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January 9, 1998

- this CAP was not approved nor endorsed by ACDEH

Mr. Scott O. Seery, CHMM
Alameda County Department of Environmental Health
Hazardous Materials Division
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502-6577

Re: **Corrective Action Plan**
Shell Service Station
1784 150th Avenue
San Leandro, California
WIC #204-6852-1404
Cambria Project #240-612-1

Dear Mr. Seery:

As requested in your December 2, 1997 letter to Mr. Alex Perez of Shell Oil Products Company (Shell), Cambria Environmental Technology, Inc. (Cambria) is submitting this Corrective Action Plan (CAP) to address hydrocarbons in ground water at the site referenced above. Discussed below are a site background, the historical hydrocarbon distribution, a risk-based corrective action (RBCA) summary, a remedial alternative evaluation, and our recommended corrective action. The site summary and historical data are based on previous reports submitted on behalf of Shell by Weiss Associates (WA) of Emeryville, California.

SITE BACKGROUND

Site Characteristics

Site Location: The site is an active service station located at the southern corner of the intersection of 150th and Freedom Avenues in San Leandro, California (Figure 1). The site is about 50 ft above mean sea level and the local topography slopes toward the west. San Leandro Creek is located about 1.5 miles to the north and the San Francisco Bay is located 6 miles to the west. The site is located in a mixed residential/commercial area.

Site Lithology: Sediments beneath the site are Quaternary alluvial deposits derived from sedimentary and igneous rocks of the Diablo Range. The site is adjacent to active traces of the Hayward Fault. The site is underlain by low estimated permeability sediments (clays and silts) with interspersed moderate estimated permeability sediments (sands).

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Ground Water Flow: Ground water is typically encountered 20 to 30 ft below ground surface (bgs). The ground water flow direction has a historical range from northwest to south. During 1995 and early 1996, the ground water flow was predominantly southward. In late 1996 and 1997 ground water monitoring results show the ground water flow to be north to northwest. These ground water flow direction variations are not easily attributed to seasonal changes and may be related to the proximity to the Hayward Fault. Historically, the ground water gradient beneath the site has ranged from 0.0008 ft/ft to 0.017 ft/ft.

Site Chronology

The following summarizes the environmental investigation activities that have occurred at the site. Tables summarizing the previous analytical data are included in Attachment A (RBCA Tier 1 Summary Report, Appendix A).

Waste Oil Underground Storage Tank (UST) Replacement: In 1986, a 550-gallon waste oil UST was removed. Soil samples collected from the tank pit contained petroleum oil and grease (POG) at 196 parts per million (ppm) at 8 ft bgs and 167 ppm at 11 ft bgs. Ground water was not encountered during the tank removal and sampling activities. A new 550-gallon fiberglass waste oil UST was installed at the same location.

Well Installation: In March 1990, monitoring well MW-1 was installed adjacent to the waste oil UST. Total petroleum hydrocarbons as gasoline (TPH-g) and benzene were detected in the initial ground water sample at 510 parts per billion (ppb) and 1.5 ppb, respectively. Up to 21 ppb 1,2-dichloroethane (DCA) has been detected in ground water samples from well MW-1 since that time.

Well Installation: In February 1992, wells MW-2 and MW-3 were installed to determine ground water gradient and define extent of hydrocarbons in soil and ground water. Well MW-2 was located adjacent to the gasoline underground storage tanks and well MW-3 was located in the eastern corner of the property. TPH-g, benzene and 1,2-DCA were detected in the initial ground water samples from well MW-2 at 17,000 ppb, 6,200 ppb, and 200 ppb, respectively, and from well MW-3 at 4,500 ppb, 97 ppb, and 9.1 ppb, respectively.

Well Survey: In 1992, a well survey identified 21 wells within a one half-mile radius of the site. The survey identified twelve monitoring wells, eight irrigation wells and one domestic well. No municipal wells were identified.

Subsurface Investigation: In June 1994, soil and ground water samples were collected from ten soil borings (BH-1 to BH-10). No hydrocarbons were detected in the soil samples analyzed except for benzene at 0.013 ppm in the 16 ft sample from boring BH-3. Ground water from borings BH-2 and BH-3 contained elevated TPH-g concentrations. Petroleum hydrocarbon concentrations in ground water samples collected from the other borings were low or below detection limits. The predominant ground water flow direction was assumed to be northwestward based on topography and distribution of dissolved hydrocarbons.

Well Installation: In March 1995, well MW-4 was installed northwest of the site in Portofino Drive. This well location was selected based on the predominant ground water flow direction and the distribution of dissolved hydrocarbons determined during the previous investigations. No petroleum hydrocarbons were detected in the initial ground water samples.

Ground Water Monitoring: Ground water has been monitored since March 1990. The monitoring results indicate that hydrocarbon concentrations are generally stable to decreasing. Analytic results are presented in Table 1.

Soil Vapor Survey and Soil Investigation: In July 1996, a subsurface investigation was conducted to obtain site-specific data for a risk-based corrective action evaluation of the site. Soil vapor and soil samples were collected from the vadose zone at ten onsite and offsite locations. Soil vapor samples were analyzed for petroleum hydrocarbons, total volatile hydrocarbons, oxygen, carbon dioxide and methane. Soil samples were analyzed for petroleum hydrocarbons, and physical and chemical parameters including moisture content, particle size distribution, dry and natural bulk densities and fraction organic carbon. The results of this investigation indicated that the vadose zone generally contains low petroleum hydrocarbon concentrations, but detected no total volatile hydrocarbons. Oxygen was locally depleted with elevated carbon dioxide and methane concentrations. The depleted oxygen, elevated carbon dioxide and methane concentrations in the vadose zone and the generally stable to decreasing hydrocarbons concentration trend in ground water indicate that biodegradation is occurring at the site.

RBCA Evaluation: In 1997, WA prepared a RBCA evaluation for the site (Attachment A). The RBCA is discussed in more detail below and the summary report produced by WA is included in Attachment A. WA recommended preparation of a CAP to address the potential risk associated with a hypothetical, but unlikely, ground water ingestion exposure pathway.

Dispenser and Turbine Sump Upgrade: In 1997, the dispensers and turbine sumps were upgraded at this site. Soil samples were collected during upgrade activities. A report summarizing these soil sample analytical results will be presented during the first quarter 1998.

RBCA SUMMARY

A Tier 1 and Tier 2 RBCA evaluation for the site was performed by WA (RBCA Summary Reports are included as Attachment A). The constituents of concern (COC) used in the RBCA analysis include benzene, toluene, ethylbenzene, xylenes (BTEX), 1,2-DCA, methyl-tert-butyl-ether (MTBE), and tetrachloroethene (PCE).

Tier 1 Site Conditions: Two exposure pathways to an adjacent residential property were evaluated. First, potential risk due to inhalation of vapors by an offsite resident was determined by comparing COC concentrations in soil vapors, soil and ground water to risk based screening levels (RBSLs). Second, potential risk due to ingestion of ground water from a hypothetical (not actual) well located 25 ft from the site was determined by comparing the highest COC concentrations in monitoring wells MW-2 and MW-3 to RBSLs.

Tier 1 Results: Based on the site specific soil vapor results and the COC concentrations in soil and in ground water at well MW-1 and well MW-2, the air exposure pathway for offsite residential inhalation did not exceed Tier 1 RBSLs. The ground water exposure pathway for ingestion from a hypothetical well exceeded Tier 1 RBSLs. The Tier 1 evaluation concluded the following: (1) vapor concentrations, collectively attributed from soil vapor, soil and ground water, pose no short-term or long-term threat to human health due to inhalation to an offsite resident, and (2) proceed to Tier 2 to further evaluate the ground water ingestion pathway.

Tier 2 Site Conditions: A Tier 2 evaluation was conducted to continue the evaluation of the hypothetical ground water ingestion pathway. The evaluation involved comparison of dissolved ground water concentrations and soil leachate concentrations to site specific target levels (SSTLs). The point of exposure for benzene, toluene, MTBE and 1,2-DCA was 25 ft, the distance between the assumed source and hypothetical receptor (distance between well MW-2 and nearest residential property). The offsite point of exposure for PCE was 10 ft, the distance between the assumed source and hypothetical receptor (distance between well MW-1 and nearest residential property).

Tier 2 Results: The representative ground water COC concentrations did exceed SSTLs. Based on the Tier 2 evaluation, WA recommended preparing a corrective action plan to address hydrocarbons in ground water that may impact the hypothetical drinking water well. At this time, no ground water in the vicinity of this site is known to be used. Therefore, this pathway is not complete and the potential risk calculations for hypothetical ground water ingestion are not applicable to actual or likely future conditions.

CORRECTIVE ACTION PLAN

The current site conditions and complete exposure pathways were used in the evaluation of remediation alternatives:

(1) The site is an active service station. Aggressive remediation is not warranted based on this current commercial use of the site.

(2) Although the residential inhalation of exposure pathway is complete, the Tier 1 RBCA evaluation indicates that vapor concentrations do not pose a significant risk to adjacent residential properties.

(3) There are no sensitive ground water receptors identified within 600 ft of the site.

(4) The ingestion of ground water from a potential well is not believed to be a plausible exposure scenario and was not used in the evaluation of remediation alternatives.

REMEDIATION ALTERNATIVE EVALUATION

Cambria evaluated four alternatives to remediation petroleum hydrocarbons at the site. A description of each alternative is presented below. In accordance with UST regulations presented in Title 23, we propose to implement the most cost-effective alternative that will meet the water quality objectives set for this site.

Remediation Alternative	Description/Recommendation	Relative Cost
Ground Water Extraction (GWE)	GWE uses pumps to extract and treat hydrocarbon-bearing ground water. The low volume of impacted ground water makes GWE impractical and overly expensive.	Very High ($150,000 to $250,000)
Soil Vapor Extraction (SVE)	SVE uses a vacuum to remove hydrocarbon vapors from soils in the vadose zone. The clayey soil beneath the site makes SVE impractical.	Very High ($150,000 to $250,000)
Enhanced Biodegradation with ORC Injection	Increasing the dissolved oxygen (DO)concentration in the upgradient and source area wells with ORC injection is practical and cost effective at sites with a limited ground water plume. This option is viable to enhance the natural biodegradation processes.	Moderate ($50,000 to $100,000)
Natural Attenuation and the Installation of Three Additional Ground Water Monitoring Wells for Improved Plume Monitoring	The stable to decreasing hydrocarbon concentrations in ground water and the depleted oxygen and elevated carbon dioxide and methane indicate biodegradation is occurring. However, due to the historical variation of the ground water flow, additional wells are needed to confirm plume dimensions and stability and to accurately determine flow direction. We recommend installing three ground water monitoring wells and to continue monitoring all wells for petroleum hydrocarbons, HVOCs and dissolved oxygen.	Low ($25,000 to $50,000)

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PROPOSED SCOPE OF WORK

Based on the evaluation of the remedial alternatives above, Cambria recommends installing three monitoring wells at the locations illustrated on Figure 2, and adding these wells to the ground water monitoring program. This will increase the ground water monitoring network to seven wells. Additional ground water data should confirm that the hydrocarbon plume is stable and the predominant ground water flow direction is toward the northwest. Pre-purge DO measurements will be collected and used to assess natural biodegradation of the hydrocarbons.

Rationale for Well Locations

The proposed well locations complement previous soil and ground water investigations conducted at this site. The addition of three wells will increase the monitoring network to seven wells and will provide adequate coverage to determine plume definition, plume stability and the predominant ground water flow direction. Wells are not proposed in the adjacent residential property for the following reasons: (1) soil vapor survey points SVS-2 and SVS-3, along the southern boundary of the site, measured low concentrations of BTEX as compared to SVS-5 indicating the plume extends northwest, (2) no TPH-g, BTEX and MTBE concentrations detected in soil samples from SVS-3 and SVS-5, (3) the distribution of dissolved TPH-g in ground water indicates the plume extends northwestward, away from the adjacent residential. *

Well MW-5 will be located in the northern corner of the site to provide ground water elevation data, northern plume definition, and confirmation of plume stability. It is located in close proximity to boring BH-2 where grab ground water samples had elevated concentrations of TPH-g and BTEX. Access limitations in this direction due to Interstate 580 and steep topography dictated the well location.

Well MW-6 will be located northwest (down gradient) of the site to provide ground water elevation data, northwestern plume definition, and confirmation of plume stability. The well is located in Portofino Circle and in close proximity to boring BH-5 where no hydrocarbons were detected in grab ground water samples.

Well MW-7 will be located south (up and cross gradient) of the site to provide ground water elevation data, southern plume definition, confirmation of plume stability and monitor potential impact to adjacent residential property. This well is located between borings BH-3, where hydrocarbons were detected, and boring BH-8 where no ground water was encountered.

* This is a misleading statement. No sample points have been advanced into areas within the residential development abutting the Shell site, yet as stated on Page 2, "Ground water Flow," flow direction has included westerly and southerly components. The noted residential development is directly in the path of this flow. Further, independent of GW flow, the geometric shape of the plume may be significantly beneath structures at the residential development. To suggest that the plume extends only to the NW is simply because that is where Shell looked for it.

Well Installation Procedure

Utility Location: Cambria will notify Underground Service Alert (USA) prior to drilling activities to identify any underground utilities that exist near the proposed drilling locations.

Permits: Cambria will obtain drilling permits from the Alameda County Department of Public Works. In addition, we will obtain encroachment permits from the City of San Leandro for the wells installed on public property.

Site Health and Safety Plan: Cambria will prepare a site health and safety plan identifying the potential site hazards associated with the drilling and will include a map of the route to the nearest hospital.

Soil Boring: Cambria will drill the soil borings using 7" diameter hollow-stem augers. We will collect soil samples at five ft intervals, at lithologic changes and from just above the water table. The borings will continue 10 ft below the first-encountered ground water and be converted into monitoring wells. The estimated depth of each boring will be 30-40 ft. We will select soil samples for chemical analysis based on observations of staining and odor and on the results of field screening with a organic vapor analyzer. Our standard field procedures are presented as Attachment B.

Soil Analysis: Selected soil samples will be analyzed for TPH-g by modified EPA Method 8015, BTEX and MTBE by EPA Method 8020.

Well Construction: The wells will be constructed using 2-inch diameter 0.010-inch slotted PVC and will be screened from 10 ft below to 5 ft above the static water table. The specific well construction details will be determined in the field based on boring lithology. The wells will be covered with a traffic-rated vault and a locking well cap. Our standard field procedures are included in Attachment B.

Well Development and Sampling: At least 72 hours after installation, the wells will be developed using consecutive episodes of surge block agitation and well evacuation. Evacuation will continue until at least 10 well-casing volumes of water have been removed and well purge water is as sediment-free as practical. Following well development, each well will be purged and sampled following our standard field procedures included in Attachment B.

Ground Water Analysis: Dissolved oxygen will be measured prior to purging. Samples collected from the wells will be analyzed for TPH-g by modified EPA Method 8015, BTEX and MTBE by EPA Method 8020, and HVOCs by EPA Method 8010. Selected samples may be analyzed using EPA Method 8260 to confirm the presence of MTBE.

Reporting: Following well installation and sampling, we will prepare a report that will contain:

- A summary of the site background and history;
- Descriptions of the drilling, well installation, development and sampling methods;
- Boring log and well construction diagram for each well;
- Tabulated soil and ground water analytic results;
- Analytic reports and chain-of-custody forms;
- Soil and water disposal methods; and
- Hydrogeologic interpretation.

Natural Attenuation Monitoring

At sites undergoing natural hydrocarbon biodegradation in ground water, we commonly observe relationships between hydrocarbon concentrations and DO concentrations. For natural attenuation to occur by aerobic processes, there needs to be about 1 to 2 mg/l DO. At most hydrocarbon sites, DO concentrations are reduced in the hydrocarbon source area compared to the region up gradient and down gradient of the hydrocarbon source area.

Once oxygen is depleted, hydrocarbon biodegradation may produce methane through anaerobic processes. In the hydrocarbon source area where oxygen is depleted, sulfates and nitrates can also act as electron receptors and allow anaerobic hydrocarbon degradation. As with the hydrocarbon/DO relationship, there is an inverse relationship with sulfates and nitrates and the hydrocarbon concentrations. Finally, since the source area is commonly oxygen deficient and often becomes a reducing environment, oxidation/reduction potential is another indicator that natural attenuation is occurring. Because it is costly to analyze for each parameter listed above to confirm that hydrocarbons are biodegrading, we typically recommend analyzing for DO to confirm that sufficient concentrations exist to allow continued remediation by natural attenuation.

As described previously, the existing ground water and soil vapor sample data suggest that biodegradation of petroleum hydrocarbons is occurring at the site. Petroleum hydrocarbon and DO concentrations measured during sampling of ground water from the existing and proposed monitoring wells will be used to confirm the existing data.

SCHEDULE

Upon receiving written approval of this corrective action plan from the ACDEH, Cambria will obtain necessary permits and schedule field activities. We will submit our report approximately four to six weeks after completing the field work.

Mr. Scott O. Seery
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CONTINGENCY PLAN

If it becomes apparent that natural attenuation is not sufficient, we will re-evaluate the remedial alternatives discussed above and other applicable alternatives that may be appropriate for this site.

CLOSING

In summary, we recommend installing three wells to evaluate plume stability, assess the ground water flow direction, and confirm natural attenuation. We trust that this submittal meets your requirements. Please call if you have any questions.

Sincerely,
Cambria Environmental Technology, Inc.

Gina Kathuria, P.E.
Senior Project Engineer

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Attachments: A - Weiss Associates RBCA Tier 1 and Tier 2
B - Standard Field Procedure for Monitoring Well Installation

cc: A. E. (Alex) Perez, Shell Oil Products Company, P.O. Box 8080, Martinez, CA 94553

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Environmental Technology, Inc.

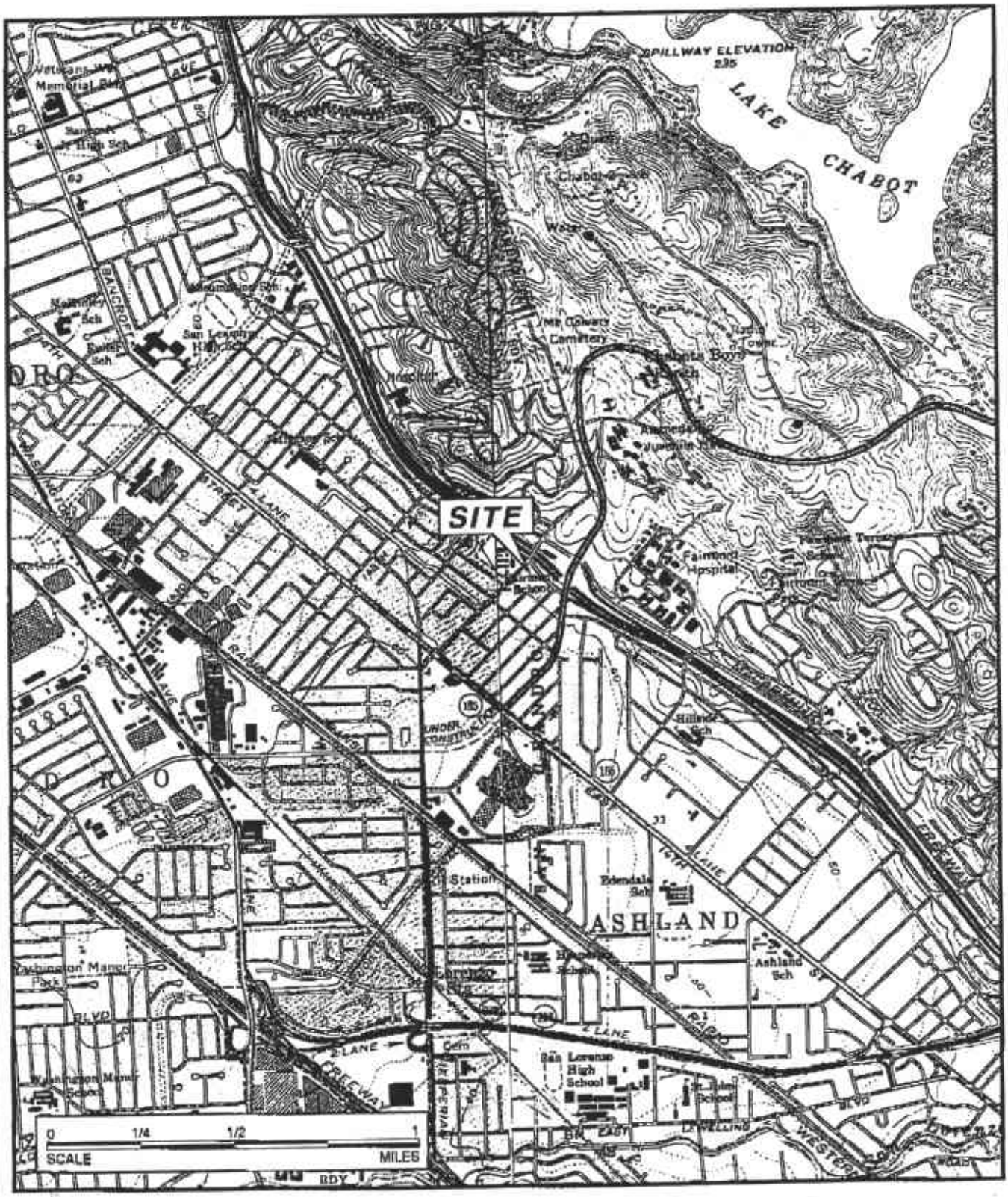

Figure 1. Site Location Map - Shell Service Station WIC #204-6852-1404, 1784 150th Avenue, San Leandro, California

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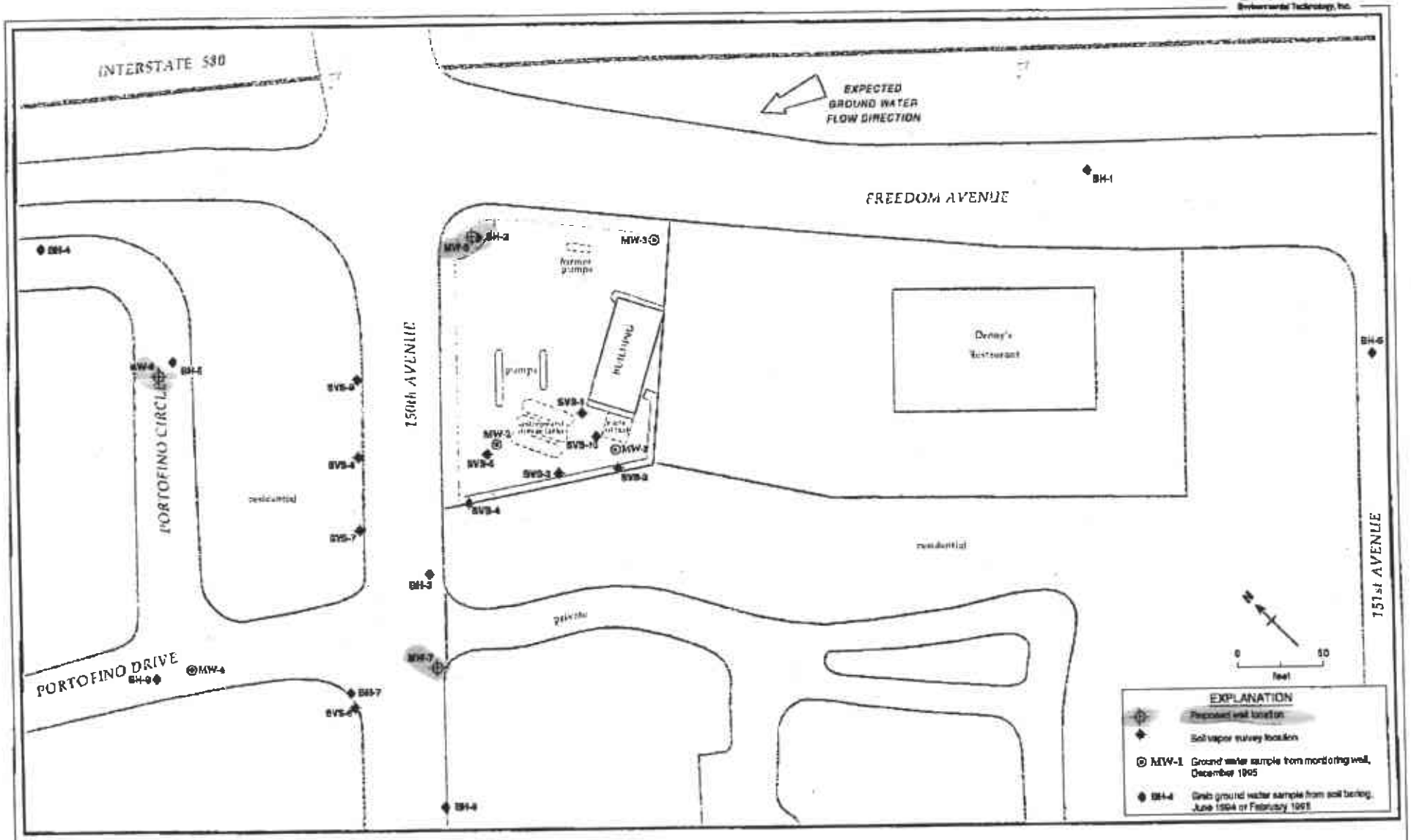


Figure 2. Proposed Monitoring Well Locations - Shell Service Station WIC #204-6852-1404, 1784 150th Avenue, San Leandro, California

Table 1. **Analytic Results for Ground Water** - Shell Service Station WIC #204-6852-1404, 1784 150th Avenue, San Leandro, California

Well ID	Date Sampled	Depth to Water (ft)	TPH-G	TPH-D	POG	B	E	T	X	1,2-DCA	MTBE	DO (mg/L)
			← parts per billion (µg/l) →									
MW-1	03/08/90	25.29	510	120[a]	<10,000	1.5	<0.5	0.8	5.4	12	---	---
	06/12/90	25.85	390	100[a]	<10,000	86	0.7	1.3	6.2	<0.4	---	---
	09/13/90	27.49	100	130[a]	<10,000	56	2.4	0.75	2.8	<0.4[b]	---	---
	12/18/90	27.41	480	<50[a]	<10,000	54	3.3	1.7	3.7	5.3	---	---
	03/07/91	25.79	80	<50[a]	---	266	1.2	<0.5	<1.5	6.7	---	---
	06/07/91	25.64	510	<50[a]	---	130	6.1	3.8	11	7.9	---	---
	09/17/91	27.54	330	120[ac]	---	67	3	<0.5	2.2	6	---	---
	12/09/91	27.81	140[d]	80	---	<0.5	1.7	<0.5	4.7	5.4	---	---
	03/01/92	23.36	<50	<50	---	<0.5	<0.5	<0.5	<0.5	3	---	---
	06/03/92	24.64	1,500	---	---	520	72	180	230	3	---	---
	09/01/92	26.74	130	---	---	16	1.8	1.4	3.4	1.3[e]	---	---
	12/04/92	27.14	150	---	---	360	1.8	0.7	2.1	3.3	---	---
	03/03/93	20.50	<50	---	---	1.5	<0.5	<0.5	<0.5	0.76	---	---
	06/17/93	22.42	1,600	---	---	340	120	120	440	3	---	---
	09/10/93	24.11	2,600	---	---	670	310	340	730	2.3	---	---
	12/13/93	23.73	11,000	---	---	470	380	320	2,300	6.3	---	---
	03/03/94	22.08	16,000	---	---	700	480	690	3,200	---	---	---
	06/06/94	23.10	7,500	---	---	420	200	280	1,000	3.1	---	---
	09/12/94	25.19	1,200	---	---	110	3.3	21	420	2.6	---	---
	12/19/94	23.06	4,600	---	---	470	230	330	1,300	3.7	---	---
	02/28/95	20.90	500	---	---	59	6.8	32	68	5.0	---	---
	06/26/95	20.40	5,500	---	---	740	300	420	1,800	8.6	---	---
	09/13/95	22.62	84,000	---	---	1,900	3,000	2,600	14,000	12	---	---
	12/19/95	22.10	80,000	---	---	660	170	350	18,000	<0.4	---	---
	03/06/96[SPH]	---	---	---	---	---	---	---	---	---	---	---
	06/28/96	21.46	270,000	---	---	2,800	1,000	820	16,000	---	<0.5	---
	06/28/96[dup]	21.46	790,000	---	---	2,200	1,000	780	13,000	---	15,000	---
	09/26/96	23.57	29,000	---	---	1,100	270	260	1,900	9.8	<1,000	---
	09/26/96[dup]	23.57	25,000	---	---	1,200	240	320	1,900	11	<1,000	---
	12/10/96	21.43	13,000	---	---	510	230	240	1,200	16	100	1.0

Table 1. **Analytic Results for Ground Water** - Shell Service Station WIC #204-6852-1404, 1784 150th Avenue, San Leandro, California (continued)

Well ID	Date Sampled	Depth to Water (ft)	TPH-G	TPH-D	POG	B	E	T	X	1,2-DCA	MTBE	DO (mg/L)
			← parts per billion (µg/l) →									
	12/10/96[dup]	21.43	8,400	---	---	420	140	130	680	17	81	1.0
	03/10/97	20.08	4,200	---	---	13	16	8.8	74	12	<12	2.0
	03/10/97[dup]	20.08	5,100	---	---	12	17	8.9	79	11	<25	2.0
	06/30/97	21.68	5,700	---	---	320	140	120	700	21	47	1.6
	06/30/97[dup]	21.68	5,300	---	---	300	120	95	580	22	45	1.6
	09/12/97	21.78	6,300	---	---	120	82	26	260	12	30	2.1
MW-2	02/24/92	19.61	17,000	2,700[f]	---	6,200	550	1,600	1,900	200	---	---
	03/01/92	21.11	86,000	1,000[f]	---	30,000	2,300	34,000	16,000	82	---	---
	06/03/92	21.58	87,000	---	---	28,000	2,000	18,000	10,000	<50	---	---
	09/01/92	23.46	110,000	---	---	21,000	1,900	13,000	7,800	83[h]	---	---
	12/04/92	23.89	42,000	---	---	15,000	960	2,400	2,900	100	---	---
	03/03/93	17.28	160,000	---	---	36,000	32,000	3,800	21,000	7.7	---	---
	03/03/93[h]	17.28	150,000	---	---	31,000	20,000	3,100	14,000	16	---	---
	06/17/93	19.06	65,000	---	---	34,000	3,200	15,000	11,000	37	---	---
	06/17/93[h]	19.06	62,000	---	---	28,000	2,700	14,000	10,000	36	---	---
	09/10/93[f]	20.88	72,000	---	---	24,000	2,300	16,000	11,000	28.0	---	---
	09/10/93[dup,f]	20.88	71,000	---	---	23,000	2,300	15,000	10,000	27.0	---	---
	12/13/93	20.42	19,000	---	---	5,400	680	4,900	3,100	<0.5	---	---
	12/13/93[dup]		17,000	---	---	6,200	720	5,500	3,500	3.4	---	---
	03/03/94	18.48	110,000	---	---	21,000	2000	24,000	13,000	---	---	---
	03/03/94[dup]	18.48	93,000	---	---	19,000	1,800	22,000	12,000	---	---	---
	06/06/94	20.26	10,000	---	---	1,900	2,500	3,300	13,000	5.8	---	---
	06/06/94[dup]	20.26	99,000	---	---	9,900	2,400	12,000	12,000	5.7	---	---
	09/12/94	21.80	160,000	---	---	22,000	3,400	33,000	23,000	<0.4	---	---
	09/12/94[dup]	21.80	150,000	---	---	23,000	3,500	34,000	23,000	<0.4	---	---
	12/19/94	19.66	80,000	---	---	17,000	2,300	16,000	14,000	<0.4	---	---
	12/19/94[dup]	19.66	100,000	---	---	28,000	3,400	26,000	20,000	<0.4	---	---
	02/28/95	17.51	100,000	---	---	24,000	2,300	18,000	17,000	<0.4	---	---

Table 1. **Analytic Results for Ground Water** - Shell Service Station WIC #204-6852-1404, 1784 150th Avenue, San Leandro, California (continued)

Well ID	Date Sampled	Depth to Water (ft)	TPH-G	TPH-D	POG	B	E	T	X	1,2-DCA	MTBE	DO (mg/L)
			← parts per billion (µg/l) →									
	02/28/95[dup]	17.51	100,000	---	---	31,000	3,200	21,000	18,000	<0.4	---	---
	06/26/95	17.58	45,000	---	---	14,000	1,500	12,000	7,500	3.4	---	---
	06/26/95[dup]	17.58	68,000	---	---	13,000	1,800	11,000	7,700	---	---	---
	09/13/95	19.28	110,000	---	---	19,000	2,800	19,000	15,000	7.2	---	---
	09/13/95[dup]	19.28	120,000	---	---	20,000	2,900	20,000	15,000	<0.4	---	---
	12/19/95	18.61	180,000	---	---	18,000	4,100	29,000	24,000	<0.4	---	---
	12/19/95[dup]	18.61	160,000	---	---	18,000	3,800	28,000	24,000	<0.4	---	---
	03/06/96	15.41	120,000	---	---	28,000	3,900	15,000	17,000	<20	---	---
	06/28/96	17.84	96,000	---	---	20,000	4,100	20,000	22,000	---	2,400	---
	09/26/96	19.60	87,000	---	---	7,600	2,500	11,000	15,000	56**	990*	---
	12/10/96[SPH]	18.15	---	---	---	---	---	---	---	---	---	---
	03/10/97[SPH]	17.02	---	---	---	---	---	---	---	---	---	---
	06/30/97	19.42	57,000	---	---	3,600	1,300	4,600	9,700	<50	2,300	2.4
	09/12/97	19.40	88,000	---	---	7,800	2,600	8,800	16,000	<25	3,200	1.7
	09/12/97[dup]	19.40	90,000	---	---	8,300	2,700	9,400	17,000	<25	3,400	1.7
MW-3	02/24/92	25.60	4,500	1,300[c]	---	97	78	<5	18	9.1	---	---
	03/01/92	26.00	2,200	440	---	69	<0.5	<0.5	<0.5	13	---	---
	06/03/92	27.70	4,100	---	---	13	44	72	65	16	---	---
	09/01/92	29.46	1,900	---	---	20	5.5	6.8	<5	19	---	---
	09/01/92[dup]	29.46	1,900	---	---	21	3.4	6.6	<5	21	---	---
	12/04/92	29.93	2,400	---	---	8.2	<5	<5	<5	16	---	---
	12/04/92[dup]	29.93	2,100	---	---	11	5.7	<0.5	<0.5	18	---	---
	03/03/93	23.08	5,100	---	---	63	75	61	150	3.3	---	---
	06/17/93	25.21	4,000	---	---	94	82	140	150	23	---	---
	09/10/93	26.95	3,200	---	---	140	12.5	12.5	12.5	20.0	---	---
	12/13/93	26.52	6,200	---	---	<12.5	<12.5	<12.5	<12.5	13	---	---
	03/03/94	24.50	4,500	---	---	73	<5	<5	<5	---	---	---
	06/06/94	26.33	3,200	---	---	<0.5	3.1	<0.5	<0.5	16	---	---

Table 1. **Analytic Results for Ground Water** - Shell Service Station WIC #204-6852-1404, 1784 150th Avenue, San Leandro, California (continued)

Well ID	Date Sampled	Depth to Water (ft)	TPH-G	TPH-D	POG	B	E	T	X	1,2-DCA	MTBE	DO (mg/L)
			← parts per billion (µg/l) →									
	09/12/94	27.98	3,900	---	---	<0.5	9.6	<0.5	4.1	7.8	---	---
	12/19/94	25.63	2,400	---	---	21	4.2	22	2.6	25	---	---
	02/28/95	23.45	4,000	---	---	58	7.1	<0.5	3.5	18	---	---
	06/26/95	23.64	3,900	---	---	8.1	12	<0.5	2.4	15	---	---
	09/13/95	25.40	4,100	---	---	58	5.5	5.5	<0.5	6.7	---	---
	12/19/95	24.53	3,600	---	---	<0.5	2.1	4.3	1.1	6.6	---	---
	03/06/96[SPH]	---	---	---	---	---	---	---	---	---	---	---
	06/28/96	23.95	2,400	---	---	55	<0.5	<0.5	11	---	120	---
	09/26/96	25.89	2,500	---	---	<5.0	<5.0	<5.0	<5.0	25	160	---
	12/10/96	24.22	1,600	---	---	28	<2.0	4.2	3.9	34	110	0.8
	03/10/97	23.05	130	---	---	<0.50	<0.50	<0.50	1.4	3.5	4.2	2.8
	06/30/97	24.34	1,200	---	---	21	<2.0	2.3	<2.0	97	69	2.3
	09/12/97	24.47	440	---	---	8.3	<0.50	0.82	1.9	5.0	3.4	1.9
MW-4	03/24/95	9.16	<50	---	---	<0.5	<0.5	<0.5	<0.5	<0.4	---	---
	06/26/95	12.06	<50	---	---	<0.5	<0.5	<0.5	<0.5	<0.4	---	---
	09/13/95	13.90	<50	---	---	<0.5	<0.5	<0.5	<0.5	<0.4	---	---
	12/19/95	12.90	<50	---	---	<0.5	<0.5	<0.5	<0.5	<0.4	---	---
	03/06/96	9.63	<50	---	---	<0.5	<0.5	<0.5	<0.5	<0.4	---	---
	06/28/96	12.30	40	---	---	<0.5	.97	.59	3.8	---	26	---
	09/26/96	14.12	<50	---	---	<0.5	<0.5	<0.5	<0.5	<0.5	<2.5	---
	12/10/96[1]	12.31	<50	---	---	<0.5	<0.5	<0.5	<0.5	---	<2.5	1.2
	03/10/97[m]	11.34	<50	---	---	<0.50	<0.50	<0.50	<0.50	---	<2.5	---
	06/30/97[n]	13.80	<50	---	---	<0.50	<0.50	<0.50	<0.50	<0.50	<2.5	1.9
	09/12/97	13.99	<50	---	---	<0.50	<0.50	<0.50	<0.50	<0.50	<2.5	1.7
Trip Blank	03/08/90		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	06/12/90		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	12/18/90		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---

Table 1. **Analytic Results for Ground Water** - Shell Service Station WIC #204-6852-1404, 1784 150th Avenue, San Leandro, California (continued)

Well ID	Date Sampled	Depth to Water (ft)	TPH-G	TPH-D	POG	B	E	T	X	1,2-DCA	MTBE	DO (mg/L)
			← parts per billion (µg/l) →									
	03/07/91		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	06/07/91		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	09/17/91		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	12/09/91		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	02/24/92		<50	---	---	<0.5	0.6	2.5	2.2	---	---	---
	03/01/92		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	06/03/92		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	09/01/92		<50	---	---	<0.5	<0.5	<0.5	<0.5	<0.5	---	---
	12/04/92		<50	---	---	<0.5	<0.5	<0.5	<0.5	<0.5[j]	---	---
	03/03/93		<50	---	---	<0.5	<0.5	<0.5	<0.5	<0.5	---	---
	06/17/93		<50	---	---	<0.5	<0.5	<0.5	<0.5	<0.5	---	---
	09/10/93		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	12/13/93		<50	---	---	<0.5	<0.5	<0.5	<0.5	<0.5[k]	---	---
	03/03/94		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	06/06/94		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	09/12/94		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	12/19/94		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	02/28/95		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	03/24/95		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	06/26/95		<50	---	---	4.1	<0.5	3.0	1.5	---	---	---
	09/13/95		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	12/19/95		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
Bailer Blank	03/08/90		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	09/01/92		<50	---		<0.5	<0.5	0.7	<0.5	<0.5	---	---
	12/04/92[j]		60	---		<0.5	<0.5	<0.5	<0.5	<0.5	---	---
MCLs			NE	NE	NE	1	700	150	1,750	0.5	NE	NE

Table 2. **Analytic Results for Ground Water** - Shell Service Station WIC #204-6852-1404, 1784 150th Avenue, San Leandro, California (continued)

Abbreviations:

TPH-G = Total Petroleum Hydrocarbons as Gasoline by Modified EPA Method 8015
TPH-D = Total Petroleum Hydrocarbons as Diesel by Modified EPA Method 8015
POG = Petroleum oil and grease by American Public Health Association Standard Method 503E or 5520F
MTBE = Methyl tert-Butyl Ether by EPA Method 8020
B = Benzene by EPA Method 8020
E = Ethylbenzene by EPA Method 8020
T = Toluene by EPA Method 8020
X = Xylenes by EPA Method 8020
1,2-DCA = 1,2-Dichloroethane by EPA Method 8010. No other halogenated hydrocarbons detected unless otherwise noted.
DO = Dissolved oxygen
--- = Not analyzed
<n = Not detected above method detection limit of n ppb
MCLs = California Primary maximum contaminant levels for drinking water (22 CCR 64444)
NE = Not established
SPH = Separate-phase hydrocarbons present in well
µg/L = Micrograms per liter
mg/L = Milligrams per liter
ppb = Parts per billion, which is equivalent to µg/L
ft = Feet
dup = duplicate sample

Notes:

a = No total petroleum hydrocarbons as motor oil detected above modified EPA Method 8015 detection limit of 500 ppb
b = Tetrachloroethene (PCE) detected at 24 ppb by EPA Method 8010; MCL for PCE is 5 ppb
c = Result is due to hydrocarbon compounds lighter than diesel
d = Result due to a non-gasoline hydrocarbon
e = In the matrix spike/matrix spike duplicate of sample MW-1, the RPD for Freon 113 and 1,3-dichlorobenzene was greater than 25%
f = The MW-2 and duplicate samples each contained 1.6 ppb of methylene chloride which is within normal laboratory background levels
h = Sample MW-2 was diluted 1:100 for EPA Method 8010 due to the interfering hydrocarbon peaks
j = The trip and bailer blank samples contained 14 and 10 mg/L 1,3-dichlorobenzene, respectively
k = 1.4 mg/L Chloroethene detected in equipment blank; trip blank not analyzed
l = Tetrachloroethene (PCE) detected at 0.50 ppb by EPA Method 8010
Trichloroethene (TCE) detected at 0.57 ppb by EPA Method 8010; MCL for TCE is 5 ppb
m = Trichloroethene detected at 0.52 ppb by EPA Method 8010
n = Trichloroethene detected at 0.55 ppb by EPA Method 8010
* = MTBE confirmed by EPA Method 8260
** = Result should be considered estimated due to being reported under the detection limit of 125 ppb

FACSIMILE

To:	**Mr. Scott Seery**
Organization:	**Alameda County Department of Environmental Health**
Fax #:	**337-9335**
Re:	**1784 150th Avenue, San Leandro Corrective Action Plan**
Date:	**January 9, 1998**
Pages:	**18, including this cover sheet.**

Please find attached the Corrective Action Plan for the above-referenced site. The hard copy will follow by mail. Please call Gina Kathuria at 420-3330 if you have any questions.

Thank you.

From the desk of...

Maureen D. Feineman
Geologist
Cambria Environmental Technology, Inc.
1144 65th Street, Suite C
Oakland, CA 94608

(510) 420-0700
Fax: (510) 420-9170

G:\ADMIN\PERSONAL\Maureen\FAX.WPD

COPY

RBCA

SUMMARY REPORT

■ TIER 1 / ❑ TIER 2 RBCA SITE EVALUATION

Shell Service Station, WIC #204-6852-1404

1784 150th Avenue, San Leandro, California

Weiss Associates

PREPARED BY

April 21, 1997

DATE ISSUED

REVIEWED BY Steven Leung

DATE 4/21/97

Site Name: Shell Service Station WIC #204-6852-1404 | Date Completed: April 21, 1997

Site Location: 1784 150th Avenue, San Leandro, California | Completed By: Weiss Associates | *Page 1 of 2*

TIER 1 / TIER 2 RBCA REPORT INDEX

(u) = For Tier 2, update Tier 1 version as needed

■ = ENCLOSED

TIER 1 / TIER 2 REPORT INDEX *continued*

■ = ENCLOSED

(u) = For Tier 2, update Tier 1 version as needed.		Tier 1	Tier 2
7.0 NATURAL ATTENUATION FACTORS			
7.1	Tier 2 NAF Calculation Methods & Results		☐
8.0 TIER 2 SSTL EVALUATION			
8.1	Soil Vapor SSTL Values		☐
8.2	Groundwater SSTL Values		☐
ATTACHMENTS			
Figure 1	Site Location Map	■	☐ *(u)*
Figure 2	Extended Site Map	■	☐ *(u)*
Figure 3	Site Plan	☐	☐ *(u)*
Figure 4	Site Photos	☐	☐ *(u)*
Figure 5	Groundwater Plume Maps		☐
Figure 6	Groundwater Elevation Map	☐	☐ *(u)*
Figure 7	Soil Boring Location Map	☐	☐ *(u)*
APPENDICES			
Appendix A	Chemical Analysis Data Tables	■	☐ *(u)*
Appendix B	Well Logs	■	☐ *(u)*
Appendix C	Soil Vapor RBSL Calculations	■	☐

Site Name: Shell Service Station WIC #204-6852-1404 | Date Completed: April 21, 1997

Site Location: 1784 150th Avenue, San Leandro, California | Completed By: Weiss Associates | *Page 1 of 1*

TIER 1 EXECUTIVE SUMMARY

VISUAL/HISTORICAL ASSESSMENT (■ TO SELECT)

Site size (acres)	■	<1	☐	<10	☐	>10	☐ N/A
Site use	☐	undeveloped	■	commercial	☐	residential	☐ N/A
Site access	☐	capped	☐	fenced-in	■	open	☐ N/A
Visual evidence of environmental impact	■	none	☐	limited	☐	extensive	☐ N/A
Current site land use	☐	undeveloped	■	commercial	■	residential	☐ N/A
Contaminant sources	■	tanks/spills	☐	trench/drums	☐	ponds/pits	☐ N/A
Affected environmental media	■	soil (>3 ft BGS)	■	groundwater	☐	surface soil (<3 ft BGS)	■ soil vapor
Types of compounds likely to be present	■☐	petroleum hydrocarbons	☐	metals			
		inorganic compounds	■	VOCs			

BASELINE RECEPTOR IDENTIFICATION

Reasonable potential receptors (greatest concern)	☐	none	☐	ecological	■	human	☐N/A
Distance from fenceline to nearest off-site receptor (ft)	☐	>500	☐	100 - 500	■	<100	☐N/A
Travel time to closest groundwater receptor (yr)	☐	>10	☐	2 - 10	■	<2	☐N/A
Depth to first encountered groundwater (ft)	☐	>150	☐	50 - 150	■	<50	☐N/A
Complete exposure pathways	☐	none	■	ingestion	■	inhalation	☐N/A
	☐	ecological	☐	dermal	☐	absorption	☐N/A

TIER 1 TASKS COMPLETED

- ■ Visual / historical assessment
- ■ Initial (screening) site assessment
- ■ Site prioritization / classification
- ■ Detailed site characterization
- ■ RBSL comparison
- ☐ Corrective action planned or implemented

TIER 1 CLASSIFICATION EVALUATION

Classification No.	Scenario Description	Prescribed Interim Action	Date Implemented
4	Low hydrocarbon vapor concentrations have been detected in soil adjacent to residential buildings.	Perform RBCA Tier 1 and, if necessary, Tier 2 evaluation. For Tier 2 evaluation, model fate and transport of hydrocarbons in ground water and determine the most appropriate future action.	March 1997
3	Dissolved hydrocarbons may impact an irrigation well, located about 600 ft downgradient of the site.		
4	Low hydrocarbon concentrations have been detected in soil.		

TIER 1 CORRECTIVE ACTION CRITERIA

Affected Medium	Screening Level Criteria Exceeded? (■ if yes) Risk-Based	Other (MCL)	Others: (specify)	_____	_____	Not Applicable	None Exceeded
• Surface Soil (< 3ft BGS)	☐	☐	☐	☐	☐	■	☐
• Subsurface Soil (>3ft BGS)	■	☐	☐	☐	☐	☐	☐
• Groundwater (potable/nonpotable)	■	■	☐	☐	☐	☐	☐
• Soil Vapor	☐	☐	☐	☐	☐	☐	☐
• Surface waters	☐	☐	☐	☐	☐	■	☐

PROPOSED TIER 1 ACTION

- ☐ ***No Action:*** Site does not exceed Tier 1 criteria. - Apply for closure.
- ☐ ***Interim Corrective Action:*** Site exceeds some Tier 1 criteria. - Propose interim corrective action and reprioritize site.
- ☐ ***Final Corrective Action:*** Site exceeds some Tier 1 criteria. - Propose corrective action to achieve Tier 1 criteria.
- ■ ***Tier 2 Evaluation:*** Site exceeds some Tier 1 criteria. - Re-evaluate corrective action goals per Tier 2 risk assessment.

NOTE:
Rationale for proposed action documented on Worksheets 1.3 and 10.1-10.3.

ALL WORKSHEETS ENCLOSED IN THIS REPORT ARE IDENTIFIED ON THE TABLE OF CONTENTS FORM.

EXECUTIVE SUMMARY

Instructions: *Provide brief description of site history, hydrogeologic conditions, ecological assessment, possible exposure pathways, RBSL / SSTL results, and the scope of work for proposed corrective action activity. Address proposed methods, implementation schedule, cost, and anticipated risk reduction at or near the site.*

SITE DESCRIPTION AND HISTORY

• **Worksheets 2.1 - 2.5** • **Figures 1 - 4**

Briefly discuss site chronology, operations, features of potential concern, and future plans for site use.

The site is an active service station that dispenses gasoline and services automobiles. Three 10,000-gallon underground gasoline tanks, two pumps islands, an underground 550-gallon waste oil tank and garage are present on the property. Another pump island was previously located on the eastern portion of the property. Shell intends to operate the service station indefinitely.

In November 1986, Shell replaced the waste oil tank. Because soil beneath the former waste oil tank contained petroleum hydrocarbons, a subsurface investigation was performed. Between March 1990 and December 1996, soil and ground water samples have been collected from four ground water monitoring wells and about 23 soil borings. For the first time, separate-phase hydrocarbons were measured in the site's ground water monitoring wells in 1996. Dissolved hydrocarbons are beneath the site and beneath residential property and 150th Avenue to the west, the presumed ground water flow direction. To address concerns of potential indoor inhalation of hydrocarbon vapors emanating from the subsurface, WA collected soil vapor samples in July 1996.

SITE ASSESSMENT INFORMATION

GEOLOGIC AND HYDROGEOLOGIC SUMMARY

• **Worksheets 3.1 - 3.4** • **Figures 6 and 7**

Briefly describe regional site features, climate, vadose zone soils, and groundwater depth, quality, and use.

The site is located at the base of the Berkeley Hills on the eastern edge of the East Bay Plain Ground Water Basin in San Leandro, California. Active traces of the Hayward Fault have been mapped beneath Freedom Avenue adjacent to the site and beneath and east of Highway 580. Bedrock may be less than 100 ft deep beneath the site. On average, the area receives about 22 inches of precipitation per year, mostly during the winter.

Soil beneath the site consists of silty clay to silty sand with low to moderate estimated permeability. Ground water is typically 20 to 30 ft beneath ground surface. Ground water has flowed various directions between 1990 and 1997 with flat gradients relative to the topographical gradient. Ten irrigation wells are documented within one-half mile of the site. One of these wells is about 600 ft downgradient of the site.

BASELINE EXPOSURE ASSESSMENT

COMPLETE EXPOSURE PATHWAYS AND APPLICABLE RECEPTORS

• **Worksheets 4.1 - 4.5**

Discuss current or potentially complete pathways for human or ecological exposure to site constituents.

WA has identified the following potentially complete exposure pathways:

- Volatilization of hydrocarbons from soil to outdoor air
- Leachate of hydrocarbons from soil to ground water for ingestion
- Volatilization of hydrocarbons from ground water to outdoor air
- Ingestion of ground water
- Intrusion of subsurface hydrocarbon vapors into buildings

ECOLOGICAL ASSESSMENT SUMMARY

• **Worksheet 3.5**

Discuss potentially sensitive ecological receptors and habitat in the vicinity of site, if any.

No ecological receptors were identified.

EXECUTIVE SUMMARY DISCUSSION Continued

TIER 1 RBSL OR TIER 2 SSTL EVALUATION

COMPARISON TO SOURCE MEDIA CONCENTRATIONS

- **Worksheets 5.1 - 5.7, 6.1 - 6.3**

For complete pathways, compare representative source concentrations to applicable RBSL or SSTL values.

Representative concentrations of the following chemical of concerns exceeded the conservatively derived RBSLs:

- Benzene in ground water for ingestion
- Toluene in ground water for ingestion
- 1,2-Dichloroethane in ground water for ingestion
- Tetrachloroethane in ground water for ingestion
- Methyl tertiary-butyl ether in ground water for ingestion
- Benzene in soil leaching to ground water for ingestion.

QUALITATIVE UNCERTAINTY ASSESSMENT

- **Worksheets 4.2, 4.4, and 5.1 - 5.7**

Discuss uncertainty / conservatism of the site data and calculation methods used in deriving RBSL or SSTL values.

Comparing the Tier 1 default input parameters with site-specific data and conditions indicate that the RBSLs are conservatively derived.

PROPOSED CORRECTIVE ACTION

- **Worksheets 10.1 - 10.3**

Describe rationale for proposed action (i.e., no action, interim action, final action, or tier upgrade), considering site classification and land use. Discuss basis for remedy selection, if applicable.

The chemical of concern-exposure pathway combinations listed above will be further analyzed in a Tier 2 evaluation.

REFERENCE DOCUMENTS

- **Appendices**

List the document sources for the data cited in this report.

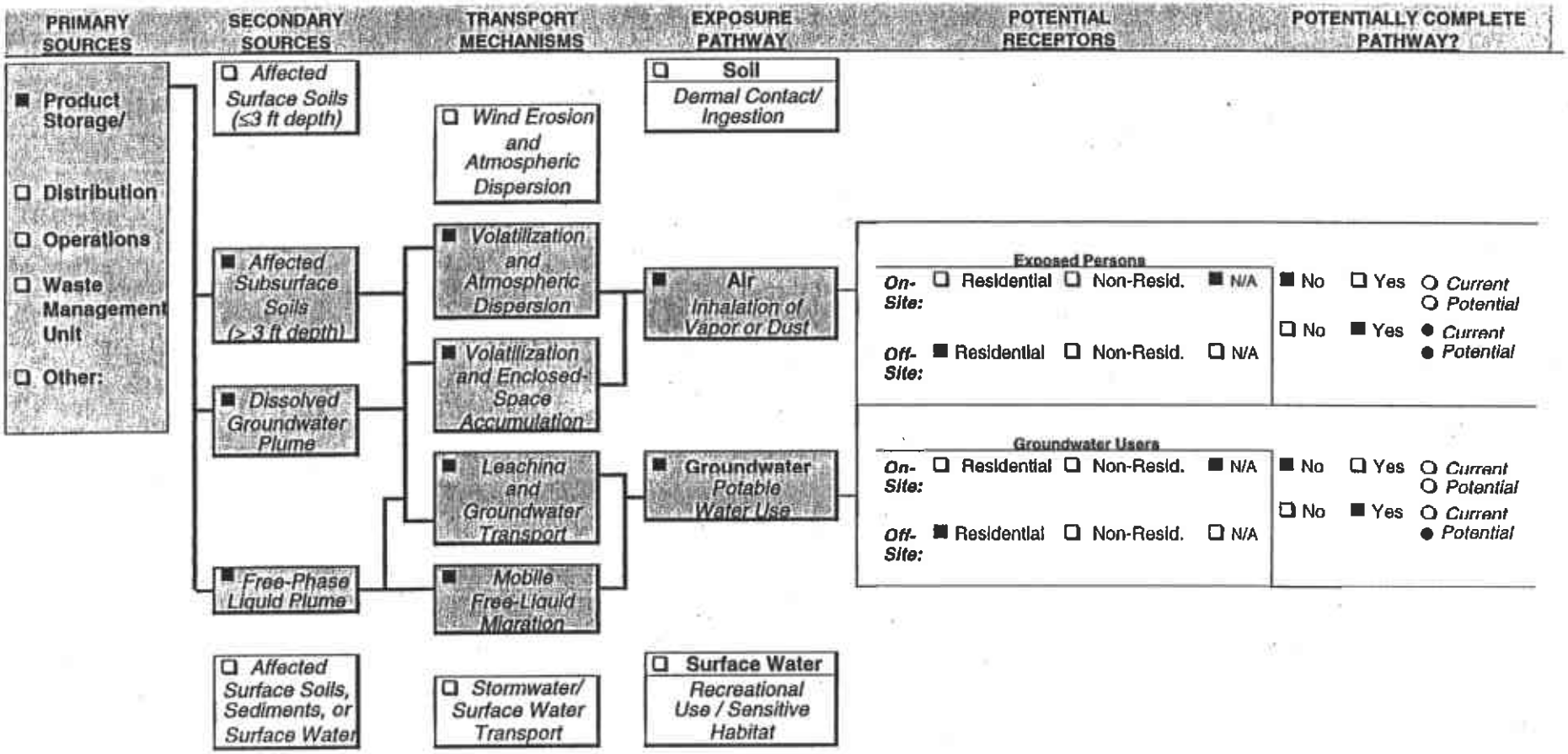
Alameda County Zone 7 Water Agency, 1993, Geologic Framework of the East Bay Plain Groundwater Basin
Alameda County Zone 7 Water Agency, 1997, Supply well inventory database
RWQCB - San Francisco Bay Region, 1997, LUFT Case List
USGS, 1980, Preliminary Geologic Map of the Hayward Quadrangle
WA, 1992, Subsurface Investigation Report
WA, 1994, Subsurface Investigation Report
WA, 1995, First Quarter 1995 Status Report

Site Name: **Shell Service Station WIC #204-6852-1404** Date Completed: April 21, 1997

Site Location: **1784 150th Avenue, San Leandro, California** Completed By: Weiss Associates

BASELINE EXPOSURE FLOWCHART

Instructions: *To characterize baseline exposure conditions, check boxes to identify applicable primary sources, secondary sources (affected media), potential transport mechanisms, and current or potential exposure pathways and receptors (■ = applicable to site). Identify types(s) of both on-site and off-site receptors, if applicable. Provide detailed information on complete pathways, exposure factors, and risk goals on Worksheets 4.3 - 4.5.*



(■ OR ● TO SELECT)

Worksheet 1.6 Comparison of Site Characterization Data to Tier 1 Risk-Based Screening Levels - **Residential Receptors** - Shell Service Station, WIC #204-6852-1404, 1784 150th Avenue, San Leandro, California

Source Medium	Exposure Pathway	Potentially Complete Pathway?	Benzene		Toluene		Ethylbenzene		Xylenes	
			Maximum Detected Concentration[a]	RBSL[b]	Maximum Detected Concentration[a]	RBSL[c]	Maximum Detected Concentration[a]	RBSL[c]	Maximum Detected Concentration[a]	RBSL[c]
Soil (mg/kg)	Volatilization to Outdoor Air	Yes	0.59	0.79	1.5	RES	0.91	RES	4.1	RES
	Surficial Soil (0-3 ft depth): Ingestion/Dermal/Inhalation	No	NA	16.8	NA	13,300	NA	7,830	NA	145,000
	Leachate to Ground Water for Ingestion	Yes	0.59	0.05	1.5	129	0.91	575	4.1	RES
Ground Water (mg/l)	Volatilization to Outdoor Air	Yes	18.5	31.9	15	>S	3.5	>S	18	>S
	Ingestion	Yes	**18.5**	**0.0085**	**15**	**7.30**	3.5	3.65	18	73.0
Soil Vapor **(ppmv)**	Vapor Intrusion to Buildings[d]	Yes	0.41	2.07	0.56	904	0.19	2,310	0.66	16,800

@ 3' depth

Notes:

RBSL = ASTM RBCA Tier 1 Risk-Based Screening Level
RES = Selected risk level is not exceeded for pure compound present at any concentration in soil.
NA = Not Applicable. Impacted soil located at depths greater than 3 feet below ground surface.
>S = At pure compound solubility (mg/l), selected risk level is not exceeded.
a = **Maximum concentrations of benzene, toluene, ethylbenzene and xylenes (BTEX) in soil were detected in a sample collected on February 4, 1992 from 21.5 to 26.5 ft depth in the soil boring BH-B (MW-2). Maximum concentrations of BTEX ~~in ground water~~ were are averages of the results from the most recent year of ground water sampling (First Quarter 1996 - Fourth Quarter 1996) in well MW-2.** Well MW-2 has consistently contained the highest dissolved BTEX concentrations since monitoring began at the subject site. Fourth quarter 1996 concentrations of dissolved BTEX were not available for MW-2 due to the presence of separate phase hydrocarbons. **Maximum concentrations of BTEX in soil vapors near the potential receptor buildings were detected in a sample collected on July 18, 1996 from 1 foot depth in soil vapor sampling location SVS-3.**
b = RBSLs are based on a carcinogenic risk of 1 in 100,000 (10^{-5}) and California's standard cancer slope factor of 0.1 mg/kg-day.
c = RBSLs are based on a chronic hazard quotient of 1.0.
d = **RBSLs for soil vapor correspond to a depth of 3 feet below ground surface.** RBSLs for other depths will differ.

Worksheet 1.6 (cont'd) - Comparison of Site Characterization Data to Tier 1 Risk-Based Screening Levels - Residential Receptors - Shell Service Station, WIC #204-6852-1404, 1784 150th Avenue, San Leandro, California

Source Medium	Exposure Pathway	Potentially Complete Pathway?	1,2-Dichloroethane		Tetrachloroethene		Methyl-t-Butyl-Ether	
			Maximum Detected Concentration[a]	RBSL[b]	Maximum Detected Concentration[a]	RBSL[b]	Maximum Detected Concentration[a]	RBSL[c]
Soil (mg/kg)	Volatilization to Outdoor Air	Yes	0.0064	78	<0.005	24,000	<0.025	RES
	Vapor Intrusion to Buildings	Yes	0.0064	0.097	<0.005	490	<0.025	320
	Surficial Soil (0-3 ft depth): Ingestion/Dermal/Inhalation	No	NA	6.0	NA	11	NA	120
	Leachate to Ground Water for Ingestion	Yes	0.0064	0.074	<0.005	260	<0.025	0.43
Ground Water (mg/l)	Volatilization to Outdoor Air	Yes	0.056	75	0.024	>S	0.99	>S
	Vapor Intrusion to Buildings	Yes	0.056	0.22	0.024	1.0	0.99	1,400
	Ingestion	Yes	**0.056**	**0.0094**	**0.024**	**0.016**	**0.99**	**0.18**

Notes:

RBSL= ASTM RBCA Tier 1 Risk-Based Screening Level
RES =Selected risk level is not exceeded for pure compound present at any concentration in soil.
>S = At pure compound solubility (mg/l), selected risk level is not exceeded.
a = Representative concentration of 1,2-dichloroethane in soil was detected in a sample collected on March 5, 1990 from 29.2 ft depth in the soil boring BH-A (MW-1). Maximum concentration of 1,2-dichloroethane in ground water during the most recent year of ground water sampling (First Quarter 1996 - Fourth Quarter 1996) was detected in well MW-2 on September 26, 1996. The maximum concentration of tetrachloroethene in ground water was detected in well MW-1 on September 13, 1990. Maximum concentration of methyl-t-butyl-ether (MTBE) detected in ground water and confirmed by GC/MS analysis during the most recent year of ground water sampling (First Quarter 1996 - Fourth Quarter 1996) was detected in well MW-2 on September 26, 1996.
b = RBSLs based on a carcinogenic risk of 1 in 100,000 (10^{-5}).
c = RBSLs based on a chronic hazard quotient of 1.0.

Site Name: **Shell Service Station WIC #204-6852-1404** | Date Completed: April 21, 1997

Site Location: **1784 150th Avenue, San Leandro, California** | Completed By: Weiss Associates | *Page 1 of 1*

SITE DESCRIPTION

Location Description (see Figure 1)

Address: 1784 150th Avenue, San Leandro, California
Cross-Street: Freedom Avenue
City: San Leandro
County: Alameda
State: California

Notes:

Regulatory Agencies

Identify regulatory authorities and regulatory / legal status of site.

1) Agency: Alameda County Health Care Services Agency
Contact: Scott Seery
Agency: Regional Water Quality Control Board - San Francisco Bay Region
Contact: Kevin Graves
3) Other Involved Parties: none
(■ *TO SELECT*) ☐ Consent order ☐ Lawsuit

Discussion:

Local Land Use (See Figure 2)

(■ *TO SELECT*)

On-Site Use	Current	Potential	Prior
Commercial	■	■	■
Residential	☐	☐	☐
Industrial	☐	☐	☐
Sensitive Habitat	☐	☐	☐
Other: (below)	☐	☐	☐

Other Comments:

Discuss options for listed items (including anticipated future use)

The site is currently an operating service station and is expected to remain in operation indefinitely.

Topography (See Figures 1 and 3)

Terrain ☐ Flat ■ Steep ☐ Variable
Site Elevation Interval (ft-MSL)
High Pt. 52 Low Pt. 45
Average Ground Surface Slope
Direction west Grade (ft/ft) 0.04

Other Comments:

Local Climate

Average Annual Rainfall (in): 22
Annual Average Evapotranspiration (in/yr): 51 (pan)
Within 100 Year Floodplain?: ☐ yes / ■ no
Summer Temperature Range (°F): 60-90
Winter Temperature Range (°F): 40-75

Other Comments:

Infiltration is probably low because most of site is paved.

Site Name: **Shell Service Station WIC #204-6852-1404** Date Completed: April 21, 1997

Site Location: **1784 150th Avenue, San Leandro, California** Completed By: Weiss Associates

SITE OWNERSHIP & ACTIVITY RECORD

Time Period		Instructions: *Identify (past and present) property owner and operator. Describe past production and materials handling activities, waste disposal practices, and chemicals used.*
Begin	End	
Unknown	Present	The property is presently occupied by an operating service station. The station has dispensed leaded and unleaded gasoline. Currently, the site has three 10,000-gallon underground gasoline tanks, one underground 550-gallon waste oil tank, two dispenser islands and an automotive services garage.

Site Name: **Shell Service Station WIC #204-6852-1404** Date Completed: April 21, 1997

Site Location: **1784 150th Avenue, San Leandro, California** Completed By: Weiss Associates *Page 1 of 1*

PAST RELEASES OR SOURCE AREAS

Time Period		Instructions: *Describe potential sources and spill events, including location, type and estimated volume of materials stored or released, time and duration of release, and affected media (soil, groundwater, surface water, etc.). Discuss past corrective action efforts as appropriate.*
Begin	End	
Unknown	Unknown	The presence of petroleum hydrocarbons in the subsurface indicates a release has occurred. However, no documented releases have been confirmed. The underground waste oil and gasoline tanks, product piping, dispenser islands and garage are potential hydrocarbon sources.

Site Name: **Shell Service Station WIC #204-6852-1404** Date Completed: April 21, 1997

Site Location: **1784 150th Avenue, San Leandro, California** Completed By: Weiss Associates

SUMMARY OF CURRENT & COMPLETED SITE ACTIVITIES

Typical site activities to be recorded include: ● *Preliminary Site Assessment/Site Inspection* ● *Emergency Response* ● *Review Hazard Ranking System* ● *Risk/Exposure Assessment* ● *Remedy Selection* ● *Remedy Implementation*

Types of sampling & testing include: ● *Soil* ● *Groundwater* ● *Surface Water* ● *Vapors*

Date Completed	Description of Task	Sampling and Testing Conducted	Goal / Result / Product / Impact
November 1986	Replaced waste oil tank	Sampled soil beneath former tank for petroleum oil and grease (POG)	Soil samples between 8 and 11 ft depth contained up to 196 parts per million (ppm) POG. The lead agency requested a subsurface investigation.
March 1990	Installed ground water monitoring well MW-1 adjacent to former waste oil tank	Sampled soil from boring for POG, total petroleum hydrocarbons as gasoline (TPH-G), TPH as diesel (TPH-D), benzene toluene, ethylbenzene and xylenes (BTEX) and halogenated volatile organic compounds (HVOCs).	Soil contained hydrocarbons only at the capillary fringe: 35 ppm TPH-G, 0.23 ppm benzene and 0.0064 ppm 1,2-dichloroethane (1,2-DCA). No TPH-D or POG detected.
February 1992	Installed ground water monitoring wells MW-2 (located adjacent to the underground gasoline tanks) and MW-3 (located adjacent to the upgradient corner of the service station property)	Sampled soil from borings for TPH-G, BTEX and HVOCs.	Only soil at the capillary fringe or in the saturated zone contained hydrocarbons. Up to 79 ppm TPH-G and 0.59 ppm benzene detected. No HVOCs were detected.
June 1994 through March 1995	Collected soil and grab ground water samples from soil borings BH-1 through BH-10 and installed downgradient ground water monitoring well MW-4	Soil samples from between 15 and 21 ft depth and ground water samples from these borings were sampled for hydrocarbons.	Only one sample contained hydrocarbons: soil from 16 ft depth in boring BH-3 contained 0.013 ppm benzene. No TPH-G, toluene, ethylbenzene, xylenes or HVOCs detected in any soil samples. The water samples from borings BH-2 and BH-3 contained 5,200 and 120,000 parts per billion (ppb) TPH-G, respectively. The water sample from boring BH-3 also contained 25,000 ppb benzene.
July 1996	Collected soil and soil vapor samples from borings SVS-1 through SVS-10	Selected soil samples were analyzed for petroleum hydrocarbons and geotechnical parameters. Soil vapor samples were analyzed for BTEX and atmospheric gases	No TPH-G, BTEX or methyl tertiary-butyl ether (MTBE) were detected in the soil samples, except 1.1 ppm TPH-G in one sample. BTEX vapors were detected in vapor from depths between 1 and 20 ft depth in all borings. Vapors from three different depths were sampled in borings SVS-3, SVS-5 and SVS-9. These samples did not show a declining concentration trend from the water table toward ground surface. Some samples contained atmospheric gas concentrations that differed from concentrations in ambient air, suggesting that biodegradation of hydrocarbons is occuring.
March 1990 through present	Measured ground water depths and sampled ground water quarterly	Ground water samples from wells MW-1 through MW-4 were analyzed for petroleum hydrocarbons and HVOCs	Ground water samples from wells MW-1 and MW-2 have contained more than 10,000 ppb TPH-G and 1,000 ppb benzene. No hydrocarbons or low concentrations of petroleum hydrocarbons have been detected in ground water from downgradient well MW-4. In December 1996, 0.25 ft of separate-phase hydrocarbons were measured in well MW-2. (and March 1997. SP also in MW-1 (3/96) and MW-3 (3/96)

Site Name: **Shell Service Station WIC #204-6852-1404** Date Completed: April 21, 1997

Site Location: **1784 150th Avenue, San Leandro, California** Completed By: Weiss Associates

SUMMARY OF POTENTIAL NEAR-TERM SITE ACTIVITIES (1-2 YRS.)

Typical site activities to be recorded include: ● *Preliminary Site Assessment/Site Inspection* ● *Emergency Response* ● *Review Hazard Ranking System* ● *Risk/Exposure Assessment* ● *Remedy Selection* ● *Remedy Implementation*

Types of sampling & testing include: ● *Soil* ● *Groundwater* ● *Surface Water* ● *Vapors*

Date Completed	Description of Task	Sampling and Testing Conducted	Goal / Result / Product / Impact	Project Cost
March 1997	Submittal of a corrective action plan and RBCA evaluation	none	Determine the most appropriate corrective action for the site and implement corrective action	NA
Ongoing	Ground Water Monitoring	Sampling of ground water monitoring wells for petroleum hydrocarbons	Assess whether dissolved hydrocarbons in ground water are declining	NA

Site Name: **Shell Service Station, WIC 204-6852-1404** Date Completed: April 21, 1997

Site Location: **1784 150th Ave, San Leandro, CA** Completed By: Weiss Associates *Page 1 of 1*

REGIONAL HYDROGEOLOGIC CONDITIONS

REGIONAL HYDROGEOLOGY (See Figure 6)

Instructions: ***Describe regional geologic framework through depth of principal regional aquifer and any other potentially impacted lithologic units. Identify principal formations and water-bearing units.***

Regional Stratigraphy Identify principal formations, soil or rock type, depth intervals, etc. Add horizontal lines to segregate units. Stratum Description:	FORMATION	DEPTH	AQUIFER	Principal Aquifers Identify principal water-bearing zones. Indicate aquifer use designation (if any), inherent water quality (TDS, etc.), and potential yield ("low" = <1500 gpd/well; "medium" = 1500 to 15000 gpm/well; "high" = >15000 gpd/well)
(Ground Surface) Predominately clay and silt to 15 to 25 ft depth Water table between 20 and 25 ft depth; first water-bearing zone appears semi-confined beneath parts of site		0		Quaternary alluvial deposits
Clayey sand to silty sand from about 25 ft depth to total depth explored of about 40 ft depth		25		
Contact depth beneath site uncertain		50 75		
Gabbro - diabase bedrock		100 125 150 175		

NOTES:

- Actively creeping trace of Hayward Fault underlies Freedom Avenue adjacent to site
- Alluvium-bedrock contact depth increases toward the west from the Hayward Fault.

Site Name: Shell Service Station, WIC 204-6852-1404 | Date Completed: April 21, 1997

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HYDROGEOLOGIC CONDITIONS

SITE HYDROGEOLOGY

A. UNSATURATED / VADOSE ZONE (See Figure 6)

Depth to first encountered water (ft.):	20-30
* Unsaturated zone permeability:	low to moderate - estimated
Soil or rock type:	silty clay to silty sand
Soil affected by hydrocarbons (Y/N)?	yes

Discussion:

B. WATER-BEARING UNITS (See Figures 5 and 6)

	First Encountered Water Unit	Primary Drinking Water Unit
Aquifer type (perched, confined, unconfined):	unconfined, possibly semi-confined	NA
Depth to groundwater (ft):	20-30	NA
* Aquifer thickness (ft):	unknown	NA
* Seasonal/Historical water level fluctuations (± ft):	10	NA
Gradient (ft/ft)/ and flow direction:	0.00007 to 0.002/varies	NA
Soil or rock type:	silty clay to silty sand	NA
* Maximum well yield (gpm/ft):	unknown	NA
* Saturated hydraulic conductivity (ft/day):	unknown	NA
* Hydraulic conductivity test method: (■ TO SELECT)	☐ grain size ☐ slug test ☐ pump test ☐ other (specify)	☐ grain size ☐ slug test ☐ pump test ☐ other (specify)

Discussion: Based on ground water elevations, the flow direction of ground water in the first water-bearing zone has varied. Based on the distribution of hydrocarbons in ground water, ground water in this zone flows westward, which is consistent with the topographical gradient. Gradient magnitudes for the first encountered water unit were calculated from depth to water data from wells MW-2, MW-3 and MW-4.

* C. AQUITARD/CONFINING LAYER (if known)

	Below First Encountered Water Unit	Above Primary Drinking Water Unit
Depth below grade (ft):	NA	NA
Thickness (ft):	NA	NA
Soil or rock type:	NA	NA

Discussion:

D. CURRENT GROUNDWATER QUALITY DATA (see Figure 7)

	First Encountered Water Unit	Primary Drinking Water Unit
Total dissolved solids: (mg/L)	NA	NA
Observed groundwater quality impact (Y/N):	yes	no
Separate phase product present (Y/N)?:	yes	unknown
Off-site hydrocarbon sources (Y/N, Identify below):	yes	unknown

Discussion: An ARCO station is about 400 ft southeast (crossgradient) of the Shell station. Fairmount Hospital, located about 0.25 miles east (upgradient) of the Shell site is listed as an open leaking underground storage case site with the Regional Water Qualtiy Control Board.

REFERENCE DOCUMENTS FOR SITE

Title	Author	Date Issued
Geologic Framework of the East Bay Plain Groundwater Basin	Alameda County Zone 7 Water Agency	1993
RWQCB LUFT Case List	RWQCB - SFB	1997

* Items not required for Tier 1 analysis.

Site Name: Shell Service Station, WIC 204-6852-1404 | Date Completed: April 21, 1997

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BENEFICIAL USE SUMMARY

Instructions: ***The purpose of this worksheet is to identify existing and reasonable beneficial uses for land, groundwater, and surface water. These uses will help establish any existing or potential receptors.***

LAND USE (■ TO SELECT)

Site Land Use *(See Figures 1 and 3)*

	Current	Potential	Prior
Residential	☐	☐	☐
Commercial	■	■	■
Industrial	☐	☐	☐
Sensitive Habitat	☐	☐	☐
Other:	☐	☐	☐

Surrounding Land Use *(See Figure 2)*

	Current	Potential	Prior
Residential	■	■	■
Commercial	■	■	■
Industrial	☐	☐	☐
Sensitive Habitat	☐	☐	☐
Other:	☐	☐	☐

Notes: *Discuss options for listed items (including anticipated future use).*

SURFACE AND GROUNDWATER USE

Surface Water Use *(See Figures 1 and 3)*

	Current	Potential
Recreational	☐	☐
Domestic/Municipal Supply	☐	☐
Industrial Process Supply	☐	☐
Sensitive Habitat	☐	☐
Commercial/Sport Fishing	☐	☐
None	☐	☐
Other: Not applicable	■	■

First Encountered Groundwater *(See Worksheet 3.1, 3.2, & Figure 6)*

	Current	Potential
Domestic Supply	☐	■
Public/Municipal Supply	☐	■
Industrial Process Supply	☐	☐
Freshwater Replenishment	☐	☐
None	☐	☐
Other: Irrigation	■	■

Notes: *Discuss options for listed items (including anticipated future use).*
Based on USGS topographical maps, no surface water exists within 1 mile of the site.

POTENTIAL RECEPTOR SURVEY

Comments: ***Discuss type of utility (water, storm sewer, sanitary sewer, electical, etc.). Discuss type of building construction (slab on grade, crawl space, basement). Listing of receptor is <u>not</u> necessary if not near source or if a deep water table is present. (Indicate N/A in table where appropriate). Discuss nearest and other receptors and indicate on Figure 1.***

	Name & Type:	Distance & Direction from Source Area:
Underground Utility Survey (Figure 1, 2, 3)		
Nearest Underground Utility	storm and sanitary sewer	30 ft northwest (estimated)
Nearest Off-Site Underground Utility	storm and sanitary sewer	30 ft northwest (estimated)
Nearest Downgradient Utility	storm and sanitary sewer	40 ft west (estimated)
Building Survey (Figure 1, 2, 3)		
Nearest Building	residential	25 ft southwest
Nearest Inhabited Building	residential	25 ft southwest
Nearest Off-Site Inhabited Building	residential	25 ft southwest
Surface Water Hydrology		
Nearest Surface Water	Lake Chabot	1.1 miles east
Nearest Downgradient Surface Water	San Francisco Bay	3.5 miles west

Notes:

depths ? directions ?

Site Name: Shell Service Station, WIC 204-6852-1404 Date Completed: April 21, 1997

Site Location: 1784 150th Ave, San Leandro, CA Completed By: Weiss Associates *Page 1 of 1*

WELL INVENTORY SURVEY

SUMMARY OF WELLS WITHIN 0.5 MILE RADIUS OF SITE

See Figure 1 for the well inventory survey within a 0.5 mile radius of the site.

	Radial Distance		Downgradient Direction		
Well Type	Total No.	Active No.	Total No.	Active No.	No. Screened in Potentially Impacted Aquifer
Public/Municipal	0	0	0	0	0
Industrial	0	0	0	0	0
Domestic	1	up to 1	0	0	0
Irrigation	10	up to 10	4	up to 4	up to 4

POTENTIAL RECEPTOR POINTS

	Closest Downgradient Supply Well (1)	Closest Downgradient Drinking Water Well (2)	Closest Actual Down-gradient Receptor (3)	Closest Reasonable Potential Well (4)
Well No. or Designation:	3S/2W 6C	none	3S/2W 6C	NA
Distance from Site (ft):	600	NA	600	25
Total Well Depth (ft):	30	NA	30	any depth
Current Use of Water:	irrigation	NA	irrigation	any use
Screened Interval below Ground Surface (ft):	unknown	NA	unknown	any interval
Seal Interval below Ground Surface (ft):	unknown	NA	unknown	minimum 20
Year Constructed:	unknown	NA	unknown	future
Water Use Classification (see Worksheet 3.3):	irrigation	NA	irrigation	any classification

Information Sources:

(1) Well 3S/2W6C is located at 1524 150th Avenue, San Leandro.
(2) No drinking water wells were identified within 0.5 mile downgradient of the site.
(3) Well 3S/2W6C is considered the closest downgradient ground water receptor.
(4) The closest reasonable location in the downgradient direction for a supply well is beneath the adjacent residential property.

Source of (1,2,3): Alameda County Zone 7 Water Agency well inventory databsae.

Notes:

1. *Supply Well: Any water supply well (drinking water, agricultural, industrial, etc.), which has not been abandoned and is completed through any lithologic unit that could be potentially impacted.*
2. *Drinking Water Well: Municipal or residential drinking water suppy completed in any lithologic unit.*
3. *Actual Receptor: Municipal or residential drinking water supply well completed in same lithologic unit in which plume is migrating.*
4. *Potential Well: Closest resonable placement for the future location of an off-site well.*

Site Name: Shell Service Station, WIC 204-6852-1404 | Date Completed: April 21, 1997

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ECOLOGICAL ASSESSMENT SUMMARY

QUALITATIVE ECOLOGICAL IMPACT ASSESSMENT (■ TO SELECT)

Visual Site Inspection

Date Conducted: February 27, 1997 By: Weiss Associates

Observed Impacts Associated with Site

On-site vegetation	■ none	☐ limited	☐ extensive
Off-site vegetation	■ none	☐ limited	☐ extensive
On-site mammals, birds, fish, etc.	■ none	☐ suspected	☐ observed
Off-site mammals, birds, fish, etc.	■ none	☐ suspected	☐ observed
Other impacts	■ none	☐ yes (explain below)	

Discussion:

The site is located in a mixed commercial and residential area adjacent to Highway 580. The site is paved with small planters in the northern property corner and along the southwestern property boundary. Surrounding properties are landscaped. No impacts to vegetation were observed.

HABITAT CHARACTERIZATION

Presence of Sensitive Habitat

Site located within or impacts a sensitive or protected habitat? ■ no ☐ yes (explain below)

Description of Sensitive Habitat

Name:

Location:

Habitat Type:	☐ Aquatic	☐ Wetland	☐ Riparian	☐ Upland
Habitat Condition:	☐ Pristine	☐ Highly Altered	☐ Early Recovery	☐ Late Recovery

Discussion: *Provide other information relative to habitat characterization including regulatory authority, basis for protection, etc.*

To the best of WA's knowledge, no sensitive habitats are near the site.

ECOLOGICAL RECEPTORS

Presence of Impacted Ecological Receptors

Site conditions have impacted sensitive ecological receptors, either on-site or off-site? ■ no ☐ yes (explain below)

List of Affected Receptors

Threatened or Endangered Species	Economically/Sport Significant Species

ECOLOGICAL ASSESSMENT SUMMARY AND RECOMMENDED ACTION

Observed or Potential Impacts	–	Recommended Action
■ None observed or anticipated	–	No action required
☐ Potential for significant impact	–	Further study required (describe below)
☐ Significant impact observed	–	Further study and/or remedial action required (describe below)

Site Name: **Shell Service Station WIC #204-6852-1404** Date Completed: April 21, 1997

Site Location: **1784 150th Ave, San Leandro, CA** Completed By: Weiss Associates

RBCA SITE CLASSIFICATION SUMMARY

Instructions: ***Determine RBCA Site Classification using site classification flowcharts provided in Tier 1 RBCA Guidance Manual, as follows:***

Evaluate available information on site soils, vapors, groundwater, surface water, and miscellaneous impacts using the corresponding flowcharts. Record two-digit site classification number for each medium.

Compare numerical values from individual media to identify critical site classification(s) (i.e., lowest values).

Record critical site classification scenario and initial response action in space provided. If there is more than one number within the lowest classification group (e.g., Class 2), record both (e.g., 2.1, 2.3).

As site evaluation progresses, update site classification as appropriate by repeating Steps 1 - 3, based upon additional site data or completion of corrective measure.

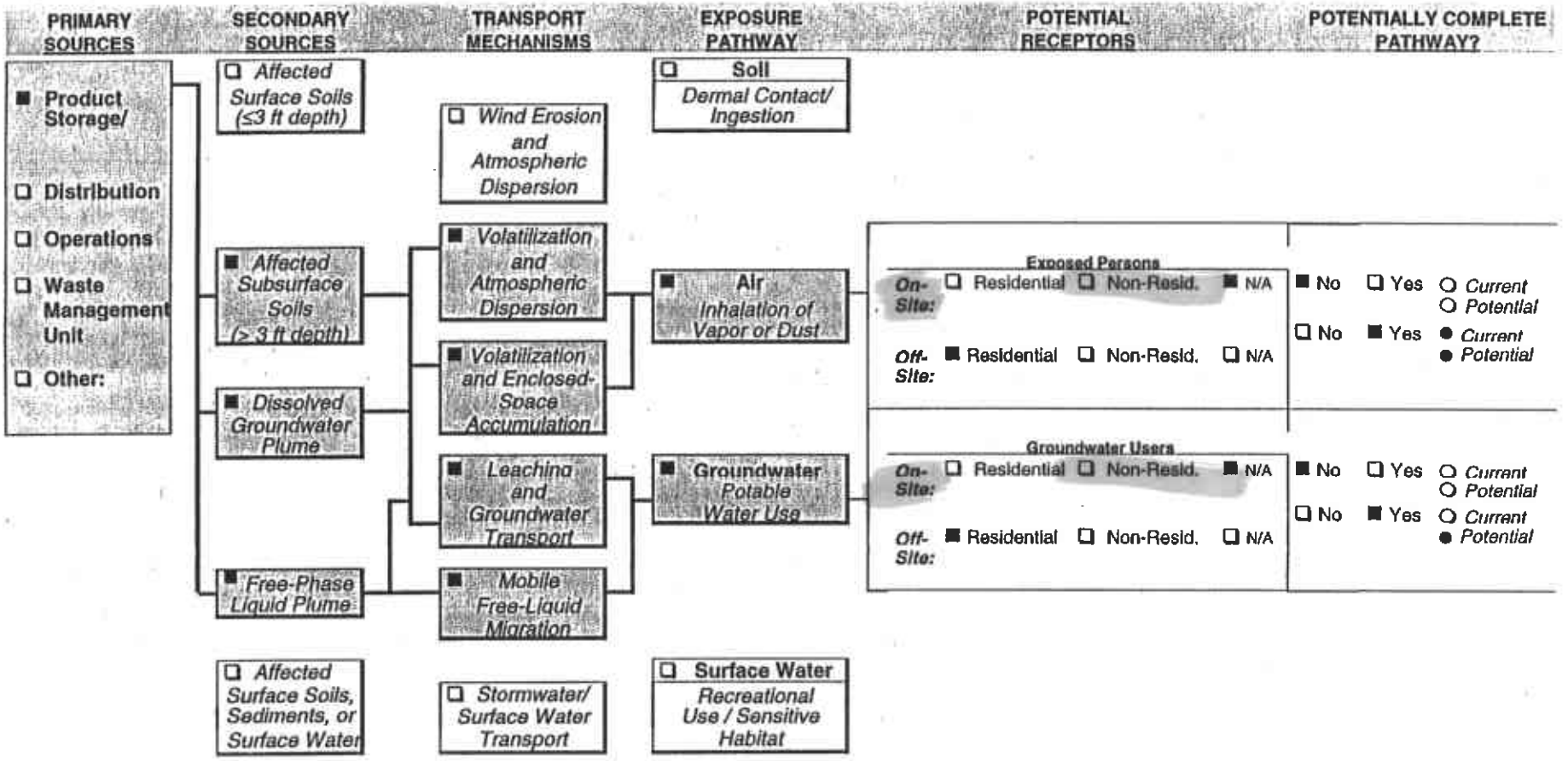
SITE STATUS		MEDIUM-SPECIFIC CLASSIFICATION VALUES					CRITICAL CLASSIFICATION(S)	
Date	Status Description	Soil	Ground-water	Vapor	Surface Water	Misc.	Classification No. and Scenario	Prescribed Initial Response
INITIAL CLASSIFICATION:								
March 1997	Low hydrocarbon concentrations detected in soil. Separate-phase hydrocarbons measured on water table. BTEX vapors detected in soil pore spaces.	4	3	4	NA		4 Soil vapor concentrations indicate no short-term or long-term threat to human health due to inhalation 3 Downgradient irrigation well may be impacted by petroleum hydrocarbons in the future 4 Soil not severely impacted based on analytic data	Perform Tier 2 evaluation to determine risk to irrigation well using fate and transport of dissolved hydrocarbons in ground water.
REVISED CLASSIFICATION:								

Site Name: **Shell Service Station WIC #204-6852-1404** Date Completed: April 21, 1997

Site Location: **1784 150th Avenue, San Leandro, California** Completed By: Weiss Associates

BASELINE EXPOSURE FLOWCHART

Instructions: ***To characterize baseline exposure conditions, check boxes to identify applicable primary sources, secondary sources (affected media), potential transport mechanisms, and current or potential exposure pathways and receptors (n = applicable to site). Identify types(s) of both on-site and off-site receptors, if applicable. Provide detailed information on complete pathways, exposure factors, and risk goals on Worksheets 4.3 - 4.5.***



(■ OR ● TO SELECT)

Site Name: Shell Service Station, WIC 204-6852-1404 | Date Completed: April 21, 1997

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SITE PARAMETER CHECKLIST FOR RISK-BASED SCREENING LEVELS

Instructions: *For Tier 1 evaluation (generic screening levels), review specified default parameters (*) to ensure values are conservative for site. For Tier 2 Option 1 SSTL calculation (site-specific screening levels), provide site-specific values for sensitive parameters (§). Indicate parameter value used in evaluation by completing check box (■).*

Note: * Confirm conservatism of these values for Tier 1 evaluation.
§ Provide site-specific measurement or estimate for Tier 2 evaluation.

		Default Value Used		Site-Specific Value Used		
Soil Parameters						
	soil type	■	sandy soil	☐		*§
Θ_T	Soil porosity	■	0.38 (dim)	☐		§
Θ_{ws}	water content - vadose zone	■	0.12 (dim)	☐		§
Θ_{as}	air content - vadose zone (= Θ_T - Θ_{ws})	■	0.26 (dim)	☐		
Θ_{wcap}	water content - capillary fringe	■	0.342 (dim)	☐		
Θ_{acap}	air content - capillary fringe (= Θ_T - Θ_{wcap})	■	0.038 (dim)	☐		
ρ_s	Soil density	■	1.7 g/cm^3	☐		§
foc	mass fraction of organic carbon in soil	■	0.01 (dim)	☐		§
Ls	Depth to contaminated soil	■	100 cm	☐		§
Lgw	Depth to groundwater	■	300 cm	☐		§
h_{cap}	capillary zone thickness	■	5 cm	☐		
hv	vadose zone thickness (= Lgw - hc)	■	295 cm	☐		
pH	Soil/water pH	■	6.5	☐		
Groundwater Parameters						
I	Water infiltration rate	■	30 cm/yr	☐		§
V_{gw}	[redacted]	■	82.0 ft/yr	☐		*§
δ_{gw}	groundwater mixing zone depth	■	200 cm	☐		*§
DF	aquifer dilution factor (= 1 + V_{gw} δ_{gw}/ (IW))	■	12.1	☐		
Surface Parameters						
U_{air}	Amb. air velocity in mixing zone	■	225 cm/s	☐		*§
δ_{air}	Mixing zone height	■	200 cm	☐		*§
A	Contaminated Area	■	2250000 cm^2	☐		
W	Width of Contaminated Area	■	1500 cm	☐		§
d	Thickness of Surficial Soils	■	100 cm	☐		§
Pe	Particulate areal emission rate	■	2.17E-10 g/cm^2-s	☐		§
Building Parameters						
L_{crack}	Foundation crack thickness	■	15 cm	☐		
η	Foundation crack fraction	■	0.01 (dim)	☐		
Lb_r	Building Volume/Foundation Area Ratio (res.)	■	200 cm	☐		
Lb_c	Building Volume/Foundation Area Ratio (com./ind.)	■	300 cm	☐		
ER_r	Building vapor volume exchange rate (res.)	■	12 dy^{-1}	☐		
ER_c	Building vapor volume exchange rate (com./ind.)	■	20 dy^{-1}	☐		

Discussion: *Provide rationale for default parameter revision; discuss additional site-specific features of note; etc.*

(continue on next page if needed)

Site Name: Shell Service Station, WIC 204-6852-1404 | Date Completed: April 21, 1997

Site Location: 1784 150th Ave, San Leandro, CA | Completed By: Weiss Associates | *Page 1 of 1*

SUMMARY OF MEDIA INVESTIGATION & CHEMICAL ANALYSES

		Site Media Analyzed (■ TO SELECT)					
		Ground Water	Surface Soil	Subsurf. Soil	Soil Vapor	Ambient Vapor	Surface Water
	Applicable?	■	☐	■	■	☐	☐
	Sampled?	■	☐	■	■	☐	☐
Chemical Analysis	**EPA Analysis Method**	•ana. = chemical analyzed; •det. = chemical detected					
Organic Chemicals		ana./det.	ana./det.	ana./det.	ana./det.	ana./det.	ana./det.
Volatile Organics	*8240 / 624*	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐
Semi-Volatile Organics	*8270 / 625*	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐
Polynuclear Aromatic Hydrocarbons	*8310 / 8270*	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐
Purgeable Aromatics	*8020 / 602*	■ ■	☐ ☐	■ ■	■ ■	☐ ☐	☐ ☐
Total Petroleum Hydrocarbons (GC)	*8015G / 8015D*	■ ■	☐ ☐	■ ■	☐ ☐	☐ ☐	☐ ☐
Halogenated Organic Chemicals		ana./det.	ana./det.	ana./det.	ana./det.	ana./det.	ana./det.
Halogenated Volatile Organics	*8010 / 601*	■ ■	☐ ☐	■ ■	☐ ☐	☐ ☐	☐ ☐
Organochlorine & PCBs	*8080*	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐
Inorganic Chemicals		ana./det.	ana./det.	ana./det.	ana./det.	ana./det.	ana./det.
Metals	*6010 / 7xxx series*	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐
Others		ana./det.	ana./det.	ana./det.	ana./det.	ana./det.	ana./det.
• Petroleum oil and grease	*APHA 5520*	■ ■	☐ ☐	■ ■	☐ ☐	☐ ☐	☐ ☐
• _____		☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐
• _____		☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐
• _____		☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐	☐ ☐

DISCUSSION OF MEDIA INVESTIGATION & CHEMICAL ANALYSES

Items for discussion include: •Selection of sampled media •Selected analysis methods •Planned additional sampling

Items	
Subsurface soil and ground water	Samples collected to assess the extent of hydrocarbons in subsurface soil and ground water. Ground water will continue to be sampled regularly.
Soil vapor	Soil vapor samples were collected to assess whether BTEX vapors are attenuating as they migrate toward ground surface. No additional soil vapor sampling is planned.

Site Name: Shell Service Station, WIC 204-6852-1404 | Date Completed: April 21, 1997

Site Location: 1784 150th Ave, San Leandro, CA | Completed By: Weiss Associates | *Page 1 of 1*

SUMMARY OF SOURCE ZONE CHARACTERISTICS

Instructions: *Provide information regarding presence and dimensions of affected soil and groundwater zones. For each affected medium, list constituents of concern (COCs) and representative concentration data on Worksheets 5.4 - 5.6. Describe source area histories on Worksheets 2.2 and 2.3 and show locations on Figures 3 through 7. (Under RBCA, the affected soil or groundwater zone is defined as the area or volume containing COC concentrations in excess of Tier 1 screening levels.)*

AFFECTED SURFACE SOILS (≤ 3 ft BGS) (■ TO SELECT)

- ☐ Present
- ☐ Not Present
- ■ Not Measured

If present, complete the following:

- Maximum areal extent (ft^2):
- Width of affected zone (ft):
- Length of affected zone (ft) :
- Depth interval (ft,BGS):

(Provide COC data on Worksheet 5.4)

AFFECTED SUBSURFACE SOILS (> 3 ft BGS)

- ■ Present
- ☐ Not Present
- ☐ Not Measured

If present, complete the following:

- Depth to top of affected soil (ft) (min. 3 ft, BGS):
- Depth to base of affected soil (ft, BGS):
- Maximum areal extent (ft^2):

(Provide COC data on Worksheet 5.5)

Except for petroleum oil and grease beneath the former waste oil tank, no hydrocarbons have been detected in the vadose zone above the capillary fringe.

AFFECTED GROUNDWATER

- ■ Present
- ☐ Not Present
- ☐ Not Measured

If present, complete the following:

Maximum areal extent (ft^2):	42,700
Length of plume (ft):	170
Width of plume (ft):	160
Depth to top of affected water-bearing unit (ft, BGS):	20-30
Depth to base of plume (ft, BGS):	35 (estimated)

(Provide COC data on Worksheet 5.6)

? 27,200 ft²

plume is longer than 170 x 160'

OTHER SOURCE MEDIUM

- ■ Present
- ☐ Not Present

If present, describe nature of material and dimensions:

Hydrocarbons are present in soil vapor near the underground gasoline tanks, along the Shell station's southwestern property boundary and beneath 150th Avenue.

(Provide COC data on separate table)

Site Name: **Shell Service Station WIC #204-6852-1404** Date Completed: April 21, 1997

Site Location: **1784 150th Avenue, San Leandro, California** Completed By: Weiss Associates

SUBSURFACE SOIL CONCENTRATION DATA SUMMARY (>3 FT BGS)

Source of Data: Previous subsurface investigation data

Sample ID or Sample Set Used: All unsaturated soil data used

Worse Case Depth to Max. Impact: 8 ft

Sample Date: November 1986 through July 1996

CONSTITUENTS DETECTED		ANALYTICAL METHOD		SAMPLE POPULATION		DETECTED CONCENTRATIONS			SELECTED REPRESENTATIVE CONC. (mg/kg)
CAS No.	Name	Method No.	Typical Detection Limit (mg/kg)	No. of Samples	No. of Detects	Max Conc. (mg/kg)	Mean Conc. (mg/kg)	Upper 90%CL Conc. (mg/kg)	
71-43-2	Benzene	EPA 8020	0.0025	28	8	0.59	NA	NA	0.59
108-88-3	Toluene	EPA 8020	0.0025	28	3	1.5	NA	NA	1.5
100-41-4	Ethylbenzene	EPA 8020	0.0025	28	4	0.91	NA	NA	0.91
1330-20-7	Xylenes	EPA 8020	0.0025	28	4	4.1	NA	NA	4.1
107-06-2	1,2-Dichloroethane	EPA 8010	0.0005	11	1	0.0064	NA	NA	0.0064
1643-04-4	Methyl tertiary-butyl ether	EPA 8020	0.0025	7	0	<0.025	NA	NA	<0.025
127-18-4	Tetrachloroethene	EPA 8010	0.0005	11	0	<0.005	NA	NA	<0.005

RBCA SUMMARY REPORT

Worksheet 5.6

Site Name: **Shell Service Station WIC #204-6852-1404** Date Completed: April 21, 1997

Site Location: **1784 150th Avenue, San Leandro, California** Completed By: Weiss Associates

GROUNDWATER CONCENTRATION DATA SUMMARY

Source of Data: Ground water monitoring data

Sample ID or Sample Set Used: All data used from between first and fourth quarters 1996; mean concentrations are for most impacted well: MW-2

Worse Case Depth to Max. Impact 20 ft

Sample Date: See notes

CONSTITUENTS DETECTED		ANALYTICAL METHOD		SAMPLE POPULATION		DETECTED CONCENTRATIONS			SELECTED REPRESENTATIVE CONC.
CAS No.	Name	Method No.	Typical Detection Limit (mg/kg)	No. of Samples	No. of Detects	Max Conc. (mg/kg)	Mean Conc. (mg/kg)	Upper 90%CL Conc. (mg/kg)	(mg/kg)
71-43-2	Benzene[a]	EPA 8020	0.0005	13	8	28	10.5	NA	10.5
108-88-3	Toluene[a]	EPA 8020	0.0005	13	8	20	15	NA	15
100-41-4	Ethylbenzene[a]	EPA 8020	0.0005	13	7	4.1	3.5	NA	3.5
1330-20-7	Xylenes[a]	EPA 8020	0.0005	13	9	22	18	NA	18
107-06-2	1,2-Dichloroethane[b]	EPA 8010	0.0005	8	5	0.056	NA	NA	0.056
1643-04-4	Methyl tertiary-butyl ether[c]	EPA 8260	0.0025	11	8	0.99	NA	NA	0.99
127-18-4	Tetrachloroethene[d]	EPA 8010	0.0005	68	3	0.024	NA	NA	0.024

a = Representative value is the mean concentration for samples from most impacted well (MW-2) between March and December 1996.
b = Representative value is the maximum concentration for samples from the most impacted well (MW-2) between March and December 1996.
c = Representative value is maximum concentration for well MW-2 that was confirmed by EPA Method 8260.
d = Representative value is the maximum concentration for ground water.

RBCA SUMMARY REPORT

Worksheet 5.7

Site Name: **Shell Service Station WIC #204-6852-1404** Date Completed: April 21, 1997

Site Location: **1784 150th Avenue, San Leandro, California** Completed By: Weiss Associates

SOIL VAPOR CONCENTRATION DATA SUMMARY

Source of Data: July 1996 Soil Vapor Investigation

Sample ID or Sample Set Used: Soil vapor sample locations SVS-2, SVS-3, SVS-4. These sample locations were nearest the residential receptor buildings.

Worse Case Depth to Max. Impact 1 ft

Sample Date: July 18, 1996

appears to only be SVS-3 @ 1' sampled

CONSTITUENTS DETECTED		ANALYTICAL METHOD		SAMPLE POPULATION		DETECTED CONCENTRATIONS			SELECTED REPRESENTATIVE CONC. (mg/kg)
CAS No.	Name	Method No.	Typical Detection Limit (mg/kg)	No. of Samples	No. of Detects	Max Conc. (mg/kg)	Mean Conc. (mg/kg)	Upper 95%CL Conc. (mg/kg)	
71-43-2	Benzene	CARB 410A	2	7	7	0.41	NA	NA	0.41
108-88-3	Toluene	CARB 410A	2	7	7	0.56	NA	NA	0.56
100-41-4	Ethylbenzene	CARB 410A	2	7	7	0.19	NA	NA	0.19
1330-20-7	Xylenes	CARB 410A	2	7	7	0.66	NA	NA	0.66

RBCA SUMMARY REPORT

Worksheet 6.2

Site Name: **Shell Service Station WIC #204-6852-1404** Date Completed: April 21, 1997

Site Location: **1784 150th Avenue, San Leandro, California** Completed By: Weiss Associates

TIER 1 RBSL EVALUATION: SUBSURFACE SOIL (> 3 FT BGS)

Tier 1 Target Risk Limits:
Exposure Scenario = Residential
TR = 10^{-5} Individual Con
HQ = 1.0 Individual Con

Instructions: *Specify target risk limits upon which Tier 1 risk-based screening levels (RBSLs) are based. Identify complete exposure pathways for site (■ = complete). Record site sample measurements for constituents of concern (COCs) and corresponding RBSL values for complete pathways. Identify minimum RBSL value for each COC. Note whether site concentration exceeds minimum RBSL value.*

CONSTITUENTS OF CONCERN			REP. CONC.	RBSL RESULTS FOR COMPLETE EXPOSURE PATHWAYS (■ IF COMPLETE)					
				■ Leaching to Grdwtr.	❑ Leaching to GW MCL	■ Vol. to Amb. Air.	■ Vol. to Indoor Air	Minimum RBSL Value	RBSL Exceeded?
Sample ID (optional)	CAS No.	Name	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	■ If yes
	71-43-2	Benzene	[redacted]	0.05	NA	0.79	a	0.05	■
	108-88-3	Toluene	1.5	129	NA	RES	a	129	❑
	100-41-4	Ethylbenzene	0.91	575	NA	RES	a	575	❑
	1330-20-7	Xylenes	4.1	RES	NA	RES	a	RES	❑
	107-06-2	1,2-Dichoroethane	0.0064	0.074	NA	78	0.097	0.074	❑
	1643-04-3	Methyl tertiary-butyl ether	<0.025	0.43	NA	RES	320	0.43	❑
	127-18-4	Tetrachloroethene	<0.005	260	NA	24,000	490	260	❑
									❑
									❑
									❑

Notes:
TR = Target risk limit for excess lifetime carcinogenic risk.
HQ = Hazard quotient for individual constituent non-carcinogenic effects.
MCL = Drinking Water Maximum Contaminant Level, if applicable.
RES = Selected risk level not exceeded for pur compound present at any concentration in soil.
a = The volatilization from soil to indoor air is a potentially complete pathway but is evaluated as a soil vapor pathway (refer to Worksheet 6.4).

RBCA SUMMARY REPORT

Worksheet 6.3

Site Name: **Shell Service Station WIC #204-6852-1404** Date Completed: April 21, 1997

Site Location: **1784 150th Avenue, San Leandro, California** Completed By: Weiss Associates

TIER 1 RBSL EVALUATION: GROUNDWATER

Tier 1 Target Risk Limits:
Exposure Scenario = Residential
TR = 10^{-5} Individual Cor
HQ = 1.0 Individual Cor

Instructions: *Specify target risk limits upon which Tier 1 risk-based screening levels (RBSLs) are based. Identify complete exposure pathways for site (■ = complete). Record site sample measurements for constituents of concern (COCs) and corresponding RBSL values for complete pathways. Identify minimum RBSL value for each COC. Note whether site concentration exceeds minimum RBSL value.*

10^{-5}

CONSTITUENTS OF CONCERN			REP. CONC.	RBSL RESULTS FOR COMPLETE EXPOSURE PATHWAYS (■ IF COMPLETE)					
				■ Grdwtr. Ingestion	☐ GW MCL Limit	■ Vol. to Amb. Air	■ Vol. to Indoor Air	Minimum RBSL Value	RBSL Exceeded?
Sample ID (optional)	CAS No.	Name	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	■ If yes
	71-43-2	Benzene	18.5	0.0085	NA	31.9	a	0.0085	■
	108-88-3	Toluene	15	7.30	NA	>S	a	7.30	■
	100-41-4	Ethylbenzene	3.5	3.65	NA	>S	a	36.5	☐
	1330-20-7	Xylenes	18	73.0	NA	>S	a	73.0	☐
	107-06-2	1,2-Dichloroethane	0.056	0.0094	NA	75	0.22	0.0094	■
	1643-04-3	Methyl tertiary-butyl ether	0.99	0.18	NA	>S	1,400	0.18	■
	127-18-4	Tetrachloroethene	0.024	0.016	NA	>S	1.0	0.016	■
									☐
									☐
									☐
									☐

Note: TR = Target risk limit for excess lifetime carcinogenic risk.
HQ = Hazard quotient for individual constituent non-carcinogenic effects.
MCL = Drinking Water Maximum Contaminant Level, if applicable.
>S = At pure compound solubility, selected risk is not exceeded.
a = The volatilization from ground water to indoor air is a potentially complete pathway but is evaluated as a soil vapor pathway (refer to Worksheet 6.4).

Site Name: **Shell Service Station WIC #204-6852-1404** Date Completed: April 21, 1997

Site Location: **1784 150th Avenue, San Leandro, California** Completed By: Weiss Associates

TIER 1 RBSL EVALUATION: SOIL VAPOR

Tier 1 Target Risk Limits:
Exposure Scenario = Residential
TR = 10^{-5} Individual Cons
HQ = 1.0 Individual Cons

Instructions: *Specify target risk limits upon which Tier 1 risk-based screening levels (RBSLs) are based. Identify complete exposure pathways for site (■ = complete). Record site sample measurements for constituents of concern (COCs) and corresponding RBSL values for complete pathways. Identify minimum RBSL value for each COC. Note whether site concentration exceeds minimum RBSL value.*

CONSTITUENTS OF CONCERN			REP. CONC.	RBSL RESULTS FOR COMPLETE EXPOSURE PATHWAYS (■ IF COMPLETE)					
				■ Indoor Inhalation[a]	■ Outdoor Inhalation			Minimum RBSL Value	RBSL Exceeded?
Sample ID (optional)	CAS No.	Name	(ppmv)	(ppmv)	(ppmv)			(ppmv)	■ If yes
	71-43-2	Benzene	0.41	2.07	b				☐
	108-88-3	Toluene	0.56	904	b				☐
	100-41-4	Ethylbenzene	0.19	2,310	b				☐
	1330-20-7	Xylenes	0.66	16,800	b				☐
									☐
									☐
									☐
									☐
									☐
									☐
									☐
									☐
									☐
									☐
									☐

Notes: TR = Target risk limit for excess lifetime carcinogenic risk.
HQ = Hazard quotient for individual constituent non-carcinogenic effects.
a = RBSLs correspond to 1 ft depth below ground surface; RBSLs will differ for other depths.
b = Although pathway is potentially complete, WA has opted to evaluate it as a subsurface soil pathway (refer to Worksheet 6.2.)

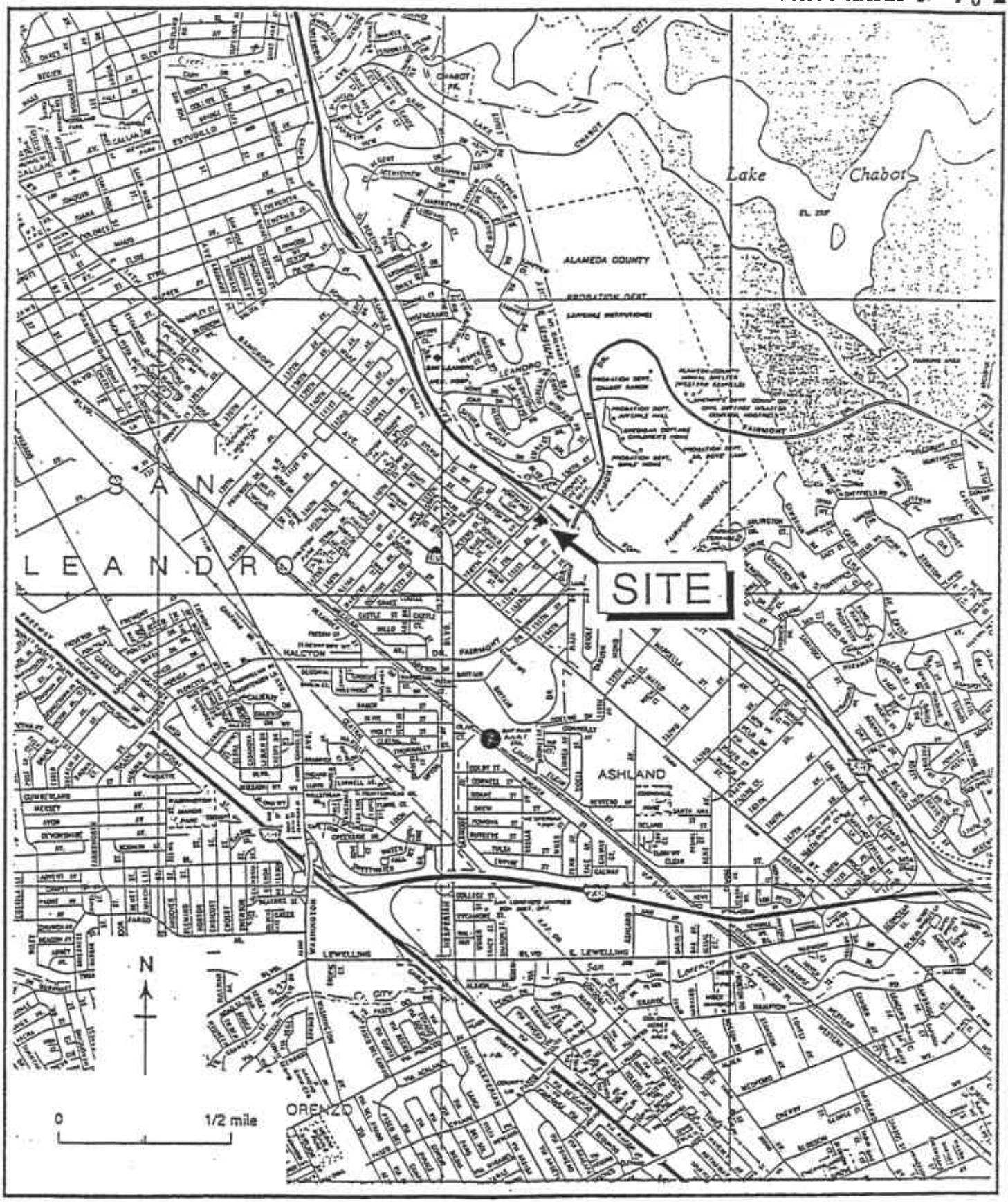


Figure 1. Site Location Map - Shell Service Station WIC #204-6852-1404, 1784 150th Avenue, San Leandro, California

3/16/90

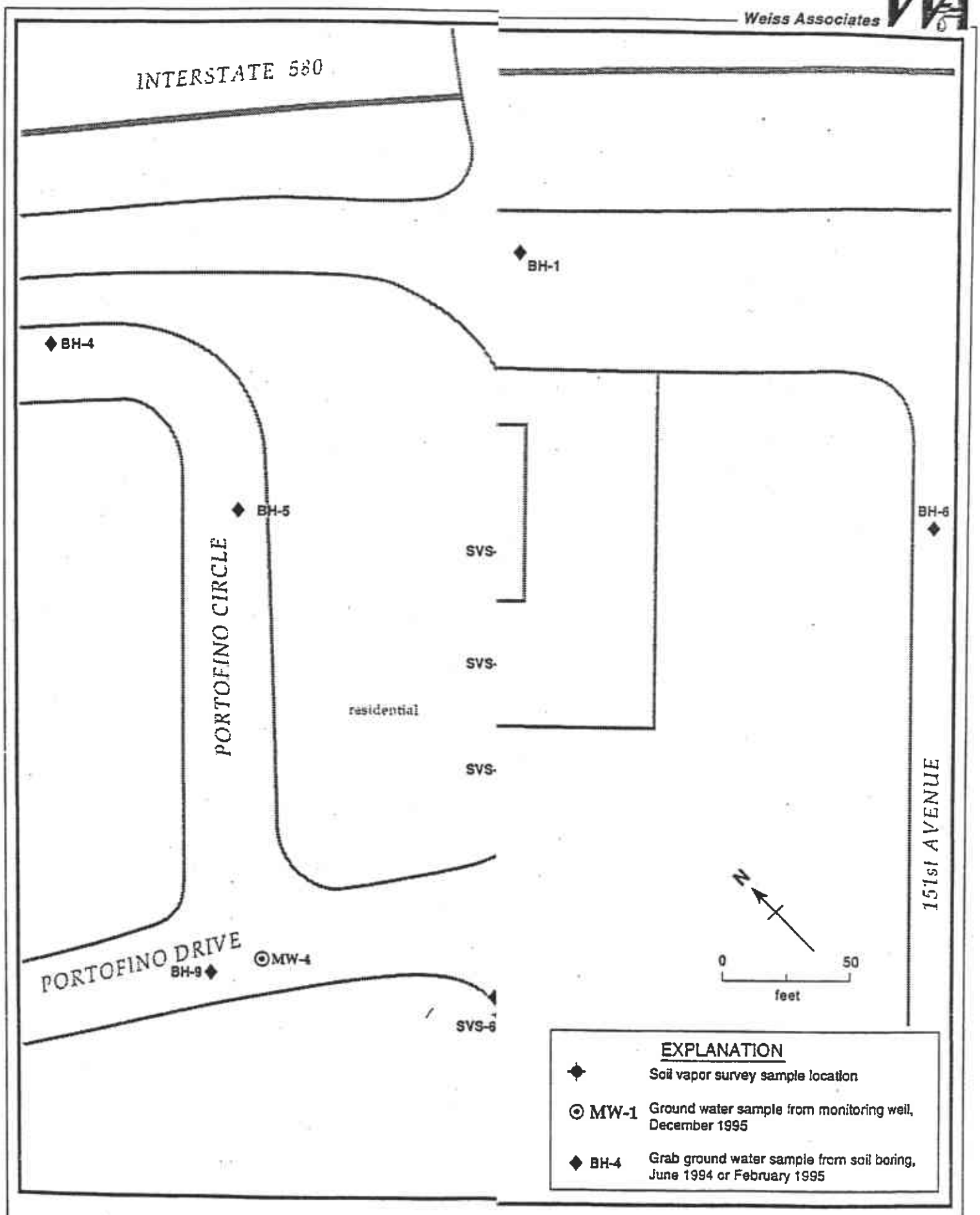


Figure 2. Soil Vapor Survey Boring Locations - Shell Servic

Table 2. Analytic Results for Soil - Shell Service Station WIC #204-6852-1404, 1784 150th Avenue, San Leandro, California

Boring ID (Well ID)	Sample Depth (ft)	Date Sampled	Ground Water Depth (ft)	TPH-G	TPH-D	POG[a]	B	E	T	X	HVOCs
				<----------parts per million (mg/kg)---------->							
BH-A (MW-1)	5.0	03/05/90	34.1	<1	---	<100	<0.0025	<0.0025	<0.0025	<0.0025	b
	15.7			<1	---	<100	<0.0025	<0.0025	<0.0025	<0.0025	b
	24.7			<1	<1[c]	<100	0.020	<0.0025	<0.0025	<0.0025	b
	29.2			35	---	<100	0.23	0.20	<0.025	0.64	d
	41.2			<1	---	<100	<0.0025	<0.0025	<0.0025	<0.0025	b
BH-B (MW-2)	11.5	02/04/92	23.8	<1	---	---	0.0026	<0.0025	<0.0025	<0.0025	b
	16.5			<1	---	---	0.0058	<0.0025	<0.0025	<0.0025	---
	21.5			79	23[e]	---	0.20	0.60	1.0	4.1	b
	26.5			74	---	---	0.59	0.91	1.5	3.9	---
BH-C (MW-3)	11.5	02/05/92	28.8	<1	---	---	0.0042	0.0029	0.0039	<0.0025	b
	21.5			<1	---	---	<0.0025	<0.0025	<0.0025	<0.0025	b
	26.5			3.9	4.9[e]	---	<0.0025	<0.0025	<0.0025	0.0054	b
	31.5			68	---	---	<0.05	<0.05	<0.05	0.17	---

Abbreviations:

TPH-G = Total Petroleum Hydrocarbons as Gasoline by Modified EPA Method 8015
TPH-D = Total Petroleum Hydrocarbons as Diesel by Modified EPA Method 8015
POG = Petroleum Oil and Grease by American Public Health Association (APHA) Standard Method 503E
B = Benzene by EPA Method 8020
E = Ethylbenzene by EPA Method 8020
T = Toluene by EPA Method 8020
X = Xylenes by EPA Method 8020
HVOCs = Halogenated volatile organic compounds by EPA Method 8010
--- = Not analyzed
<n = Not detected above method detection limit of n ppm

Analytical Laboratory:

National Environmental Testing (NET) Pacific, Inc., Santa Rosa, California

Notes:

a = No total oil and grease detected above APHA Standard Method 503D detection limit of 50 ppm in any soil samples from boring BH-A
b = No HVOCs detected
c = No total petroleum hydrocarbons as motor oil detected above Modified EPA Method 8015 detection limit of 10 ppm
d = 0.0064 ppm 1,2-dichloroethane detected
e = NET reported that detected compounds are hydrocarbons lighter than diesel

Table 3. Hydrocarbons and Volatile Organic Compounds in Soil - Shell Service station WIC #204-6852-1404, 1784 150th Avenue, San Leandro, California

Borehole/ Sample ID	Date Sampled	TPH-G	B	T	E	X	VOCs
		← parts per million (mg/kg) →					
BH-1-21	06/06/94	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	---
BH-2-20	06/06/94	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	---
BH-3-16	06/06/94	<1.0	0.013	<0.0050	<0.0050	<0.0050	ND
BH-4-20.6	06/07/94	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	---
BH-5-15.6	06/07/94	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	---
BH-6-20.5	06/07/94	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	---
BH-7-15.8	02/14/95	<1.0	<0.0025	<0.0025	<0.0025	<0.0025	---
BH-8-16.0	02/14/95	<1.0	<0.0025	<0.0025	<0.0025	<0.0025	---
BH-9-19.5	02/14/95	<1.0	<0.0025	<0.0025	<0.0025	<0.0025	---
BH-10-15.2	03/03/95	<1.0	<0.0050	<0.0050	<0.0050	<0.0050	---

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
VOCs = Volatile organic compounds by EPA Method 8010
ND = Not detected between detection limits of 0.005 and 0.050 ppm
--- = Not analyzed

Analytical Laboratory:

Sequoia Analytical, Inc. of Redwood City, California

Table 2. Analytic Results for Soil Samples - Shell Service Station, WIC #204-6852-1404, 1784 - 150th Avenue, San Leandro, California

Sample ID	Depth (feet)	TPH-G	MTBE	B	E	T	X
		← parts per million (mg/kg) →					
SVS-3	16-18	<1.0	<0.025	<0.005	<0.005	<0.005	<0.005
SVS-5	4-6	<1.0	<0.025	<0.005	<0.005	<0.005	<0.005
	8-10	<1.0	<0.025	<0.005	<0.005	<0.005	<0.005
	18-20	1.1	<0.025	<0.005	<0.005	<0.005	<0.005
SVS-9	3-5	<1.0	<0.025	<0.005	<0.005	<0.005	<0.005
	8-10	<1.0	<0.025	<0.005	<0.005	<0.005	<0.005
	16-18	<1.0	<0.025	<0.005	<0.005	<0.005	<0.005

Abbreviations:

TPH-G = Total petroleum hydrocarbons as gasoline by Modified EPA Method 8015
MTBE = Methyl-t-butyl-ether by EPA Method 8020
B = Benzene by EPA Method 8020
E = Ethylbenzene by EPA Method 8020
T = Toluene by EPA Method 8020
X = Total xylenes by EPA Method 8020
<n = Not detected at laboratory reporting limit of n ppm

Notes:

Samples collected on 7/18/96 and 7/19/96 and analyzed by Sequoia Analytical of Redwood City, California.

Table 3. Analytic Results for Soil Samples - Shell Service Station, WIC #204-6852-1404, 1784 - 150th Avenue, San Leandro, California

Sample ID	Depth (feet)	Moisture (%)	pH (pH units)	Particle Size Distribution (<70%)	Dry Bulk Density (gm/cc)	Natural Bulk Density (gm/cc)	Fraction O.C. (%)
SVS-3	4-6	16	9.0	4.87	1.79	2.11	0.31
	16-18	16	8.8	15.89	1.65	2.04	0.13
SVS-5	4-6	24	8.9	4.1	1.37	1.84	1.20
	8-10	24	9.0	1.28	1.42	1.87	1.00
	18-20	14	9.2	5.27	1.69	2.07	0.12
SVS-9	3-5	23	9.0	1.79	1.45	1.90	0.98
	8-10	21	8.9	2.44	1.53	1.95	0.43
	16-18	14	8.7	4.37	1.91	2.22	0.14

Notes:

Moisture Percent by EPA Method 160.3.
pH by EPA Method 9045.
Particle Size Distribution by ASTM Method D422.
Dry Bulk Density by American Petroleum Institute Recommended Procedure-40.
Natural Bulk Density by American Petroleum Institute Recommended Procedure-40.
Samples collected on 7/18/96 and 7/19/96 and analyzed by Sequoia Analytical of Redwood City, California and Core Laboratories of Bakersfield, California.

Abbreviations:

Fraction O.C. = Organic Carbon by Walkey Black Method
gm/cc = grams per cubic centimeter

Table 2. **Analytic Results for Ground Water** - Shell Service Station WIC #204-6852-1404, 1784 150th Avenue, San Leandro, California

Well ID	Date Sampled	Depth to Water (ft)	TPH-G	TPH-D	POG	B	E	T	X	1,2-DCA	MTBE	DO (mg/L)
			← parts per billion (µg/l) →									
MW-1	03/08/90	25.29	510	120[a]	<10,000	1.5	<0.5	0.8	5.4	12	---	---
	06/12/90	25.85	390	100[a]	<10,000	86	0.7	1.3	6.2	<0.4	---	---
	09/13/90	27.49	100	130[a]	<10,000	56	2.4	0.75	2.8	<0.4[b]	---	---
	12/18/90	27.41	480	<50[a]	<10,000	54	3.3	1.7	3.7	5.3	---	---
	03/07/91	25.79	80	<50[a]	---	266	1.2	<0.5	<1.5	6.7	---	---
	06/07/91	25.64	510	<50[a]	---	130	6.1	3.8	11	7.9	---	---
	09/17/91	27.54	330	120[ac]	---	67	3	<0.5	2.2	6	---	---
	12/09/91	27.81	140[d]	80	---	<0.5	1.7	<0.5	4.7	5.4	---	---
	03/01/92	23.36	<50	<50	---	<0.5	<0.5	<0.5	<0.5	3	---	---
	06/03/92	24.64	1,500	---	---	520	72	180	230	3	---	---
	09/01/92	26.74	130	---	---	16	1.8	1.4	3.4	1.3[e]	---	---
	12/04/92	27.14	150	---	---	360	1.8	0.7	2.1	3.3	---	---
	03/03/93	20.50	<50	---	---	1.5	<0.5	<0.5	<0.5	0.76	---	---
	06/17/93	22.42	1,600	---	---	340	120	120	440	3	---	---
	09/10/93	24.11	2,600	---	---	670	310	340	730	2.3	---	---
	12/13/93	23.73	11,000	---	---	470	380	320	2,300	6.3	---	---
	03/03/94	22.08	16,000	---	---	700	480	690	3,200	---	---	---
	06/06/94	23.10	7,500	---	---	420	200	280	1,000	3.1	---	---
	09/12/94	25.19	1,200	---	---	110	3.3	21	420	2.6	---	---
	12/19/94	23.06	4,600	---	---	470	230	330	1,300	3.7	---	---
	02/28/95	20.90	500	---	---	59	6.8	32	68	5.0	---	---
	06/26/95	20.40	5,500	---	---	740	300	420	1,800	8.6	---	---
	09/13/95	22.62	84,000	---	---	1,900	3,000	2,600	14,000	12	---	---
	12/19/95	22.10	80,000	---	---	660	170	350	18,000	<0.4	---	---
	03/06/96[SPH]	---	---	---	---	---	---	---	---	---	---	---
	06/28/96	21.46	270,000	---	---	2,800	1,000	820	16,000	---	<0.5	---
	06/28/96[DUP]	21.46	790,000	---	---	2,200	1,000	780	13,000	---	15,000	---
	09/26/96	23.57	29,000	---	---	1,100	270	260	1,900	9.8	<1,000	---
	09/26/96[DUP]	23.57	25,000	---	---	1,200	240	320	1,900	11	<1,000	---
	12/10/96	**21.43**	**13,000**	**---**	**---**	**510**	**230**	**240**	**1,200**	**16**	**100**	**1.0**
	12/10/96[dup]	**21.43**	**8,400**	**---**	**---**	**420**	**140**	**130**	**680**	**17**	**81**	**1.0**

Table 2. **Analytic Results for Ground Water** - Shell Service Station WIC #204-6852-1404, 1784 150th Avenue, San Leandro, California (continued)

Well ID	Date Sampled	Depth to Water (ft)	TPH-G	TPH-D	POG	B	E	T	X	1,2-DCA	MTBE	DO (mg/L)
			← parts per billion (µg/l) →									
MW-2	02/24/92	19.61	17,000	2,700[c]	---	6,200	550	1,600	1,900	200	---	---
	03/01/92	21.11	86,000	1,000[c]	---	30,000	2,300	34,000	16,000	82	---	---
	06/03/92	21.58	87,000	---	---	28,000	2,000	18,000	10,000	<50	---	---
	09/01/92	23.46	110,000	---	---	21,000	1,900	13,000	7,800	83[h]	---	---
	12/04/92	23.89	42,000	---	---	15,000	960	2,400	2,900	100	---	---
	03/03/93	17.28	160,000	---	---	36,000	32,000	3,800	21,000	7.7	---	---
	03/03/93[h]	17.28	150,000	---	---	31,000	20,000	3,100	14,000	16	---	---
	06/17/93	19.06	65,000	---	---	34,000	3,200	15,000	11,000	37	---	---
	06/17/93[h]	19.06	62,000	---	---	28,000	2,700	14,000	10,000	36	---	---
	09/10/93[f]	20.88	72,000	---	---	24,000	2,300	16,000	11,000	28.0	---	---
	09/10/93[dup,f]	20.88	71,000	---	---	23,000	2,300	15,000	10,000	27.0	---	---
	12/13/93	20.42	19,000	---	---	5,400	680	4,900	3,100	<0.5	---	---
	12/13/93[dup]		17,000	---	---	6,200	720	5,500	3,500	3.4	---	---
	03/03/94	18.48	110,000	---	---	21,000	2000	24,000	13,000	---	---	---
	03/03/94[dup]	18.48	93,000	---	---	19,000	1,800	22,000	12,000	---	---	---
	06/06/94	20.26	10,000	---	---	1,900	2,500	3,300	13,000	5.8	---	---
	06/06/94[dup]	20.26	99,000	---	---	9,900	2,400	12,000	12,000	5.7	---	---
	09/12/94	21.80	160,000	---	---	22,000	3,400	33,000	23,000	<0.4	---	---
	09/12/94[dup]	21.80	150,000	---	---	23,000	3,500	34,000	23,000	<0.4	---	---
	12/19/94	19.66	80,000	---	---	17,000	2,300	16,000	14,000	<0.4	---	---
	12/19/94[dup]	19.66	100,000	---	---	28,000	3,400	26,000	20,000	<0.4	---	---
	02/28/95	17.51	100,000	---	---	24,000	2,300	18,000	17,000	<0.4	---	---
	02/28/95[dup]	17.51	100,000	---	---	31,000	3,200	21,000	18,000	<0.4	---	---
	06/26/95	17.58	45,000	---	---	14,000	1,500	12,000	7,500	3.4	---	---
	06/26/95[dup]	17.58	68,000	---	---	13,000	1,800	11,000	7,700	---	---	---
	09/13/95	19.28	110,000	---	---	19,000	2,800	19,000	15,000	7.2	---	---
	09/13/95[dup]	19.28	120,000	---	---	20,000	2,900	20,000	15,000	<0.4	---	---
	12/19/95	18.61	180,000	---	---	18,000	4,100	29,000	24,000	<0.4	---	---
	12/19/95[dup]	18.61	160,000	---	---	18,000	3,800	28,000	24,000	<0.4	---	---
	03/06/96	15.41	120,000	---	---	28,000	3,900	15,000	17,000	<20	---	---
	06/28/96	17.84	96,000	---	---	20,000	4,100	20,000	22,000	---	2,400	---
	09/26/96	19.60	87,000	---	---	7,600	2,500	11,000	15,000	56**	990*	---

Table 2. **Analytic Results for Ground Water** - Shell Service Station WIC #204-6852-1404, 1784 150th Avenue, San Leandro, California (continued)

Well ID	Date Sampled	Depth to Water (ft)	TPH-G	TPH-D	POG	B	E	T	X	1,2-DCA	MTBE	DO (mg/L)
			← parts per billion (µg/l) →									
	12/10/96[SPH]	18.15	---	---	---	---	---	---	---	---	---	---
MW-3	02/24/92	25.60	4,500	1,300[c]	---	97	78	<5	18	9.1	---	---
	03/01/92	26.00	2,200	440	---	69	<0.5	<0.5	<0.5	13	---	---
	06/03/92	27.70	4,100	---	---	13	44	72	65	16	---	---
	09/01/92	29.46	1,900	---	---	20	5.5	6.8	<5	19	---	---
	09/01/92[dup]	29.46	1,900	---	---	21	3.4	6.6	<5	21	---	---
	12/04/92	29.93	2,400	---	---	8.2	<5	<5	<5	16	---	---
	12/04/92[dup]	29.93	2,100	---	---	11	5.7	<0.5	<0.5	18	---	---
	03/03/93	23.08	5,100	---	---	63	75	61	150	3.3	---	---
	06/17/93	25.21	4,000	---	---	94	82	140	150	23	---	---
	09/10/93	26.95	3,200	---	---	140	12.5	12.5	12.5	20.0	---	---
	12/13/93	26.52	6,200	---	---	<12.5	<12.5	<12.5	<12.5	13	---	---
	03/03/94	24.50	4,500	---	---	73	<5	<5	<5	---	---	---
	06/06/94	26.33	3,200	---	---	<0.5	3.1	<0.5	<0.5	16	---	---
	09/12/94	27.98	3,900	---	---	<0.5	9.6	<0.5	4.1	7.8	---	---
	12/19/94	25.63	2,400	---	---	21	4.2	22	2.6	25	---	---
	02/28/95	23.45	4,000	---	---	58	7.1	<0.5	3.5	18	---	---
	06/26/95	23.64	3,900	---	---	8.1	12	<0.5	2.4	15	---	---
	09/13/95	25.40	4,100	---	---	58	5.5	5.5	<0.5	6.7	---	---
	12/19/95	24.53	3,600	---	---	<0.5	2.1	4.3	1.1	6.6	---	---
	03/06/96[SPH]	---	---	---	---	---	---	---	---	---	---	---
	06/28/96	23.95	2,400	---	---	55	<0.5	<0.5	11	---	120	---
	09/26/96	25.89	2,500	---	---	<5.0	<5.0	<5.0	<5.0	25	160	---
	12/10/96	24.22	1,600	---	---	28	<2.0	4.2	3.9	34	110	0.8
MW-4	03/24/95	9.16	<50	---	---	<0.5	<0.5	<0.5	<0.5	<0.4	---	---
	06/26/95	12.06	<50	---	---	<0.5	<0.5	<0.5	<0.5	<0.4	---	---
	09/13/95	13.90	<50	---	---	<0.5	<0.5	<0.5	<0.5	<0.4	---	---
	12/19/95	12.90	<50	---	---	<0.5	<0.5	<0.5	<0.5	<0.4	---	---
	03/06/96	9.63	<50	---	---	<0.5	<0.5	<0.5	<0.5	<0.4	---	---
	06/28/96	12.30	40	---	---	<0.5	.97	.59	3.8	---	26	---
	09/26/96	14.12	<50	---	---	<0.5	<0.5	<0.5	<0.5	<0.5	<2.5	---

Table 2. **Analytic Results for Ground Water** - Shell Service Station WIC #204-6852-1404, 1784 150th Avenue, San Leandro, California (continued)

Well ID	Date Sampled	Depth to Water (ft)	TPH-G	TPH-D	POG	B	E	T	X	1,2-DCA	MTBE	DO (mg/L)
			← parts per billion (µg/l) →									
	12/10/96[m]	**12.31**	**<50**	**---**	**---**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**---**	**<2.5**	**1.2**
Trip Blank	03/08/90		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	06/12/90		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	12/18/90		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	03/07/91		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	06/07/91		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	09/17/91		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	12/09/91		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	02/24/92		<50	---	---	<0.5	0.6	2.5	2.2	---	---	---
	03/01/92		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	06/03/92		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	09/01/92		<50	---	---	<0.5	<0.5	<0.5	<0.5	<0.5	---	---
	12/04/92		<50	---	---	<0.5	<0.5	<0.5	<0.5	<0.5[j]	---	---
	03/03/93		<50	---	---	<0.5	<0.5	<0.5	<0.5	<0.5	---	---
	06/17/93		<50	---	---	<0.5	<0.5	<0.5	<0.5	<0.5	---	---
	09/10/93		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	12/13/93		<50	---	---	<0.5	<0.5	<0.5	<0.5	<0.5[k]	---	---
	03/03/94		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	06/06/94		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	09/12/94		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	12/19/94		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	02/28/95		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	03/24/95		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	06/26/95		<50	---	---	4.1	<0.5	3.0	1.5	---	---	---
	09/13/95		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	12/19/95		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
Bailer Blank	03/08/90		<50	---	---	<0.5	<0.5	<0.5	<0.5	---	---	---
	09/01/92		<50	---		<0.5	<0.5	0.7	<0.5	<0.5	---	---
	12/04/92		60	---		<0.5	<0.5	<0.5	<0.5	<0.5[j]	---	---
											---	---

Table 2. **Analytic Results for Ground Water** - Shell Service Station WIC #204-6852-1404, 1784 150th Avenue, San Leandro, California (continued)

Well ID	Date Sampled	Depth to Water (ft)	TPH-G	TPH-D	POG	B	E	T	X	1,2-DCA	MTBE	DO (mg/L)
			← parts per billion (µg/l) →									
DHS MCLs		NE	NE	N	1	680	100[1]	1,750	0.5	---	---	---

Table 2. **Analytic Results for Ground Water** - Shell Service Station WIC #204-6852-1404, 1784 150th Avenue, San Leandro, California (continued)

Abbreviations

TPH-G = Total Petroleum Hydrocarbons as Gasoline by Modified EPA Method 8015
TPH-D = Total Petroleum Hydrocarbons as Diesel by Modified EPA Method 8015
POG = Petroleum oil and grease by American Public Health Association Standard Method 503E or 5520F
MTBE = Methyl t-Butyl Ether by EPA Method 8020
B = Benzene by EPA Method 8020
E = Ethylbenzene by EPA Method 8020
T = Toluene by EPA Method 8020
X = Xylenes by EPA Method 8020
1,2-DCA = 1,2-Dichloroethane by EPA Method 8010
--- = Not analyzed
<n = Not detected above method detection limit of n ppb
DHS MCLs = California Department of Health Services maximum contaminant levels for drinking water
NE = Not established
SPH = Seperate-phase hydrocarbons present in well

Notes

a = No total petroleum hydrocarbons as motor oil detected above modified EPA Method 8015 detection limit of 500 ppb
b = Tetrachloroethene (PCE) detected at 24 ppb by EPA Method 601; DHS MCL for PCE = 5 ppb
c = Result is due to hydrocarbon compounds lighter than diesel
d = Result due to a non-gasoline hydrocarbon
e = In the matrix spike/matrix spike duplicate of sample MW-1, the RPD for Freon 113 and 1,3-dichlorobenzene was greater than 25%
f = The MW-2 and duplicate samples each contained 1.6 ppb of methylene chloride which is within normal laboratory background levels.
h = Sample MW-2 was diluted 1:100 for EPA Method 8010 due to the interfering hydrocarbon peaks
j = The trip and bailer blank samples contained 14 and 10 mg/L 1,3-dichlorobenzene, respectively
k = 1.4 mg/L Chloroethene detected in equipment blank, trip blank not analyzed
l = DHS recommended action level for drinking water; MCL not established
m = Tetrachloroethene (PCE) detected at 0.50 ppb by EPA Method 601; DHS MCL for PCE = 5 ppb
Tetrachloroethene detected at 0.57 ppb by EPA Method 8010
* = MTBE confirmed by EPA Method 8260
** = Result should be considered estimated due to being reported under the detection limit of 125 ppb.

Table 4. Hydrocarbon and Volatile Organic Compounds in Grab Ground Water Samples - Shell Service Station WIC #204-6852-1404, 1784 150th Avenue, San Leandro, California

Borehole/ Sample ID	Date Sampled	TPH-G	B	T	E	X	VOCs
		← parts per billion (µg/L) →					
BH-1	06/06/94	<50	<0.50	<0.50	<0.50	<0.50	---
BH-2	06/06/94	5,200[a]	8.8	<0.50	9.1	<0.50	---
BH-3	06/06/94	120,000[b]	25,000	14,000	3,100	13,000	ND
BH-4	06/07/94	<50	<0.50	<0.50	<0.50	<0.50	---
BH-5	06/07/94	<50	<0.50	<0.50	<0.50	<0.50	---
BH-6	06/07/94	<50	<0.50	<0.50	<0.50	<0.50	---
BH-7-17-W	02/14/95	100	1.0	1.0	<0.5	<0.5	---
BH-9-20-W	02/14/95	90	0.9	0.9	<0.5	<0.5	---

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
VOCs = Volatile organic compounds by EPA Method 8010
--- = Not analyzed
ND = Not detected between detection limits of 10 and 100 ppb.

Analytical Laboratory:

Sequoia Analytical, Inc. of Redwood City, California

Notes:

a = Chromatogram pattern as weathered gasoline.
b = Chromatogram pattern as gasoline.

Table 1. Analytic Results for Vapor Samples - Shell Service Station WIC #204-6852-1404, 1784 - 150th Avenue, San Leandro, California.

Sample ID	Sample Depth (ft)	B	E	T	X	O_2	CO_2	CH_4
		←parts per billion by volume (ppbv)→				←percent by volume→		
SVS-1	4	37	130	100	390	18	2.1	<0.002
SVS-2	4	50	36	85	150	19	2.8	<0.002
SVS-3	1	410	190	560	660	18	3.8	<0.002
SVS-3	2	130	75	350	220[m]	18	3.0	0.003
SVS-3	3	230	84	420	200[m]	17	5.4	<0.002
SVS-3	8	210	210	190	340	21	0.23	<0.002
SVS-3	18	26	61	170	230	20	0.45	0.004
SVS-4	4	140	160	320	280[m]	15	7.9	<0.002
SVS-5	3	7,600	1,200	4,900	4,500[m]	5.8	23	1.6
SVS-5	13	1,400	55[m]	260	660[m]	21	0.57	0.036
SVS-5dup	13	1,400	96[m]	270	620[m]	N/A	N/A	N/A
SVS-5	20	2,500	300	570	740	20	0.38	0.039
SV-6	4	180[m]	33	180	170[m]	21	0.066	<0.002
SVS-7	4	25	66	21	70	20	0.049	<0.002
SVS-8	5	180	88	190	330	21	0.057	<0.002
SVS-8dup	5	N/A	N/A	N/A	N/A	22	0.057	<0.002
SVS-9	3	21	25	24	230[m]	21	0.058	<0.002
SVS-9	6.5	150[m]	68	72	380	21	0.099	<0.002
SVS-9	13	360	290	180	220	21	0.056	0.003
SVS-9	18	320	49	110	70	21	0.046	<0.002
SVS-10	3	110	100	89	430[m]	19	1.8	<0.002

Table 1. Analytic Results for Vapor Samples - Shell Service Station WIC #204-6852-1404, 1784 - 150th Avenue, San Leandro, California (continued).

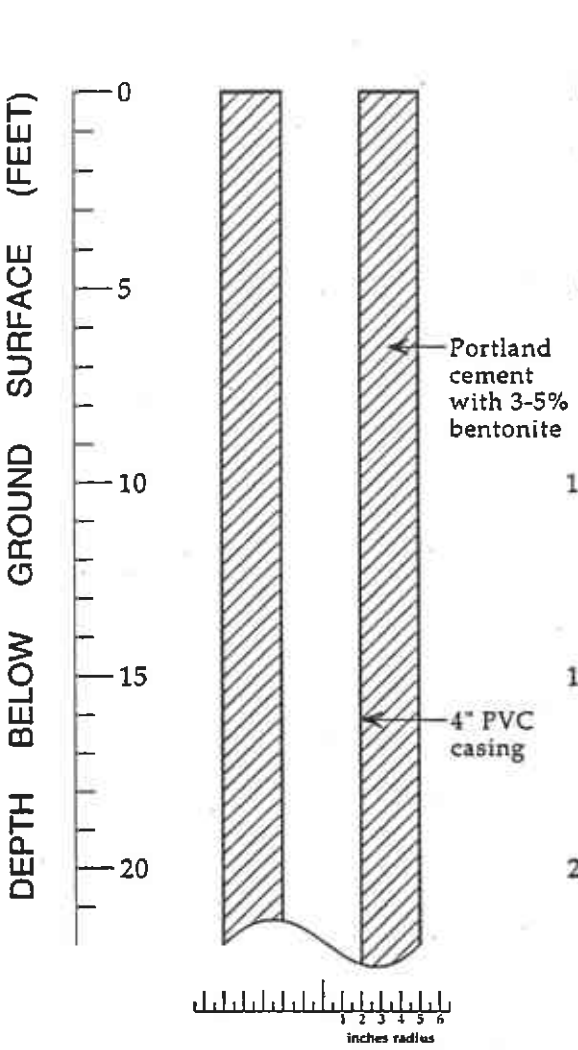
Abbreviations:

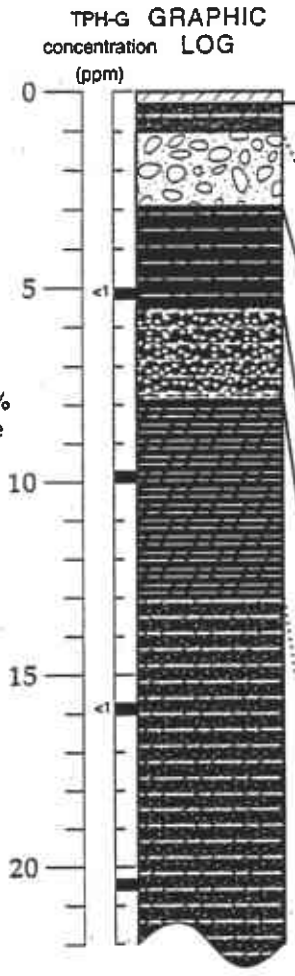
B = Benzene by Modified California Air Resources Board Method 410A
E = Ethylbenzene by Modified California Air Resources Board Method 410A
T = Toluene by Modified California Air Resources Board Method 410A
X = Xylenes by Modified California Air Resources Board Method 410A
O_2 = Oxygen by ASTM Method D3416
CO_2 = Carbon dioxide by ASTM Method D3416
CH_4 = Methane by ASTM Method D3416
<n = Not detected at detection limits of n ppbv
m = Reported value may be biased due to apparent matrix interferences
N/A = Duplicate sample not analyzed for these compounds

Notes:

Samples collected on 7/18/96 and 7/19/96 by Weiss Associates and analyzed by Air Toxics, Folsom, California

WELL MW-1 (BH-A)





DESCRIPTION

Asphaltic concrete

Sandy SILT (ML); dark brown; soft; damp; <5% clay; 75% silt; 25% fine to medium sand; low plasticity; low to moderate K

Gravelly SAND (SW); brown; medium dense; dry; 15% silt; 60% sand; 25% weathered gravel to 2" diameter; moderate to high K

Silty CLAY (CL); dark brown mottled orange and green; stiff; damp; 45% clay; 30% silt; 25% sand; medium to high plasticity; very low K

Gravelly sand lens at 5.3'

Silty SAND (SM); dark brown; loose; moist; <5% clay; 35% silt; 45% fine to coarse sand; 20% gravel to 1" diameter; moderate to high K

Clayey SILT/Silty CLAY (OH); black; medium stiff; 40% clay; 40% silt; 20% very fine sand; roots and grasses; high plasticity; very low K

Tile shard at 9.7'

Sandy SILT/Clayey SILT (ML); green-gray; very stiff; damp; 20% clay; 60% silt; 20% fine to coarse sand; medium to high plasticity; low K

3" sandy GRAVEL lens at 18.0'

Rootlets at 18.7'

Light brown-gray from 19.5'

6" sand lens at 22'

EXPLANATION

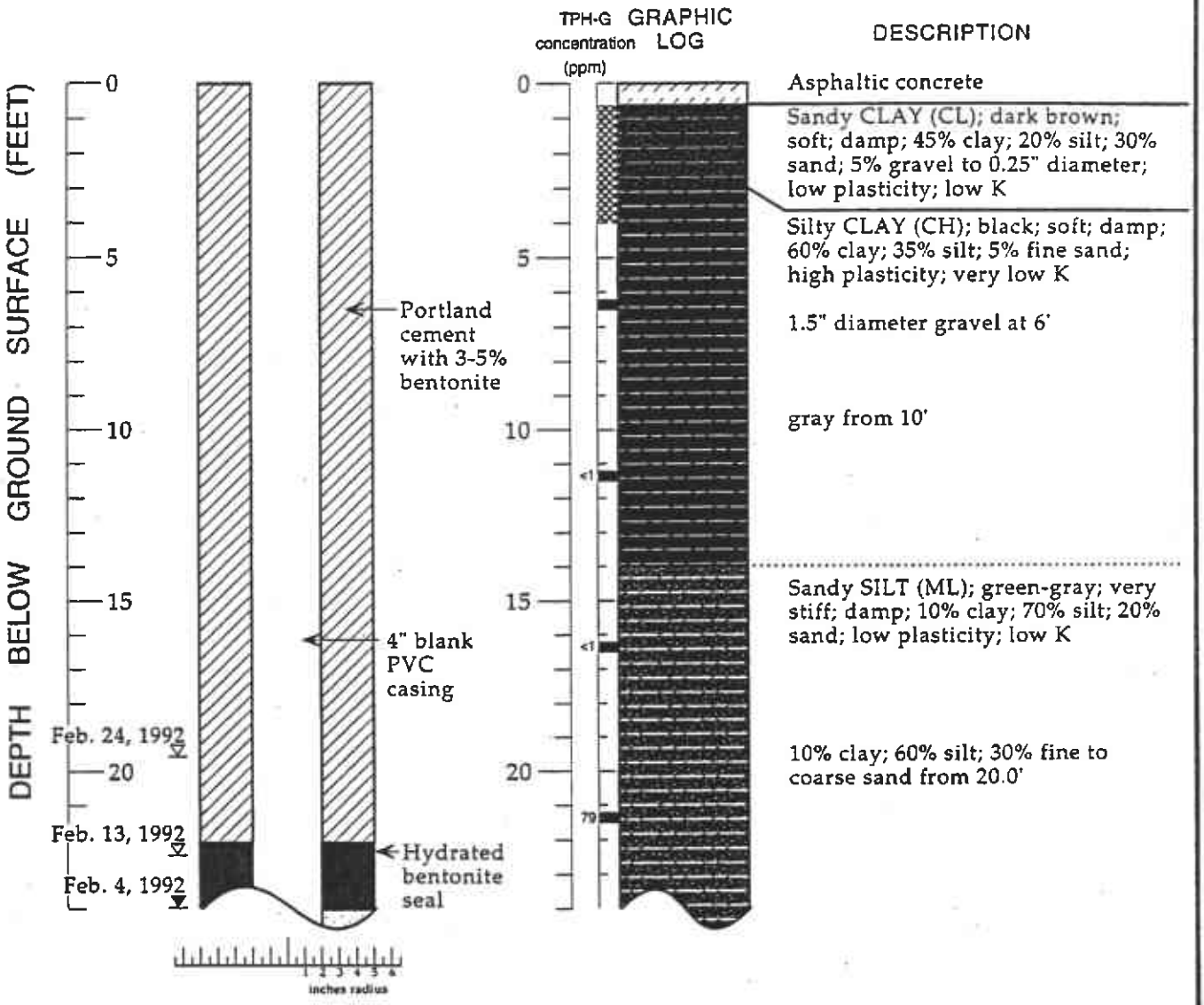
- ▼ Water level during drilling (date)
- ▽ Water level (date)
- ——····—— Contact (dotted where approximate)
- —?—?— Uncertain contact
- ////////// Gradational contact
- Location of recovered drive sample
- Location of drive sample sealed for chemical analysis
- Cutting sample
- K = Estimated hydraulic conductivity

Logged By: Karen Sixt
Supervisor: Richard Weiss; CEG 1112
Drilling Company: HEW Drilling, East Palo Alto, CA
License Number: Lic. #C57-61384167
Driller: Casto Pineda
Drilling Method: Hollow-stem auger
Date Drilled: March 6, 1990
Well Head Completion: 4" locking well-plug, traffic-rated vault
Type of Sampler: Split barrel (2" ID)
Ground Surface Elevation: 49.48 feet above mean sea level
TPH-G: Total petroleum hydrocarbon as gasoline in soil by modified EPA Method 8015

Boring Log and Well Construction Details - Well MW-1 (BH-A) - Shell Service Station WIC #204-6852-1404, 1784 150th Avenue, San Leandro, California

2/26/92

WELL MW-2 (BH-B)



EXPLANATION

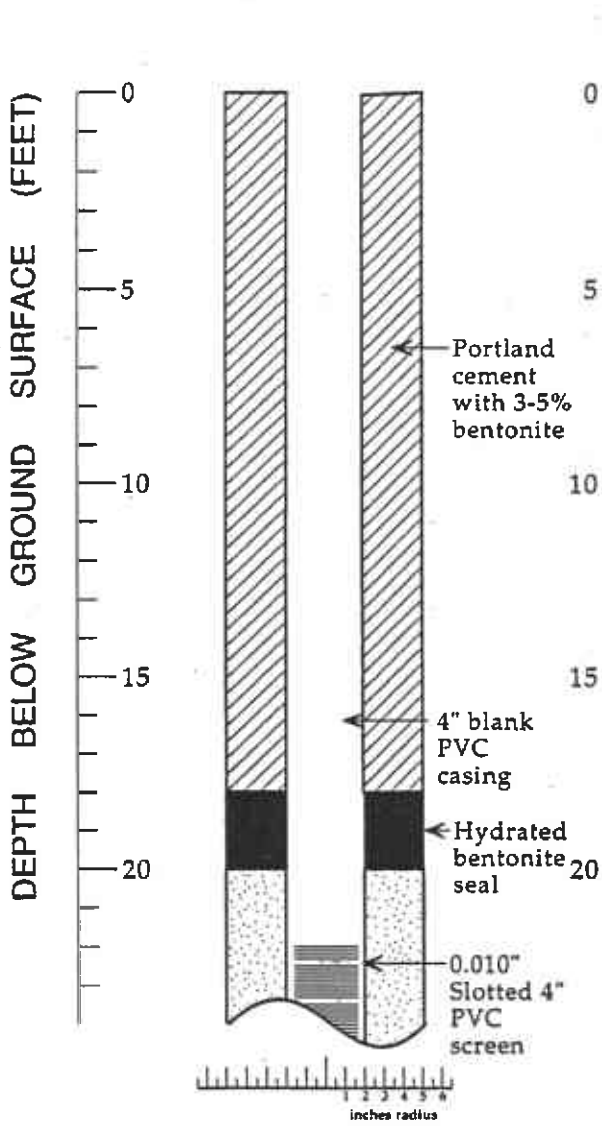
- Water level during drilling (date)
- Water level (date)
- Contact (dotted where approximate)
- Uncertain contact
- Gradational contact
- Location of recovered drive sample
- Location of drive sample sealed for chemical analysis
- Cutting sample
- K = Estimated hydraulic conductivity

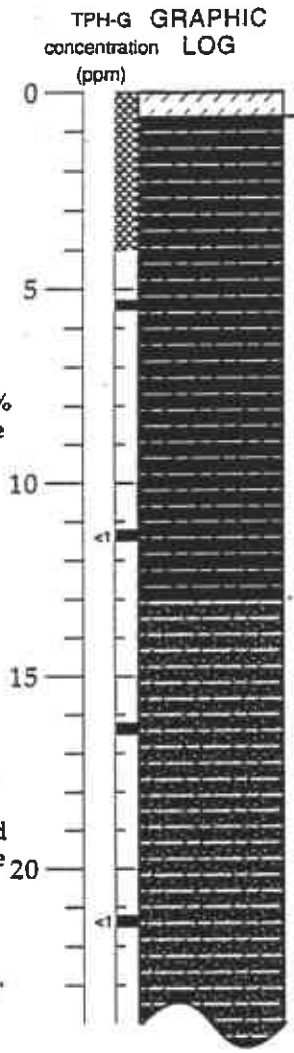
Logged By: Tom Fojut
Supervisor: Joseph P. Theisen; CEG 1645
Drilling Company: Soils Exploration Services, Benicia, CA
License Number: Lic. #C57-582696
Driller: Courtney Mossman
Drilling Method: Hollow-stem auger
Date Drilled: February 4 , 1992
Well Head Completion: 4" locking well-plug, traffic-rated vault
Type of Sampler: Split barrel (2" ID)
Ground Surface Elevation: 46.18 feet above mean sea level
TPH-G: Total petroleum hydrocarbon as gasoline in soil by modified EPA Method 8015

Boring Log and Well Construction Details - Well MW-2 (BH-B) - Shell Service Station WIC #204-6852-1404 - 1784 150th Avenue, San Leandro, California

2/26/92

WELL MW-3 (BH-C)





DESCRIPTION

Asphaltic concrete

Silty CLAY (CH); black; soft; damp; 60% clay; 35% silt; 5% fine sand; high plasticity; very low K

stiff; 65% clay; 35% silt; trace fine sand from 10'

Sandy SILT (ML); tan; medium stiff; damp; 10% clay; 65% silt; 25% fine sand; low plasticity; low to moderate K

10% clay; 65% silt; 25% fine to medium sand from 20'

driller: harder substance at 24'

EXPLANATION

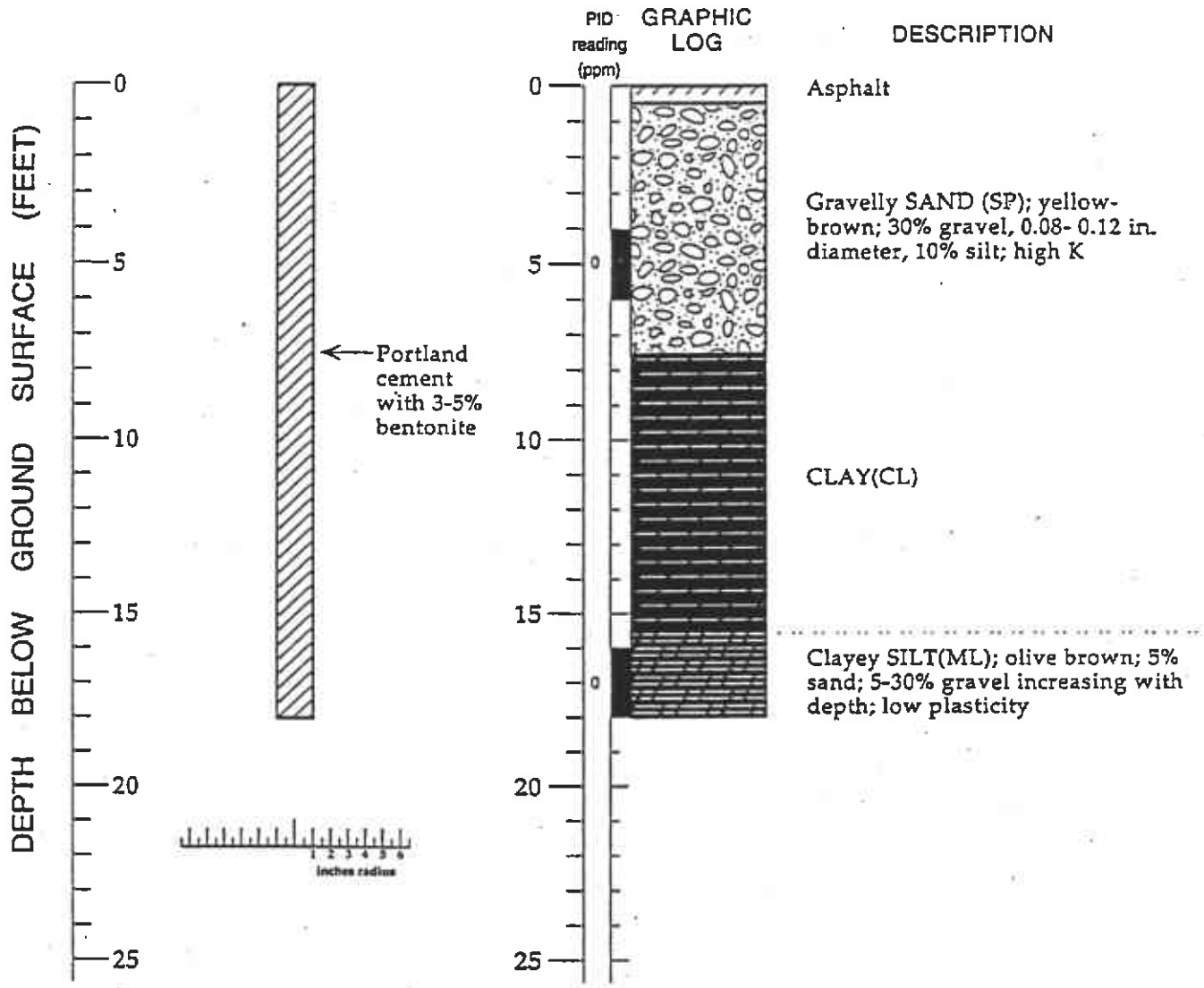
- ▼ Water level during drilling (date)
- ▽ Water level (date)
- ——····—— Contact (dotted where approximate)
- —?—?— Uncertain contact
- ////////// Gradational contact
- Location of recovered drive sample
- Location of drive sample sealed for chemical analysis
- Cutting sample
- K = Estimated hydraulic conductivity

Logged By: Tom Fojut
Supervisor: Joseph P. Theisen; CEG 1645
Drilling Company: Soils Exploration Services, Benicia, CA
License Number: Lic. #C57-582696
Driller: Courtney Mossman
Drilling Method: Hollow-stem auger
Date Drilled: February 5, 1992
Well Head Completion: 4" locking well-plug, traffic-rated vault
Type of Sampler: Split barrel (2" ID)
Ground Surface Elevation: 52.35 feet above mean sea level
TPH-G: Total petroleum hydrocarbon as gasoline in soil by modified EPA Method 8015

Boring Log and Well Construction Details - Well MW-3 (BH-C) - Shell Service Station WIC #204-6852-1404 - 1784 150th Avenue, San Leandro, California

2/26/92

LITHOLOGIC LOG SVS-3



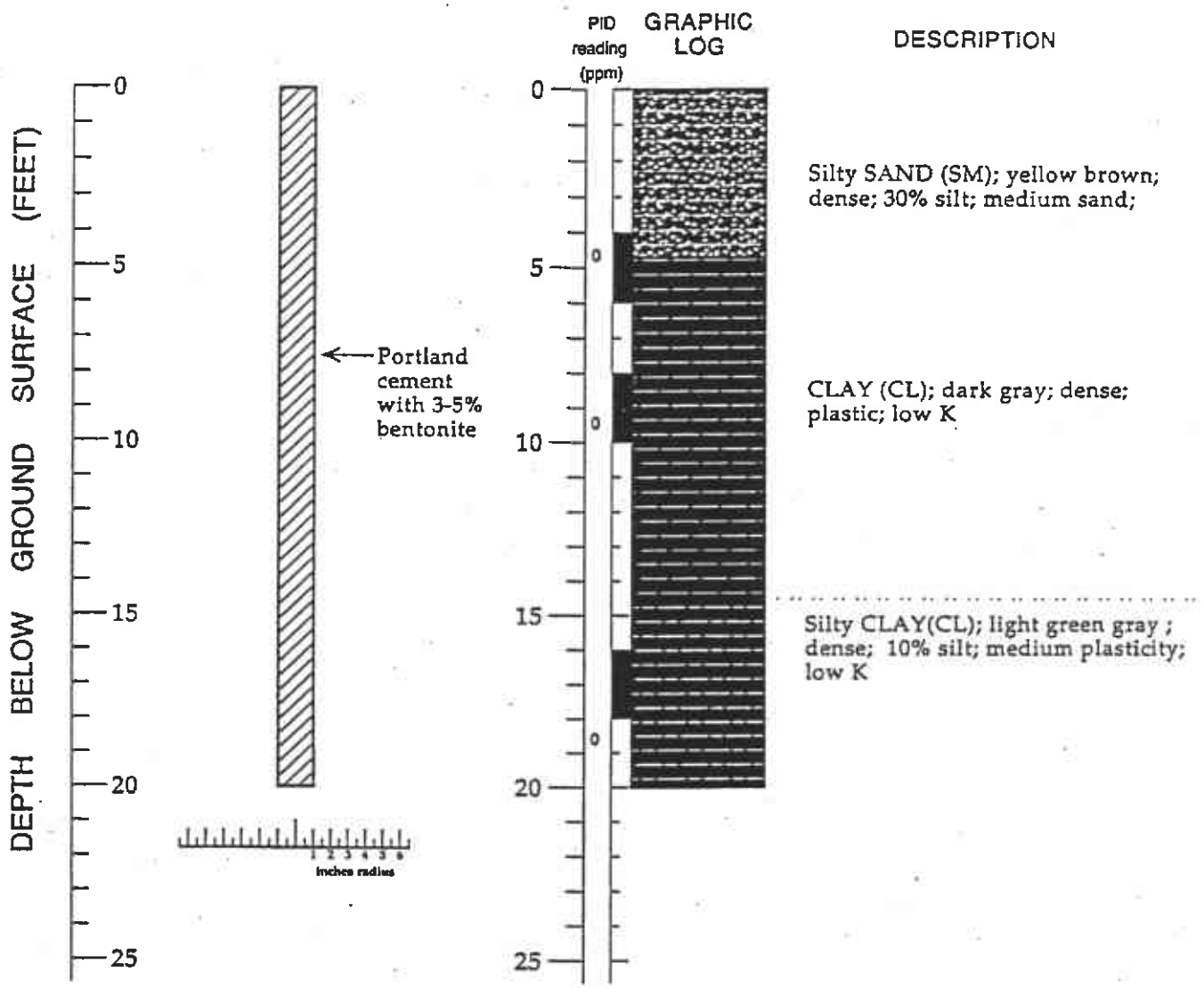
EXPLANATION

- Water level during drilling (date)
- Water level (date)
- Contact (dotted where approximate)
- Uncertain contact
- Gradational contact
- Location of recovered drive sample
- Location of drive sample sealed for chemical analysis
- Cutting sample
- K = Estimated hydraulic conductivity

Logged By: Chuck Headlee
Supervisor: Jim Carmody; CEG 1576
Drilling Company: Interphase Inc.
License Number: C57-485165
Driller: Rick Nessinger
Drilling Method: Geoprobe
Date Drilled: August 18, 1996
Type of Sampler: Geoprobe Sampler
PID: Photoionization detector

Lithographic Log Details - Lithographic Log SVS-3, Shell Service Station WIC# 204-6852-1404, 1784 150th Avenue, San Leandro, California

LITHOLOGIC LOG SVS-5



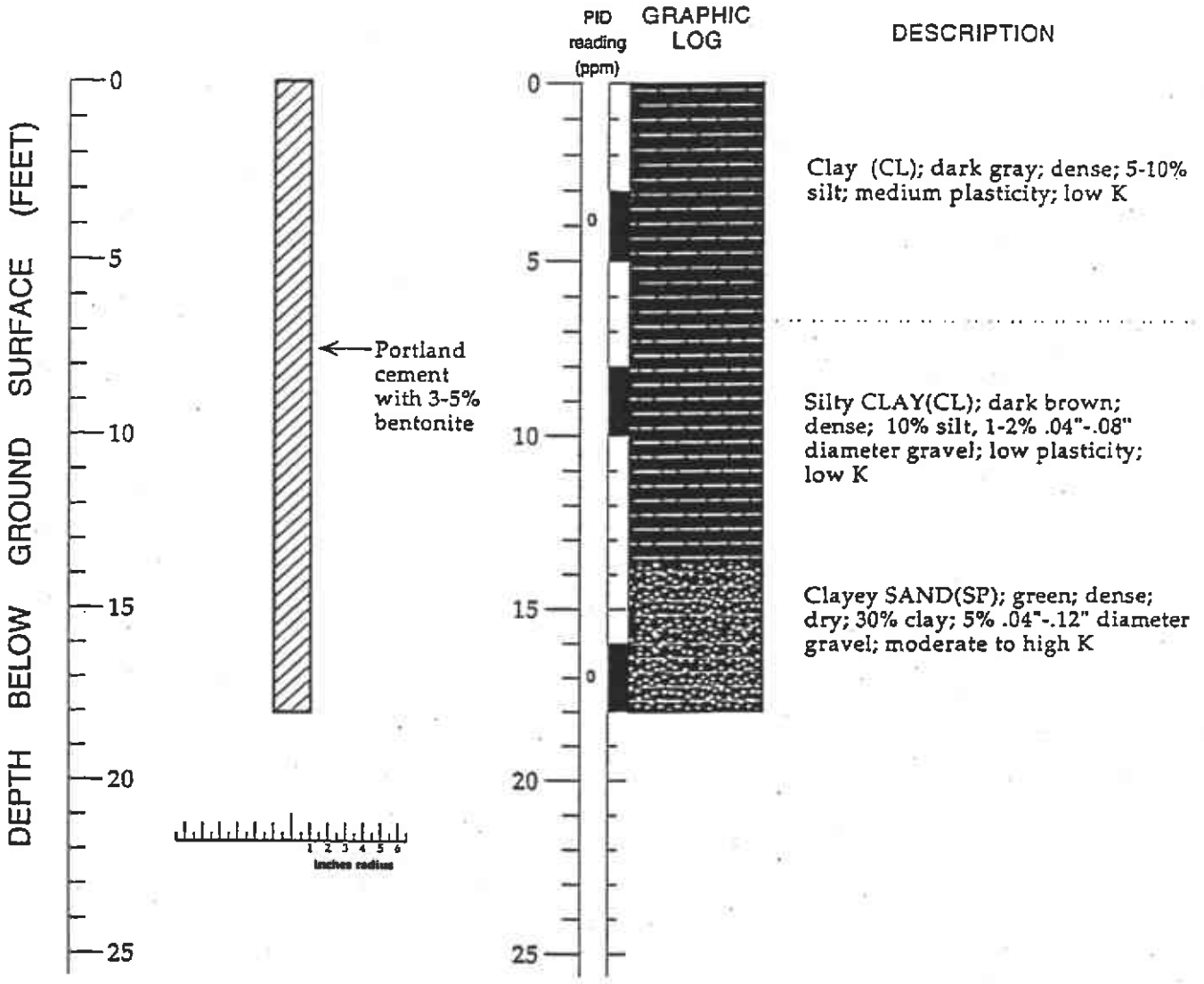
EXPLANATION

- Water level during drilling (date)
- Water level (date)
- Contact (dotted where approximate)
- Uncertain contact
- Gradational contact
- Location of recovered drive sample
- Location of drive sample sealed for chemical analysis
- Cutting sample
- K = Estimated hydraulic conductivity

Logged By: Chuck Headlee
Supervisor: Jim Carmody, CEG 1576
Drilling Company: Interphase Inc.
License Number: C57-606481
Driller: Rick Nessinger
Drilling Method: Geoprobe
Date Drilled: August 18, 1996
Type of Sampler: Geoprobe Sampler
PID: Photoionization detector

Lithographic Log Details - Lithographic Log SVS-5, Shell Service Station, WIC#204-6852-1404, 1784 150th Avenue, San Leandro, California

LITHOLOGIC LOG SVS-9



EXPLANATION

- Water level during drilling (date)
- Water level (date)
- Contact (dotted where approximate)
- Uncertain contact
- Gradational contact
- Location of recovered drive sample
- Location of drive sample sealed for chemical analysis
- Cutting sample
- K = Estimated hydraulic conductivity

Logged By: Chuck Headlee
Supervisor: Jim Carmody, CEG 1576
Drilling Company: Interphase Inc.
License Number: C57-606481
Driller: Rick Nessinger
Drilling Method: Geoprobe
Date Drilled: July 19, 1996
Type of Sampler: Geoprobe Sampler
PID: Photionization detector

Lithographic Log Details - Lithographic Log SVS-9, Shell Service Station, WIC#204-6852-1404, 1784 150th Avenue San Leandro, California

APPENDIX C

SOIL VAPOR RBSL CALCULATIONS

RBSL For Benzene in Vapor at 1 Foot Below Ground Surface

	Soil Specific Parameters		
ASTM 95	ρ_s	1.7	Bulk Density(g/cm^3) or (kg/L)
ASTM 95	θ_{as}	0.26	Air Content (v/v)
ASTM 95	θ_{acrack}	0.26	Air Content in foundation cracks(v/v)
ASTM 95	θ_{ws}	0.12	Water Content (v/v)
ASTM 95	θ_{wcrack}	0.12	Water Content in foundation cracks(v/v)
ASTM 95	θ_t	0.38	Porosity (v/v)
Actual	d	30	**Depth to (location of) vapor sample (cm) - 1 foot depth**
	Diffusivity Parameters		
ASTM 95	H	0.22	Henry's Constant for Benzene
ASTM 95	D^{air}	9.30E-02	Air Diffusion Coefficient (cm^2/s)
ASTM 95	D^{wat}	1.10E-05	Water Diffusion Coefficient (cm^2/s)
Calculated	D^{eff}_s	0.007258	Effective Diffusion Coefficient soil (cm^2/s)
Calculated	D^{eff}_{crack}	0.007258	Effective Diffusion Coefficient through foundation cracks (cm^2/s)
	Prediction of Flux From Benzene Concentration in Soil Vapor		
Iterative Calc	$C_{v,max}$	2,070	**RBSL - Benzene Concentration in Vapor (ppbv)**
Unit Conv	$C_{v,max}$	6.71	Benzene Concentration in Vapor (ug/L)
Calculated	F_{max}	1.60E-06	Maximum Diffusive Vapor Flux Predicted by Benzene Concentration in Soil Vapor (ug/cm^2-sec)
	Indoor Air Concentration		
ASTM 95	Lb	200	Enclosed Space Volume/Infiltration Area Ratio (cm)
ASTM 95	ER_{air}-indoor	0.00014	Enclosed Space Air Exchange Rate (sec^{-1})
ASTM 95	L_{crack}	15	Enclosed Space Foundation Thickness (cm)
ASTM 95	n	0.01	Areal Fraction of Cracks in Foundation (cm^2/cm^2)
Calculated	C_{indoor}	1.14E-06	Enclosed Space Air Concentration (ug/cm^3)
	Dose		
ASTM 95	IR_{air}-indoor	15	Daily Indoor Inhalation Rate (m^3/day)
ASTM 95	EF	350	Exposure Frequency (days/year)
ASTM 95	ED	30	Exposure Duration (years)
Calculated	Dose	179.0158	Dose (mg)
	Risk		
CAL EPA	SF_i	0.1	California Cancer Slope Factor for Benzene (kg-day/mg)
ASTM 95	BW	70	Body Weight (kg)
ASTM 95	AT_c	70	Averaging Time for Carcinogens (years)
Calculated	Risk	1.00E-05	Risk (positives/population)

Formulas

$$D_s^{eff} = D^{air}\frac{\theta_{as}^{3.33}}{\theta_T^2} + D^{wat}\frac{1}{H}\frac{\theta_{ws}^{3.33}}{\theta_T^2}$$

$$D_{crack}^{eff} = D^{air}\frac{\theta_{acrack}^{3.33}}{\theta_T^2} + D^{wat}\frac{1}{H}\frac{\theta_{wcrack}^{3.33}}{\theta_T^2}$$

$$F_{max} = D_s^{eff}\frac{C_{v,max}}{d}$$

$$C_{indoor} = \frac{\left[\frac{F_{max}}{ER_{air-indoor}\times L_b}\right]}{\left[1+\left(\frac{D_s^{eff}/d}{ER_{air-indoor}L_b}\right)+\left(\frac{D_s^{eff}/d}{\left(D_{crack}^{eff}/L_{crack}\right)\eta}\right)\right]}$$

$$Dose = C_{indoor}\times IR_{air-indoor}\times EF\times ED$$

$$Risk = \frac{Dose \times SF_i}{BW\times AT}$$

Notes:

ASTM 95 = American Society for Testing and Materials, 1995. Standard Guide for Risk Based Corrective Action Applied at Petroleum Release Sites, E 1739-95.

Calculations: Effective diffusivity, diffusive vapor flux, enclosed space air concentration, dose and risk calculations from ASTM 95 guidance. Formulas presented above. Maximum allowable vapor concentration calculated by iteration to achieve acceptable risk level.

RBSL For Toluene in Vapor at 1 Foot Below Ground Surface

		Soil Specific Parameters	
ASTM 95	ρ_s	1.7	Bulk Density(g/cm^3) or (kg/L)
ASTM 95	θ_{as}	0.26	Air Content (v/v)
ASTM 95	θ_{acrack}	0.26	Air Content in foundation cracks(v/v)
ASTM 95	θ_{ws}	0.12	Water Content (v/v)
ASTM 95	θ_{wcrack}	0.12	Water Content in foundation cracks(v/v)
ASTM 95	θ_t	0.38	Porosity (v/v)
Actual	d	30	**Depth to (location of) vapor sample (cm) - 1 foot depth**
		Diffusivity Parameters	
ASTM 95	H	0.26	Henry's Constant for Toluene
ASTM 95	D^{air}	8.50E-02	Air Diffusion Coefficient (cm^2/s)
ASTM 95	D^{wat}	9.40E-06	Water Diffusion Coefficient (cm^2/s)
Calculated	D^{eff}_s	0.006633	Effective Diffusion Coefficient soil (cm^2/s)
Calculated	D^{eff}_{crack}	0.006633	Effective Diffusion Coefficient through foundation cracks (cm^2/s)
		Prediction of Flux From Toluene Concentration In Soil Vapor	
Iterative Calc	$C_{v,max}$	**904,000**	**RBSL - Toluene Concentration in Vapor (ppbv)**
Unit Conv	$C_{v,max}$	3457.54	Toluene Concentration in Vapor (ug/L)
Calculated	F_{max}	7.52E-04	Maximum Diffusive Vapor Flux Predicted by Toluene Concentration in Soil Vapor (ug/cm^2-sec)
		Indoor Air Concentration	
ASTM 95	Lb	200	Enclosed Space Volume/Infiltration Area Ratio (cm)
ASTM 95	ER_{air}-indoor	0.00014	Enclosed Space Air Exchange Rate (sec^{-1})
ASTM 95	L_{crack}	15	Enclosed Space Foundation Thickness (cm)
ASTM 95	n	0.01	Areal Fraction of Cracks in Foundation (cm^2/cm^2)
Calculated	C_{indoor}	0.000535	Enclosed Space Air Concentration (ug/cm^3)
		Dose	
ASTM 95	IR_{air}-indoor	15	Daily Indoor Inhalation Rate (m^3/day)
ASTM 95	EF	350	Exposure Frequency (days/year)
ASTM 95	ED	30	Exposure Duration (years)
Calculated	Dose	84279.37	Dose (mg)
		Risk	
ASTM 95	RfD_i	0.11	Reference Dose for Inhalation Exposure (mg/kg-day)
ASTM 95	BW	70	Body Weight (kg)
ASTM 95	AT_n	30	Averaging Time for noncarcinogens (years)
Calculated	THQ	1.00	Target Hazard Quotient

Formulas

$$D_s^{eff} = D^{air}\frac{\theta_{as}^{3.33}}{\theta_T^2} + D^{wat}\frac{1}{H}\frac{\theta_{ws}^{3.33}}{\theta_T^2}$$

$$D_{crack}^{eff} = D^{air}\frac{\theta_{acrack}^{3.33}}{\theta_T^2} + D^{wat}\frac{1}{H}\frac{\theta_{wcrack}^{3.33}}{\theta_T^2}$$

$$F_{max} = D_s^{eff}\frac{C_{v,max}}{d}$$

$$C_{indoor} = \frac{\left[\frac{F_{max}}{ER_{air-indoor}\times L_b}\right]}{\left[1+\left(\frac{D_s^{eff}/d}{ER_{air-indoor}L_b}\right)+\left(\frac{D_s^{eff}/d}{\left(D_{crack}^{eff}/L_{crack}\right)n}\right)\right]}$$

$$Dose = C_{indoor}\times IR_{air-indoor}\times EF\times ED$$

$$THQ = \frac{Dose}{BW\times AT\times RfD_i}$$

Notes:

ASTM 95 = American Society for Testing and Materials, 1995. Standard Guide for Risk Based Corrective Action Applied at Petroleum Release Sites, E 1739-95.

Calculations: Effective diffusivity, diffusive vapor flux, enclosed space air concentration, dose and risk calculations from ASTM 95 guidance. Formulas presented above. Maximum allowable vapor concentration calculated by iteration to achieve acceptable target hazard quotient.

RBSL For Ethyl Benzene in Vapor at 1 Foot Below Ground Surface

		Soil Specific Parameters	
ASTM 95	ρ_s	1.7	Bulk Density(g/cm^3) or (kg/L)
ASTM 95	θ_{as}	0.26	Air Content (v/v)
ASTM 95	θ_{acrack}	0.26	Air Content in foundation cracks(v/v)
ASTM 95	θ_{ws}	0.12	Water Content (v/v)
ASTM 95	θ_{wcrack}	0.12	Water Content in foundation cracks(v/v)
ASTM 95	θ_t	0.38	Porosity (v/v)
Actual	d	30	**Depth to (location of) vapor sample (cm) - 1 foot depth**
		Diffusivity Parameters	
ASTM 95	H	0.32	Henry's Constant for Ethyl Benzene
ASTM 95	D^{air}	7.60E-02	Air Diffusion Coefficient (cm^2/s)
ASTM 95	D^{wat}	8.50E-06	Water Diffusion Coefficient (cm^2/s)
Calculated	D^{eff}_s	0.005931	Effective Diffusion Coefficient soil (cm^2/s)
Calculated	D^{eff}_{crack}	0.005931	Effective Diffusion Coefficient through foundation cracks (cm^2/s)
		Prediction of Flux From Ethyl Benzene Concentration in Soil Vapor	
Iterative Calc	$C_{v,max}$	**2,310,000**	**RBSL - Ethyl Benzene Concentration in Vapor (ppbv)**
Unit Conv	$C_{v,max}$	10,180	Ethyl Benzene Concentration in Vapor (ug/L)
Calculated	F_{max}	1.98E-03	Maximum Diffusive Vapor Flux Predicted by Ethyl Benzene Concentration in Soil Vapor (ug/cm^2-sec)
		Indoor Air Concentration	
ASTM 95	Lb	200	Enclosed Space Volume/Infiltration Area Ratio (cm)
ASTM 95	ER_{air}-indoor	0.00014	Enclosed Space Air Exchange Rate (sec^{-1})
ASTM 95	L_{crack}	15	Enclosed Space Foundation Thickness (cm)
ASTM 95	n	0.01	Areal Fraction of Cracks in Foundation (cm^2/cm^2)
Calculated	C_{indoor}	0.001409	Enclosed Space Air Concentration (ug/cm^3)
		Dose	
ASTM 95	IR_{air}-indoor	15	Daily Indoor Inhalation Rate (m^3/day)
ASTM 95	EF	350	Exposure Frequency (days/year)
ASTM 95	ED	30	Exposure Duration (years)
Calculated	Dose	221861.6	Dose (mg)
		Risk	
ASTM 95	RfD_i	0.29	Reference Dose for Inhalation Exposure (mg/kg-day)
ASTM 95	BW	70	Body Weight (kg)
ASTM 95	AT_n	30	Averaging Time for noncarcinogens (years)
Calculated	THQ	1.00	Target Hazard Quotient

Formulas

$$D_s^{eff} = D^{air}\frac{\theta_{as}^{3.33}}{\theta_T^2} + D^{wat}\frac{1}{H}\frac{\theta_{ws}^{3.33}}{\theta_T^2}$$

$$D_{crack}^{eff} = D^{air}\frac{\theta_{acrack}^{3.33}}{\theta_T^2} + D^{wat}\frac{1}{H}\frac{\theta_{wcrack}^{3.33}}{\theta_T^2}$$

$$F_{max} = D_s^{eff}\frac{C_{v,max}}{d}$$

$$C_{indoor} = \frac{\left[\frac{F_{max}}{ER_{air-indoor}\times L_b}\right]}{\left[1+\left(\frac{D_s^{eff}/d}{ER_{air-indoor}L_b}\right)+\left(\frac{D_s^{eff}/d}{(D_{crack}^{eff}/L_{crack})n}\right)\right]}$$

$$Dose = C_{indoor}\times IR_{air-indoor}\times EF\times ED$$

$$THQ = \frac{Dose}{BW\times AT\times RfD_i}$$

Notes:

ASTM 95 = American Society for Testing and Materials, 1995. Standard Guide for Risk Based Corrective Action Applied at Petroleum Release Sites, E 1739-95.

Calculations: Effective diffusivity, diffusive vapor flux, enclosed space air concentration, dose and risk calculations from ASTM 95 guidance. Formulas presented above. Maximum allowable vapor concentration calculated by iteration to achieve acceptable target hazard quotient.

RBSL For Xylenes in Vapor at 1 Foot Below Ground Surface

		Soil Specific Parameters	
ASTM 95	ρ_s	1.7	Bulk Density(g/cm^3) or (kg/L)
ASTM 95	θ_{as}	0.26	Air Content (v/v)
ASTM 95	θ_{acrack}	0.26	Air Content in foundation cracks(v/v)
ASTM 95	θ_{ws}	0.12	Water Content (v/v)
ASTM 95	θ_{wcrack}	0.12	Water Content in foundation cracks(v/v)
ASTM 95	θ_t	0.38	Porosity (v/v)
Actual	d	30	**Depth to (location of) vapor sample (cm) - 1 foot depth**
		Diffusivity Parameters	
ASTM 95	H	0.29	Henry's Constant for Xylenes
ASTM 95	D^{air}	7.20E-02	Air Diffusion Coefficient (cm^2/s)
ASTM 95	D^{wat}	8.50E-06	Water Diffusion Coefficient (cm^2/s)
Calculated	D^{eff}_s	0.0056188	Effective Diffusion Coefficient soil (cm^2/s)
Calculated	D^{eff}_{crack}	0.0056188	Effective Diffusion Coefficient through foundation cracks (cm^2/s)
		Prediction of Flux From Xylenes Concentration in Soil Vapor	
Iterative Calc	$C_{v,max}$	**16,800,000**	**RBSL - Xylenes Concentration in Vapor (ppbv)**
Unit Conv	$C_{v,max}$	74,033	Xylenes Concentration in Vapor (ug/L)
Calculated	F_{max}	1.36E-02	Maximum Diffusive Vapor Flux Predicted by Xylenes Concentration in Soil Vapor (ug/cm^2-sec)
		Indoor Air Concentration	
ASTM 95	Lb	200	Enclosed Space Volume/Infiltration Area Ratio (cm)
ASTM 95	ER_{air}-indoor	0.00014	Enclosed Space Air Exchange Rate (sec^{-1})
ASTM 95	L_{crack}	15	Enclosed Space Foundation Thickness (cm)
ASTM 95	n	0.01	Areal Fraction of Cracks in Foundation (cm^2/cm^2)
Calculated	C_{indoor}	0.0097056	Enclosed Space Air Concentration (ug/cm^3)
		Dose	
ASTM 95	IR_{air}-indoor	15	Daily Indoor Inhalation Rate (m^3/day)
ASTM 95	EF	350	Exposure Frequency (days/year)
ASTM 95	ED	30	Exposure Duration (years)
Calculated	Dose	1528633.7	Dose (mg)
		Risk	
ASTM 95	RfD_i	2.0	Reference Dose for Inhalation Exposure (mg/kg-day)
ASTM 95	BW	70	Body Weight (kg)
ASTM 95	AT_n	30	Averaging Time for noncarcinogens (years)
Calculated	THQ	1.00	Target Hazard Quotient

Formulas

$$D_s^{eff} = D^{air}\frac{\theta_{as}^{3.33}}{\theta_T^2} + D^{wat}\frac{1}{H}\frac{\theta_{ws}^{3.33}}{\theta_T^2}$$

$$D_{crack}^{eff} = D^{air}\frac{\theta_{acrack}^{3.33}}{\theta_T^2} + D^{wat}\frac{1}{H}\frac{\theta_{wcrack}^{3.33}}{\theta_T^2}$$

$$F_{max} = D_s^{eff}\frac{C_{v,max}}{d}$$

$$C_{indoor} = \frac{\left[\frac{F_{max}}{ER_{air-indoor}\times L_b}\right]}{\left[1+\left(\frac{D_s^{eff}/d}{ER_{air-indoor}L_b}\right)+\left(\frac{D_s^{eff}/d}{(D_{crack}^{eff}/L_{crack})\eta}\right)\right]}$$

$$Dose = C_{indoor}\times IR_{air-indoor}\times EF\times ED$$

$$THQ = \frac{Dose}{BW\times AT\times RfD_i}$$

Notes:

ASTM 95 = American Society for Testing and Materials, 1995. Standard Guide for Risk Based Corrective Action Applied at Petroleum Release Sites, E 1739-95.

Calculations: Effective diffusivity, diffusive vapor flux, enclosed space air concentration, dose and risk calculations from ASTM 95 guidance. Formulas presented above. Maximum allowable vapor concentration calculated by iteration to achieve acceptable target hazard quotient.