

- Site-specific data are used to calculate risk-based clean up goals (SSTLs);
- SSTLs are based on the assumption that human exposure to affected media may occur at a separate "point of exposure" (POE), not just at the source zone; and
- The effects of natural attenuation during lateral transport from the source to a downgradient POE are considered in the SSTL calculation; they are not in the RBSL calculations.

Tier 3 Evaluation: A Tier 3 evaluation can be conducted if the reviewer believes that the SSTLs produced by the Tier 2 effort remain unrealistically high. A Tier 3 is a sophisticated site-specific analysis that can incorporate, if necessary, a full range of exposure and toxicological considerations.

Conceptual Site Model

Cambria's approach to performing this risk assessment include developing a conceptual site model (CSM) for the risk assessment, conducting Tier 1 and Tier 2 analyses, and documenting the need, if any, for future corrective action at the site. As the initial step in quantifying the human health risks due to COC exposure, Cambria developed a CSM of COC occurrence, transport, and potential exposure. This CSM is based on review of all available hydrogeologic data for the site. Specifically, Cambria reviewed soil and ground water quality, ground water level, and geologic data. In addition, we evaluated future land use and surface features at the site.

Exposure Pathways and Sensitive Receptors

Because the site will be used for commercial purposes, Cambria assumed a commercial land use scenario on site and a conservative target risk level of 1×10^{-6} . Because hydrocarbons were detected in unsaturated soil and ground water beneath the site, volatilization of COCs from these media were considered complete exposure pathways. Accordingly, Cambria's CSM includes potential exposure of site occupants (outdoor and indoor) to COC emissions from underlying soil and ground water. Complete exposure pathways and the CSM for this site are shown in Figure 2.

Selection of Representative COC Concentrations

COCs in Soil: The historical maximum BTEX soil concentrations were detected nearly ten years ago during the August 1988 site investigation (i.e. 1.9 ppm benzene at 5 ft depth in boring B-1; Attachment B). Assuming natural degradation, we estimate a current corresponding benzene concentration of less

than 0.02 ppm.³ In June 1997, additional soil samples were collected at the site (Figure 1). The maximum benzene concentration detected in these soil samples was 0.13 ppm (Attachment B). Based on the assumed degradation of petroleum hydrocarbons detected in 1988, we considered the maximum concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX) detected in soil samples collected during the most recent (June 1997) sampling event to be representative of site conditions. As shown in Attachment B, no petroleum hydrocarbons or halogenated volatile organic compounds were detected in the two waste oil tank pit samples collected beneath the footprint of the planned new building. Therefore, our use of 1997 maximum BTEX concentrations as representative of conditions beneath the building is conservative.

COCs in Ground Water: Historically, hydrocarbons have been detected in on-site ground water monitoring wells (Attachment D). The planned commercial building will be located on the eastern portion of the site and the footprint of the building will overlie the location of former monitoring wells MW-3 and MW-6 (Figure 1). Therefore, to assess the risk to future occupants of this building, we used the maximum BTEX concentrations detected in these two wells during the past four sampling events (i.e. since January 1997).

Monitoring wells MW-3 and MW-6 were destroyed to facilitate construction of the building (Figure 1). Upon completion of construction, Shell plans to install new monitoring wells to replace MW-3 and MW-6. Future ground water monitoring data from the new wells may be used in conjunction with the SSTLs presented in this RBCA analysis to evaluate the potential risk to future occupants of the building. Our CSM for this evaluation and the summary considerations for the risk assessment are presented in Table 1. A generic CSM flowchart is presented in Figure 2.

³

Assuming first-order decay and a degradation half-life of 730 days (ASTM E 1739-95).

Table 1 - Assumptions for Risk Assessment

Item		Comment
Contaminant Source Media:	Underlying Soil and Ground Water	Residual hydrocarbons have been detected in unsaturated and saturated soils beneath the site and in ground water.
Potential Chemicals of Concern (COC):	BTEX	All chemicals detected in representative samples.
Representative COC Source Concentrations in Unsaturated Soil:	benzene: 0.13 toluene: 1.6 ethylbenzene: 0.38 xylenes: 1.6	Maximum concentrations detected in samples collected in June 1997. Benzene from P-1-2.6 and toluene, ethylbenzene and xylenes from sample Disp-2-2.0 (Attachment B).
Representative COC Source Concentrations in Ground Water:	benzene: 0.5 toluene: 0.11 ethylbenzene: 0.84 xylenes: 2.6	Maximum BTEX concentrations detected in monitoring wells MW-3 and MW-6 during 1997.
Target Carcinogenic Risk Level:	1×10^{-6}	Conservative target risk level, per USEPA, for on-site commercial receptor scenario.
Non-Carcinogenic Hazard Quotient:	1.0	Consistent with ASTM default value.
Benzene Slope Factor:	0.1 (mg/kg/day) ⁻¹	Defined by California EPA.
All concentrations in ppm, equivalent to milligrams per kilogram for soil and milligrams per liter for ground water.		

Tier 1 Analysis

Consistent with the tiered approach adopted by the ASTM RBCA guidelines, Cambria initially quantified the risk associated with the site COCs by performing a Tier 1 evaluation. As outlined in ASTM E-1739-95, the site-specific COC source concentrations are compared to highly-conservative, generic Tier 1 RBSLs, which are based on simplified equations and generalized site conditions. Although a target risk level of 1×10^{-5} is commonly associated with the commercial receptor scenario, we conservatively assumed a more stringent risk level in this RBCA analysis. Table 2 contains the results of our comparison of representative COC source concentrations to Tier 1 RBSLs.

As shown in Table 2, the exposure scenarios exceeding the Tier 1 standards for BTEX compounds are benzene volatilization from both subsurface soil and ground water to indoor air. In addition, the representative benzene soil concentration is nearly equivalent to the Cal-EPA RBSL for benzene volatilization from subsurface soil to outdoor air assuming a 1×10^{-6} target risk level and a commercial receptor scenario; hence, we included this exposure pathway in our Tier 2 analysis. These three scenarios served as the basis for our Tier 2 analysis.

Table 2 - Results of Tier 1 Analysis for BTEX Compounds

Exposure Pathway	Receptor Scenario	Target Risk Level	Representative Concentrations vs. Tier 1		Representative Concentration (in ppm)	Representative Concentration vs. RBSL	
			Applicable RBSL (USEPA)	Cal EPA RBSL		Exceed	Below
Benzene							
Volatilization from soil to outdoor air	Commercial	1x10 ⁻⁶	0.457	0.132	0.13		X
Volatilization from soil to indoor air	Commercial	1x10 ⁻⁶	0.0169	0.005	0.13	X	
Volatilization from ground water to outdoor air	Commercial	1x10 ⁻⁶	18.4	5.34	0.5		X
Volatilization from ground water to indoor air	Commercial	1x10 ⁻⁶	0.0739	0.021	0.5	X	
Toluene							
Volatilization from soil to outdoor air	Commercial	HQ=1	RES	RES	1.6		X
Volatilization from soil to indoor air	Commercial	HQ=1	54.5	54.5	1.6		X
Volatilization from ground water to outdoor air	Commercial	HQ=1	>S	>S	0.11		X
Volatilization from ground water to indoor air	Commercial	HQ=1	85	85	0.11		X

Exposure Pathway	Receptor Scenario	Target Risk Level	Representative Concentrations vs. Tier 1 RBSLs		Representative Concentration (in ppm)	Representative Concentration vs. RBSL	
			Applicable RBSL (USEPA)	Cal EPA RBSL		Exceed	Below
Ethylbenzene							
Volatilization from soil to outdoor air	Commercial	HQ=1	RES	RES	0.38		X
Volatilization from soil to indoor air	Commercial	HQ=1	1,100	1,100	0.38		X
Volatilization from ground water to outdoor air	Commercial	HQ=1	>S	>S	0.84		X
Volatilization from ground water to indoor air	Commercial	HQ=1	>S	>S	0.84		X
Xylenes							
Volatilization from soil to outdoor air	Commercial	HQ=1	RES	>S	1.6		X
Volatilization from soil to indoor air	Commercial	HQ=1	RES	RES	1.6		X
Volatilization from ground water to outdoor air	Commercial	HQ=1	>S	>S	2.6		X
Volatilization from ground water to indoor air	Commercial	HQ=1	>S	>S	2.6		X
<p>All concentrations in ppm; equivalent to milligrams per kilogram for soil and milligrams per liter for water. RBSL = Risk-Based Screening Level. Cal EPA Benzene RBSL = 0.29*(USEPA Benzene RBSL) to account for Cal-EPA benzene slope factor (Table 1). Cal EPA RBSLs and USEPA RBSLs are the same for toxicants (toluene, ethylbenzene, and xylenes). Target Risk Level applicable for carcinogens (benzene). HQ = Hazard Quotient; applicable for toxicants (toluene, ethylbenzene, and xylenes). >S = Selected risk level is not exceeded for all possible dissolved levels of the constituent. RES = Selected risk level is not exceeded for pure compound present at any concentration.</p>							

Tier 2 Analysis

In Cambria's Tier 2 analysis, we re-evaluated the exposure scenarios failing the generic Tier 1 analysis by using site-specific data as input into GSI's RBCA Spreadsheet System. Standard exposure scenarios inherent to the ASTM risk evaluation employ additional conservative assumptions consistent with state and federal guidelines. Risk-related input parameters, such as duration and frequency, are selected to represent the maximally exposed individual and are not an accurate portrayal of time spent at a place of residence or business. The quantitative effect of these uncertainties contributes to overestimation of the overall potential health risk. Because ingestion of ground water beneath the site is not likely, we did not consider this exposure pathway. Our assigned values for key input variables and our justification for use of these values are summarized in Table 3 below and in Attachment F. Results of our calculation of site-specific infiltration rates from precipitation data and soil moisture contents are included in Table A and Table B, respectively. The results of our Tier 2 analysis are summarized in Table 4 and Attachment F.

Table 3 - Assigned Key Parameter Values

Parameter	Units	Default Value	Value Used in Cambria Evaluation	Justification for Use of Value
Depth to Ground Water (DTW)	cm	300	274	Based on the average depth to ground water (9 ft bgs) in on-site monitoring wells (October 1997 quarterly monitoring report, Attachment D).
Total soil porosity (θ_r)	cm ³ /cm ³ of soil	0.38	0.46	Typical for site soils such as clay/silty and sandy clay (Rawls <i>et al.</i> , 1982).
Infiltration rate of water through soil	cm/year	30	20	Based on rainfall data from Berkeley, California and the infiltration equations in the HELP Model (Schroeder <i>et al.</i> , 1994) (Table A).
Volumetric water Content (θ_w)	cm ³ -water/cm ³ -soil	0.12	0.38	Calculated from the USEPA equation and the infiltration rate (Soil Screening Guidance, USEPA, 1996) (Table B).
Air content in the vadose zone (θ_a)	cm ³ -air/cm ³ -soil	0.26	0.08	Difference of total porosity (θ_r) and the volumetric water content (θ_w) of soil.
Areal crack fraction in building foundation/walls	cm ² -cracks/cm ² -total area	0.01	0.001	Standard for a new commercial building (TAC, 1997).
Enclosed space air exchange rate	1/second (1/hour)	0.00023 (0.8)	0.0011 (4)	Based on specifications of the proposed on-site commercial building. Typical values range between 2 and 4 exchanges per hour. Value of 4/hour used in this assessment ⁽¹⁾ .
Enclosed space foundation thickness	cm	15	13.6	Based on proposed building specifications. Concrete slab thickness for the building is about 5 inches ⁽²⁾ .
USEPA, OSWER, May 1996, Technical Background Document for Soil Screening Guidance. Rawls <i>et al.</i> , Estimating soil water properties, Transaction ASAE, vol 25, No. 5, pages 1316-1320, and 1328. Schroeder <i>et al.</i> , 1994 HELP; Hydrologic Evaluation of Landfill Performance Model, Version 3, U.S. Army Corps of Engineers. Technical Advisory Committee (TAC), 1997. Oakland Urban Redevelopment Program. (1) Air exchange rates and (2) slab thickness information per Robert H. Lee and Associates; Architects for the proposed commercial building, 1997.				

Table 4 - Results of Tier 2 Analysis for Benzene

Exposure Pathway	Receptor Scenario	Target Risk Level	Representative Concentrations vs. Tier 2 SSTL		Representative Concentration (in ppm)	Representative Concentration vs. SSTL	
			Applicable SSTL (USEPA)	Cal EPA SSTL		Exceed	Below
Volatilization from soil to outdoor air on site	Commercial	1x10 ⁻⁶	27	7.83	0.13		X
Volatilization from soil to indoor air on site	Commercial	1x10 ⁻⁶	3.4	0.98	0.13		X
Volatilization from ground water to indoor air on site	Commercial	1x10 ⁻⁶	7.2	2	0.5		X

All concentrations in ppm; equivalent to mg/kg for soil and mg/L for ground water.
 Representative concentrations are 95% UCL on the mean value.
 SSTL = Site-specific target level.
 Cal-EPA SSTL (for benzene) = USEPA SSTL*0.29 to account for Cal-EPA benzene slope factor (Table 1)
 RES = Selected risk level is not exceeded for pure compound present at any concentration.

As shown below in Table 5, the risk associated with potential exposure to the site-specific benzene source concentration is significantly less than the target risk level set forth by the USEPA.

Table 5 - Comparison of Risk Levels

Exposure Scenario	Calculated Risk Level	Target Risk Level	Result
Volatilization of benzene from soil into on-site outdoor air	2x10 ⁻⁹	1 x 10 ⁻⁶	Potential health risk associated with site-specific source concentration is below target risk level.
Volatilization of benzene from soil to on-site commercial building	1x10 ⁻⁷	1x10 ⁻⁶	Potential health risk associated with site-specific source concentration is below target risk level.
Volatilization of benzene from ground water to on-site commercial building	3x10 ⁻⁷	1x10 ⁻⁶	Potential health risk associated with site-specific source concentration is below target risk level.

DISCUSSION

Consistent with ASTM standards, Cambria's risk assessment employed a conservative approach to mathematical formulation and parameter estimation. The effects of both the ASTM process and our parameter value selections on our conclusions are discussed below.

Inherent Conservatism of ASTM Model

Fate and Transport Modeling: The GSI RBCA Spreadsheet System used by Cambria employs a series of simplified fate and transport models for predicting COC concentrations at points of exposure. The simplified analytic nature of these models often result in over-estimated COC exposure point concentrations. Hence, use of these models may result in over-estimation of health risks.

Toxicological Data: Several aspects of the toxicological data employed in the ASTM RBCA process contain a high degree of uncertainty that affect estimation of risk and delineation of SSTLs. These uncertainties arise in two primary areas. First, slope factors used in this assessment correspond to the 95% upper confidence levels (UCL) on the low-dose portion of the chemical's dose-response curve, as extrapolated from high-dose human or animal response data using the EPA linearized multistage model (LMS). This assumption means actual risks are likely to be lower than the risk estimates calculated in this assessment.

Second, results of animal studies are often used to predict the potential human health effects of a chemical. Extrapolation of toxicological data from animal tests is one of the largest sources of uncertainty in the human health risk evaluation process. There may be important, but unidentified differences in uptake, metabolism, distribution, and elimination of chemicals between a test species and humans. Animal studies are usually conducted under high-dose conditions, whereas humans are rarely exposed to such high doses. The dose level itself may be responsible for the observed carcinogenic effects. Also, animal lifetimes tend to be less than two years, while assumed human life expectancy is 70 years.

Interpretation of Risk Levels: The excess lifetime cancer risk used to evaluate carcinogenic compounds is often misunderstood. For example, a risk level of one-in-one million (1×10^{-6}) associated with exposure to a particular chemical is often misconstrued as an expectation that one out of a million people exposed to the chemical will be stricken with cancer. In actuality the carcinogenic risk is not an actual risk, but rather a mathematical estimate of potential risk based on conservative scientific assumptions used in the risk assessment process. The Food and Drug Administration (FDA) uses conservative estimates such as this to ensure that the risk is not understated. However, the target risk level varies depending on the exposure scenario being commercial or residential.

Uncertainties Associated with Combinations of Conservative Assumptions: Uncertainties from the various sources discussed above are additive, hence the overall effect of using conservative assumptions in each step of the risk assessment process potentially results in significant overestimation of potential risks/hazards and an underestimation of action levels. Accordingly, evaluation of applicable SSTLs must be viewed with an understanding of the uncertainty and conservatism involved, and how these effect risk estimations. Cambria's evaluation consistently incorporated conservative assumptions for selection of parameters used to calculate risk, while attempting to maintain a reasonable, site-specific evaluation.

SUMMARY

Cambria's Tier 2 risk assessment demonstrates that the risk associated with exposure to hydrocarbons in soil and ground water beneath the new on-site building is acceptable. As shown in Table 4, benzene concentrations in soil and ground water beneath the vicinity of the building are below the Tier 2 California EPA SSTLs.

Ground water monitoring at the site will continue. Shell plans to install new monitoring wells to replace former monitoring wells MW-3 and MW-6, which were destroyed prior to construction of the on-site building (Figure 1). If the concentrations of COCs in ground water from the new monitoring wells exceed the California EPA SSTLs, the site conditions will be re-evaluated and the potential risk to building occupants will be reassessed. As shown in Table 4, the California EPA SSTL for benzene is 2 mg/l. The SSTLs for toluene, ethylbenzene, or xylenes can be calculated, using the Tier 2 methodology presented in this report, if the concentrations of those constituents exceed their Tier 1 California EPA RBSLs (Table 2). As a possible mitigation measure, a vapor extraction system was installed beneath the commercial building to extract hydrocarbon vapors, should they accumulate beneath the structure. If necessary, the vapor extraction system should further reduce the potential risk of hydrocarbon vapor inhalation by indoor occupants.

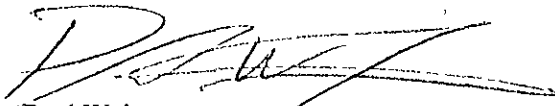
Ms. Susan Hugo
June 22, 1998

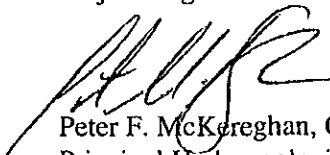
CAMBRIA

CLOSING

Cambria appreciates your continued assistance to this case. Please call Paul Waite at (510) 420-0700 if you have any questions or comments.

Sincerely,
Cambria Environmental Technology, Inc.


Paul Waite
Project Engineer


Peter F. McKereghan, CHG
Principal Hydrogeologist



Figures: 1 - Monitoring Well and Soil Sampling Location Map (June 1997)
 2 - Conceptual Site Model

Tables: Table A - Infiltration Rate Calculation
 Table B - Soil Moisture Calculations

Attachments: A - Figures by Previous Consultants
 B - Soil Analytic Data
 C - Boring Logs and Geologic Cross-Sections
 D - Ground Water Analytic Data
 E - Area Well Survey
 F - Tier 2 RBCA Results

cc: A.E. (Alex) Perez, Shell Oil Products Company, P.O. Box 8080, Martinez, California 94533.
 Ray Newsome, Shell Oil Products Company, P.O. Box 8080, Martinez, California 94533.

G:\OAK3420\RBCA\Rbca.wpd

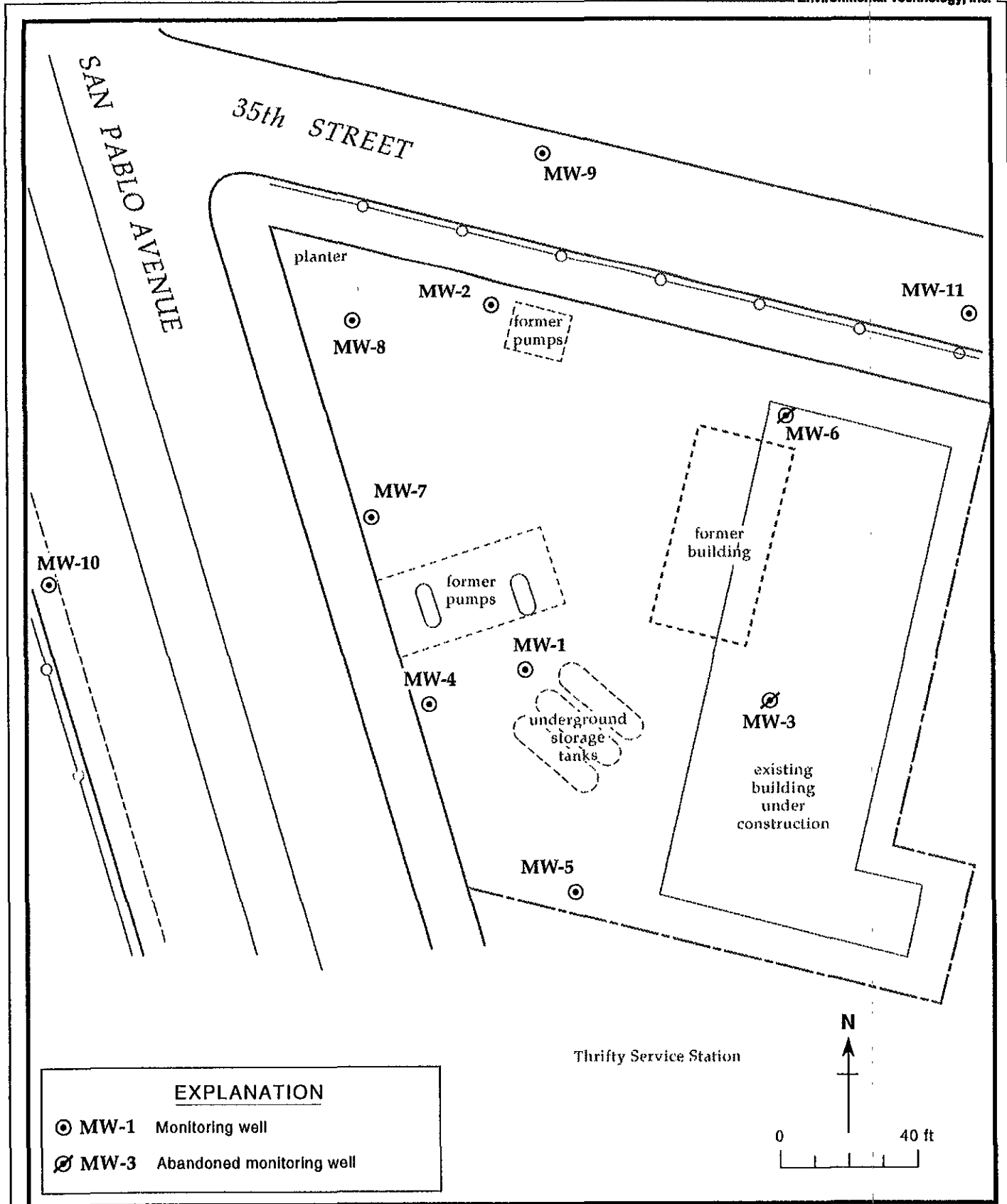


Figure 1. Ground Water Monitoring Well Locations - Shell Service Station, WIC #204-5508-5306, 3420 San Pablo Avenue, Oakland, California

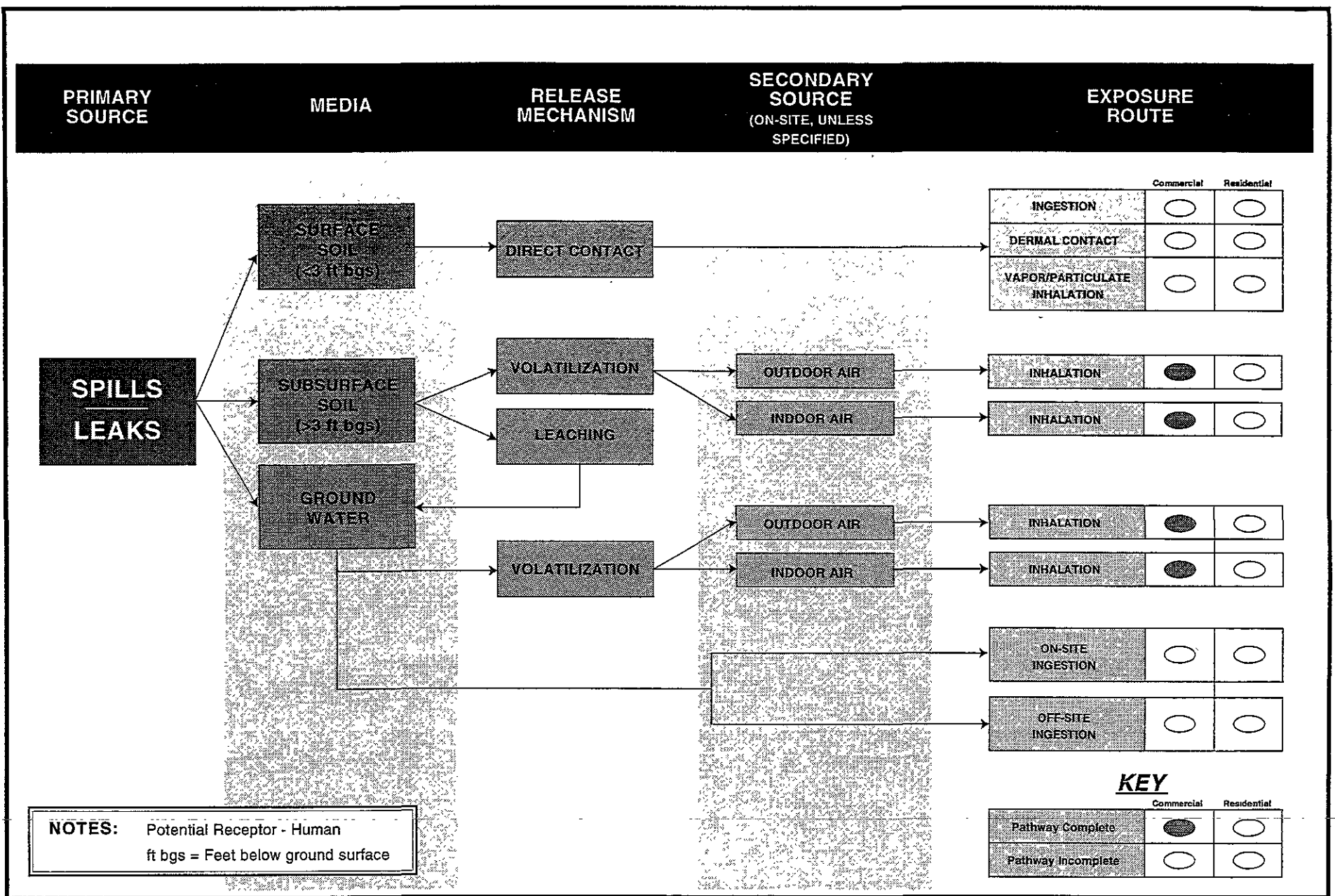


Figure 2. Conceptual Site Model with Exposure Pathways - Shell Service Station WIC # 204-5508-5306, 3420 San Pablo Avenue, Oakland, CA

Table A: Infiltration Rate Calculation

Shell Service Station WIC # 204-5508-5306, 3420 San Pablo Avenue, Oakland, California

Month	Average Precipitation P (in)	Runoff Q (in)	Infiltration I (in)
January	4.71	3.60	1.11
February	3.94	2.86	1.08
March	3.20	2.17	1.03
April	1.72	0.86	0.86
May	0.59	0.09	0.50
June	0.18	0.00	0.18
July	0.04	0.00	0.04
August	0.06	0.00	0.06
September	0.27	0.00	0.27
October	1.26	0.50	0.76
November	2.82	1.82	1.00
December	4.08	3.00	1.08
Yearly Total	22.87	14.90	7.97
Infiltration Rate (in/hr) =	0.00091	= 20.2 cm/year	

Calculations:

Monthly precipitation averages (P) are from records between January 1919 and June 1997 at Berkeley, California

Runoff (Q) calculated by the following equation: $Q = (P - 0.2S)^2 / (P + 0.8S)$ where

P = Precipitation, S = Water retention parameter, calculated by the equation: $S = (1,000/CN) - 10$

$S = 1.11$

CN = the curve number for roads and right of way with moderate runoff potential = 90

Runoff equation valid only when $P > 0.2S$. Else, runoff assumed to be zero.

Infiltration (I) = P - Q

Notes:

Evapotranspiration not considered in the above calculation

References:

(1) Schroeder et al., The Hydrologic Evaluation of Landfill Performance Model, Version 3
EPA/600/R-94/168b, September 1994.

(2) Water Quality Assessment: A Screening Procedure for Toxic and Conventional Pollutants
in Surface and Ground Water - Part I (Revised 1985); EPA/600/6-85/002A

Table B: Soil Parameter Calculation

Shell Service Station WIC # 204-5508-5306, 3420 San Pablo Avenue, Oakland, California

Parameter	Value
Total Porosity (n)	0.46
Infiltration Rate I (cm/year) (Table A)	20.2
Saturated Hydraulic Conductivity (K_{sat}) ⁽¹⁾ (m/year)	18
Constant $1/(2b+3)$ for clay/silty clay ⁽²⁾	0.042
Moisture Content (M.C.)	0.38
Air Content (A.C.)	0.08

Notes

Saturated hydraulic conductivity calculated as the average value for clay/silty and sandy clay (see VADSAT reference below)

Constant $1/(2b+3)$ for clay/silty and sandy clay soils (see USEPA Reference below)

Calculations:

Moisture Content calculated by the following equation (USEPA reference cited below):

$$M.C. = n(I/K_{sat})^{1/(2b+3)}$$

Air content calculated by the following equation

$$A.C. = (n - M.C.)$$

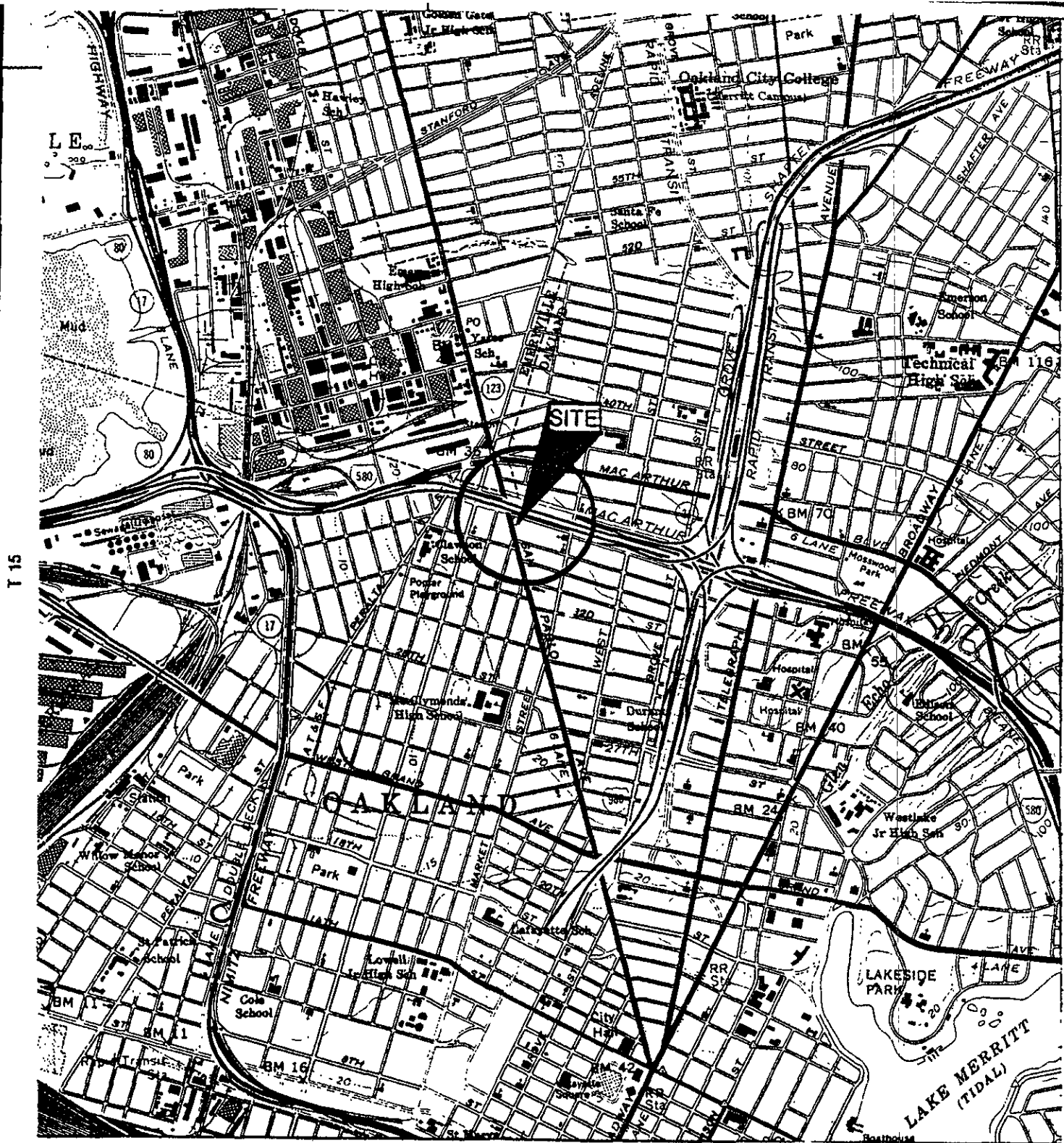
References:

(1) API, 1994: VADSAT: A Monte Carlo Model for Assessing the Effect of Land-Disposal Exploration and Production Wastes on Groundwater Quality

(2) USEPA, 1996: Soil Screening Guidance: Technical Background Document

Attachment A

Figures by Previous Consultants



T 15

R 4 W

GENERAL NOTES:
 BASE MAP FROM U.S.G.S.
 OAKLAND WEST, CA.
 7.5 MINUTE TOPOGRAPHIC
 SCALE 1 : 24,000'



SCALE



QUADRANGLE LOCATION

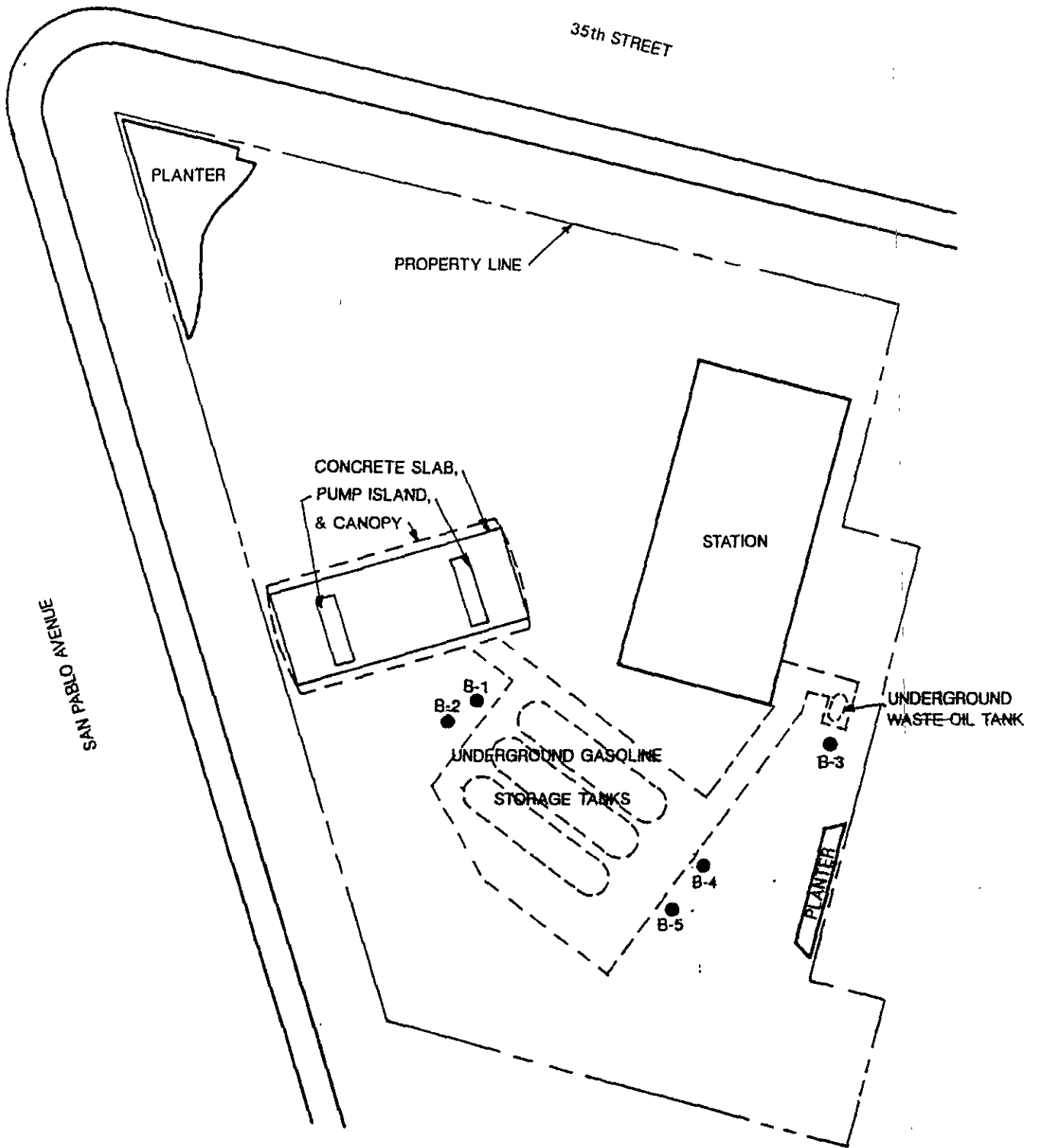


Delta
 Environmental
 Consultants, Inc.

FIGURE 1
 SITE LOCATION MAP
 3420 SAN PABLO AVENUE
 OAKLAND, CA.

JOB NO. 40-88-666	DRAWN BY: <i>CLM</i> 1-6-89
	CHK BY:

120866



LEGEND:

● B-1 SOIL BORING LOCATION



SCALE



Delta
Environmental
Consultants, Inc.

FIGURE 2
SITE MAP

3420 SAN PABLO AVENUE
OAKLAND, CA.

JOB NO. 40-88-666	DRAWN BY: <i>CPM</i> 1-5-89
	CHK. BY:

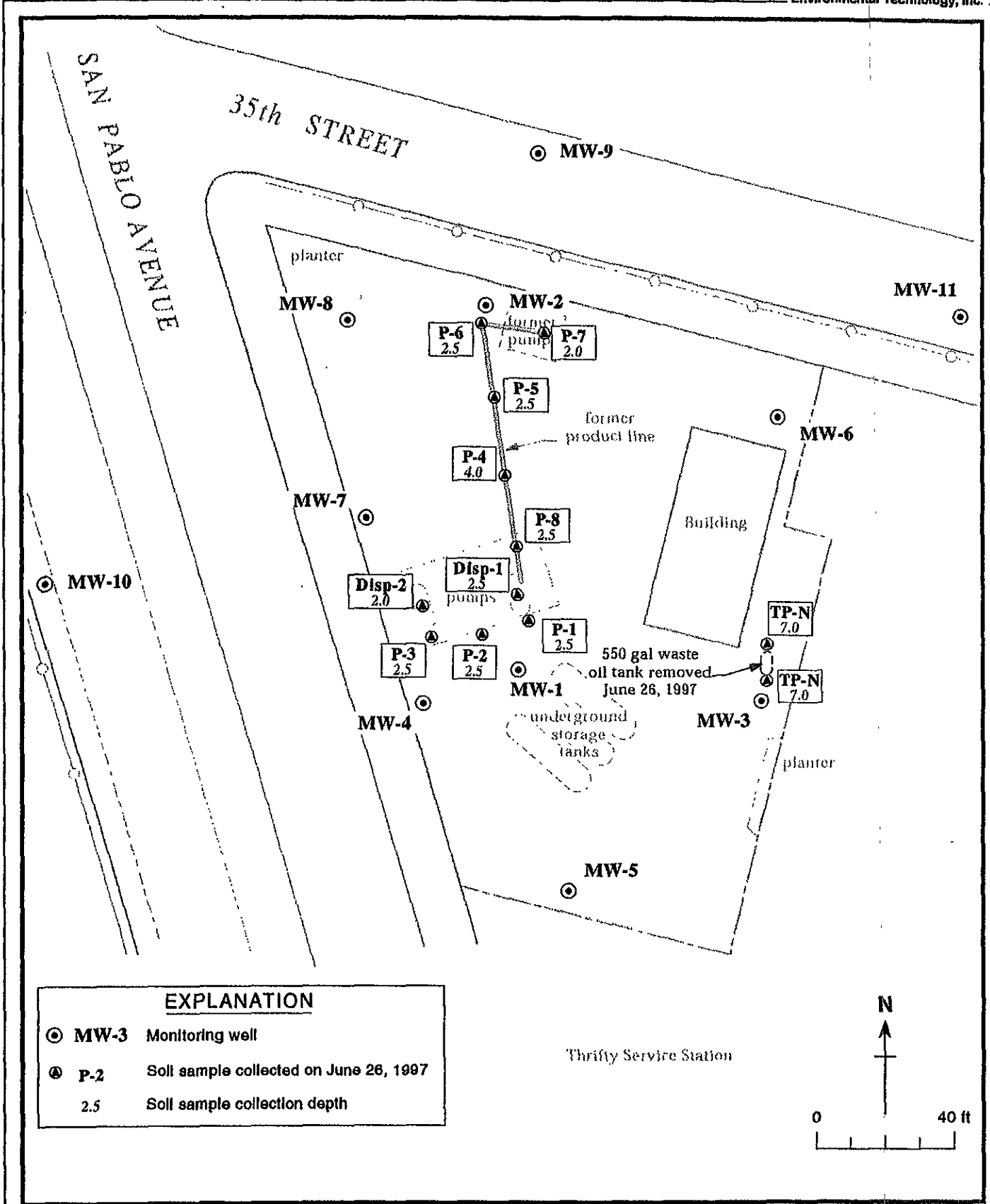


Figure 1. Soil Sampling Locations - Shell Service Station WIC #204-5508-5306, 3420 San Pablo Avenue, Oakland, California

Attachment B

Soil Analytic Data

TABLE 2

Soil Chemical Analysis
Concentrations in parts per million (ppm)

<u>Sample Number</u>	<u>Sample Depth (ft)</u>	<u>Date Sampled</u>	<u>Benzene</u>	<u>Toluene</u>	<u>Ethyl-benzene</u>	<u>Xylenes</u>	<u>EDB^a</u>	<u>EDC^b</u>	<u>TPH^c</u>	<u>Total Lead</u>
B-1-1 ^d	5-5.5	08/08/88	1.90	42.00	43.00	120.00	NA ^d	NA	1,400.00	NA
B-1-2 ^d	9.5-10	08/08/88	NA	NA	NA	NA	NA	NA	80.00	NA
B-1-3 ^d	15-15.5	08/08/88	NA	NA	NA	NA	NA	NA	<5.0	NA
B-1-4 ^d	20-20.5	08/08/88	NA	NA	NA	NA	NA	NA	<5.0	NA
B-2-1 ^d	5-5.5	08/08/88	1.50	16.00	35.00	33.00	NA	NA	550.0	NA
B-2-2 ^d	10-10.5	08/08/88	0.70	3.30	7.80	48.00	NA	NA	580.00	NA
B-3-1-2-3 ^d (composite)	5, 10 and 15	08/08/88	NA	NA	NA	NA	NA	NA	<5.0	NA
B-4-1-2-3 ^d (composite)	5, 10 and 15	08/08/88	NA	NA	NA	NA	NA	NA	<5.0	NA
B-5-1-2-3 ^d (composite)	5, 10 and 15	08/08/88	NA	NA	NA	NA	NA	NA	<5.0	NA

NOTES:

^aEthylene dibromide.

^b1,2-dichloroethane.

^cTotal petroleum hydrocarbons as gasoline.

^dSoil samples collected by Ensco Environmental Services, Inc.

^eNot analyzed.

^fNot detected.

^gSoil samples collected by Delta Environmental Consultants, Inc.

TABLE 2-Continued

Soil Chemical Analysis
Concentrations in parts per million (ppm)

<u>Sample Number</u>	<u>Sample Depth (ft)</u>	<u>Date Sampled</u>	<u>Benzene</u>	<u>Toluene</u>	<u>Ethyl-benzene</u>	<u>Xylenes</u>	<u>EDB^a</u>	<u>EDC^b</u>	<u>TPH^c</u>	<u>Total Lead</u>
MW-1-1 ^g	5.5-6	04/11/89	1.2	14	19	100	<0.2	<0.2	850	4
MW-1-2 ^g	10.5-11	04/11/89	<0.05	1.9	1.9	16	<0.5	<0.5	80	3
MW-2-2 ^g	10.5-11	04/10/89	0.4	1.5	1.7	15	<0.2	<0.2	70	8
MW-3-2 ^g	10.5-11	04/10/89	<0.002	0.010	0.008	0.069	<0.002	<0.002	<0.2	3
MW-4-2 ^g	10.5-11	04/10/89	<0.002	0.005	0.004	0.031	<0.002	<0.002	<0.2	2
MW-5-1 ^g	5.5-6	01/19/90	ND ^f	ND	ND	ND	NA	NA	5.0	NA
MW-6-1 ^g	5.5-6	01/19/90	ND	ND	ND	ND	NA	NA	ND	NA
MW-7-1 ^g	5.5-6	01/19/90	0.078	ND	0.21	ND	NA	NA	14	NA
MW-8-1 ^g	5.5-6	01/18/90	ND	ND	ND	ND	NA	NA	ND	NA
MW-9-2 ^g	10.5-11	01/18/90	ND	ND	0.39	0.14	NA	NA	6.1	NA

NOTES:

^aEthylene dibromide.^b1,2-dichloroethane.^cTotal petroleum hydrocarbons as gasoline.^dSoil samples collected by Ensco Environmental Services, Inc.^eNot analyzed.^fNot detected.^gSoil samples collected by Delta Environmental Consultants, Inc.



SEQUOIA ANALYTICAL

680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Delta Environmental Consultants 3330 Data Drive Rancho Cordova, CA 95670 Attention: Lisa Ranger	Client Project ID: #40-88-666, Shell Matrix Descript: Soil Analysis Method: EPA 5030/8015/8020 First Sample #: 110-4496	Sampled: Oct 23, 1991 Received: Oct 24, 1991 Analyzed: 10/29-30/91 Reported: Nov 2, 1991
--	--	---

TOTAL PETROLEUM FUEL HYDROCARBONS with BTEX DISTINCTION (EPA 8015/8020)

Sample Number	Sample Description	Low/Medium B.P. Hydrocarbons mg/kg (ppm)	Benzene mg/kg (ppm)	Toluene mg/kg (ppm)	Ethyl Benzene mg/kg (ppm)	Xylenes mg/kg (ppm)
110-4496	MW-10-5	1.4	0.015	0.0060	0.010	0.0080
110-4497	MW-10-10	1.8	0.060	N.D.	0.027	0.0070
110-4498	MW-11-5	N.D.	N.D.	N.D.	N.D.	N.D.
110-4499	MW-11-10	N.D.	N.D.	N.D.	N.D.	N.D.
110-4500	A,B,C,D	N.D.	N.D.	N.D.	N.D.	N.D.

Detection Limits:	1.0	0.0050	0.0050	0.0050	0.0050
--------------------------	------------	---------------	---------------	---------------	---------------

Low to Medium Boiling Point Hydrocarbons are quantitated against a gasoline standard.
Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL


Maile A. Springer
Project Manager

Table 1. Soil Analytic Data - Petroleum Hydrocarbons with BTEX and MTBE - Shell Service Station WIC# 204-5508-5306, 3240 San Pablo Avenue, Oakland, California

Sample ID	Sample Location	Date Sampled	TPPH as Gas (mg/kg)	MTBE (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethyl Benzene (mg/kg)	Xylenes (mg/kg)	TEPH as Diesel (mg/kg)	Notes
Disp-1-2.5	Dispensers	6/26/97	8.4	1.6	0.054	0.046	0.0094	0.21	---	
Disp-2-2.0	Dispensers	6/26/97	51	7.9	0.075	1.6	0.38	1.6	---	
TP-N-7	Waste Oil Tank Pit	6/26/97	<1.0	<0.025	<0.0050	<0.0050	<0.0050	<0.0050	---	a,b
TP-S-7	Waste Oil Tank Pit	6/26/97	<1.0	<0.025	<0.0050	<0.0050	<0.0050	<0.0050	---	a,b
P-1-2.5	Product Lines	6/26/97	39	0.82	0.13	0.051	0.012	0.032	---	
P-2-2.5	Product Lines	6/26/97	17	0.33	0.035	0.079	0.063	0.11	---	
P-3-2.5	Product Lines	6/26/97	16	0.092	0.028	0.059	0.019	0.026	---	
P-4-4.0	Product Lines	6/26/97	19	<0.050	0.041	0.053	<0.010	0.078	---	
P-5-4.0	Product Lines	6/26/97	3.1	0.028	0.016	0.0054	<0.0050	0.018	---	
P-6-2.5	Product Lines	6/26/97	<1.0	<0.025	<0.0050	<0.0050	<0.0050	<0.0050	---	
P-7-2.0	Product Lines	6/26/97	4.5	<0.025	0.040	0.0097	0.0095	0.053	---	
P-8-2.5	Product Lines	6/26/97	120	<0.62	<0.12	0.43	0.33	0.42	---	
SP-(1,2,3,4) Comp	Tank Stock Pile	6/26/97	---	---	<0.0050	<0.0050	<0.0050	<0.0050	---	c,d,e,f
SP-5	Piping Stock Pile	6/26/97	5.6	---	0.046	0.012	0.025	0.088	250	
SP-6	Piping Stock Pile	6/26/97	1.2	---	0.028	0.012	0.015	0.046	290	
SP-7	Piping Stock Pile	6/26/97	5.5	---	<0.0050	0.011	0.011	0.053	340	
SP-8	Piping Stock Pile	6/26/97	3.5	---	0.087	0.11	0.037	0.025	140	

**Table 1. Soil Analytic Data - Petroleum Hydrocarbons with BTEX and MTBE - Shell Service Station WIC# 204-5508-5306,
3240 San Pablo Avenue, Oakland, California**

Sample ID	Sample Location	Date Sampled	TPPH as Gas (mg/kg)	MTBE (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethyl Benzene (mg/kg)	Xylenes (mg/kg)	TEPH as Diesel (mg/kg)	Notes
-----------	-----------------	--------------	---------------------	--------------	-----------------	-----------------	-----------------------	-----------------	------------------------	-------

Abbreviations

TPPH as Gas = Total Purgeable Petroleum Hydrocarbon as Gasoline by Modified EPA Method 8015
 TEPH as Diesel = Total Extractable Petroleum Hydrocarbons as Diesel by Modified EPA Method 8015
 Benzene, Toluene, Ethyl Benzene, and Xylenes by EPA Method 8020
 MTBE = Methyl tert-Butyl Ether by EPA Method 8020
 TCLP = Toxicity Characteristic Leaching Procedure
 mg/kg = milligrams per kilogram
 <n = Below detection limit of n mg/kg
 --- = Not Analyzed

Notes

a = All Halogenated Volatile Organics EPA Method 8010 were below detection limits
 b = Fuel Fingerprint : Motor Oil by Modified EPA Method 8015 was below detection limit
 c = All Polychlorinated Biphenyls by EPA Method 8080 were below detection limits
 d = TCLP Metal Barium detected at 0.80 mg/L by EPA Method 6010/7470,
 all other analytes tested below detection limits
 e = All TCLP Semivolatiles by EPA Method 8270 were below detection limits
 f = All TCLP Volatiles by EPA Method 8240 were below detection limits

Table 2. Soil Analytic Data - TRPH, Cyanide: Reactive, Sulfide: Reactive, pH, and Organic Lead - Shell Service Station WIC# 204-5508-5306, 3240 San Pablo Avenue, Oakland, California

Sample ID	Sample Location	Date Sampled	TRPH (mg/kg)	Cyanide: Reactive (mg/kg)	Sulfide: Reactive (mg/kg)	pH	Organic Lead (mg/kg)
SP-1	Tank Stock Pile	6/26/97	<15	---	---	---	---
SP-2	Tank Stock Pile	6/26/97	<15	---	---	---	---
SP-3	Tank Stock Pile	6/26/97	<15	---	---	---	---
SP-4	Tank Stock Pile	6/26/97	<15	---	---	---	---
SP-(1,2,3,4) Comp	Tank Stock Pile	6/26/97	---	<0.50	<13	7.5	---
SP-(5,6,7,8) Comp	Piping Stock Pile	6/26/97	---	---	---	---	<5.0

Abbreviations and Notes:

TRPH = Total Recoverable Petroleum Hydrocarbons by EPA Method 418.1

Cyanide: Reactive by EPA Method SW-846, Chapter 7, Section 7.3

Sulfide: Reactive by EPA Method 9030

Organic Lead by California LUFT Method

mg/kg = milligrams per kilogram

<n = Below detection limit of n mg/kg

--- = Not Analyzed

Table 3. Soil Analytic Data - Total Metals - Shell Service Station WIC# 204-5508-5306, 3240 San Pablo Avenue, Oakland, California

Sample ID	Sample Location	Date Sampled	Cadmium (mg/kg)	Chromium (mg/kg)	Lead (mg/kg)	Nickel (mg/kg)	Zinc (mg/kg)
Disp-1-2.5	Dispensers	6/26/97	--	--	5.8	--	--
Disp-2-2.0	Dispensers	6/26/97	--	--	9.6	--	--
TP-N-7	Waste Oil Tank Pit	6/26/97	<0.5	18	<5.0	14	16
TP-S-7	Waste Oil Tank Pit	6/26/97	<0.5	38	6.4	34	33
P-1-2.5	Product Lines	6/26/97	--	--	7.4	--	--
P-2-2.5	Product Lines	6/26/97	--	--	7.4	--	--
P-3-2.5	Product Lines	6/26/97	--	--	6.9	--	--
P-4-4.0	Product Lines	6/26/97	--	--	7.4	--	--
P-5-4.0	Product Lines	6/26/97	--	--	7.4	--	--
P-6-2.5	Product Lines	6/26/97	--	--	33	--	--
P-7-2.0	Product Lines	6/26/97	--	--	2,000	--	--
P-8-2.5	Product Lines	6/26/97	--	--	8.2	--	--

Abbreviations and Notes:

Total Metals by EPA Method 6010

mg/kg = milligrams per kilogram

<n = Below detection limit of n mg/kg

-- = Not Analyzed

Attachment C

Boring Logs and Geologic Cross Sections



ensco
environmental
services, inc.

PROJECT NAME: SHELL STATION
3420 SAN PABLO AVE.
OAKLAND, CA

BORING NO. B-1

DATE DRILLED: 8/8/88

PROJECT NUMBER: 1859G

LOGGED BY: RAG

DEPTH (ft.)	SAMPLE No	BLOWS/FOOT 140 ft/lbs.	UNIFIED SOIL CLASSIFICATION	SOIL DESCRIPTION	WATER LEVEL	OVA READING ppm
				Asphalt - 2", baserock - 4"		
1			CL	SILTY CLAY, very dark gray (7.5YR 3/0), slight petroleum odor, moderately high plasticity, stiff, moist		
2						
3						
4						
5	B-1-1	27	CH	SILTY CLAY, dark gray (10YR 4/1), some angular brown gravel sized fragments, petroleum odor, moderately high plasticity, very stiff, moist,		155
6						
7			CL	SILTY CLAY, olive gray to gray (5Y 5/2 to 7.5Y 5/0), localized fine grained sands, some angular gravel up to 1.5" across, petroleum odor, moderate plasticity, very stiff, moist		
8						
9						
10	B-1-2	32				150
11						
12						
13						
14			CL	SANDY CLAY, mottled browns (10YR 5/4 to 10YR 5/8), some fine to medium sands and angular, medium gravels, no petroleum odor, stiff, moist to very moist		
15	B-1-3	13				0
16						
17						
18			CL	SILTY CLAY, mottled reddish yellow to light yellow (7.5YR 6/8 to 2.5Y 6/4), locally sandy areas, some gravels, no petroleum odor, very stiff, moist to very moist		
19					▽	
20	B-1-4	32				0
21				Bottom of boring = 20.5 feet		

SUPERVISED AND APPROVED BY R.G.C.E.G. *[Signature]*



ensco
environmental
services, inc.

PROJECT NAME: SHELL STATION
3420 SAN PABLO AVE.
OAKLAND, CA

BORING NO. B-2
DATE DRILLED: 8/8/88

PROJECT NUMBER: 1859G

LOGGED BY: RAG

DEPTH (ft.)	SAMPLE No	BLOWS/FOOT 140 ft/lbs.	UNIFIED SOIL CLASSIFICATION	SOIL DESCRIPTION	WATER LEVEL	OVA READING ppm
1	B-2-1	30	CH	Asphalt - 2", baserock - 9"	230	230
2				SILTY CLAY, very dark gray (7.5 3/0), some fine grained sands and gravels, moderately high plasticity, petroleum odor, stiff, moist		
3			CL	SILTY CLAY to SANDY CLAY, gray (2.5Y 5/0), fine grained sands, some subangular gravels up to 0.5" across, petroleum odor, very stiff, moist		
4						
5	B-2-2	30	CL	SILTY CLAY, mottled light gray to grayish brown (7.5YR 6/0 to 10YR 5/2), some medium to coarse grained sands and gravels up to 0.5" across, petroleum odor, very stiff, moist	210	210
6						
7			8/8/88, Groundwater encountered - 8 ft.			
8	Bottom of boring = 10.5 feet				-	-
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						

SUPERVISED AND APPROVED BY R.G.J.C.E.G.

RAG



ensco
environmental
services, inc.

PROJECT NAME: SHELL STATION
3420 SAN PABLO AVE.
OAKLAND, CA

BORING NO. B-3
DATE DRILLED: 8/8/88
LOGGED BY: RAG

PROJECT NUMBER: 1859G

DEPTH (ft.)	SAMPLE No	BLOWS/FOOT 140 ft/lbs.	UNIFIED SOIL CLASSIFICATION	SOIL DESCRIPTION	WATER LEVEL	OVA READING ppm
1				Asphalt - 2", baserock - 6"		
2			CH	SILTY CLAY, very dark gray (7.5YR 3/0), localized fine grained sands, no petroleum odor, moderately high plasticity, stiff, moist		
3						
4						
5	B-3-1	30	CH	SILTY CLAY, mottled strong brown to brownish yellow (7.5YR 6/6 to 7.5YR 6/5), localized fine grained sands and angular to subangular gravels up to 0.5" across, no petroleum odor, moderately high plasticity, very stiff, moist		0
6						
7						
8						
9						
10	B-3-2	25				0
11						
12						
13						
14			CL	SANDY CLAY, mottled brownish yellow to yellowish brown (10YR 6/6 to 10YR 5/8), fine grained sands, no petroleum odor, stiff, moist to very moist		
15	B-3-3	16				0
16						
17			CL-SC	SANDY CLAY to CLAYEY SAND, mottled light gray to dark brown (10YR 7/1 to 10YR 3/8), fine grained sands up to 60%, no petroleum odor, stiff to medium dense, wet		
18						
19						
20	B-3-4	16			8/8/88, Groundwater encountered - 19 ft.	0
21				Bottom of boring = 20.5 feet		

SUPERVISED AND APPROVED BY R.G.J.C.E.G.

RAG



ensco
environmental
services, inc.

PROJECT NAME: SHELL STATION
3420 SAN PABLO AVE.
OAKLAND, CA

BORING NO. B-4

DATE DRILLED: 8/8/88

PROJECT NUMBER: 1859G

LOGGED BY: RAG

DEPTH (ft.)	SAMPLE No	BLOWS/FOOT 140 ft/lbs.	UNIFIED SOIL CLASSIFICATION	SOIL DESCRIPTION	WATER LEVEL	OVA READING ppm
1				Asphalt - 2", baserock - 4"		
2			CH	SILTY CLAY, very dark gray (7.5YR 3/0), localized fine grained sands, no petroleum odor, moderately high plasticity, stiff, moist		
3						
4						
5	B-4-1	24	CL	SANDY CLAY, mottled gray to strong brown (7.5YR 5/0 to 7.5YR 5/6), fine to medium grained sands up to 40%, angular to subangular gravels up to 0.5" across, locally very sandy and gravelly, no petroleum odor, very stiff, moist		0
6						
7						
8						
9			CL	SANDY CLAY, mottled brown to yellowish brown (10YR 5/3 to 10YR 5/6), fine grained sand, locally very sandy and very clayey, no petroleum odor, hard, moist		0
10	B-4-2	35				
11						
12						
13						
14				Localized very gravelly beds, very stiff		
15	B-4-3	18		Root holes containing free water		0
16						
17						
18						
19					▽	
20	B-4-4	30				0
21				Bottom of boring = 20.5 feet		

SUPERVISED AND APPROVED BY R.G./C.E.G. *[Signature]*



ensco
environmental
services, inc.

PROJECT NAME: SHELL STATION
3420 SAN PABLO AVE.
OAKLAND, CA

BORING NO. B-5

DATE DRILLED: 8/8/88

PROJECT NUMBER: 1859G

LOGGED BY: RAG

DEPTH (ft.)	SAMPLE No	BLOWS/FOOT 140 ft/lbs.	UNIFIED SOIL CLASSIFICATION	SOIL DESCRIPTION	WATER LEVEL	OVA READING ppm
1				Asphalt - 2", baserock - 4"		
2			CH	SILTY CLAY, very dark gray (7.5YR 3/0), localized fine grained sands, no petroleum odor, moderately high plasticity, stiff, moist		
3						
4						
5	B-5-1	28	CL	SANDY CLAY, mottled grayish brown to yellowish brown (10YR 5/2 to 10YR 5/6), fine to coarse sand up to 40%, locally abundant gravels up to 0.5" across, no petroleum odor, very stiff, moist		0
6						
7						
8						
9			CL	SANDY CLAY, mottled gray to brownish yellow (10YR 6/1 to 10YR 6/6), fine grained sands up to 30%, root holes, no petroleum odor, low plasticity, hard, moist		0
10	B-5-2	38				
11						
12						
13						
14						
15	B-5-3	13	CL	SANDY CLAY, mottled yellow browns (10YR 5/4 to 10YR 5/8), fine grained sands up to 40%, locally abundant gravels up to 0.5" across, no petroleum odor, stiff, moist to very moist, free water in root holes		0
16						
17						
18						
19				Decreasing sand, very stiff	8/8/88, Groundwater encountered - 19 ft.	
20	B-5-4	23				0
21				Bottom of boring = 20.5 feet		

SUPERVISED AND APPROVED BY R.G./C.E.G.

RAG

PROJECT NAME / LOCATION 3420 San Pablo Avenue Oakland, CA	PROJECT NUMBER: 40-88-666	BORING NUMBER: MW-1	SHEET 1 OF 2
	CONTRACTOR: West Hazmat Drilling		DRILLING METHOD: H.S.A.
	DRILLER: Randy Reidhead		DRILLING RIG: CME-55
	START: 8:00		COMPLETED: 4-11-89/10:30

LAND OWNER: Shell Oil Company	SURFACE ELEVATION: 100.00 (relative)	LOGGED BY: Hal Hansen
-------------------------------	--------------------------------------	-----------------------

SAMPLE	TYPE	SUMP	NUMBER	BLOWNTS	SIAMT PL E(ft)	SRMCP PLV E(in)	DEPTH SCALE 1"= 4'	DESCRIPTIONS OF MATERIALS AND CONDITIONS	CONTAMINANT OBSERVATION	GENERAL OBSERVATION NOTES
									INSTRUMENT:	Odor
							1	ASPHALT AND ROAD BASE		
							2	CLAY; very dark gray, highly plastic, slightly moist, no sand (CH)		
							3			
							4			
CA	MWL	1	9/12/15		5.0-6.5	18	5	SANDY CLAY; dark greenish gray, moderately plastic, slightly moist, sand fine to coarse, some gravel toward the bottom of the unit (CL)	1100	Strong odor
							6			
							7			
							8			
							9			
CA	MWL	2	12/15/18		10.0-11.5	18	10		375	Slight odor
							11			
							12			
							13			
							14			
CA	MWL	3	6/6/9		15.0-16.5	17	15	SILTY CLAY; dark yellowish brown, moderately plastic, very moist, stiff, some gravel at the bottom of unit (CL)	30	Slight odor
							16			
							17			
							18			
							19			
CA	MWL	4	11/15/21		20.0-21.5	15	20		3	Very slight odor
							21			
							22			
							23			

WATER LEVEL DATA				PROFESSIONAL GEOLOGIST	
DATE				SIGNATURE	TYPED NAME
TIME					
GWL					
CASING DEPTH					

PROJECT NAME / LOCATION 3420 San Pablo Avenue Oakland, CA	PROJECT NUMBER: 40-88-666	BORING NUMBER: MW-1	SHEET 2 OF 2
	CONTRACTOR: West Hazmat		DRILLING METHOD: H.S.A.
	DRILLER: Randy Reidhead		DRILLING RIG: CME-55
	START: 8:00/4-11-89		COMPLETED: 10:30/4-11-89

LAND OWNER: Shell Oil Company	SURFACE ELEVATION: 100.00 (relative)	LOGGED BY: Hal Hansen
-------------------------------	--------------------------------------	-----------------------

S A M P L E	T Y P E	S T A M P P L E	N U M B E R	B L O U M B E R	C O U N T S	S I N T P L E (ft)	S R A M C P O L V E (in)	DEPTH SCALE 1"= 4'	DESCRIPTIONS OF MATERIALS AND CONDITIONS	CONTAMINANT OBSERVATION	GENERAL OBSERVATION NOTES
										INSTRUMENT:	
CA	MWL		6	12/14/20		25.0-26.5	6	25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47	GRAVELLY SAND; brown, very coarse sand, saturated, gravel 1/2 inch to 1/4 inch, minor plastic fines (SW) Total Depth 25.0 feet	Lost sample	No odor

WATER LEVEL DATA				PROFESSIONAL GEOLOGIST	
DATE				SIGNATURE	TYPED NAME
TIME					
GWL					
CASING DEPTH					

PROJECT NAME / LOCATION 3420 San Pablo Avenue Oakland, CA	PROJECT NUMBER: 40-88-666	BORING NUMBER: MW-2	SHEET 1 OF 1
	CONTRACTOR: West Hazmat		DRILLING METHOD: H.S.A.
	DRILLER: Randy Reidhead		DRILLING RIG: CME-55
	START: 8:00/4-10-89		COMPLETED: 9:45/4-10-89
LAND OWNER: Shell Oil Company		SURFACE ELEVATION: 100.29 (relative)	LOGGED BY: Hal Hansen

S A M P L E	T Y P E	S A M P L E	N U M B E R	B O R I N G	C O U N T S	S I A N T P L E (ft)	S R A E M C P O L V E (in)	D E P T H S C A L E 1"=4'	D E S C R I P T I O N S O F M A T E R I A L S A N D C O N D I T I O N S	CONTAMINANT OBSERVATION	G E N E R A L O B S E R V A T I O N N O T E S
										INSTRUMENT:	
										UNITS: Tip	
CA	MW2	1	6/19/19	5.0-6.5	18	1	ASPHALT AND ROAD BASE				
						2	CLAY; very dark gray, highly plastic, slightly moist, no sand (CH)				
						3					
						4					
CA	MW2	1	9/10/14	10.0-11.5	17	5	SANDY CLAY; dark greenish gray, moderately low plasticity, slightly moist, sand grades to gravel at bottom of the unit (CL)	25		Moderate odor	
						6					
						7					
						8					
						9					
CA	MW2	2	4/5/7	15.0-16.5	16	10					Moderate odor
						11					
						12					
						13					
						14					
CA	MW2	3	12/26/35	20.0-21.5	17	15	SILTY CLAY; dark yellowish brown, moderately low plasticity, moist stiff gravel toward bottom of the unit (CL)	0		No odor	
						16					
						17					
						18					
						19					
CA	MW2	4				20	Total Depth 20.0 feet	0		No odor	
						21					
						22					
						23					

WATER LEVEL DATA				PROFESSIONAL GEOLOGIST	
DATE				SIGNATURE	TYPED NAME
TIME					
GWL					
CASING DEPTH					

PROJECT NAME / LOCATION 3420 San Pablo Avenue Oakland, CA	PROJECT NUMBER: 40-88-666	BORING NUMBER: MW-3	SHEET 1 OF 2
	CONTRACTOR: West Hazmat		DRILLING METHOD: H.S.A.
	DRILLER: Randy Reidhead		DRILLING RIG: CME-55
	START: 11:00/4-10-89		COMPLETED: 1:00/4-10-89

LAND OWNER: Shell Oil Company	SURFACE ELEVATION: 100.00 (relative)	LOGGED BY: Hal Hansen
-------------------------------	--------------------------------------	-----------------------

SAMPLE	TYPE	S N M P L E	B L O W S	S I M P L E (ft)	S R A E M C P O L V E (in)	DEPTH SCALE 1"= 4'	DESCRIPTIONS OF MATERIALS AND CONDITIONS	CONTAMINANT OBSERVATION	GENERAL OBSERVATION NOTES
								INSTRUMENT: UNITS: Tip	
CA	MW3	-1	8/ 13/ 13	5.0- 6.5	18	1 2 3 4 5	ASPHALT AND ROAD BASE CLAY; very dark gray, highly plastic, slightly moist, no sand (CH)	0	No odor
CA	MW3	-2	13/ 23/ 21	10.0- 11.5	18	6 7 8 9 10 11 12 13	SILTY CLAY; olive brown with light olive brown mottles, moderately high plasticity, slightly moist (CL)	0	No odor
CA	MW3	-3	11/ 14/ 15	15.0- 16.5	17	14 15 16 17 18 19	SANDY CLAY; yellowish brown, moderately low plasticity, moist, fine sands (CL)	0	No odor
CA	MW3	-4	3/8/ 15	20.0- 21.5	15	20 21 22 23		0	No odor

WATER LEVEL DATA				PROFESSIONAL GEOLOGIST	
DATE				SIGNATURE	TYPED NAME
TIME					
GWL					
CASING DEPTH					

PROJECT NAME / LOCATION 3420 San Pablo Avenue Oakland, CA	PROJECT NUMBER: 40-88-666	BORING NUMBER: MW-3	SHEET 2 OF 2
	CONTRACTOR: West Hazmat Drilling		DRILLING METHOD: H.S.A.
	DRILLER: Randy Reidhead		DRILLING RIG: CME-55
	START: 11:00/4-10-89		COMPLETED: 1:00/4-10-89

LAND OWNER: Shell Oil Company	SURFACE ELEVATION: 100.50' (relative)	LOGGED BY: Hal Hansen
-------------------------------	---------------------------------------	-----------------------

S A M P L E	T Y P E	S U M P L E	N U M B E R	B C O U N T S	S I A M T P L E (ft)	S R A E M C P O L V E (in)	DEPTH SCALE 1"= 4'	DESCRIPTIONS OF MATERIALS AND CONDITIONS	CONTAMINANT OBSERVATION	GENERAL OBSERVATION NOTES
									INSTRUMENT:	
CA	MW3	-5	25/ 25/ 42	25.0 26.5	14	23 24 25 26 27 28 29	GRAVELLY SAND; brown, coarse sand, gravel, saturated, minor plastic fines (SW)	0	No odor	
CA	MW3	-6	18/ 23/ 39	30.0 31.5	15	30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45	Total Depth 30.0 feet	0	No odor	

WATER LEVEL DATA				PROFESSIONAL GEOLOGIST	
DATE				SIGNATURE	
TIME					
GWL				TYPED NAME	
CASING DEPTH					

PROJECT NAME / LOCATION 3420 San Pablo Avenue Oakland, CA	PROJECT NUMBER: 40-88-666	BORING NUMBER: MW-4	SHEET 1 OF 2
	CONTRACTOR: West Hazmat Drilling		DRILLING METHOD: H.S.A.
	DRILLER: Randy Reidhead		DRILLING RIG: CME-55
	START: 2:30/4-10-89		COMPLETED: 6:30/4-10-89

LAND OWNER: Shell Oil Company	SURFACE ELEVATION: 99.03' (relative)	LOGGED BY: Hal Hansen
-------------------------------	--------------------------------------	-----------------------

SAMPLE	SYMBOL	SAMPLER	NUMBER	BLOW COUNTS	SAMPLING DEPTH (ft)	SAMPLING INTERVAL (in)	DEPTH SCALE, 1"= 4'	DESCRIPTIONS OF MATERIALS AND CONDITIONS	CONTAMINANT OBSERVATION	GENERAL OBSERVATION NOTES
									INSTRUMENT:	
									UNITS:	Odor
CA	MW4	-1	17/25/32	5.0-6.5	18		1 - ASPHALT AND ROAD BASE 2 - LEAN CLAY; very dark gray, highly plastic, slightly moist, no sand (CH) 3 - 4 - 5 - 6 - SILTY CLAY; dark greenish gray, medium plasticity, slightly moist, some gravel (CL) 7 - 8 - 9 -	7		Slight odor
CA	MW4	-2	6/8/12	10.0-11.5	17		10 - SILTY CLAY; dark yellowish brown, dark greenish-gray, mottles, moderately plastic, moist (CL) 11 - 12 - 13 - 14 -	0		No odor
CA	MW4	-3	8/9/12	14.0-16.5	17		15 - SANDY CLAY; yellowish brown, moderately plastic, moist, fine sand, grades to a coarse sand at the bottom of the unit (CL) 16 - 17 - 18 - 19 -	0		No odor
CA	MW4	-4	9/8/24	20.0-21.5	15		20 - 21 - 22 - 23 -	0		No odor

WATER LEVEL DATA				PROFESSIONAL GEOLOGIST	
DATE				SIGNATURE	
TIME					
GWL					
CASING DEPTH				TYPED NAME	

PROJECT NAME / LOCATION 3420 San Pablo Avenue Oakland, CA	PROJECT NUMBER: 40-88-666	BORING NUMBER: MW-4	SHEET 2 OF 2
	CONTRACTOR: West Hazmat Drilling		DRILLING METHOD: H.S.A.
	DRILLER: Randy Reidhead		DRILLING RIG: CME-55
	START: 2:30/4-10-89		COMPLETED: 6:30/4-10-89

LAND OWNER: Shell Oil Company	SURFACE ELEVATION: 99.03 (relative)	LOGGED BY: Hal Hansen
-------------------------------	-------------------------------------	-----------------------

SAMPLE	TYPE	SAMPLER	NO. OF BLOW COUNTS	SAMPLING DEPTH (ft)	SCREEN SIZE (in)	DEPTH SCALE 1"= 4'	DESCRIPTIONS OF MATERIALS AND CONDITIONS	CONTAMINANT OBSERVATION	GENERAL OBSERVATION NOTES
								INSTRUMENT:	Odor
CA	MW4	-5	25/ 24/ 30	25.0 26.5	16	23 24 25 26 27 28 29	GRAVELLY SAND; brown, coarse sand, saturated, gravel 1/2" to 1", some plastic fines (SW)	0	No odor
CA	MW4	-6	19/ 22/ 37	30.0 31.5	17	30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45	Total Depth 31.5	0	No odor

WATER LEVEL DATA				PROFESSIONAL GEOLOGIST	
DATE				SIGNATURE	TYPED NAME
TIME					
GWL					
CASING DEPTH					

PROJECT NAME / LOCATION Oakland Shell 3420 San Pablo Avenue Oakland, CA	PROJECT NUMBER: 40-88-666	BORING NUMBER: MW-5	SHEET 1 OF 2
	CONTRACTOR: West Hazmat Drilling		DRILLING METHOD: H.S.A.
	DRILLER: Randy Reidhead		DRILLING RIG: CME-75
	START: 12:15/01-19-90		COMPLETED: 2:40/01-19-90

LAND OWNER: Shell Oil Company	SURFACE ELEVATION: 20.91	LOGGED BY: Hal Hansen
-------------------------------	--------------------------	-----------------------


SAY M P L E	TYP E	S A U P L E R	N U M B E R	B C O U N T S	S I A N T P L E (ft)	S R A E M C P O L Y E (in)	DEPTH SCALE 1"= 4'	DESCRIPTIONS OF MATERIALS AND CONDITIONS	CONTAMINANT OBSERVATION	GENERAL OBSERVATION NOTES
									INSTRUMENT: OVM UNITS: ppm	
							1	Asphalt road base		
							2	CLAY; very dark gray, highly plastic, slightly moist (CH)		
							3			
							4			
CA	MW	5-1	9/12/38		5.0-6.5	18	5	SANDY CLAY; yellowish brown, moderately plastic, slightly moist (CL)	50	Slight odor
							6			
							7			
							8			
							9			
CA	MW	5-2	12/16/9		10.0-11.5	18	10	Saturated	0	No odor
							11			
							12			
							13			
							14			
CA	MW	5-3	5/7/11		15.0-16.5	18	15		0	No odor
							16			
							17	SILTY CLAY; dark yellowish brown, moderately plastic, saturated (CL)		
							18			
							19			
CA	MW	5-4	4/4/7		20.0-21.5	18	20		0	No odor
							21			
							22			
							23			

WATER LEVEL DATA				GEOLOGIST	
DATE	02-02			<i>Hal Hansen</i>	
TIME	2:40				SIGNATURE
GWL	7.89				Hal Hansen
CASING DEPTH	25'				TYPED NAME

PROJECT NAME / LOCATION Oakland Shell 3420 San Pablo Avenue Oakland, CA	PROJECT NUMBER: 40-88-666	BORING NUMBER: MW-5	SHEET 2 OF 2
	CONTRACTOR: West Hazmat Drilling		DRILLING METHOD: H.S.A.
	DRILLER: Randy Reidhead		DRILLING RIG: CME-75
	START: 12:15/01-19-90		COMPLETED: 2:40/01-19-90

LAND OWNER: Shell Oil Company	SURFACE ELEVATION: 20.91	LOGGED BY: Hal Hansen
-------------------------------	--------------------------	-----------------------

S A M P L E	T Y P E	S A M P L E N U M B E R	B C L O U N T S	S I A N T P L E (ft)	S R E M C P O L Y E (in)	D E P T H S C A L E 1"= 4'	D E S C R I P T I O N S O F M A T E R I A L S A N D C O N D I T I O N S	CONTAMINANT OBSERVATION	G E N E R A L O B S E R V A T I O N N O T E S
								INSTRUMENT: OVM UNITS: ppm	
CA	MW-5-5	26/47/50 for 4"		25.0-26.5	12	25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47	GRAVELLY SAND; brown, coarse sand, saturated, minor plastic fines (SW) Total Depth at 26.5 feet	1	No odor

WATER LEVEL DATA				GEOLOGIST	
DATE	02-02			 SIGNATURE Hal Hansen TYPED NAME	
TIME	2:40				
GWL	7.89				
CASING DEPTH	25'				

PROJECT NAME / LOCATION Oakland Shell 3420 San Pablo Avenue Oakland, CA	PROJECT NUMBER: 40-88-666	BORING NUMBER: MW-6	SHEET 1 OF 1
	CONTRACTOR: West Hazmat Drilling		DRILLING METHOD: H.S.A.
	DRILLER: Randy Reidhead		DRILLING RIG: CME-75
	START: 9:00/01-19-90		COMPLETED: 1:00/01-19-90


LAND OWNER: Shell Oil Company	SURFACE ELEVATION: 22.32	LOGGED BY: Hal Hansen
-------------------------------	--------------------------	-----------------------

STATE	WELL	DEPTH (ft)	SAND	SILT	CLAY	SPECIAL	DEPTH (in)	DEPTH SCALE 1"=4'	DESCRIPTIONS OF MATERIALS AND CONDITIONS	CONTAMINANT OBSERVATION	GENERAL OBSERVATION NOTES
										INSTRUMENT: OVM UNITS: ppm	
CA	MW-6-1	10/12/38	5.0-6.5				18		Asphalt road base CLAY; very dark gray, highly plastic, slightly moist (CH)	0	No odor
CA	MW-6-2	9/13/20	10.0-11.5				18		Color change to yellowish brown Saturated	14	Slight odor
CA	MW-6-3	5/8/11	15.0-16.5				18		SILTY CLAY; yellowish brown, moderately plastic, saturated (CL)	0	No odor
CA	MW-6-4	4/7/11	20.0-21.5				18		Total Depth at 21.5 feet	0	No odor

WATER LEVEL DATA				GEOLOGIST	
DATE	02-02			<i>Hal Hansen</i> SIGNATURE Hal Hansen TYPED NAME	
TIME	11:41				
GWL	7.86				
CASING DEPTH	20'				


PROJECT NAME / LOCATION Oakland Shell 3420 San Pablo Avenue Oakland, CA	PROJECT NUMBER: 40-88-666	BORING NUMBER: MW-7	SHEET 1 OF 1
	CONTRACTOR: West Hazmat Drilling		DRILLING METHOD: H.S.A.
	DRILLER: Randy Reidhead		DRILLING RIG: CME-75
	START: 11:00/01-19-90		COMPLETED: 12:00/01-19-90
LAND OWNER: Shell Oil Company		SURFACE ELEVATION: 20.36	LOGGED BY: Hal Hansen

S A Y P L E	T I P P L E	S A U P L E R	N U M B E R	B C L O U N T S	S I A N T P L E(ft)	S R A E M C O L V E(in)	DEPTH SCALE 1"= 4'	DESCRIPTIONS OF MATERIALS AND CONDITIONS	CONTAMINANT OBSERVATION	GENERAL OBSERVATION NOTES
									INSTRUMENT: OVM UNITS: ppm	
CA	MW-7-1	16/22/30	5.0-6.5	18	1	Asphalt road base				
					2	CLAY; very dark gray, highly plastic, slightly moist (CH)				
					3					
					4					
					5	SANDY CLAY; greenish gray, moderately plastic, slightly moist (CL)	95		Moderate odor	
					6					
					7					
					8					
					9					
CA	MW-7-2	9/15/25	10.0-11.5	18	10	Color change to yellowish brown	85		Moderate odor	
					11	Saturated				
					12					
					13					
					14					
CA	MW-7-3	6/8/10	15.0-16.5	18	15		5		Slight odor	
					16	SILTY CLAY; yellowish brown, moderately plastic, saturated (CL)				
					17					
					18					
					19					
CA	MW-7-4	6/8/14	20.0-21.5	18	20		0		No odor	
					21					
					22	Total Depth at 21.5 feet				
					23					

WATER LEVEL DATA				GEOLOGIST	
DATE	02-02			 SIGNATURE Hal Hansen TYPED NAME	
TIME	11:52				
GWL	8.91				
CASING DEPTH	20'				

PROJECT NAME / LOCATION Oakland Shell 3420 San Pablo Avenue Oakland, CA		PROJECT NUMBER: 40-88-666	BORING NUMBER: MW-8	SHEET 1 OF 1
		CONTRACTOR: West Hazmat Drilling	DRILLING METHOD: H.S.A.	
		DRILLER: Randy Reidhead	DRILLING RIG: CME-75	
		START: 2:30/01-18-90	COMPLETED: 3:45/01-18-90	
LAND OWNER: Shell Oil Company		SURFACE ELEVATION: 20.95		LOGGED BY: Hal Hansen

SAY MPE L E	TY AUM PPE L E R	SN MPE L E R	BC L O U N T S	SI A N T P L E (ft)	SR A E M C P O L V E (in)	DEPTH SCALE 1"= 4'	DESCRIPTIONS OF MATERIALS AND CONDITIONS	CONTAMINANT OBSERVATION	GENERAL OBSERVATION NOTES
								INSTRUMENT: OVM UNITS: ppm	
CA	MW-8-1	16/27/28	5.0-6.5	18	1	Asphalt road base			
					2	CLAY; very dark gray, highly plastic, slightly moist (CH)			
					3				
					4				
CA	MW-8-2	11/13/19	10.0-11.5	18	5	SANDY CLAY; greenish gray, moderately plastic, slightly moist (CL)	3	Slight odor	
					6				
					7				
					8				
					9				
CA	MW-8-3	4/5/7	15.0-16.5	18	10	Saturated	100	Moderate odor	
					11				
					12				
					13				
					14				
CA	MW-8-4	9/11/16	20.0-21.5	18	15	SILTY CLAY; dark yellowish brown, slightly plastic, saturated (CL)	0	No odor	
					16				
					17				
					18				
					19				
					20				
					21				
					22	Total Depth at 21.5 feet			
					23				

WATER LEVEL DATA				GEOLOGIST	
DATE	02-02			 SIGNATURE Hal Hansen TYPED NAME	
TIME	11:49				
GWL	7.32				
CASING DEPTH	20'				

PROJECT NAME / LOCATION Oakland Shell 3420 San Pablo Avenue Oakland, CA	PROJECT NUMBER: 40-88-666	BORING NUMBER: MW-9	SHEET 1 OF 1
	CONTRACTOR: West Hazmat Drilling		DRILLING METHOD: H.S.A.
	DRILLER: Randy Reidhead		DRILLING RIG: CME-75
	START: 12:30/01-19-90		COMPLETED: 2:00/01-19-90

LAND OWNER: Shell Oil Company	SURFACE ELEVATION: 21.19	LOGGED BY: Hal Hansen
-------------------------------	--------------------------	-----------------------

S A M P L E	T Y P E	S A M P L E R	N U M B E R	B L O C K N O T E S	S I A N T P L E (ft)	S R A E M C P O L Y E (in)	D E P T H S C A L E 1"= 4'	D E S C R I P T I O N S O F M A T E R I A L S A N D C O N D I T I O N S	CONTAMINANT OBSERVATION	G E N E R A L O B S E R V A T I O N N O T E S
									INSTRUMENT: OVM UNITS: ppm	
CA	MW	9-1	9/23/27		5.0-6.5	10	1 - Asphalt road base 2 - CLAY; very dark gray, highly plastic, slightly moist (CH) 3 - 4 - 5 - SANDY CLAY; yellowish brown, moderately plastic, slightly moist (CL) 6 - 7 - 8 - 9 -	0	No odor	
CA	MW	9-2	16/21/31		10.0-11.5	18	10 - 11 - 12 - 13 - 14 -	30	Slight odor	
CA	MW	9-3	5/9/12		15.0-16.5	18	15 - SILTY CLAY; dark yellowish brown, slightly plastic saturated (CL) 16 - 17 - 18 - 19 -	0	No odor	
CA	MW	9-4			20.0-21.5	18	20 - 21 - 22 - Total Depth at 21.5 feet 23 -	0	No odor	

WATER LEVEL DATA				GEOLOGIST	
DATE	02-02			<i>Hal Hansen</i> SIGNATURE Hal Hansen TYPED NAME	
TIME	11:43				
GWL	9.02				
CASING DEPTH	20'				

PROJECT NAME/LOCATION:		Project Number	40-88-666	Boring Number	MW-10
Oakland Shell 3420 San Pablo Oakland, California		Contractor	West Hazmat	Drilling Method	H.S.A 10"
		Driller	Tom Wright	Drilling Rig	Acker
		Start	9:00 a.m. 10/23/91	Completed	10:45 a.m. 10/23/91
Landowner: City of Oakland		Surface Elev.		Logged By	Charles K. Almeida

Sample		Blow Count	Sample		Depth Scale 1" = 4'	Descriptions of Materials and Conditions	Observations	
Type	No.		Interval (ft.)	Recovery (in.)			Instrument: OVM Units: ppm	General Observation Notes
CA	MW-10-1	7-20-25	5-6.5	16	1 ----- Asphalt/Road Base ----- 2 3 4 5 CLAY; silty dark gray, medium plasticity; dry (CL) 6 7 8 9	55		
CA	MW-10-2	7-12-21	10-11.5	18	10 ----- 11 CLAY; silty, some coarse grained sand and .25" diameter angular grains, very moist (CL) 12 13 14	213		
CA	MW-10-3	4-8-15	15-16.5	18	15 16 CLAY; silty gray green, medium to coarse gravely sand, minor fragments; very moist (CL) 17 ----- 18 19	118		
CA	MW-10-4	6-15-20	20-21.5	18	20 21 SANDY SILT; clayey tan brown, very fine grained sand, soft; very moist (ML) 22 ----- Total Depth at 21.5 ft. ----- 23	51		

BOREHOLE WATER LEVEL DATA

Date	10/23/91		
Time	10:50 a.m.		
GWL	16.54		
Casing Depth	19.3		



PROJECT NAME/LOCATION		Project Number	40-88-666	Boring Number	MW-11
Oakland Shell 3420 San Pablo Avenue Oakland, California		Contractor	West Hazmat	Drilling Method	H.S.A. 10"
		Driller	Tom Wright	Drilling Rig	Acker
		Start	12:20 p.m. 10/23/91	Completed	2:15 p.m. 10/23/91 p.m.
Landowner: City of Oakland		Surface Elev.		Logged By	Charles K. Almeida

Sample		Blow Count	Sample		Depth Scale 1" = 4'	Descriptions of Materials and Conditions	Observations	
Type	No.		Interval (ft)	Recovery (in.)			Instrument OVM Units: ppm	General Observation Notes
CA	MW-11-1	4-14-35	5-6.5	15	1 --- Asphalt/Road Base 2 --- 3 --- 4 --- 5 --- CLAY; silty dark brown, minor fine grained sand, medium plasticity--dry (CL) 6 --- 7 --- 8 --- 9 ---	0		
CA	MW-11-2	4-18-31	10-11.5	10	10 --- Tan brown, very moist. 11 --- 12 --- 13 --- 14 --- gradational contact	0		
CA	MW-11-3	6-10-13	15-16.5	15	15 --- SILT; clayey, tan brown, minor fine to medium grained sand; saturated (ML) 16 --- 17 --- 18 --- 19 ---	0		
CA	MW-11-4	16-24-35	20-21.5	20	20 --- CLAYEY SILTY GRAVEL; brown, .25-.5" angular grains, minor coarse grained sand; saturated (GC) 21 --- 22 --- Total Depth at 21.5 ft. 23 ---	0		

BOREHOLE WATER LEVEL DATA			
Date	10/23/91		
Time	3:15 p.m.		
GWL	14.0		
Casing Depth	19.0		



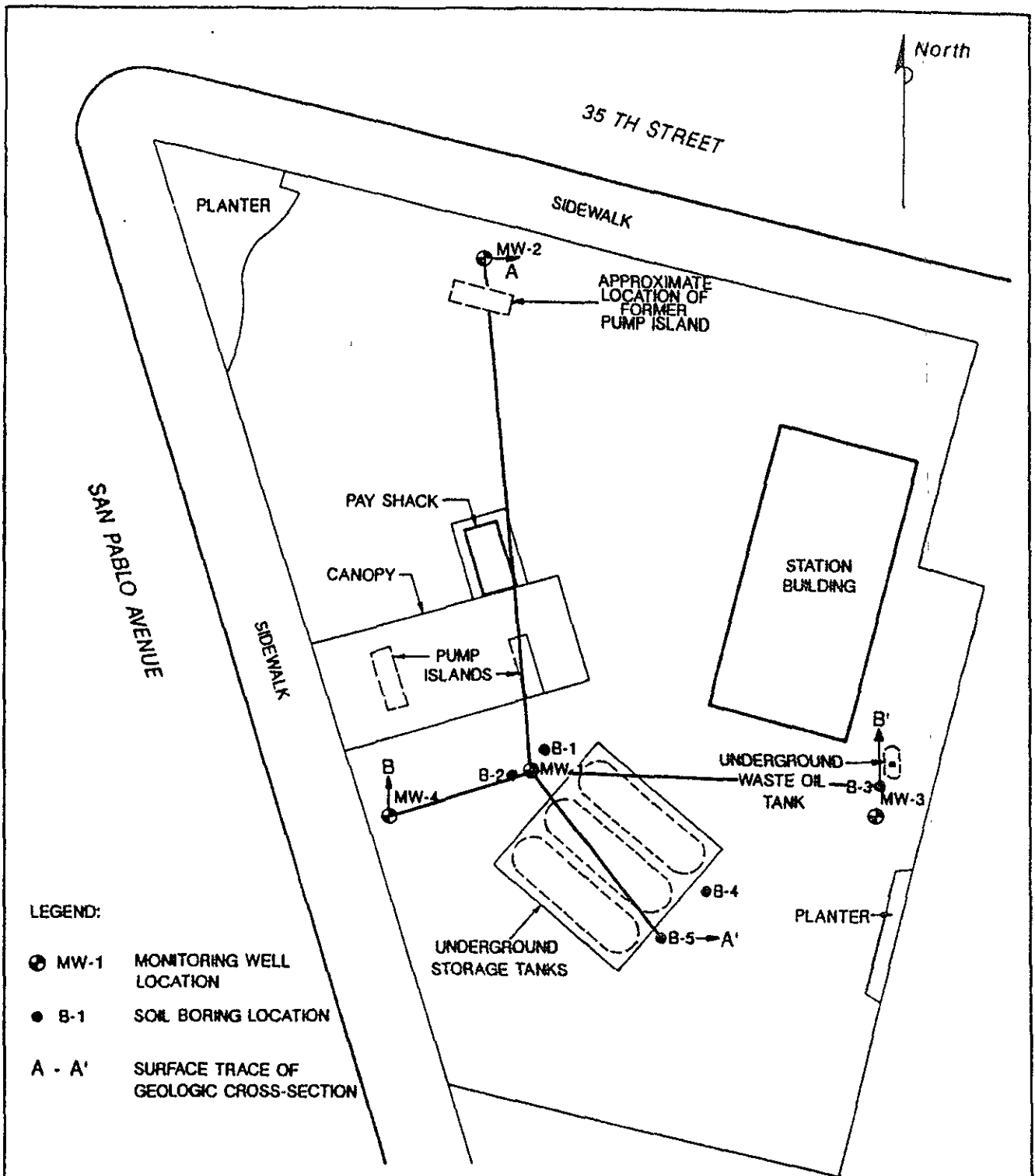

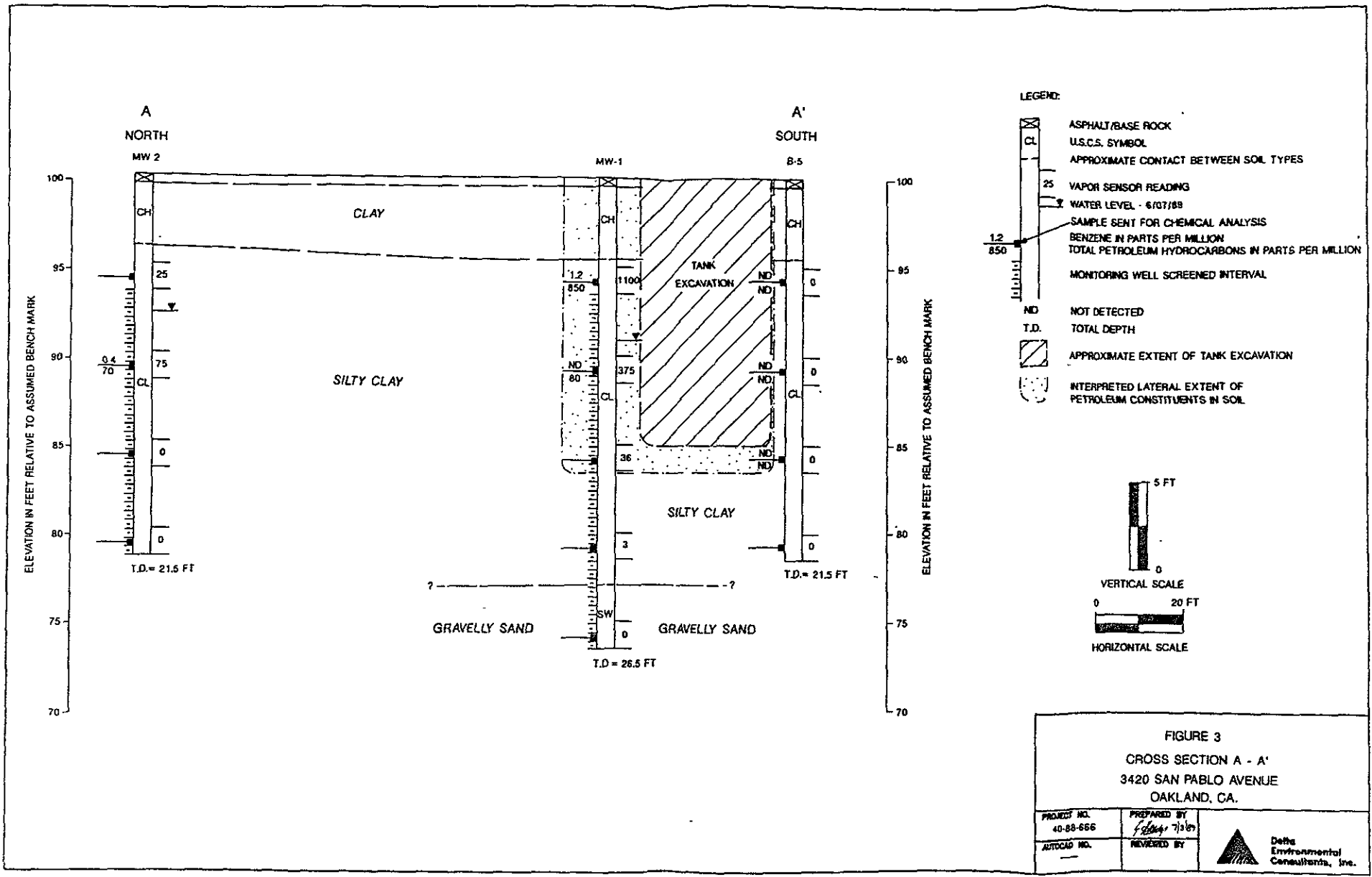


FIGURE 2
 SITE MAP
 3420 SAN PABLO AVENUE
 OAKLAND, CA.

PROJECT NO. 40-88-666	PREPARED BY <i>[Signature]</i> 6/29/89	 Delta Environmental Consultants, Inc.
AUTOCAD NO. —	REVIEWED BY <i>[Signature]</i> 7/7/89	



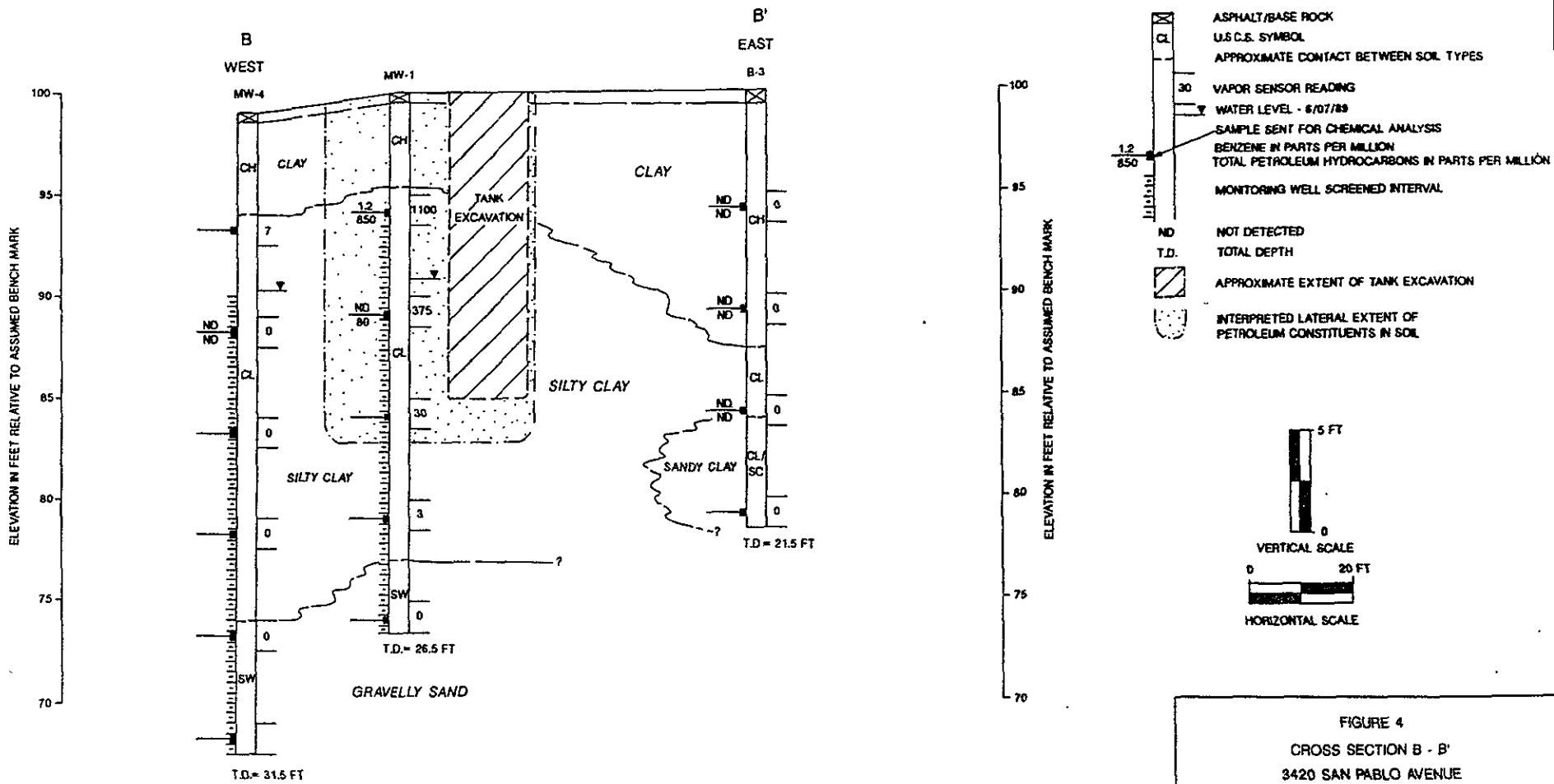



FIGURE 4
CROSS SECTION B - B'
3420 SAN PABLO AVENUE
OAKLAND, CA.

PROJECT NO. 40-88-888	PREPARED BY <i>[Signature]</i> 7/1/89	 Delta Environmental Consultants, Inc.
AUTOCAD NO.	REVIEWED BY	

Attachment D

Ground Water Analytic Data

CAMBRIA

Table 3. Analytical Results for Ground Water - Shell Service Station WIC #204-5508-5306, 3420 San Pablo Avenue, Oakland, California

Well ID	Date Sampled	Depth to water (ft below TOC)	(Concentrations in µg/L)						DO (mg/L)
			TPH-G	B	T	E	X	MTBE	
MW-1	08/06/91 ^{SPH}	10.86	---	---	---	---	---	---	---
	10/23/91	11.05	32,000	2,700	360	550	3,700	---	---
	01/28/92	10.84	14,000	1,000	106	450	1,600	---	---
	05/05/92	9.42	98,000	11,000	1,200	3,500	18,000	---	---
	07/13/92	11.36	11,000	1,100	130	740	1,300	---	---
	10/12/92 ^{SPH}	13.14	---	---	---	---	---	---	---
	01/12/93 ^{SPH}	7.52	---	110	---	---	---	---	---
	04/06/93 ^{SPH}	7.13	---	---	---	---	---	---	---
	07/12/93 ^{SPH}	11.02	---	---	---	---	---	---	---
	10/13/93 ^{SPH}	12.18	---	---	---	---	---	---	---
	01/20/94 ^{SPH}	9.18	---	---	---	---	---	---	---
	04/13/94 ^{SPH}	8.72	---	---	---	---	---	---	---
	07/19/94	8.76	17,000	420	140	530	1,300	---	---
	10/27/94	10.49	23,000	1,200	130	990	960	---	---
	01/03/95	6.15	31,000	610	160	1,200	5,000	---	---
	04/13/95	5.24	20,000	340	42	680	2,900	---	---
	06/30/95	7.24	16,000	450	62	460	1,200	---	---
	10/11/95	9.48	8,400	660	47	510	850	8,000	---
	10/13/95	---	7,400	730	54	490	1,100	8,200	---
	01/17/96	6.48	24,000	570	110	820	2,900	15,000	---
	04/10/96	5.38	20,000	120	11	420	1,400	15,000	---
	07/30/96	7.61	7,900	240	22	170	300	12,000	---
	10/17/96	8.66	6,600	1,000	20	120	130	10,000	1.4
	01/22/97	5.00	13,000	170	<50	330	1,200	18,000	1.6
	04/01/97	6.42	7,900	240	26	130	200	6,400	1.4
	07/14/97	8.92	5,000	<20	<20	59	61	9,000	1.9
10/08/97	9.43	3,200	180	7.6	18	6.1	11,000	4.8	
01/19/98	1.20	8,100	39	<20	280	660	1,100	2.6	
01/19/98 ^{dup}	1.20	8,200	43	<20	280	660	1,100	2.6	
04/28/98	4.81	2,900	62	<10	160	370	1,200(1,200)	2.4 ^c	

Table 3. Analytical Results for Ground Water - Shell Service Station WIC #204-5508-5306, 3420 San Pablo Avenue, Oakland, California

Well ID	Date Sampled	Depth to water (ft below TOC)	TPH-G	B	T	E	X	MTBE	DO (mg/L)
MW-2	08/06/91	9.72	50,000	15,000	---	2,700	13,000	---	---
	10/23/91	10.03	120,000	11,000	1,400	3,500	19,000	---	---
	01/28/92	8.78	49,000	7,400	800	1,800	8,300	---	---
	05/05/92	7.58	52,000	12,000	1,100	2,200	12,000	---	---
	07/13/92	9.63	47,000	15,000	2,400	4,500	16,000	---	---
	10/12/92 ^{SPH}	11.66	---	---	---	---	---	---	---
	01/12/93 ^{SPH}	7.13	---	---	---	---	---	---	---
	04/06/93 ^{SPH}	6.40	---	---	---	---	---	---	---
	07/12/93	8.75	59,000	12,000	950	2,400	11,000	---	---
	10/13/93	10.28	54,000	14,000	1,200	3,700	22,000	---	---
	01/20/94	---	---	---	---	---	---	---	---
	04/13/94	7.35	79,000	9,400	740	2,100	12,000	---	---
	04/13/94 ^{dup}	7.35	110,000	11,000	710	2,400	13,000	---	---
	07/19/94	8.24	63,000	13,000	810	1,900	13,000	---	---
	07/19/94 ^{dup}	8.24	12,000	12,000	140	340	12,000	---	---
	10/27/94	10.26	64,000	8,800	480	2,100	10,000	---	---
	01/03/95	6.44	67,000	9,800	720	2,800	11,000	---	---
	01/03/95 ^{dup}	6.44	58,000	9,700	620	2,700	12,000	---	---
	04/13/95	5.89	83,000	10,000	490	2,600	13,000	---	---
	04/13/95 ^{dup}	5.89	74,000	9,500	350	2,100	11,000	---	---
	06/30/95	7.41	65,000	12,000	1,800	2,400	12,000	---	---
	10/11/95	8.02	68,000	8,800	840	3,000	13,000	1,400	---
	01/17/96	7.42	79,000	12,000	640	2,700	14,000	2,200	---
	01/17/96 ^{dup}	7.42	78,000	12,000	920	2,500	12,000	2,500	---
	04/10/96	6.91	84,000	7,200	310	1,700	7,800	2,900	---
	07/30/96	7.63	26,000	6,800	210	1,300	5,500	4,500	---
	10/17/96	8.27	46,000	9,800	340	2,000	6,500	4,900	1.8
	01/22/97	7.09	52,000	6,200	220	1,400	6,600	3,000	1.9
	01/22/97 ^{dup}	7.09	54,000	6,100	230	1,400	6,500	2,600	1.9
	04/01/97	6.91	69,000	6,000	380	2,400	11,000	3,800	2.0

Table 3. Analytical Results for Ground Water - Shell Service Station WIC #204-5508-5306, 3420 San Pablo Avenue, Oakland, California

Well ID	Date Sampled	Depth to water (ft below TOC)	TPH-G	(Concentrations in µg/L)					DO (mg/L)
				B	T	E	X	MTBE	
	07/14/97	9.93	53,000	7,700	260	1,600	5,200	2,400	1.2
	07/14/97 ^{dup}	9.93	59,000	8,700	400	1,900	6,900	2,700	1.2
	10/08/97	10.43	56,000	8,500	320	1,600	5,100	4,200	2.1
	10/08/97 ^{dup}	10.43	53,000	8,300	330	1,600	5,200	2,900	2.1
	01/19/98	3.60	64,000	10,000	230	2,400	12,000	2,700	2.4
	04/28/98	4.81	45,000	9,800	310	2,700	11,000	2,400(2,000)	2.0 ^c
	04/28/98 ^{dup}	4.81	4,400	9,200	260	2,500	9,700	2,300	2.0 ^c
MW-3 ^d	08/06/91	11.18	430	8	1	4	15	---	---
	10/23/91	11.69	390	2.10	<0.3	0.48	2	---	---
	01/28/92	9.99	190	<0.5	<0.5	<0.5	<0.5	---	---
	05/04/92	9.46	190	<1	<1	<1	0.71	---	---
	07/20/92	11.29	200 ^a	<0.5	<0.5	<0.5	<0.5	---	---
	10/12/92	13.10	180 ^a	<0.5	<0.5	<0.5	<0.5	---	---
	01/12/93	7.32	180	<0.5	2.3	0.9	5.6	---	---
	01/12/93 ^{dup}	7.32	260	<0.5	<0.5	<0.5	<0.5	---	---
	04/06/93	7.44	280	<0.5	<0.5	<0.5	<0.5	---	---
	07/12/93	10.62	310 ^a	<0.5	<0.5	<0.5	<0.5	---	---
	10/13/93	12.05	150	<0.5	<0.5	<0.5	<0.5	---	---
	01/20/94	9.62	180	<0.5	<0.5	<0.5	<0.5	---	---
	04/13/94	9.15	270	<0.5	<0.5	<0.5	<0.5	---	---
	07/19/94	10.13	190*	<0.5	<0.5	<0.5	<0.5	---	---
	10/27/94	11.66	160*	<0.5	<0.5	<0.5	<0.5	---	---
	01/03/95	6.89	100*	<0.5	<0.5	<0.5	<0.5	---	---
	04/13/95	6.79	120*	<0.5	<0.5	<0.5	<0.5	---	---
	06/30/95	8.94	180*	<0.5	<0.5	<0.5	<0.5	---	---
	10/11/95	10.62	150	2.2	<0.5	<0.5	<0.5	2.3	---
	01/17/96	7.18	120	<0.5	<0.5	<0.5	<0.5	7.8	---
	04/10/96	6.76	160	<0.5	<0.5	<0.5	<0.5	12	---
	07/30/96	9.04	57	<0.5	<0.5	<0.5	<0.5	<2.5	---

CAMBRIA

Table 3. Analytical Results for Ground Water - Shell Service Station WIC #204-5508-5306, 3420 San Pablo Avenue, Oakland, California

Well ID	Date Sampled	Depth to water (ft below TOC)	TPH-G	B	T	E	X	MTBE	DO (mg/L)
	10/17/96	9.04	<50	<0.5	<0.5	<0.5	<0.5	<2.5	2.0
	01/22/97	5.03	<50	<0.5	<0.5	<0.5	<0.5	3.7	2.4
	04/01/97	8.23	71	<0.50	<0.50	<0.50	<0.50	— ^c	1.6
	07/14/97	9.09	<50	<0.50	<0.50	<0.50	1.5	— ^c	1.9
	10/08/97	10.23	73	<0.50	<0.50	<0.50	<0.50	— ^c	5.5
MW-4	08/06/91	10.57	1,300	28	18	68	150	—	—
	10/23/91	10.46	1,900	97	6.10	38	77	—	—
	01/28/92	9.54	200	7.60	<0.5	3	3.30	—	—
	05/04/92	8.33	690	98	3	13	<1	—	—
	07/13/92	9.87	1,500	140	2.90	17	12	—	—
	07/13/92 ^{dup}	9.87	870	95	1.90	10	7.10	—	—
	10/12/92 ^{SPH}	12.43	—	—	—	—	—	—	—
	01/12/93 ^{SPH}	7.12	—	—	—	—	—	—	—
	04/06/93 ^{SPH}	7.23	—	—	—	—	—	—	—
	07/12/93 ^{SPH}	10.08	—	—	—	—	—	—	—
	10/13/93 ^{SPH}	11.35	—	—	—	—	—	—	—
	01/20/94 ^{SPH}	9.06	—	—	—	—	—	—	—
	04/13/84 ^{SPH}	8.58	—	—	—	—	—	—	—
	07/18/94	9.71	12,000	230	43	230	660	—	—
	10/27/94 ^{SPH}	10.60	—	—	—	—	—	—	—
	01/03/95 ^{SPH}	5.49	—	—	—	—	—	—	—
	04/13/95 ^{SPH}	6.53	—	—	—	—	—	—	—
	06/30/95	9.57	7,400	140	<0.5	160	350	—	—
	10/11/95	10.30	3,000	29	10	100	82	9,700	—
	01/17/96	6.68	9,700	190	<0.5	190	410	4,500	—
	04/10/96	7.90	2,800	16	<0.5	22	50	6,100	—
	07/30/96	8.73	1,600	68	<12	58	39	8,500	2.8
	10/17/96	7.63	4,800	120	<25	150	96	11,000	2.8
	01/22/97	5.26	12,000	83	<20	170	240	4,300	2.6

Table 3. Analytical Results for Ground Water - Shell Service Station WIC #204-5508-5306, 3420 San Pablo Avenue, Oakland, California

Well ID	Date Sampled	Depth to water (ft below TOC)	TPH-G	B	T	E	X	MTBE	DO
	04/01/97	8.02	4,800	65	<5.0	81	93	3,200	2.4
	07/14/97	10.05	2,400	35	<10	30	20	6,000	2.0
	10/08/97	10.22	2,900	66	<20	<20	<20	7,300	5.9
	01/19/98 ^b	---	---	---	---	---	---	---	---
	04/28/98 ^b	---	---	---	---	---	---	---	---
MW-5	08/06/91	10.23	9,100	210	27	240	660	---	---
	10/23/91	10.89	12,000	92	18	230	450	---	---
	01/28/92	8.45	3,300	130	10	180	220	---	---
	05/04/92	8.05	3,900	95	<12.5	260	120	---	---
	07/13/92	10.00	4,100	180	12	250	73	---	---
	10/12/92 ^{SPH}	11.83	---	---	---	---	---	---	---
	01/12/93 ^{SPH}	6.10	---	---	---	---	---	---	---
	04/06/93	6.18	6,200	71	<0.5	53	150	---	---
	07/12/93	9.59	3,400	130	<0.5	170	130	---	---
	10/13/93 ^{SPH}	10.80	---	---	---	---	---	---	---
	01/20/94 ^{SPH}	7.42	---	---	---	---	---	---	---
	04/13/94 ^{SPH}	7.05	---	---	---	---	---	---	---
	07/19/94	8.57	11,000	180	13	180	260	---	---
	10/27/94	10.14	6,900	82	<5	210	1110	---	---
	01/03/95	5.84	12,000	110	46	790	510	---	---
	04/13/95	5.28	10,000	61	<20	330	140	---	---
	06/30/95	7.43	12,000	180	8.60	440	340	---	---
	10/11/95	8.90	11,000	<50	<50	440	340	5,100	---
	10/11/96 ^{dup}	8.90	11,000	95	<50	440	330	660	---
	01/17/96	6.40	82,000	330	120	960	1,400	820	---
	04/10/96	5.70	23,000	<50	<50	360	190	770	---
	04/10/96 ^{dup}	5.70	19,000	84	<50	430	200	590	---
	07/30/96	7.71	38,000	3,000	<100	1,100	2,600	560	---
	10/17/96	9.04	13,000	36	<10	210	160	720	1.4

Table 3. Analytical Results for Ground Water - Shell Service Station WIC #204-5508-5306, 3420 San Pablo Avenue, Oakland, California

Well ID	Date Sampled	Depth to water (ft below TOC)	TPH-G	B	T	E	X	MTBE	DO (mg/L)
	10/17/96 ^{dup}	9.04	11,000	75	<10	180	150	450	1.4
	01/22/97	4.85	20,000	63	<50	380	390	650	1.6
	04/01/97	6.54	16,000	110	<50	390	320	2,200	1.4
	07/14/97	8.54	15,000	70	<20	220	170	450	1.8
	10/08/97	9.09	9,100	27	11	170	57	530	4.7
	01/19/98	2.11	9,500	92	<50	200	77	1,100	2.5
	04/25/98	4.90	15,000	100	53	150	80	460	2.2
MW-6 ^d (Abandoned)	08/06/91	10.61	28,000	1,400	200	1,300	4,200	---	---
	10/23/91	11.68	53,000	1,400	230	1,800	6,700	---	---
	01/28/92	8.90	87,000	1,200	470	2,000	6,600	---	---
	05/05/92	8.01	230,000	<500	<500	3,200	11,000	---	---
	07/13/92	10.77	2,700,000	<2,500	3,500	14,000	36,000	---	---
	10/12/92 ^{SPH}	8.68	---	---	---	---	---	---	---
	01/12/93 ^{SPH}	6.40	---	---	---	---	---	---	---
	04/06/93	5.93	320,000	2,500	14,000	980	14,000	---	---
	07/12/93	10.25	31,000	1,100	4,500	150	4,500	---	---
	07/12/93 ^{dup}	10.25	25,000	1,200	4,800	270	4,800	---	---
	10/13/93 ^{SPH}	12.28	---	---	---	---	---	---	---
	01/20/94 ^{SPH}	9.14	---	---	---	---	---	---	---
	04/13/94 ^{SPH}	7.67	---	---	---	---	---	---	---
	07/19/94 ^{SPH}	10.07	---	---	---	---	---	---	---
	10/27/94 ^{SPH}	11.84	---	---	---	---	---	---	---
	01/03/95 ^{SPH}	7.80	---	---	---	---	---	---	---
	04/13/95 ^{SPH}	5.77	---	---	---	---	---	---	---
	06/30/95	7.78	1,100,000	6,600	6,100	12,000	29,000	---	---
	10/11/95	10.06	30,000	130	<50	1,400	4,200	710	---
	01/17/96	6.91	450,000	510	1,400	2,700	11,000	630	---
	04/10/96	5.92	22,000	47	<10	350	860	<50	---
	07/30/96	8.97	38,000	3,000	<100	1,100	2,600	560	---

CAMBRIA

Table 3. Analytical Results for Ground Water - Shell Service Station WIC #204-5508-5306, 3420 San Pablo Avenue, Oakland, California

Well ID	Date Sampled	Depth to water (ft below TOC)	TPH-G	B	T	E	X	MTBE	DO (mg/L)
	07/30/96 ^{dup}	8.97	38,000	450	100	1,000	3,100	800	---
	10/17/96 ^{SPH}	9.87	34,000	470	<100	1,300	3,900	<500	1.0
	01/22/97	4.43	26,000	<100	<100	600	1,700	<500	1.3
	04/01/97	6.84	30,000	96	33	840	2,600	190	1.4
	07/14/97	10.30	29,000	200	<100	690	2,000	<500	2.3
	10/08/97	10.46	55,000	500	110	640	1,500	900	0.0
MW-7	08/06/91	8.00	13,000	4,300	76	770	730	---	---
	10/23/91	8.16	18,000	3,200	31	660	770	---	---
	01/28/92	7.11	5,000	1,200	<10	220	54	---	---
	05/05/92	6.47	9,500	3,100	72	620	880	---	---
	07/13/92	7.73	20,000	4,200	130	1,600	1,100	---	---
	10/12/92	9.97	16,000	2,500	170	560	170	---	---
	01/12/93	6.26	15,000	2,300	<50	690	440	---	---
	04/06/93	5.92	26,000	5,400	<0.5	1,200	3,000	---	---
	04/06/93 ^{dup}	5.92	21,000	5,200	180	1,200	3,000	---	---
	07/12/93	7.27	10,000	3,000	100	510	530	---	---
	10/13/93	9.40	59,000	13,000	4,400	4,400	20,000	---	---
	01/20/94 ^{SPH}	7.03	---	---	---	---	---	---	---
	04/13/94 ^{SPH}	6.56	---	---	---	---	---	---	---
	07/19/94 ^{SPH}	6.91	---	---	---	---	---	---	---
	10/27/94 ^{SPH}	8.28	---	---	---	---	---	---	---
	01/03/95 ^{SPH}	6.48	---	---	---	---	---	---	---
	04/13/95 ^{SPH}	6.54	---	---	---	---	---	---	---
	06/30/95	7.08	900,000	11,000	8,500	14,000	52,000	---	---
	10/11/95 ^{SPH}	7.88	---	---	---	---	---	---	---
	01/17/96 ^{SPH}	7.26	---	---	---	---	---	---	---
	04/10/96 ^{SPH}	6.98	---	---	---	---	---	---	---
	07/30/96	7.34	---	---	---	---	---	---	---
	10/17/96 ^{SPH}	7.63	---	---	---	---	---	---	---

Table 3. Analytical Results for Ground Water - Shell Service Station WIC #204-5508-5306, 3420 San Pablo Avenue, Oakland, California

Well ID	Date Sampled	Depth to water (ft below TOC)	(Concentrations in µg/L)						DO (mg/L)
			TPH-G	B	T	E	X	MTBE	
	01/22/97	6.46	56,000	2,000	520	1,400	8,400	1,800	0.5
	04/01/97	6.97	66,000	3,600	460	2,400	10,000	2,300	1.6
	07/14/97 ^{SPH}	8.90	---	---	---	---	---	---	---
	10/08/97	9.21	68,000	3,200	470	2,400	9,700	3,300	2.1
	01/19/98	4.65	44,000	1,800	220	1,700	7,800	1,600	1.6
	04/28/98	6.53	82,000	1,500	<500	1,200	8,900	<2,500	1.3^c
MW-8	08/06/91	9.60	32,000	3,700	1,100	1,400	6,100	---	---
	10/23/91	9.73	63,000	4,800	1,300	1,300	6,900	---	---
	01/28/92	7.72	32,000	1,900	750	1,400	6,300	---	---
	05/05/92	6.48	180,000	2,200	2,000	2,700	13,000	---	---
	07/13/92	8.55	56,000	4,500	1,500	2,700	9,100	---	---
	10/12/92	9.97	34,000	2,400	550	1,400	6,400	---	---
	10/12/92 ^{dup}	9.97	34,000	3,100	700	1,500	7,200	---	---
	01/12/93	6.94	110,000	2,100	1,200	2,400	12,000	---	---
	04/06/93	5.72	38,000	2,500	840	1,100	4,900	---	---
	07/12/93	7.65	27,000	2,800	990	1,200	5,300	---	---
	10/13/93	8.25	32,000	3,300	1,300	1,600	8,400	---	---
	10/13/93 ^{dup}	8.25	47,000	3,200	1,300	1,600	8,500	---	---
	01/20/94	7.25	78,000	1,900	670	1,300	6,600	---	---
	01/20/94 ^{dup}	7.25	60,000	1,700	680	1,100	5,500	---	---
	04/13/94	7.12	41,000	1,300	720	1,200	6,000	---	---
	07/19/94	7.43	140,000	1,800	1,400	2,000	9,000	---	---
	10/27/94	7.55	32,000	1,200	670	1,200	5,700	---	---
	10/27/94 ^{dup}	7.55	42,000	1,100	650	1,100	5,700	---	---
	01/03/95	6.04	38,000	1,000	700	1,500	7,500	---	---
	04/13/95	5.04	31,000	1,200	570	1,000	5,300	---	---
	06/30/95	5.72	110,000	2,000	1,500	2,000	9,700	---	---
	10/11/95	7.06	36,000	170	60	1,300	6,300	510	---
	01/17/96	5.84	38,000	1,000	520	1,100	6,200	950	---

CAMBRIA

Table 3. Analytical Results for Ground Water - Shell Service Station WIC #204-5508-5306, 3420 San Pablo Avenue, Oakland, California

Well ID	Date Sampled	Depth to water (ft below TOC)	TPH-G	B	(Concentrations in µg/L)				DO (mg/L)
					T	E	X	MTBE	
	04/10/96	5.03	54,000	650	260	850	4,700	<250	---
	07/30/96	6.36	33,000	780	330	830	4,200	1,700	---
	10/17/96	5.94	35,000	750	300	1,100	5,000	1,200	1.6
	01/22/97	5.93	25,000	260	78	420	2,400	120	1.8
	04/01/97	6.24	22,000	680	180	550	2,500	260	1.8
	07/14/97	8.59	29,000	870	200	850	3,100	500	1.4
	10/08/97	9.04	27,000	1,000	190	960	3,000	170	4.6
	01/19/98	3.34	21,000	660	160	740	3,300	170	2.2
	04/28/98	---	---	---	---	---	---	---	---
MW-9	08/06/91	10.33	11,000	1,700	95	520	1,400	---	---
	10/23/91	11.13	20,000	1,000	47	<0.3	940	---	---
	01/28/92	9.02	3,500	120	<10	280	36	---	---
	05/04/92	7.67	7,700	1,200	<50	380	630	---	---
	07/20/92	10.26	11,000	910	<50	220	1,200	---	---
	10/12/92	12.19	2,100	340	15	77	44	---	---
	01/12/93 ^b	---	---	---	---	---	---	---	---
	04/06/93 ^b	---	---	---	---	---	---	---	---
	07/12/93 ^b	---	---	---	---	---	---	---	---
	10/13/93	11.17	2,900	140	<5	<5	120	---	---
	01/20/94	8.03	1,700	380	6.90	150	400	---	---
	04/13/94	7.81	6,000	1,000	<20	450	420	---	---
	07/19/94	8.96	12,000	1,400	<5	740	1,200	---	---
	10/27/94	11.00	10,000	1,200	160	280	860	---	---
	01/03/95	6.60	4,400	680	7.70	180	370	---	---
	04/13/95	6.73	1,700	270	<10	69	170	---	---
	06/30/95	7.32	14,000	2,200	18	900	2,600	---	---
	06/30/95 ^{dup}	7.32	13,000	2,100	17	870	2,500	---	---
	10/11/95	8.10	9,600	35	12	360	980	590	---
	01/17/96	5.75	2,800	150	7.41	54	130	170	---

Table 3. Analytical Results for Ground Water - Shell Service Station WIC #204-5508-5306, 3420 San Pablo Avenue, Oakland, California

Well ID	Date Sampled	Depth to water (ft below TOC)	TPH-G	B	T	E	X	MTBE	DO (mg/L)
	04/10/96	5.17	5,200	290	<5	92	220	240	---
	07/30/96	8.1	5,100	960	<10	380	770	670	---
	10/17/96	9.12	15,000	2,100	<25	590	1,300	1,500	2.4
	01/22/97	4.72	5,600	690	<5.0	140	310	620	2.2
	04/01/97	6.86	4,000	590	<10	140	200	600	2.2
	04/01/97 ^{dup}	6.86	4,800	660	<25	160	230	810	2.2
	07/14/97	10.04	7,100	860	<10	51	230	950	3.8
	10/08/97	11.38	1,500	57	<2.0	2.0	13	540	8.2
	01/19/98	3.88	2,500	280	<20	79	61	620	1.4
	04/28/98	5.87	2,200	330	<20	91	110	640	1.6
MW-10	10/23/91	8.57	27,000	1,600	110	1,800	510	---	---
	01/28/92	7.60	3,800	360	14	170	39	---	---
	05/04/92	7.54	3,000	360	<12.5	140	26	---	---
	07/20/92	8.59	15,000	400	<25	180	67	---	---
	10/12/92	10.23	16,000	320	<50	360	100	---	---
	01/12/93 ^b	---	---	---	---	---	---	---	---
	04/06/93	6.70	14,000	370	<0.5	880	210	---	---
	07/12/93	8.05	10,000	440	58	890	220	---	---
	10/13/93	8.25	15,000	1,000	51	810	170	---	---
	01/20/94	7.20	12,000	820	56	1,100	350	---	---
	04/13/94	7.57	18,000	760	36	700	130	---	---
	07/19/94	8.18	24,000	400	2.30	800	22	---	---
	10/27/94	8.68	11,000	360	43	310	89	---	---
	01/03/95	6.86	17,000	770	38	690	160	---	---
	04/13/95	6.91	9,900	650	16	280	40	---	---
	06/30/95	7.61	12,000	750	20	480	130	---	---
	01/17/96	7.00	17,000	870	260	93	830	---	---
	04/10/96	6.80	14,000	470	38	110	370	---	---
	07/30/96	---	---	---	---	---	---	---	---

Table 3. Analytical Results for Ground Water - Shell Service Station WIC #204-5508-5306, 3420 San Pablo Avenue, Oakland, California

Well ID	Date Sampled	Depth to water (ft below TOC)	TPH-G	B	(Concentrations in µg/L)				DO (mg/L)
					T	E	X	MTBE	
	10/17/96	---	---	---	---	---	---	---	---
	01/22/97	6.68	10,000	520	<20	64	32	180	3.1
	04/01/97	7.34	11,000	590	<20	53	32	210	2.8
	07/14/97	8.10	6,600	410	13	28	11	89	1.4
	10/08/97	8.2	7,600	220	13	65	22	190	6.4
	01/19/98 ^b	---	---	---	---	---	---	---	---
	04/28/98 ^b	---	---	---	---	---	---	---	---
MW-11	10/23/91	8.06	140	<12	<0.3	0.37	0.56	---	---
	01/28/92	13.32	<50	<0.5	<0.5	<0.5	<0.5	---	---
	05/04/92	13.77	<50	<0.5	<0.5	<0.5	<0.5	---	---
	07/13/92	11.56	140	<0.5	<0.5	<0.5	<0.5	---	---
	10/12/92	12.40	75	<0.5	<0.5	<0.5	<0.5	---	---
	01/12/93 ^b	---	---	---	---	---	---	---	---
	04/06/93 ^b	---	---	---	---	---	---	---	---
	07/12/93 ^b	---	---	---	---	---	---	---	---
	10/13/93	11.47	<50	<0.5	<0.5	<0.5	<0.5	---	---
	01/20/94	9.09	<50	<0.5	<0.5	<0.5	<0.5	---	---
	04/13/94	8.02	<50	<0.5	<0.5	<0.5	<0.5	---	---
	07/19/94	9.82	50	<0.5	<0.5	<0.5	<0.5	---	---
	10/27/94	11.66	60*	<0.5	<0.5	<0.5	<0.5	---	---
	01/03/95	6.15	<50	<0.5	<0.5	<0.5	<0.5	---	---
	04/13/95	6.00	<50	<0.5	<0.5	<0.5	<0.5	---	---
	06/30/95	8.31	70	<0.5	<0.5	<0.5	<0.5	---	---
	10/11/95	10.30	60	53	<0.5	<0.5	0.80	3.0	---
	01/17/96	6.45	<50	<0.5	<0.5	<0.5	<0.5	<2	---
	04/10/96	6.05	<50	<0.5	<0.5	<0.5	<0.5	3.9	---
	07/30/96	8.92	<50	<0.5	<0.5	<0.5	<0.5	<2.5	---
	10/17/96	9.24	3,000	28	23	29	210	76	---
	01/22/97	5.12	<50	<0.5	<0.5	<0.5	<0.5	<2.5	3.7

Table 3. Analytical Results for Ground Water - Shell Service Station WIC #204-5508-5306, 3420 San Pablo Avenue, Oakland, California

Well ID	Date Sampled	Depth to water (ft below TOC)	TPH-G	(Concentrations in µg/L)					DO (mg/L)
				B	T	E	X	MTBE	
	04/01/97	7.41	<50	<0.50	<0.50	<0.50	<0.50	<2.5	2.8
	07/14/97	9.74	<50	<0.50	<0.50	<0.50	<0.50	<2.5	1.9
	10/08/97	10.23	<50	<0.50	<0.50	<0.50	<0.50	<2.5	2.4
	01/19/98	3.69	<50	<0.50	<0.50	<0.50	<0.50	<2.5	3.2
	04/28/98	5.83	<50	<0.50	<0.50	<0.50	<0.50	<2.5	3.0
Equipment	07/13/92	---	<50	<0.5	<0.5	<0.5	<0.5	---	---
Blank	07/20/92	---	<50	<0.5	<0.5	<0.5	<0.5	---	---
	10/12/92	---	<50	<0.5	<0.5	<0.5	<0.5	---	---
	04/13/94	---	<50	<0.5	0.67	<0.5	<0.5	---	---
	07/19/94	---	<50	<0.5	<0.5	<0.5	<0.5	---	---
	10/27/94	---	<50	<0.5	<0.5	<0.5	<0.5	---	---
	01/03/95	---	<50	<0.5	<0.5	<0.5	<0.5	---	---
	04/13/95	---	<50	<0.5	<0.5	<0.5	<0.5	---	---
	06/30/95	---	<50	<0.5	<0.5	<0.5	<0.5	---	---
	10/11/95	---	<50	<0.5	<0.5	<0.5	<0.5	<0.5	---
	01/17/96	---	<50	<0.5	<0.5	<0.5	<0.5	<2	---
	04/01/97	---	<50	<0.50	<0.50	<0.50	<0.50	<2.5	---
Trip Blank	01/28/92	---	<50	<0.5	<0.5	<0.5	<0.5	---	---
	05/05/92	---	<50	<0.5	<0.5	<0.5	<0.5	---	---
	07/13/92	---	<50	<0.5	<0.5	<0.5	<0.5	---	---
	07/20/92	---	<50	<0.5	<0.5	<0.5	<0.5	---	---
	10/12/92	---	<50	<0.5	<0.5	<0.5	<0.5	---	---
	01/12/93	---	<50	<0.5	<0.5	<0.5	<0.5	---	---
	04/06/93	---	<50	<0.5	<0.5	<0.5	<0.5	---	---
	07/12/93	---	<50	<0.5	<0.5	<0.5	<0.5	---	---
	10/13/93	---	<50	<0.5	<0.5	<0.5	<0.5	---	---
	01/20/94	---	<50	<0.5	<0.5	<0.5	<0.5	---	---
	04/13/94	---	<50	<0.5	<0.5	<0.5	<0.5	---	---

Table 3. Analytical Results for Ground Water - Shell Service Station WIC #204-5508-5306, 3420 San Pablo Avenue, Oakland, California

Well ID	Date Sampled	Depth to water (ft below TOC)	TPH-G	B	T	E	X	MTBE	DO
			← (Concentrations in µg/L) →						
	07/19/94	---	<50	<0.5	<0.5	<0.5	<0.5	---	---
	10/27/94	---	<50	<0.5	<0.5	<0.5	<0.5	---	---
	01/03/95	---	<50	<0.5	<0.5	<0.5	<0.5	---	---
	04/13/95	---	<50	<0.5	<0.5	<0.5	<0.5	---	---
	06/30/95	---	<50	<0.5	<0.5	<0.5	<0.5	---	---
	10/11/95	---	<50	<0.5	<0.5	<0.5	<0.5	<0.5	---
MCLs			NE	1	150	700	1,750	NE	

Abbreviations:

TPH-G = Total petroleum hydrocarbons as gasoline by modified EPA Method 8015
 B = Benzene by EPA Method 8020
 T = Toluene by EPA Method 8020
 E = Ethylbenzene by EPA Method 8020
 X = Xylenes by EPA Method 8020
 MTBE = Methyl tert-butyl ether by EPA Method 8020. Result in parentheses indicates MTBE by EPA Method 8260
 DO = Dissolved oxygen
 MCLs = California primary maximum contaminant levels for drinking water (22 CCR 64444)
 NE = MCLs not established
 --- = Not analyzed
 <n = Not detected at detection limits of n µg/L
 dup = Duplicate sample
 SPH = Not sampled, separate-phase hydrocarbons detected in well
 µg/L = Micrograms per liter
 mg/L = Milligrams per liter
 TOC = Top of casing

Notes:

a = Concentration reported as gasoline is due to the presence of a discrete hydrocarbon peak that is not indicative of gasoline
 b = Not sampled; well inaccessible
 c = Analytic laboratory noted that MTBE could not be quantified due to co-eluting compounds
 d = Well abandoned December 5, 1997
 e = DO measurements collected May 1, 1998
 * = The result for gasoline is an unknown hydrocarbon which consists of a single peak as confirmed by NET Laboratory

Attachment E

Area Well Survey



APPOXIMATE WELL LOCATIONS

Domestic Well Inventory

Well Property Owner	Well Use
1. PG&E	Industrial
2. PG&E	Industrial
3. Arco	Monitoring
4. Sherwin Williams Co.	Industrial
5. Presto-Lite Co.	Industrial
6. AC Transit	Industrial
7. City of Emeryville	Municipal
8. Del Monte Corp.	Monitoring
9. PG&E	Industrial
10. Yosemite Laundry Co.	Industrial
11. Toscani Bakery	Industrial
12. American Creamery Co.	Industrial
13. California Linen Supply Co.	Industrial
14. City of Paris Laundry	Industrial
15. Arco	Monitoring
16. Providence Hospital	Municipal
17. PG&E	Industrial
18. Oakland School District	Municipal
19. Providence Hospital	Municipal
20. Chevron Corp.	Monitoring
21. Anheuser-Busch Co.	Monitoring
22. Joseph Kelly	Domestic
23. John Moore	Domestic
24. PG&E	Industrial
25. City of Oakland	Municipal
26. PG&E	Industrial
27. Chevron	Monitoring
28. August Santos	Domestic
29. PG&E	Industrial
30. Shell Development Corp.	Industrial
31. Cetus Corp.	Industrial
32. East Bay D.M.V.	Monitoring

GENERAL NOTES.

BASE MAP FROM U.S.G.S.
 OAKLAND WEST, CA.
 7.5 MINUTE TOPOGRAPHIC
 SCALE 1 : 24,000'



Delta
 Environmental
 Consultants, Inc.

FIGURE 3
 DOMESTIC WELL LOCATION MAP
 3420 SAN PABLO AVENUE
 OAKLAND, CA.

Attachment F

Tier 2 RBCA Results

RBCA TIER 1/TIER 2 EVALUATION

Output Table 1

Site Name: Shell Service Station WIC # 20 Job Identification: 240-0554
 Site Location: 3420 San Pablo Avenue, Oakland Date Completed: 12/8/97
 Completed By: Sam Rangarajan, Cambra Env. Tech. Inc

Software: GSI RBCA Spreadsheet
 Version: 1.0.1

NOTE: values which differ from Tier 1 default values are shown in bold italics and underlined.

Exposure Parameter	Definition (Units)	Residential			Commercial/Industrial	
		Adult	(1-6yrs)	(1-16 yrs)	Chronic	Constrctn
ATc	Averaging time for carcinogens (yr)	70				
ATn	Averaging time for non-carcinogens (yr)	30	6	16	25	1
BW	Body Weight (kg)	70	15	35	70	
ED	Exposure Duration (yr)	30	6	16	25	1
t	Averaging time for vapor flux (yr)	30			25	1
EF	Exposure Frequency (days/yr)	350			250	180
EF.Derm	Exposure Frequency for dermal exposure	350			250	
IRgw	Ingestion Rate of Water (L/day)	2			1	
IRs	Ingestion Rate of Soil (mg/day)	100	200		50	100
IRadj	Adjusted soil ing. rate (mg-yr/kg-d)	1.1E+02			9.4E+01	
IRa.in	Inhalation rate indoor (m ³ /day)	15			20	
IRa.out	Inhalation rate outdoor (m ³ /day)	20			20	10
SA	Skin surface area (dermal) (cm ²)	5.8E+03		2.0E+03	5.8E+03	5.8E+03
SAadj	Adjusted dermal area (cm ² -yr/kg)	2.1E+03			1.7E+03	
M	Soil to Skin adherence factor	1				
AAFs	Age adjustment on soil ingestion	FALSE			FALSE	
AAFd	Age adjustment on skin surface area	FALSE			FALSE	
tox	Use EPA tox data for air (or PEL based)?	TRUE				
gwMCL?	Use MCL as exposure limit in groundwater?	FALSE				

Surface Parameters	Definition (Units)	Residential	Commercial
A	Contaminated soil area (cm ²)	<u>6.5E+06</u>	1.0E+06
W	Length of affect. soil parallel to wind (cm)	1.5E+03	1.0E+03
W.gw	Length of affect. soil parallel to groundwater (cm)	1.5E+03	
Uair	Ambient air velocity in mixing zone (cm/s)	2.3E+02	
delta	Air mixing zone height (cm)	2.0E+02	
Lss	Thickness of affected surface soils (cm)	<u>1.5E+01</u>	
Pe	Particulate areal emission rate (g/cm ² /s)	6.9E-14	

Groundwater Parameters	Definition (Units)	Value
delta.gw	Groundwater mixing zone depth (cm)	2.0E+02
I	Groundwater infiltration rate (cm/yr)	3.0E+01
Ugw	Groundwater Darcy velocity (cm/yr)	<u>9.4E+02</u>
Ugw.tr	Groundwater seepage velocity (cm/yr)	<u>2.5E+03</u>
Ks	Saturated hydraulic conductivity (cm/s)	3.0E-03
grad	Groundwater gradient (cm/cm)	1.0E-02
Sw	Width of groundwater source zone (cm)	
Sd	Depth of groundwater source zone (cm)	
phi.eff	Effective porosity in water-bearing unit	3.8E-01
foc.sat	Fraction organic carbon in water-bearing unit	1.0E-03
BIO?	Is bioattenuation considered?	FALSE
BC	Biodegradation Capacity (mg/L)	

Soil Parameters	Definition (Units)	Value
hc	Capillary zone thickness (cm)	<u>3.0E+01</u>
hv	Vadose zone thickness (cm)	<u>2.4E+02</u>
rho	Soil density (g/cm ³)	<u>1.65</u>
foc	Fraction of organic carbon in vadose zone	0.01
phi	Soil porosity in vadose zone	<u>0.46</u>
Lgw	Depth to groundwater (cm)	<u>2.7E+02</u>
Ls	Depth to top of affected subsurface soil (cm)	<u>1.5E+01</u>
Lsubs	Thickness of affected subsurface soils (cm)	<u>2.6E+02</u>
pH	Soil/groundwater pH	6.5
		<u>capillary</u> <u>vadose</u> <u>foundation</u>
phi.w	Volumetric water content	<u>0.38</u> <u>0.38</u> <u>0.18</u>
phi.a	Volumetric air content	<u>0.08</u> <u>0.08</u> <u>0.2</u>

Building Parameters	Definition (Units)	Residential	Commercial
Lb	Building volume/area ratio (cm)	2.0E+02	3.0E+02
ER	Building air exchange rate (s ⁻¹)	1.4E-04	<u>4.2E-04</u>
Lcrk	Foundation crack thickness (cm)	1.5E+01	
eta	Foundation crack fraction	<u>0.001</u>	

Transport Parameters	Definition (Units)	Residential	Commercial
Groundwater			
ax	Longitudinal dispersivity (cm)		
ay	Transverse dispersivity (cm)		
az	Vertical dispersivity (cm)		
Vapor			
dcy	Transverse dispersion coefficient (cm)		
dcz	Vertical dispersion coefficient (cm)		

Matrix of Exposed Persons to Complete Exposure Pathways	Residential		Commercial/Industrial		
	Chronic	Constrctn	Chronic	Constrctn	
Outdoor Air Pathways:					
SS.v	Volatiles and Particulates from Surface Soils	FALSE		FALSE	TRUE
S.v	Volatilization from Subsurface Soils	FALSE		TRUE	
GW.v	Volatilization from Groundwater	FALSE		TRUE	
Indoor Air Pathways:					
S.b	Vapors from Subsurface Soils	FALSE		FALSE	
GW.b	Vapors from Groundwater	FALSE		FALSE	
Soil Pathways:					
SS.d	Direct Ingestion and Dermal Contact	FALSE		FALSE	FALSE
Groundwater Pathways:					
GW.i	Groundwater Ingestion	FALSE		FALSE	
S.l	Leaching to Groundwater from all Soils	FALSE		FALSE	

Matrix of Receptor Distance and Location On- or Off-Site	Residential		Commercial/Industrial	
	Distance	On-Site	Distance	On-Site
GW	Groundwater receptor (cm)	FALSE		FALSE
S	Inhalation receptor (cm)	FALSE		TRUE

Matrix of Target Risks	Individual	Cumulative
TRab	Target Risk (class A&B carcinogens)	1.0E-06
TRc	Target Risk (class C carcinogens)	<u>1.0E-06</u>
THQ	Target Hazard Quotient	1.0E+00
Opt	Calculation Option (1, 2, or 3)	2
Tier	RBCA Tier	2

RBCA SITE ASSESSMENT

Tier 2 Worksheet 9.2

Site Name: Shell Service Station WIC # 204-5508-5306

Completed By: Sam Rangarajan, Cambria Env. Tech. Inc

Site Location: 3420 San Pablo Avenue, Oakland, California

Date Completed: 12/8/1997

1 OF 1

**SUBSURFACE SOIL SSTL VALUES
(> 0.5 FT BGS)**

Target Risk (Class A & B) 1.0E-6

MCL exposure limit?

Calculation Option: 2

Target Risk (Class C) 1.0E-6

PEL exposure limit?

Target Hazard Quotient 1.0E+0

SSTL Results For Complete Exposure Pathways ("x" if Complete)

CONSTITUENTS OF CONCERN		Representative Concentration	Soil Leaching to Groundwater			Soil Volatilization to Indoor Air		Soil Volatilization to Outdoor Air		Applicable SSTL	SSTL Exceeded ?	Required CRF
			Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)	Residential: (on-site)	Commercial: (on-site)	Residential: (on-site)	Commercial: (on-site)			
CAS No.	Name	(mg/kg)								(mg/kg)	<input type="checkbox"/> * If yes	Only if "yes" left
71-43-2	Benzene	1.3E-1	NA	NA	NA	NA	NA	NA	2.7E+1	2.7E+1	<input type="checkbox"/>	<1

>Res indicates risk-based target concentration greater than constituent residual saturation value

RBCA SITE ASSESSMENT

Tier 2 Worksheet 9.3

Site Name: Shell Service Station WIC # 204-5508-5306
 Site Location: 3420 San Pablo Avenue, Oakland, California

Completed By: Sam Rangarajan, Cambria Env. Tech. Inc
 Date Completed: 12/8/1997

1 OF 1

GROUNDWATER SSTL VALUES

Target Risk (Class A & B) 1.0E-6 MCL exposure limit?
 Target Risk (Class C) 1.0E-6 PEL exposure limit?
 Target Hazard Quotient 1.0E+0

Calculation Option: 2

SSTL Results For Complete Exposure Pathways ("x" if Complete)

CONSTITUENTS OF CONCERN		Representative Concentration (mg/L)	Groundwater Ingestion			Groundwater Volatilization to Indoor Air <input checked="" type="checkbox"/>		Groundwater Volatilization to Outdoor Air		Applicable SSTL (mg/L)	SSTL Exceeded ? * If yes <input type="checkbox"/>	Required CRF
			Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)	Residential: (on-site)	Commercial: (on-site)	Residential (on-site)	Commercial (on-site)			
CAS No.	Name	(mg/L)	Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)	Residential: (on-site)	Commercial: (on-site)	Residential (on-site)	Commercial (on-site)	(mg/L)	* If yes <input type="checkbox"/>	Only if "yes" left
71-43-2	Benzene	5.0E-1	NA	NA	NA	NA	NA	NA	1.7E+2	1.7E+2	<input type="checkbox"/>	<1

>Sol indicates risk-based target concentration greater than constituent solubility

RBCA TIER 1/TIER 2 EVALUATION

Output Table 1

Site Name: Shell Service Station WIC # 20 Job Identification: 240-0554
 Site Location: 3420 San Pablo Avenue, Oakland Date Completed: 12/8/97

Software: GSI RBCA Spreadsheet
 Version: 1.0.1

Completed By: Sam Rangarajan, Cambria Env. Tech. Inc

NOTE: values which differ from Tier 1 default values are shown in bold italics and underlined.

Exposure Parameter	Definition (Units)	Residential			Commercial/Industrial	
		Adult	(1-6yrs)	(1-16 yrs)	Chronic	Constrctn
ATc	Averaging time for carcinogens (yr)	70				
ATn	Averaging time for non-carcinogens (yr)	30	6	16	25	1
BW	Body Weight (kg)	70	15	35	70	
ED	Exposure Duration (yr)	30	6	16	25	1
t	Averaging time for vapor flux (yr)	30			25	1
EF	Exposure Frequency (days/yr)	350			250	180
EF.Derm	Exposure Frequency for dermal exposure	350			250	
IRgw	Ingestion Rate of Water (L/day)	2			1	
IRs	Ingestion Rate of Soil (mg/day)	100	200		50	100
IRadj	Adjusted soil ing rate (mg-yr/kg-d)	1.1E+02			9.4E+01	
IRa.in	Inhalation rate indoor (m ³ /day)	15			20	
IRa.out	Inhalation rate outdoor (m ³ /day)	20			20	10
SA	Skin surface area (dermal) (cm ²)	5.8E+03		2.0E+03	5.8E+03	5.8E+03
SAadj	Adjusted dermal area (cm ² -yr/kg)	2.1E+03			1.7E+03	
M	Soil to Skin adherence factor	1				
AAFs	Age adjustment on soil ingestion	FALSE			FALSE	
AAFd	Age adjustment on skin surface area	FALSE			FALSE	
tox	Use EPA tox data for air (or PEL based)?	TRUE				
gwMCL?	Use MCL as exposure limit in groundwater?	FALSE				

Surface Parameters	Definition (Units)	Residential	Constrctn
A	Contaminated soil area (cm ²)	<u>6.5E+06</u>	1.0E+06
W	Length of affect. soil parallel to wind (cm)	1.5E+03	1.0E+03
W.gw	Length of affect. soil parallel to groundwater (cm)	1.5E+03	
Uair	Ambient air velocity in mixing zone (cm/s)	2.3E+02	
delta	Air mixing zone height (cm)	2.0E+02	
Lss	Thickness of affected surface soils (cm)	<u>1.5E+01</u>	
Pe	Particulate areal emission rate (g/cm ² /s)	6.9E-14	

Groundwater Parameters	Definition (Units)	Value
delta.gw	Groundwater mixing zone depth (cm)	2.0E+02
I	Groundwater infiltration rate (cm/yr)	3.0E+01
Ugw	Groundwater Darcy velocity (cm/yr)	<u>9.4E+02</u>
Ugw.tr	Groundwater seepage velocity (cm/yr)	<u>2.5E+03</u>
Ks	Saturated hydraulic conductivity (cm/s)	3.0E-03
grad	Groundwater gradient (cm/cm)	1.0E-02
Sw	Width of groundwater source zone (cm)	
Sd	Depth of groundwater source zone (cm)	
phi.eff	Effective porosity in water-bearing unit	3.8E-01
foc.sat	Fraction organic carbon in water-bearing unit	1.0E-03
BIO?	Is bioattenuation considered?	FALSE
BC	Biodegradation Capacity (mg/L)	

Matrix of Exposed Persons to Complete Exposure Pathways	Residential		Commercial/Industrial	
	Chronic	Constrctn	Chronic	Constrctn
Outdoor Air Pathways:				
SS.v	Volatiles and Particulates from Surface Soils	FALSE	FALSE	FALSE
S.v	Volatilization from Subsurface Soils	FALSE	FALSE	FALSE
GW.v	Volatilization from Groundwater	FALSE	FALSE	FALSE
Indoor Air Pathways:				
S.b	Vapors from Subsurface Soils	FALSE	TRUE	TRUE
GW.b	Vapors from Groundwater	FALSE	TRUE	TRUE
Soil Pathways:				
SS.d	Direct Ingestion and Dermal Contact	FALSE	FALSE	FALSE
Groundwater Pathways:				
GW.i	Groundwater Ingestion	FALSE	FALSE	FALSE
S.l	Leaching to Groundwater from all Soils	FALSE	FALSE	FALSE

Soil Parameters	Definition (Units)	Value												
hc	Capillary zone thickness (cm)	<u>3.0E+01</u>												
hv	Vadose zone thickness (cm)	<u>2.4E+02</u>												
rho	Soil density (g/cm ³)	<u>1.65</u>												
foc	Fraction of organic carbon in vadose zone	0.01												
phi	Soil porosity in vadose zone	<u>0.46</u>												
Lgw	Depth to groundwater (cm)	<u>2.7E+02</u>												
Ls	Depth to top of affected subsurface soil (cm)	<u>1.5E+01</u>												
Lsubs	Thickness of affected subsurface soils (cm)	<u>2.6E+02</u>												
pH	Soil/groundwater pH	6.5												
<table border="1"> <thead> <tr> <th></th> <th>capillary</th> <th>vadose</th> <th>foundation</th> </tr> </thead> <tbody> <tr> <td>phi.w</td> <td>Volumetric water content</td> <td><u>0.38</u></td> <td><u>0.38</u></td> </tr> <tr> <td>phi.a</td> <td>Volumetric air content</td> <td><u>0.08</u></td> <td><u>0.08</u></td> </tr> </tbody> </table>				capillary	vadose	foundation	phi.w	Volumetric water content	<u>0.38</u>	<u>0.38</u>	phi.a	Volumetric air content	<u>0.08</u>	<u>0.08</u>
	capillary	vadose	foundation											
phi.w	Volumetric water content	<u>0.38</u>	<u>0.38</u>											
phi.a	Volumetric air content	<u>0.08</u>	<u>0.08</u>											

Matrix of Receptor Distance and Location On- or Off-Site	Residential		Commercial/Industrial	
	Distance	On-Site	Distance	On-Site
GW	Groundwater receptor (cm)	FALSE	FALSE	FALSE
S	Inhalation receptor (cm)	FALSE	FALSE	FALSE

Building Parameters	Definition (Units)	Residential	Commercial
Lb	Building volume/area ratio (cm)	2.0E+02	3.0E+02
ER	Building air exchange rate (s ⁻¹)	1.4E-04	<u>1.1E-03</u>
Lcrk	Foundation crack thickness (cm)	<u>1.3E+01</u>	
eta	Foundation crack fraction	<u>0.001</u>	

Matrix of Target Risks	Definition	Individual	Cumulative
TRab	Target Risk (class A&B carcinogens)	1.0E-06	
TRc	Target Risk (class C carcinogens)	<u>1.0E-06</u>	
THQ	Target Hazard Quotient	1.0E+00	
Opt	Calculation Option (1, 2, or 3)	2	
Tier	RBCA Tier	2	

Transport Parameters	Definition (Units)	Residential	Commercial
Groundwater			
ax	Longitudinal dispersivity (cm)		
ay	Transverse dispersivity (cm)		
az	Vertical dispersivity (cm)		
Vapor			
dcy	Transverse dispersion coefficient (cm)		
dcz	Vertical dispersion coefficient (cm)		

RBCA SITE ASSESSMENT

Tier 2 Worksheet 9.2

Site Name: Shell Service Station WIC # 204-5508-5306

Completed By: Sam Rangarajan, Cambria Env. Tech. Inc

Site Location: 3420 San Pablo Avenue, Oakland, California

Date Completed: 12/8/1997

1 OF 1

**SUBSURFACE SOIL SSTL VALUES
(> 0.5 FT BGS)**

Target Risk (Class A & B) 1.0E-6

MCL exposure limit?

Calculation Option: 2

Target Risk (Class C) 1.0E-6

PEL exposure limit?

Target Hazard Quotient 1.0E+0

SSTL Results For Complete Exposure Pathways ("X" if Complete)

CONSTITUENTS OF CONCERN		Representative Concentration	Soil Leaching to Groundwater			Soil Volatilization to Indoor Air		Soil Volatilization to Outdoor Air		Applicable SSTL	SSTL Exceeded ?	Required CRF
			Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)	Residential: (on-site)	Commercial: (on-site)	Residential: (on-site)	Commercial: (on-site)			
CAS No.	Name	(mg/kg)								(mg/kg)	* If yes	Only if "yes" left
71-43-2	Benzene	1.3E-1	NA	NA	NA	NA	3.4E+0	NA	NA	3.4E+0	<input type="checkbox"/>	<1

>Res indicates risk-based target concentration greater than constituent residual saturation value

RBCA SITE ASSESSMENT

Tier 2 Worksheet 9.3

Site Name: Shell Service Station WIC # 204-5508-5306
 Site Location: 3420 San Pablo Avenue, Oakland, California

Completed By: Sam Rangarajan, Cambria Env. Tech. Inc
 Date Completed: 12/8/1997

1 OF 1

GROUNDWATER SSTL VALUES

Target Risk (Class A & B) 1.0E-6 MCL exposure limit?
 Target Risk (Class C) 1.0E-6 PEL exposure limit?
 Target Hazard Quotient 1.0E+0

Calculation Option: 2

SSTL Results For Complete Exposure Pathways ("x" if Complete)

CONSTITUENTS OF CONCERN		Representative Concentration (mg/L)	Groundwater Ingestion			Groundwater Volatilization to Indoor Air		Groundwater Volatilization to Outdoor Air		Applicable SSTL (mg/L)	SSTL Exceeded ? * If yes	Required CRF
			Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)	Residential: (on-site)	Commercial: (on-site)	Residential (on-site)	Commercial: (on-site)			
71-43-2	Benzene	5.0E-1	NA	NA	NA	NA	7.2E+0	NA	NA	7.2E+0	<input type="checkbox"/>	<1

>Sol indicates nsk-based target concentration greater than constituent solubility