MANMOHAN S. CHOPRA
4216 WARBLER LOOP
FREMONT, CA 94555
TEL. (510) 489-5696

July 7,2000

Alameda County Department of Enviromental Health
1131 Harbor Bay Parkway, 2nd Floor
ALAMEDA, CA 94502-6577

ATTN: Mr Scott Seery

SUB: Risk-Based Corrective Action Evaluation
1401 Grand Ave. San Leandro, CA

Dear Mr seery,

Attached for your review and records, please find a copy of risk Based Corrective Action Evaluation performed by P&D Enviromental, for the above site. This evaluation was performed in order to satisfy your department's requirements for closure of corrective action at the site. I am sure this report meets all your requirements, however if I or Paul King of P&D Enviromental could be of any further assistance, please do contact us.

Sincerely,

Manmohan S. Chopra
Property Owner

Attachments: RBCA report #0055-R14 dated june 22,2000

P & D ENVIRONMENTAL
A Division of Paul H. King, Inc.
4020 Panama Court
Oakland, CA 94611
(510) 658-6916

June 22, 2000
Report 0055.R14

Mr. Manmohan Chopra
4216 Warbler Loop
Fremont, CA 94555

SUBJECT: RISK-BASED CORRECTIVE ACTION EVALUATION TIER 2
Former ARCO Service Station
1401 Grand Avenue
San Leandro, CA

Dear Mr. Chopra:

P&D Environmental, a division of Paul H. King, Inc. (P&D), is pleased to present this report documenting the Tier 2 evaluation of the Risk-Based Corrective Action (RBCA) described in ASTM 1739 (a revision of ES 38-94) Guide for Risk-Based Corrective Action Applied at Petroleum Release Site. This work was performed in accordance with a letter from Mr. Scott Seery of the Alameda County Department of Environmental Health. A Site Location Map (Figure 1) and a Site Vicinity Map (Figure 2) are attached with this report in Appendix A.

The Tier 2 RBCA was performed using a spreadsheet provided by the City of Oakland Urban Land Redevelopment Program (COULRP) for RBCAs. The computer model was developed based on the ASTM method, and incorporates some Oakland-specific adjustments to input parameters which are generally more conservative than the ASTM parameters. The RBCA results from the COULRP spreadsheet are presented in the form of Site-Specific Target Levels (SSTLs) for subsurface soil and groundwater samples. The SSTLs were based on the inhalation of Volatile Organic Compounds (VOCs) from indoor air. None of the soil or groundwater sample results used in the evaluation were observed to exceed the SSTLs for any of the contaminants of concern.

BACKGROUND

The site is presently used as an active gasoline station. It is P&D's understanding that historically, the underground storage tanks (USTs) at the site have stored gasoline and waste oil. It is also P&D's understanding that on April 24, 1991 Aegis Environmental, Inc. (Aegis) personnel drilled four soil borings, designated as B-1 through B-4, to a vertical depth of approximately 40 feet at the site. The locations of the borings are shown on Figure 2. A total of nine soil samples collected from the boreholes were analyzed for total petroleum hydrocarbons as gasoline (TPH-G); benzene, toluene, ethylbenzene, and total xylenes (BTEX) by EPA Method 8260; and for total lead by EPA Method 7420. TPH-G concentrations ranged from below detection limit to 66 parts per million (ppm). Benzene concentrations ranged from not detected to 0.94 ppm. Total lead concentrations ranged from not detected to 3 ppm. Documentation of the subsurface investigation and results are presented in a report prepared by Aegis titled, "Soil Boring Results Report," dated June 10, 1991.

It is P&D's understanding that on April 14, 1992 Aegis personnel returned to the site to drill three slant borings, designated as B5 through B7, to a total vertical depth of approximately 49 feet at the site. The borings were drilled at an angle of approximately 26 to 28 degrees to collect samples from beneath the underground storage tanks. The locations of the borings are shown on Figure 2. A total of twenty-two soil samples were analyzed for TPH-G using EPA Method 5030; and for BTEX using EPA Method 8240. In addition, one of the samples was analyzed for total lead using EPA Method 7420, and several of the soil samples were analyzed for soluble lead using the California Waste Extraction Test. TPH-G concentrations ranged from not detected to 4,000 ppm. Benzene concentrations ranged from not detected to 11 ppm. Total lead was not detected, and soluble lead concentrations ranged from not detected to 0.061 ppm. Documentation of the

subsurface investigation and results are presented in a report prepared by Aegis titled, "Initial Subsurface Investigation Results Report," dated June 22, 1992.

It is P&D's understanding that between September 15 and 18, 1992 Aegis personnel returned to the site to install five groundwater monitoring wells, designated as MW1 through MW5. The wells were drilled to total depths of between 50 and 55 feet, and were constructed using four-inch diameter PVC pipe. Wells MW1 and MW2 were constructed with perforated casing between the depths of approximately 15 and 55 feet. Wells MW3, MW4 and MW5 were constructed with perforated casing between the depths of approximately 35 and 55 feet. Groundwater was reported to have been first encountered at a depth of 42 feet. The locations of the wells are shown in Figure 2.

A total of thirty-one soil samples were analyzed for TPH-G using EPA Method 5030/8015; and for BTEX using EPA Method 8020. In addition, three soil samples containing TPH-G were analyzed for total metals concentrations of cadmium, chromium, lead, and zinc using EPA Method 6010 and 7421. One soil sample was collected from each borehole from below the air-water interface and analyzed for petrophysical properties, including saturated permeability and grain size distribution.

TPH-G concentrations ranged from not detected to 39 ppm. Benzene concentrations ranged from not detected to 0.27 ppm. The total metals concentrations were all less than 10 times their respective STLC values. The subsurface materials encountered in the borings indicate that soil types vary across the site, but generally consist of silty clay, silt, clayey silt and sandy silt from the surface to a depth of between 30 and 35 feet. Below the depth of 30 to 35 feet, layers of sand and sandy silt were reported to have been encountered.

It is P&D's understanding that on September 29, 1992 Aegis personnel collected groundwater samples from wells MW1, MW2, MW4 and MW5 at the site. A sample was not collected from well MW-3 due to the reported presence of 0.02 feet of floating hydrocarbons. The measured depth to water ranged from approximately 41.5 to 44.5 feet. The samples were analyzed for TPH-G using EPA Method 5030/8015; and for BTEX using EPA Method 8020. TPH-G concentrations ranged from 0.06 to 20 ppm, and benzene concentrations ranged from 0.16 to 10 ppm. Based upon the water level measurements in the wells, the groundwater flow direction was reported to be to the northwest. The water level measurements are summarized in Table 1. The analytical results are summarized in Table 2.

It is P&D's understanding that on October 7, 1992 Aegis personnel performed rising head slug tests wells MW1, MW2, and MW4 to estimate the saturated hydraulic conductivity at the site. In addition, two short-term soil vapor extraction tests were performed on wells MW1 and MW2. Wells MW-3, MW-4, and MW-5 were used as vacuum influence monitoring points. Documentation of the monitoring well groundwater sample collection, slug test and vapor extraction tests are presented in a report prepared by Aegis titled, "Problem Assessment Report," dated December 16, 1992.

On February 18, 1994 P&D personnel monitored the five groundwater monitoring wells at the site for depth to water and the presence of free product or sheen. The depth to water was measured using an electric water level indicator, and the presence of free product and sheen was evaluated using a transparent bailer. The measured depth to water in the wells ranged from approximately 39.8 to 42.9 feet. No evidence of free product or sheen was detected in any of the wells. Based on the measured depth to water in the wells, the groundwater flow direction was calculated to be to the north with a gradient of 0.054. In a letter dated October 19, 1995 Mr. Scott Seery of the Alameda County Department of Environmental Health requested that all of the onsite and offsite wells be monitored and sampled on a quarterly basis.

On June 15 and 16, 1995 P&D installed three offsite monitoring wells, designated as MW6 through MW8. The locations of the wells are shown on Figure 2. Documentation of the well installation and sample results is presented in P&D's report 0055.R5 dated August 23, 1995.

The underground storage tanks and dispensers at the subject site were replaced in the first half of 1997. Following removal of the tanks and dispensers, over-excavation of petroleum hydrocarbon-impacted soil was performed in the tank pit and dispenser areas. Following over-excavation activities, confirmation soil samples were collected from the bottom and sidewalls of the excavated areas. In addition, as a result of the excavation activities, the elevation at the top of well MW1 was altered. The present elevation for the top of well MW1 is unknown. Documentation of the tank and dispenser replacement activities is presented in Bernabe & Brinker, Inc.'s Tank Closure Report dated July 9, 1997.

On December 4, 1998 P&D personnel collected one downgradient groundwater grab sample from borehole B10. Documentation of field activities and sample results are presented in P&D's Subsurface Investigation Report 0055.R12 dated December 31, 1998.

GEOLOGY AND HYDROGEOLOGY

The subsurface materials encountered in the borings drilled by Aegis indicate that soil types vary across the subject site, but generally consist of silty clay, silt, clayey silt and sandy silt from the surface to a depth of between 30 and 35 feet. Below the depth of 30 to 35 feet, layers of sand and sandy silt were reported to have been encountered to the total depths explored. Groundwater has historically been encountered at the site at depths ranging from approximately 40 to 45 feet below grade, in the sand and sandy silt.

Based upon the regional groundwater flow direction identified by Woodward-Clyde Consultants in a report titled, "Hydrogeology of Central San Leandro and Remedial Investigation of Regional Groundwater Contamination - San Leandro Plume - San Leandro, California - Volume I," prepared for the California Environmental Protection Agency and dated December 29, 1993 the regional groundwater flow direction to the west of the site appears to be to the southwest. However, based upon the measured depth to water in the five wells at the site on September 29, 1992 Aegis identified a northwesterly groundwater flow direction. Based upon water level measurements collected by P&D from the five wells at the site on subsequent dates, groundwater flow directions ranging from north to northwest were identified.

TIER 2 SITE SPECIFIC FIELD DATA

The analytical results of the 31 soil samples collected from soil borings B1 through B7 drilled by Aegis, and the analytical results of the 36 soil samples collected from the soil borings for wells MW1 through MW5 drilled by P&D are summarized in Table 1.

Following over-excavation of the tank pit and dispenser area in May, 1997 a total of eleven confirmation tank pit soil samples designated as TP7 through TP17 and a total of two confirmation dispenser area samples designated as DP5 and DP6 were collected from the bottom or sidewalls of the excavated areas to evaluate residual petroleum hydrocarbon concentrations. The results of these confirmation samples are presented in Table 2.

Between September, 1992 and February 16, 1999 the groundwater monitoring wells at the site were monitored and sampled a total of 14 times. Monitoring results for the monitoring wells are presented in Table 3. Groundwater sample results are presented in Table 4.

On December 4, 1998 one groundwater grab sample, designated as B10, was collected from downgradient of the subject site. The groundwater grab sample results are presented in Table 5.

All of the tables are attached with this report as Appendix B.

ASSUMPTIONS FOR TIER 2 APPROACH

The following assumptions were used in preparation of the Tier 2 RBCA.

1) Groundwater at or near the subject site is not considered a source of drinking water.

2) The study area encompassed the area defined by the Figure 2 property boundaries for an on-site commercial exposure scenario.

3) The detected chemicals of concern (COCs) used in the RBCA were as follows: methyl tert-butyl ether (MTBE) and benzene, toluene, ethylbenzene, and xylenes (BTEX). These COCs are considered to be the representative COCs at the subject site. Benzene is considered a carcinogen and the other COCs are not considered carcinogens. Carcinogens are evaluated using Target Risk values and the non-carcinogens are evaluated using Target Hazard Quotients.

4) The highest historical contaminant concentrations encountered were used in both soil and groundwater.

The maximum groundwater benzene concentration encountered within the study area (10 ppm) was used to evaluate this region (the sample was collected from monitoring well MW2 during the May 1995 monitoring and sampling episode - see Table 4). Monitoring well MW2 is located at the west end of the former UST pit, and is generally considered to be downgradient of the pit (see Figure 2). Although more recent groundwater sample laboratory analytical results from monitoring well MW2 have shown benzene concentrations ranging from 0.42 ppm (in the most recent monitoring & sampling episode) to 6.2 ppm (see Table 4), the highest historical benzene concentration encountered was used to provide a conservative evaluation.

The maximum soil benzene concentration encountered within the study area (the sample taken at 40 feet below grade from boring B7, with a benzene concentration of 11 ppm - see Figure 2 and Table 1) was used to evaluate this area. Boring B7 is a slant-boring located in the approximate center of the subject site. As this was the highest historical benzene concentration encountered, it was used to provide a conservative evaluation.

pretty deep sample pt.

5) Air exposure pathways from surface soil (vapor and dust inhalation), and soil exposure pathways from surface soil (dermal contact and ingestion) are assumed to not be applicable because contaminated soil and groundwater are encountered at a depth greater than 3 feet. Similarly, groundwater exposure pathways from groundwater (ingestion) are not applicable because groundwater at the subject site is not considered a source of drinking water.

On-site commercial workers are assumed to be exposed to subsurface chemicals (at a depth greater than 3 feet) by means of volatilization and inhalation of vapor emissions only. An exposure control flow chart is attached with this report in Appendix C.

6) Exposure of on-site commercial workers to volatile emissions from subsurface soil and groundwater emissions from groundwater were conservatively evaluated using maximum detected concentrations, and a combination of default parameters for Merritt sand and clayey silt provided in the COULRP RBCA Spreadsheet, with site specific values used where known. COULRP default Merritt sand values were used to describe the capillary fringe, the groundwater mixing zone thickness, and the groundwater Darcy velocity, as groundwater was encountered at depths coincident with sand and silty sand materials. COULRP default clayey silt values were used for the remaining soil parameters, as clayey silt was observed in the subsurface materials above the sand at the site. Finally, where the value of a certain parameter was known for the site, site-specific values were used; these included depth to subsurface contamination, depth to groundwater, and building air volume to floor area ratio.

   The depth to groundwater was assumed to be 30 feet instead of 40 feet (as shown by site monitoring data) for the following reasons. The thickness of silty clay materials is conservatively 30 feet, underlain by an additional 10 feet of sandy material before groundwater is encountered. Using a depth to groundwater value of 40 feet would have resulted in an evaluation which calculated vapor phase transport of COCs volatilizing from groundwater through 40 feet of clayey silt, instead of the 30 to 35 feet of clayey silt which exists at the site. It was assumed that the effects of the sand material were negligible on the vapor phase transport of COCs volatilizing from groundwater. This effectively placed the water table at the top of the sand material and the bottom of the clayey silt material and prevented inaccurate representation of the clayey silt material thickness.

   A copy of the Parameter Table is attached with this report in Appendix C.

7) The target risk for an excess cancer risk for the on-site commercial assessment was 1 in 100,000 (1×10^{-5}). This cancer target risk level is within the target range of 1×10^{-4} to 1×10^{-6} described in Table X2.1 of ASTM 1739 (a revision of ES 38-94) Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites.

8) Natural attenuation was not incorporated in this risk assessment.

TIER 2 CALCULATION RESULTS

The air exposure pathways (vapor inhalation) resulting from volatilization of petroleum hydrocarbons from subsurface soil (at a depth greater than 3 feet) or groundwater are the only pathways that apply to the subject site. Air exposure pathways are divided into outdoor and indoor exposures. As the subject site is paved outside, only the indoor exposure pathway is applicable.

The target risk is an assigned value, and is defined in the Assumptions Section above (number 7) for this site as 1.0×10^{-5} for on-site commercial exposures. This means that one additional person in 100,000 would become ill or get cancer from exposure to the COCs. The source concentration is the representative subsurface soil or groundwater contaminant concentration. The Site Specific Target Levels (SSTLs) for subsurface soil and groundwater are obtained through RBCA Tier 2 calculations (see the RBCA Results Spreadsheet in Appendix D). The baseline risk is the projected number of people who will get sick or develop cancer based upon the assigned target risk and the actual contaminant concentrations at a given location.

To calculate baseline risk, the following formula is used:

Baseline Risk = Target Risk X (Source Concentration / SSTL)

By comparing the source concentration and the SSTL, it is possible to determine if an unacceptable level of risk exists for a specific location or region. Evaluation of the Baseline Risk makes it possible to determine quantitatively the degree to which site conditions comply with or exceed the Target Risk. For example, if the source concentration exceeds the corresponding SSTL, the area is identified as having an unacceptable level of risk.

The calculated SSTL values and associated baseline risk levels for the subject site are presented below. Except for benzene, all of the indoor air pathway SSTL values for the COCs exceed the COC's respective solubility limits in water and saturation limits in soil. In essence, this means that in order for the SSTLs to be exceeded, soil at the site would have to be saturated with the COCs, and groundwater at the site would have to have a separate phase layer of the COCs. Neither of these conditions have been observed at the site; for this reason, the only COC discussed below is benzene.

o On-Site Commercial

The calculated benzene SSTL for the complete exposure pathway from groundwater volatilization to indoor air indicates an applicable SSTL of 46 mg/L (ppm). The representative concentration used for benzene in monitoring well MW2 was 10 ppm. This resulted in a Baseline Risk from groundwater volatilization to indoor air equal to 2.2×10^{-6}. This Baseline Risk value of 2.2×10^{-6} is less than the Target Risk value of 1.0×10^{-5}.

The benzene SSTL for the complete exposure pathway from subsurface soil volatilization (impacted soil at a depth greater than 3 feet) to indoor air indicates an applicable SSTL of 37 mg/kg (ppm). The representative concentration used for benzene in the soil sample for 40 feet below grade in boring B7 was 11 ppm. This resulted in a Baseline Risk from subsurface soil volatilization to indoor air equal to 1.0×10^{-5}. This Baseline Risk value of 3.0×10^{-6} is less than the Target Risk value of 1.0×10^{-5}.

The total Baseline Risk due to groundwater and subsurface soil volatilization to indoor air is the sum of the Baseline Risk from groundwater and the Baseline Risk from subsurface soil. This total Baseline Risk is equal to 5.2×10^{-6}. This total Baseline Risk does not exceed the Target Risk for this site. The SSTL spreadsheets showing the results for the complete pathways for petroleum-impacted soil and groundwater are summarized in Appendix D.

DISCUSSION AND RECOMMENDATIONS

The SSTL is a value which is established using site-specific conditions and which is used to evaluate the presence of an unacceptable health risk resulting from the presence of COC's. SSTLs were evaluated for exposure to COC vapors in commercial buildings resulting from the volatilization of COCs from soil and the water table at the subject site.

Based on evaluation of the highest COC concentrations for soil and groundwater, the RBCA Tier 2 results show acceptable risk for all potential sources evaluated (soil and groundwater). The use of the highest COC values in each region evaluated, and the assumptions of the model resulted in a conservative evaluation.

Based on the results of this evaluation, P&D recommends that no further action be performed, and that case closure be requested from the regulatory agencies.

DISTRIBUTION

Copies of this report should be forwarded to Mr. Scott Seery at the Alameda County Department of Environmental Health and to the San Francisco Bay Regional Water Quality Control Board.

LIMITATIONS

This report was prepared solely for the use of Mr. Manmohan Chopra. The content and conclusions provided by P&D in this assessment are based on information collected during our investigation, which may include, but not be limited to, visual site inspections; interviews with site owner, regulatory agencies and other pertinent individuals; review of available public documents; subsurface exploration and our professional judgement based on said information at the time of preparation of this document. Any subsurface sample results and observations presented herein are considered to be representative of the area of investigation; however, geological conditions may vary between borings and may not necessarily apply to the general site as a whole. If future subsurface or other conditions are revealed which vary from these findings, the newly-revealed conditions must be evaluated and may invalidate the findings of this report.

This report is issued with the understanding that it is the responsibility of the owner, or his representative, to ensure that the information contained herein is brought to the attention of the appropriate regulatory agencies, where required by law. Additionally, it is the sole responsibility of the owner to properly dispose of any hazardous materials or hazardous wastes left onsite, in accordance with existing laws and regulations.

This report has been prepared in accordance with generally accepted practices using standards of care and diligence normally practiced by recognized consulting firms performing services of a similar nature. P&D is not responsible for the accuracy or completeness of information provided by other individuals or entities which is used in this report. This report presents our professional judgement based upon data and findings identified in this report and interpretation of such data based upon our experience and background, and no warranty, either express or implied, is made. The conclusions presented are based upon the current regulatory climate and may require revision if future regulatory changes occur.

Should you have any questions, please do not hesitate to contact us at (510) 658-6916.

Sincerely,

P&D Environmental

Greg Brown
Project Scientist

Paul H. King
California Registered Geologist
Registration No. : 5901
Expires: 12/31/01

Attachments:
Appendix A: Figures 1 & 2
Appendix B: Tables 1, 2, 3, 4, & 5
Appendix C: Default Parameter Table
Appendix D: SSTL Tier 2 Calculation Spreadsheets

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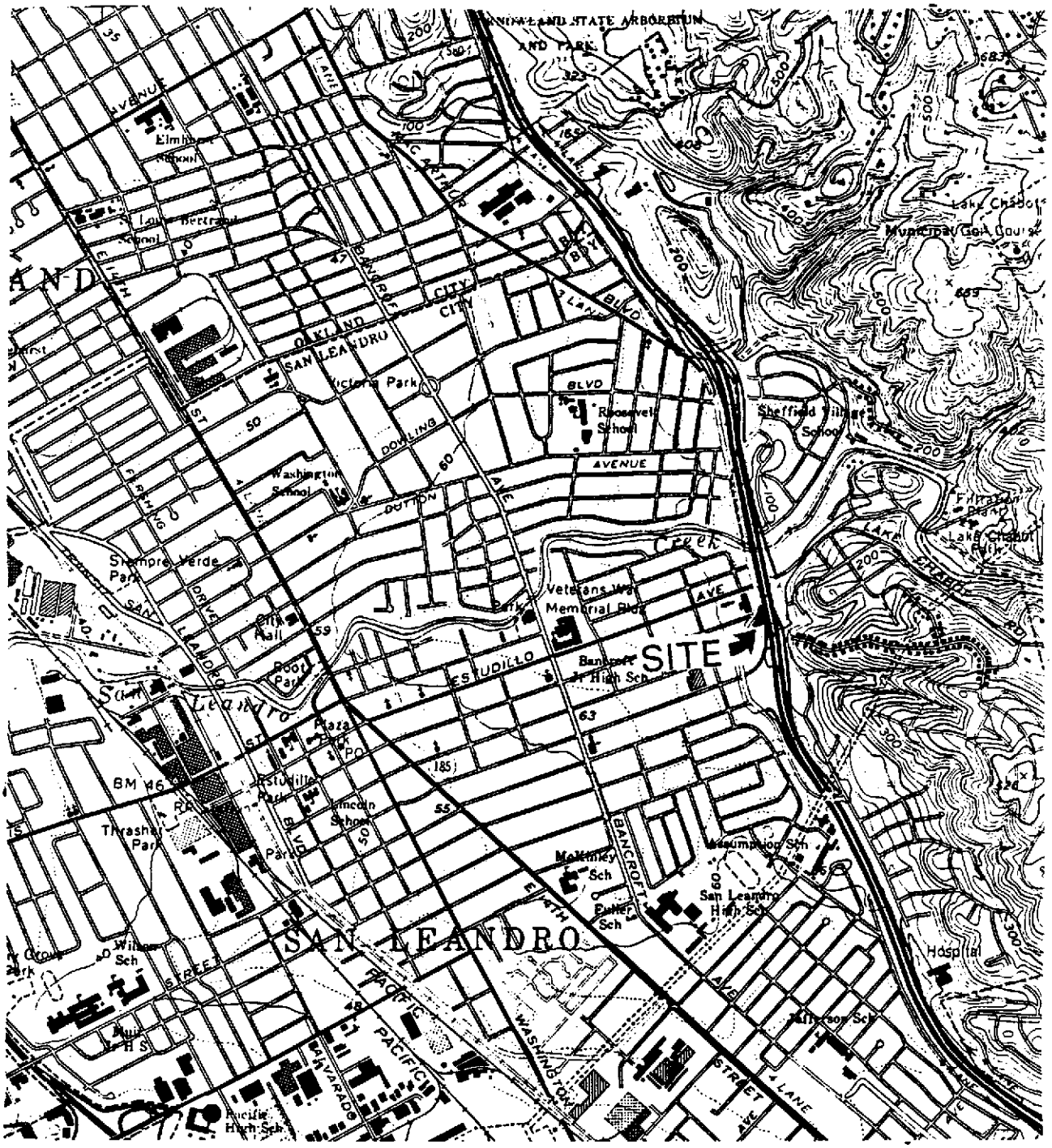

Base Map from:
U.S. Geological Survey
San Leandro, Calif.
7.5 Minute Quadrangle
Photorevised 1980

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Scale in Feet
0 1000 2000 3000

Figure 1
SITE LOCATION MAP
Former ARCO Service Station
1401 Grand Avenue
San Leandro, California

P & D ENVIRONMENTAL
A Division of Paul H. King, Inc.
4020 Panama Court
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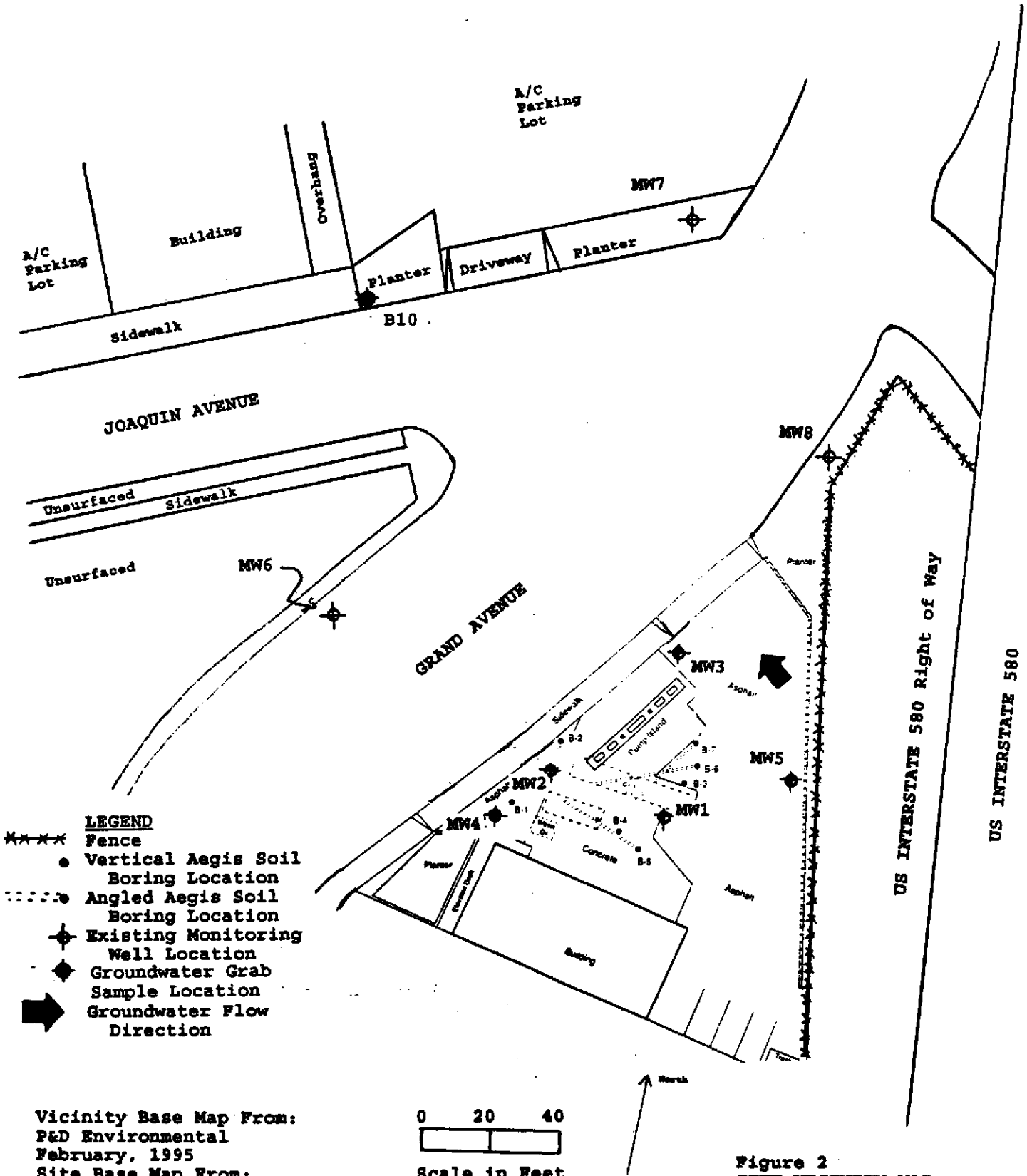


Vicinity Base Map From:
P&D Environmental
February, 1995
Site Base Map From:
Aegis Environmental, Inc.
Problem Assessment Report
dated December 16, 1992

Figure 2
SITE VICINITY MAP
Former ARCO Service Station
1401 Grand Avenue
San Leandro, California

Table 1

ANALYTICAL RESULTS: SOIL

ARCO SERVICE STATION
1401 GRAND AVENUE, SAN LEANDRO, CALIFORNIA
(All results in parts-per-million)

Sample ID	Date Collected	Sample Depth (Feet)	Total Petroleum Hydrocarbons	Aromatic Volatile Organics				Total Lead
			Gasoline	Benzene	Toluene	Ethyl-benzene	Total Xylenes	
B-1-3	04/24/91	16.0	<	<	<	<	<	ND
B-1-7	04/24/91	25.5	0.2	0.076	0.003	0.004	0.015	ND
B-2-2	04/24/91	11.0	<	<	<	<	<	ND
B-2-5	04/24/91	25.5	66	0.94	3.8	1.3	8.7	3
B-2-8	04/24/91	40.5	2.0	0.46	0.30	0.049	0.24	ND
B-3-3	04/24/91	16.0	<	<	<	<	<	ND
B-3-7	04/24/91	36.0	0.2	0.022	0.004	0.004	0.033	ND
B-4-4	04/24/91	21.0	<	<	<	<	<	ND
B-4-7	04/24/91	35.5	1.4	0.48	0.003	0.021	0.007	ND
SS-1A, 1B, 1C, 1D	04/14/92	1.0	0.7	0.002	<	<	0.005	0.06[1]
B5 at 10 feet	04/14/92	10	<	<	<	<	<	—
B5 at 20 feet	04/14/92	20	<	<	<	<	<	—
B5 at 25 feet	04/14/92	25	2.6	0.17	<	0.075	0.059	—
B5 at 30 feet	04/14/92	30	3.5	0.19	0.0037	0.099	0.12	—
B5 at 35 feet	04/14/92	35	1.0	0.17	0.067	0.021	0.067	—
B5 at 40 feet	04/14/92	40	<	0.076	0.040	0.0046	0.018	—
B5 at 45 feet	04/14/92	45	900	2.4	18	8.9	53	<<0.2[1]
B5 at 50 feet	04/14/92	50	2.6	0.24	0.32	0.039	0.17	—
B5 at 55 feet	04/14/92	55	760	5.7	24	10	53	<<0.2[2]

NOTES:
- < = Below Practical Quantitation Reporting Limits per "Tri-Regional Board Staff Recommendations for Preliminary Evaluation and Investigation of Underground Tank Sites" (August 10, 1990). (PQL for BTEX = 0.005 ppm, TPH, as gasoline and diesel = 1.0 ppm.)
- << = Below the indicated detection limit as labeled in the analytical laboratory results reports.
- ND = Not detected.
- — = Not analyzed.
- 1 = Total lead.
- 2 = Soluble lead (California Waste Extraction Test).

Analytical methods are listed in the attached laboratory reports.

Table 1 (Continued)

ANALYTICAL RESULTS: SOIL

ARCO SERVICE STATION
1401 GRAND AVENUE, SAN LEANDRO, CALIFORNIA
(All results in parts-per-million)

Sample ID	Date Collected	Sample Depth (Feet)	Total Petroleum Hydrocarbons	Aromatic Volatile Organics				Total Lead
			Gasoline	Benzene	Toluene	Ethyl-benzene	Total Xylenes	
B6 at 5 feet	04/14/92	5	<	<	0.006	<	0.0078	—
B6 at 15 feet	04/14/92	15	<	<	<	<	<	—
B6 at 25 feet	04/14/92	25	1.4	0.081	0.0024	0.0055	0.0087	—
B6 at 35 feet	04/14/92	35	1.7	0.16	0.022	0.0065	0.020	—
B6 at 45 feet	04/14/92	45	510	0.94	0.47	2.2	8.6	—
B6 at 55 feet	04/14/92	55	<	0.023	0.0083	0.0084	0.029	—
B7 at 10 feet	04/14/92	10	<	<	<	<	<	—
B7 at 20 feet	04/14/92	20	<	0.14	<	<	<	—
B7 at 30 feet	04/14/92	30	<	0.091	0.0051	0.0078	<	—
B7 at 40 feet	04/14/92	40	4,000	11	3	25	140	—
B7 at 50 feet	04/14/92	50	<	0.016	<	<	<	—
SS-1	04/14/92	Soil	620	<	2.8	3	16	0.044[2]
SS-2	04/14/92	Stockpile	100	<	<	0.15	0.9	0.061[2]

NOTES: < = Below Practical Quantitation Reporting Limits per "Tri-Regional Board Staff Recommendations for Preliminary Evaluation and Investigation of Underground Tank Sites" (August 10, 1990). (PQL for BTEX = 0.005 ppm, TPH, as gasoline and diesel = 1.0 ppm.)

--- = Not analyzed.

[2] = Soluble lead (California Waste Extraction Test).

Analytical methods are listed in the attached laboratory reports.

Table 1 (Continued)

ANALYTICAL RESULTS: SOIL

ARCO SERVICE STATION
1401 GRAND AVENUE, SAN LEANDRO, CALIFORNIA
(All results in parts-per-million)

Sample ID	Date Collected	Sample Depth (Feet)	Total Petroleum Hydrocarbons	Aromatic Volatile Organics			
			Gasoline	Benzene	Toluene	Ethyl-benzene	Total Xylenes
MW-1/1	09/15/9~	4	<<	<<	<<	<<	<<
MW-1/2	09/15/92	9	<<	<<	0.0029	<<	0.0068
MW-1/3	09/15/92	14.5	<<	<<	<<	<<	0.0028
MW-1/4	09/15/92	19	<<	<<	<<	<<	<<
MW-1/5	09/15/92	24.5	<<	<<	<<	<<	<<
MW-1/6	09/15/92	29.5	<<	<<	<<	<<	0.003
MW-1/7	09/15/92	33.5	<<	<<	<<	<<	0.0025
MW-1/8	09/15/92	39	<<	0.0083	<<	<<	<<
MW-1/9	09/15/92	44	<<	0.026	<<	<<	<<
MW-1/10	09/15/92	49.5	<<	<<	<<	<<	<<
MW-1/11	09/15/92	53	<<	<<	<<	<<	<<

NOTE: << = Below the indicated detection limit labeled in the analytical laboratory results reports.

Table 1 (Continued)

ANALYTICAL RESULTS: SOIL
ARCO SERVICE STATION
1401 GRAND AVENUE, SAN LEANDRO, CALIFORNIA
(All results in parts-per-million)

Sample ID	Date Collected	Sample Depth (Feet)	Total Petroleum Hydrocarbons	Aromatic Volatile Organics				Total Lead	Cadmium	Chromium	Zinc
			Gasoline	Benzene	Toluene	Ethyl-benzene	Total Xylenes				
MW-2/4	09/15/92	19.5	<<	0.0062	<<	<<	<<	—	—	—	—
MW-2/6	09/15/92	29.5	11	0.160	0.550	0.180	1.7	4.3	<<	4.5	50
MW-2/8	09/15/92	39	39	<<	0.078			—	—	—	—
MW-2/10	09/15/92	49.5	<<	0.078	0.058	0.0054	0.021	—	—	—	—
MW-3/4	09/18/92	19.5	<<	<<	<<	<<	<<	—	—	—	—
MW-3/6	09/19/92	29	<<	<<	<<	<<	<<	—	—	—	—
MW-3/8	09/18/93	40	<<	<<	<<	<<	<<	—	—	—	—
MW-3/9	09/18/92	44.5	<<	0.012	<<	<<	<<	—	—	—	—
MW-3/10	09/18/92	50	<<	<<	<<	<<	<<	—	—	—	—
MW-4/2	09/18/92	9.5	<<	<<	<<	<<	<<	—	—	—	—
MW-4/3	09/18/92	14.5	<<	<<	<<	<<	<<	—	—	—	—
MW-4/4	09/18/92	19.5	<<	<<	0.0028	<<	0.0035	—	—	—	—
MW-4/6	09/18/92	29.5	1.9	0.27	0.210	0.044	0.370	4.4	2.9	24	33
MW-4/8	09/18/92	38.5	<<	0.027	<<	<<	0.0078	—	—	—	—
MW-4/9	09/18/92	44	<<	<<	<<	<<	0.0025	—	—	—	—
MW-5/1	09/17/92	4.5	<<	<<	<<	<<	0.0028	—	—	—	—
MW-5/3	09/17/92	18.5	<<	<<	<<	<<	<<	—	—	—	—
MW-5/5	09/17/92	29	<<	<<	<<	<<	<<	—	—	—	—
MW-5/8	09/17/92	44.5	<<	<<	<<	<<	<<	—	—	—	—
MW-5/9	09/17/92	48.5	<<	<<	<<	<<	<<	—	—	—	—
~~Northside~~	~~09/18/92~~	~~Stockpile~~	<<	<<	<<	<<	0.0032	—	—	—	—
~~Southside~~	~~09/18/92~~	~~Stockpile~~	~~0.77~~	~~0.0047~~	~~0.0068~~	~~0.0047~~	~~0.039~~	~~5.3~~	~~3.8~~	~~55~~	~~40~~

NOTES: << = Below the indicated detection limit labeled in the analytical laboratory results reports.
— = Not analyzed.

TABLE 2
UST REMOVAL PIT BOTTOM AND
SIDEWALL SAMPLES
LABORATORY ANALYTICAL RESULTS
(Samples collected on May 10, 1997)

Sample No.	TPH-G	MTBE	Benzene	Toluene	Ethyl benzene	Total Xylenes
TP-7-15.0	ND	ND	ND	0.010	0.005	0.019
TP-8-17.0	ND	ND	ND	0.016	0.006	0.035
TP-9-17.5	4.2	6.0	0.017	0.029	0.028	0.17
TP-10-16.5	4200	87	6.3	130	78	600
TP-11-13.5	ND	ND	ND	ND	ND	ND
TP-12-12.0	4.4	ND	ND	0.049	0.037	0.28
TP-13-12.0	1000	10	1.9	37	22	130
TP-14-12.0	320	ND	ND	0.35	1.0	2.7
TP-15-13.0	1.7	0.23	ND	0.012	0.005	0.020
TP-16-13.5	ND	3.1	ND	0.008	ND	0.012
TP-17-12.0	ND	ND	ND	0.037	0.006	0.038
DP-5-5.5	4.8	0.30	0.012	0.13	0.064	0.049
DP-6-5.5	73	8.0	ND	0.14	0.11	3.2

NOTES:
TPH-G = Total Petroleum Hydrocarbons as Gasoline.
MTBE = Methyl Tert Butyl Ether.
ND = Not Detected.
Results are in parts per million (ppm), unless otherwise specified.

TABLE 3
WELL MONITORING DATA

Well No.	Date Monitored	Top of Casing Elev. (ft.)	Depth to Water (ft.)	Water Table Elev. (ft.)
MW1	2/16/99	Not Available	34.58	Not Available
	1/25/98	Not Available	33.70	Not Available
	7/14/97	Not Available	39.45	Not Available
	3/11/97	87.98+	36.90	51.08
	6/21/96		38.56	49.42
	3/28/96		37.10	50.88
	12/19/95		40.16	47.82
	6/23/95		38.54	49.44
	5/04/95	87.96++	37.65	50.33
	2/01/95		38.46	49.52
	10/12/94		42.01	45.97
	7/05/94		41.36	46.62
	2/18/94		41.02	46.96
	9/29/92		42.77	45.21
MW2	2/16/99	86.61+	33.51	53.10
	1/25/98		32.80	53.81
	7/14/97		38.46	48.15
	3/11/97		35.71	50.90
	6/21/96		37.30	49.31
	3/28/96		35.97	50.64
	12/19/95		38.80	47.81
	6/23/95		37.40	49.21
	5/04/95	86.60++	36.54	50.07
	2/01/95		37.27	49.34
	10/12/94		40.77	45.84
	7/05/94		40.13	46.48
	2/18/94		39.81	46.80
	9/29/92		41.55	45.06
MW3	2/16/99	87.48+	34.91	52.57
	1/25/98		33.91	53.57
	7/14/97		40.61	46.87
	3/11/97		38.71	48.77
	6/21/96		40.61	46.87
	3/28/96		38.75	48.73
	12/19/95		42.20	45.28
	6/23/95		40.65	46.83
	5/04/95	87.50++	39.61	47.87
	2/01/95		40.13	47.35
	10/12/94		43.92	43.56
	7/05/94		43.32	44.16
	2/18/94		43.09	44.39
	9/29/92		44.60	42.88*

NOTES:
Elevations are in feet Mean Sea Level.
ft. = Feet.
+ = Indicates survey data provided by Kier & Wright dated June 26, 1995.
++ = Indicates survey data provided by Aegis Environmental, Inc.
* = Indicates groundwater elevation corrected for the presence of free product.

TABLE 3
WELL MONITORING DATA
(Continued)

Well No.	Date Monitored	Top of Casing Elev. (ft.)	Depth to Water (ft.)	Water Table Elev. (ft.)
MW4	2/16/99	86.21+	33.43	52.78
	1/25/98		32.96	53.25
	7/14/97		38.10	48.11
	3/11/97		33.24	52.97
	6/21/96		37.12	49.09
	3/28/96		35.00	51.21
	12/19/95		38.45	47.76
	6/23/95		37.40	48.81
	5/04/95	86.20++	36.33	49.88
	2/01/95		36.96	49.25
	10/12/94		40.48	45.73
	7/05/94		39.69	46.52
	2/18/94		39.36	46.85
	9/29/92		44.29	41.92
MW5	2/16/99	89.10+	35.08	54.02
	1/25/98		34.08	55.02
	7/14/97		41.20	47.90
	3/11/97		38.02	51.08
	6/21/96		40.03	49.07
	3/28/96		38.30	50.80
	12/19/95		41.79	47.31
	6/23/95		39.87	49.23
	5/04/95	89.06++	38.94	50.16
	2/01/95		39.94	49.16
	10/12/94		43.81	45.29
	7/05/94		43.08	46.02
	2/18/94		42.88	46.22
	9/29/92		44.53	44.57
MW6	2/16/99	84.02+	32.82	51.20
	1/25/98		31.64	52.38
	7/14/97		39.04	44.98
	3/11/97		36.32	47.70
	6/21/96		38.00	46.02
	3/28/96		36.18	47.84
	12/19/95		39.25	44.77
	6/23/95		38.17	45.85
	6/21/95**		38.11	45.91

NOTES:
Elevations are in feet Mean Sea Level.
ft. = Feet.
+ = Indicates survey data provided by Kier & Wright dated June 26, 1995.
++ = Indicates survey data provided by Aegis Environmental, Inc.
** = Indicates depth to water measurements prior to groundwater monitoring well development.

TABLE 3
WELL MONITORING DATA
(Continued)

Well No.	Date Monitored	Top of Casing Elev. (ft.)	Depth to Water (ft.)	Water Table Elev. (ft.)
MW7	2/16/99	87.11+	34.59	52.52
	1/25/98		33.47	53.64
	7/14/97		41.97	45.14
	3/11/97		38.96	48.15
	6/21/96		40.80	46.31
	3/28/96		38.94	48.17
	12/19/95		42.26	44.85
	6/23/95		41.00	46.11
	6/21/95**		40.30	46.81
MW8	2/16/99	89.70+	33.92	55.78
	1/25/98		32.73	56.97
	7/14/97		39.98	49.72
	3/11/97		36.74	52.96
	6/21/96		38.69	51.01
	3/28/96		36.98	52.72
	12/19/95		40.35	49.35
	6/23/95		38.36	51.34
	6/21/95**		38.20	51.50

NOTES:
Elevations are in feet Mean Sea Level.
ft. = Feet.
+ = Indicates survey data provided by Kier & Wright dated June 26, 1995.
** = Indicates depth to water measurements prior to groundwater monitoring well development.

TABLE 4
GROUNDWATER
LABORATORY ANALYTICAL RESULTS

Well No.	TPH-G	MTBE	Benzene	Toluene	Ethyl-benzene	Total Xylenes
			Samples Collected On February 16 & 17, 1999			
MW1	0.97	0.29	0.067	0.12	0.0093	0.058
MW2	7.3	0.56	0.42	1.0	0.38	1.8
MW3	ND	0.021	ND	ND	ND	ND
MW4	0.23	0.20	0.065	0.0022	0.0096	0.033
MW5	0.17	ND	ND	0.00074	ND	ND
MW6	ND	ND	ND	ND	ND	ND
MW7	ND	ND	ND	ND	ND	ND
MW8	ND	ND	ND	ND	ND	ND

NOTES:
TPH-G = Total Petroleum Hydrocarbons as Gasoline.
MTBE = Methyl Tert Butyl Ether.
ND = Not Detected.
Results are in parts per million (ppm), unless otherwise specified.

TABLE 4
GROUNDWATER
LABORATORY ANALYTICAL RESULTS
(Continued)

Well No.	TPH-G	MTBE	Benzene	Toluene	Ethyl-benzene	Total Xylenes
			Samples Collected On January 25, 1998			
MW1	0.30	ND<0.014	0.021	0.00073	0.0076	0.0010
MW2	24	2.7	2.7	4.9	0.70	4.0
MW3	0.49	0.71	0.0079	0.0061	0.0053	0.029
MW4	0.91	0.23	0.15	0.019	0.31	0.14
MW5	ND	ND	ND	ND	ND	ND
MW6	ND	ND	ND	ND	ND	ND
MW7	ND	ND	ND	ND	ND	ND
MW8	ND	ND	ND	ND	ND	ND
			Samples Collected On July 14, 1997			
MW1	0.20	0.035	0.020	0.0055	0.0012	0.0023
MW2	43	1.6	6.2	8.9	1.5	7.4
MW3	0.40	0.11	0.00093	0.0010	0.0013	0.00068
MW4	0.98	0.40	0.21	0.0017	0.090	0.046
MW5	ND	ND	ND	ND	ND	ND
MW6	ND	0.019	ND	ND	ND	ND
MW7	ND	ND	ND	ND	ND	ND
MW8	ND	ND	ND	ND	ND	ND

NOTES:
TPH-G = Total Petroleum Hydrocarbons as Gasoline.
MTBE = Methyl Tert Butyl Ether.
ND = Not Detected.
Results are in parts per million (ppm), unless otherwise specified.

TABLE 4
GROUNDWATER
LABORATORY ANALYTICAL RESULTS
(Continued)

Well No.	TPH-G	MTBE	Benzene	Toluene	Ethyl-benzene	Total Xylenes
			Samples Collected On March 11, 1997			
MW1	0.60	0.014	0.053	0.00095	0.003	0.0015
MW2	28	0.71	4.0	4.5	0.99	4.3
MW3	1.1	0.68	0.053	0.013	0.063	0.017
MW4	3.8	1.1	1.1	0.053	0.24	0.26
MW5	ND	ND	ND	ND	ND	0.00077
MW6	ND	ND	ND	ND	ND	ND
MW7	ND	ND	ND	ND	ND	ND
MW8	ND	ND	ND	ND	ND	N D
			Samples Collected On June 21, 1996			
MW1	1.4	0.019	0.30	0.0087	0.033	0.0098
MW2	49	0.53	6.6	6.3	1.4	6.2
MW3	1.3	0.3	0.094	0.0021	0.039	0.002
MW4	11	1.2	2.4	0.083	0.53	0.91
MW5	ND	ND	ND	ND	ND	ND
MW6	ND	ND	ND	ND	ND	ND
MW7	ND	ND	ND	ND	ND	ND
MW8	ND	ND	ND	ND	ND	ND

NOTES:
TPH-G = Total Petroleum Hydrocarbons as Gasoline.
MTBE = Methyl Tert Butyl Ether.
ND = Not Detected.
Results are in parts per million (ppm), unless otherwise specified.

TABLE 4
GROUNDWATER
LABORATORY ANALYTICAL RESULTS
(Continued)

Well No.	TPH-G	MTBE	Benzene	Toluene	Ethyl-benzene	Total Xylenes
			Samples Collected On March 28, 1996			
MW1	1.3	0.022	0.32	0.0023	0.034	0.0046
MW2	38	0.45	5.8	4.7	1.1	5.1
MW3	4.6	1.1	1.4	0.012	0.17	0.020
MW4	5.6	0.64	1.4	0.038	0.31	0.30
MW5	ND	ND	ND	ND	ND	ND
MW6	ND	ND	ND	ND	ND	ND
MW7	ND	ND	ND	ND	ND	ND
MW8	ND	ND	ND	ND	ND	ND
			Samples Collected On December 19, 1995			
MW1	0.50	0.0081	0.087	0.0015	0.011	0.0035
MW2	25	0.45	5.2	3.8	0.86	3.8
MW3	0.95	0.12	0.16	0.0023	0.015	0.0016
MW4	2.0	0.21	0.70	0.029	0.089	0.15
MW5	ND	ND	ND	ND	ND	ND
MW6	ND	0.01	ND	ND	ND	ND
MW7	ND	ND	ND	ND	ND	ND
MW8	ND	ND	ND	ND	ND	ND

NOTES:
TPH-G = Total Petroleum Hydrocarbons as Gasoline.
ND = Not Detected.
Results in parts per million (ppm), unless otherwise indicated.

TABLE 4
GROUNDWATER
LABORATORY ANALYTICAL RESULTS
(Continued)

Well No.	TPH-G	MTBE	Benzene	Toluene	Ethyl-benzene	Total Xylenes
			Samples Collected on June 23, 1995			
MW6	ND	3.0	ND	ND	ND	ND
MW7	ND	ND	ND	ND	ND	ND
MW8	ND	ND	ND	ND	ND	ND
			Samples Collected On May 4, 1995			
MW1	2.4	NA	0.67	0.0028	0.076	0.0060
MW2	63	NA	10	11	1.6	8.8
MW3	7.2	NA	3.1	0.038	0.20	0.062
MW4	3.3	NA	0.89	0.068	0.15	0.30
MW5	ND	NA	ND	ND	ND	ND
			Samples Collected On February 1, 1995			
MW1	4.6	NA	1.8	0.0099	0.23	0.030
MW2	45	NA	7.0	5.1	1.2	6.1
MW3	11	NA	4.2	0.031	0.33	0.29
MW4	1.4	NA	0.39	0.055	0.049	0.18
MW5	ND	NA	ND	ND	ND	ND

NOTES:
TPH-G = Total Petroleum Hydrocarbons as Gasoline.
ND = Not Detected.
NA = Not Analyzed.
Results in parts per million (ppm), unless otherwise indicated.

TABLE 4
GROUNDWATER
LABORATORY ANALYTICAL RESULTS
(Continued)

Well No.	TPH-G	MTBE	Benzene	Toluene	Ethyl-benzene	Total Xylenes
			Samples Collected On October 12, 1994			
MW1	2.5	NA	0.82	0.0039	0.10	0.020
MW2	24	NA	4.4	2.8	0.73	3.5
MW3	1.7	NA	0.39	0.00090	0.018	0.0057
MW4	0.68	NA	0.14	0.0087	0.014	0.052
MW5	ND	NA	ND	ND	ND	ND
			Samples Collected On July 5, 1994			
MW1	3.0	NA	1.3	0.0038	0.035	0.0025
MW2	46.0	NA	9.1	7.0	1.4	7.3
MW3	3.6	NA	1.6	0.0083	0.076	0.047
MW4	2.6	NA	0.47	0.045	0.084	0.25
MW5	ND	NA	ND	ND	ND	0.0010
			Samples Collected On September 29, 1992			
MW1	3.1	NA	0.16	ND	ND	0.0060
MW2	20	NA	4.6	3.8	0.26	3.3
MW3	NA	NA	NA	NA	NA	NA
MW4	0.63	NA	0.17	0.06	0.0073	0.65
MW5	0.06	NA	10	0.0071	ND	0.0069

NOTES:
TPH-G = Total Petroleum Hydrocarbons as Gasoline.
ND = Not Detected.
NA = Not Analyzed.
Results in parts per million (ppm), unless otherwise indicated.

TABLE 5
GROUNDWATER
LABORATORY ANALYTICAL RESULTS

Sample Location	TPH-G	MTBE	Benzene	Toluene	Ethyl-benzene	Total Xylenes
Sample Collected On December 4, 1998						
B10	ND	ND	0.00054	0.00073	ND	0.00052

NOTES:
TPH-G = Total Petroleum Hydrocarbons as Gasoline.
MTBE = Methyl Tert Butyl Ether.
ND = Not Detected.
Results are in parts per million (ppm), unless otherwise specified.

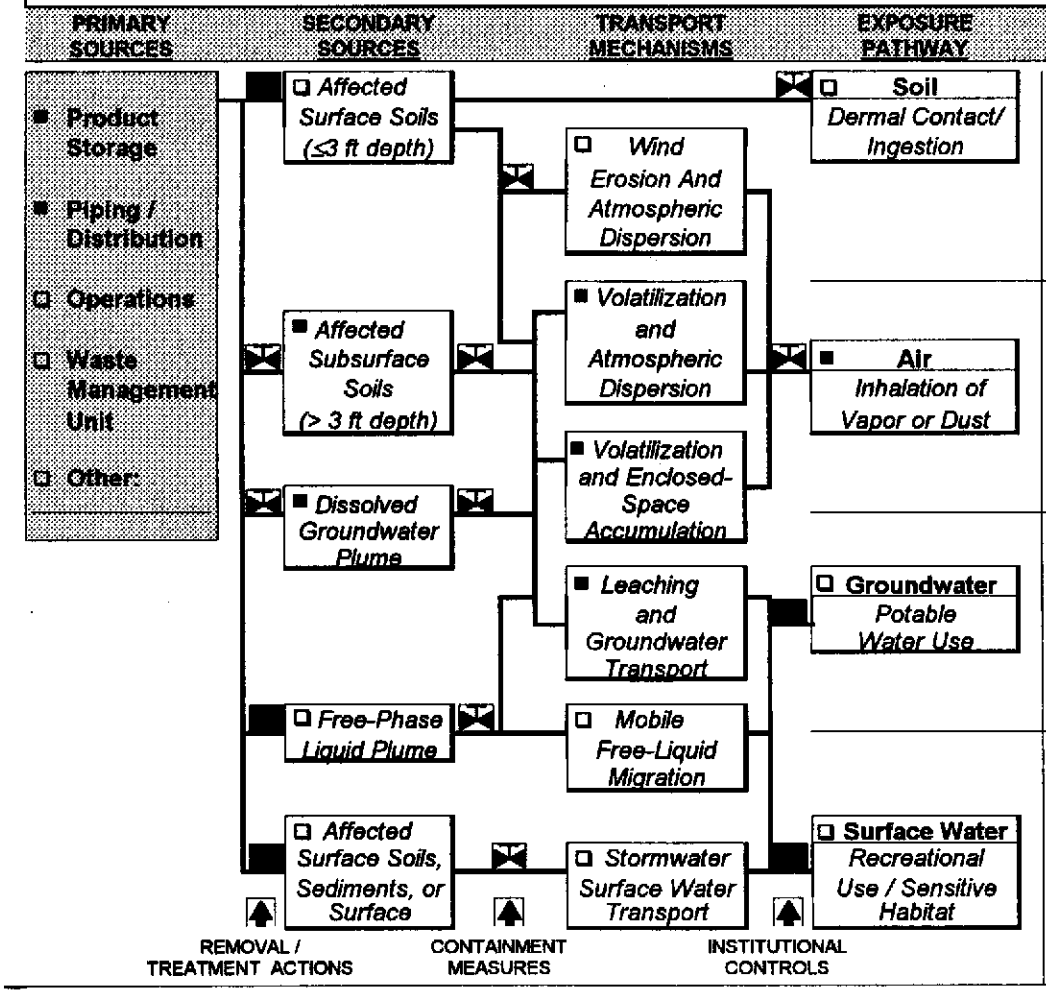
Appendix C

Default Parameter Tables

Site Name: Former ARCO Service Station | Date Completed: June 22, 2000
Site Location: 1401 Grand Avenue, San Leandro | Completed By: GMB

EXPOSURE CONTROL FLOWCHART

Instructions: *Identify remedial measures to be implemented to prevent exposure, as follows:* • Step 1 – *Baseline Exposure: Identify applicable sources, transport mechanisms, and receptors as shown on Worksheet 4.2 (■ = applicable to site).* • Step 2 – *Remedial Measures: Fill in shut-off valves (⋈) to indicate removal / treatment action, containment measure, or institutional controls to be used to "shut off" exposure pathway.* • Step 3 – *Remedial Technology Options: For each complete pathway, identify category of corrective measure to be applied and list possible technology options in space provided (see options list in RBCA Guidance Manual).*



POTENTIAL RECEPTORS	REMEDIAL ACTION TECHNOLOGY OPTIONS
Exposed Receptors *On-Site:* □ Residential □ Non-Resid. ■ N/A □ Sensitive Habitat □ Recreation *Off-Site:* □ Residential □ Non-Resid. ■ N/A □ Sensitive Habitat □ Recreation	□ Complete Pathway: ○ *Current* ○ *Potential* ⋈ Action Required: □Yes □ If yes, list technology options for ⋈
Exposed Persons *On-Site:* □Residential ■ Non-Resid. □ N/A *Off-Site:* □Residential □ Non-Resid. ■ N/A	■ Complete Pathway: ● *Current* ○ *Potential* ⋈ Action Required: □Yes ■ If yes, list technology options for ⋈ Exposure is below acceptable risk.
Groundwater Users *On-Site:* □Residential □ Non-Resid. ■ N/A *Off-Site:* □Residential □ Non-Resid. ■ N/A	□ Complete Pathway: ○ *Current* ○ *Potential* ⋈ Action Required: □Yes □ If yes, list technology options for ⋈
Surface Water Users *On-Site:* □ Residential □ Non-Resid. □ N/A □ Sensitive Habitat □ Recreation *Off-Site:* □ Residential □ Non-Resid. □ N/A □ Sensitive Habitat □ Recreation	□ Complete Pathway: ○ *Current* ○ *Potential* ⋈ Action Required: □Yes □ If yes, list technology options for ⋈

(■ OR ● OR ⋈ TO SELECT)

Inputs

	Input Parameters	Units	Residential		Commercial/ Industrial
			Child	Adult	Worker
	Receptor-Specific Parameters				
Receptor-Specific Parameters	Averaging time for carcinogens	yr	=adult residential	70	=adult residential
	Averaging time for non-carcinogens	yr	6	24	25
	Averaging time for vapor flux	s	=adult residential	9.46E+08	7.88E+08
	Body weight	kg	15	70	70
	Building air volume/floor area	cm^3/cm^2	=adult residential	229	380
	Exposure duration	yr	6	24	25
	Exposure frequency	d/yr	350	350	250
	Exp. freq. to water used for recreation	d/yr	120	120	0
	Exposure time to indoor air	hr/d	24	24	9
	Exposure time to outdoor air	hr/d	16	16	9
	Exp. time to water used for recreation	hr/d	2	1.0	0
	Groundwater ingestion rate	L/d	1	2	1
	Indoor air exchange rate	1/s	=adult residential	5.60E-04	1.40E-03
	Indoor inhalation rate	m^3/d	10	15	20
	Ingestion rate of water used for recreation	L/hr	0.05	0.05	0
	Outdoor inhalation rate	m^3/d	10	20	20
	Skin surface area exposed to soil	cm^2	2000	5000	5000
	Skin surface area exposed to water used for recreation	cm^2	8000	20000	0
	Soil ingestion rate	mg/d	200	100	50
	TARGET RISK LEVELS				
Target Risk Levels	Individual Excess Lifetime Cancer Risk	unitless	=adult residential	1.0E-05	1.0E-05
	Hazard quotient	unitless		1.0	1.0

Inputs

	Input Parameters	Units	Residential		Commercial/ Industrial
			Child	Adult	Worker
	Soil-Specific Transport Parameters				
Soil-Specific Transport Parameters	Capillary fringe thickness	cm	=adult residential	10.1	=adult residential
	Capillary fringe air content	cm^3/cm^3		0.175	
	Capillary fringe water content	cm^3/cm^3		0.325	
	Fraction organic carbon (FOC*)	g oc/g soil		0.02	
	Groundwater Darcy velocity	cm/yr		36	
	Groundwater mixing zone thickness	cm		305	
	Infiltration rate through the vadose zone	cm/yr		3	
	Soil bulk density	g/cm^3		1.33	
	Soil to skin adherence factor	mg/cm^2	1	1	1
	Total soil porosity	cm^3/cm^3	=adult residential	0.5	=adult residential
	Vadose zone air content	cm^3/cm^3		0.1	
	Vadose zone water content	cm^3/cm^3		0.4	
	Vadose zone thickness	cm		509.9	
	Non-Soil-Specific Transport Parameters				
Non-Soil-Specific Transport Parameters	Areal fraction of cracks in building foundation	cm^2/cm^2	=adult residential	0.001	0.001
	Foundation air content	cm^3/cm^3		0.26	=adult residential
	Foundation water content	cm^3/cm^3		0.12	
	Foundation thickness	cm		15	15
	Lower depth of surficial soil zone	cm		100.0	=adult residential
	Depth to subsurface soil sources	cm		100	
	Depth to groundwater	cm		520	
	Width of source area parallel to wind or groundwater flow direction	cm		914	
	Outdoor air mixing zone height	cm		200	
	Particulate emission rate	g/cm^2-s		1.38E-11	1.38E-11
	Wind speed above ground surface in outdoor air mixing zone	cm/s		322	=adult residential

Appendix D

SSTL Results From Tier 2 Calculations

0055 RBCA Results using Oakland-specific inputs

	COC	SSTLs	Sample ID	COC Concentration, in ppm	Target Risk Level	Baseline Risk Level	Total Baseline Risk Level	Hazard Type
Subsurface soil to commercial indoor air.	Benzene	3.70E+01	B7-40	11	1.00E-05	2.97E-06	5.15E-06	Carcinogen
	Ethylbenzene	SAT	TP-10	78				Hazard
	MTBE	SAT	TP-10	87				Hazard
	Toluene	SAT	TP-10	130				Hazard
	Xylenes	SAT	TP-10	600				Hazard
Groundwater to commercial indoor air.	Benzene	4.60E+01	MW2 5/95	10	1.00E-05	2.17E-06	5.15E-06	Carcinogen
	Ethylbenzene	SOL	MW2 5/95	1.6				Hazard
	MTBE	SOL	MW2 1/98	2.7				Hazard
	Toluene	SOL	MW2 5/95	11				Hazard
	Xylenes	SOL	MW2 5/95	8.8				Hazard

Notes:
COC = Contaminant Of Concern
SSTL = Site Specific Target Level
SAT = SSTL exceeds COC saturation limit in soil
SOL = SSTL exceeds COC solubility limit in water

Table 8. Oakland Tier 2 SSTLs for Clayey Silts

Medium	Exposure Pathway	Land Use	Type of Risk	Benzene	Benzo(a)-pyrene	Benzo(b)-fluoranthene	Benzo(g,h,i)-perylene	Benzo(k)-fluoranthene	Beryllium	Bis (2-ethylhexyl) phthalate
Surficial Soil [mg/kg]	Ingestion/ Dermal/ Inhalation	Residential	Carcinogenic	1.9E+01	1.7E-01	1.7E+00		1.7E+00	7.4E+04	2.4E+02
			Hazard	6.4E+01			1.6E+02		3.6E+02	7.8E+02
		Commercial/ Industrial	Carcinogenic	5.0E+01	4.3E-01	4.3E+00		4.3E+00	2.8E+05	6.2E+02
			Hazard	3.1E+02			7.4E+02		5.1E+03	3.7E+03
Subsurface Soil [mg/kg]	Inhalation of Indoor Air Vapors	Residential	Carcinogenic	1.9E+00	SAT	SAT		SAT		SAT
			Hazard	6.2E+00			SAT			SAT
		Commercial/ Industrial	Carcinogenic	3.7E+01	SAT	SAT		SAT		SAT
			Hazard	2.2E+02			SAT			SAT
	Inhalation of Outdoor Air Vapors	Residential	Carcinogenic	2.7E+02	SAT	SAT		SAT		SAT
			Hazard	1.1E+03			SAT			SAT
		Commercial/ Industrial	Carcinogenic	1.0E+03	SAT	SAT		SAT		SAT
			Hazard	SAT			SAT			SAT
	Ingestion of Groundwater Impacted by Leachate	Residential	Carcinogenic	*7.5E-03*	*2.0E+01*	SAT		SAT	1.6E+01	SAT
			Hazard	*7.5E-03*	*2.0E+01*		SAT		1.6E+01	SAT
		Commercial/ Industrial	Carcinogenic	*7.5E-03*	*2.0E+01*	SAT		SAT	1.6E+01	SAT
			Hazard	*7.5E-03*	*2.0E+01*		SAT		1.6E+01	SAT
Groundwater [mg/l]	Inhalation of Indoor Air Vapors	Residential	Carcinogenic	2.3E+00	>SOL	>SOL		>SOL		>SOL
			Hazard	7.7E+00			>SOL			>SOL
		Commercial/ Industrial	Carcinogenic	4.6E+01*	>SOL	>SOL		>SOL		>SOL
			Hazard	2.8E+02			>SOL			>SOL
	Inhalation of Outdoor Air Vapors	Residential	Carcinogenic	9.2E+02	>SOL	>SOL		>SOL		>SOL
			Hazard	>SOL			>SOL			>SOL
		Commercial/ Industrial	Carcinogenic	>SOL	>SOL	>SOL		>SOL		>SOL
			Hazard	>SOL			>SOL			>SOL
	Ingestion of Groundwater	Residential	Carcinogenic	*1.0E-03*	*2.0E-04*	5.6E-04		5.6E-04	4.0E-03	8.0E-02
			Hazard	*1.0E-03*	*2.0E-04*		>SOL		4.0E-03	3.1E-01
		Commercial/ Industrial	Carcinogenic	*1.0E-03*	*2.0E-04*	>SOL		>SOL	4.0E-03	>SOL
			Hazard	*1.0E-03*	*2.0E-04*		>SOL		4.0E-03	>SOL
Water Used for Recreation [mg/l]	Ingestion/ Dermal	Residential	Carcinogenic	6.3E-02	1.1E-05	1.1E-04		1.2E-04		>SOL
			Hazard	1.8E-01			>SOL		2.0E+00	>SOL

*Italicized concentrations based on California MCLs

SAT: RBSL exceeds saturated soil concentration of chemical

>SOL: RBSL exceeds solubility of chemical in water

Table 8. Oakland Tier 2 SSTLs for Clayey Silts

Medium	Exposure Pathway	Land Use	Type of Risk	Dimethylbenza-(a)anthracene (7,12)	Dimethyl-phenol (2,4)	di-n-Butyl-phthalate	di-n-octyl phthalate	Dinitro-toluene (2,4)	Dioxane (1,4)	Ethyl-benzene
Surficial Soil [mg/kg]	Ingestion/ Dermal/ Inhalation	Residential	Carcinogenic					6.4E+00	7.1E+01	
			Hazard	1.2E+03	7.8E+02	3.9E+03	7.8E+02			3.9E+03
		Commercial/ Industrial	Carcinogenic					1.7E+01	1.9E+02	
			Hazard	5.6E+03	3.7E+03	1.9E+04	3.7E+03			1.8E+04
Subsurface Soil [mg/kg]	Inhalation of Indoor Air Vapors	Residential	Carcinogenic					SAT	SAT	
			Hazard		SAT	SAT	SAT			SAT
		Commercial/ Industrial	Carcinogenic					SAT	SAT	
			Hazard		SAT	SAT	SAT			SAT
	Inhalation of Outdoor Air Vapors	Residential	Carcinogenic					SAT	SAT	
			Hazard		SAT	SAT	SAT			SAT
		Commercial/ Industrial	Carcinogenic					SAT	SAT	
			Hazard		SAT	SAT	SAT			SAT
	Ingestion of Groundwater Impacted by Leachate	Residential	Carcinogenic					2.4E-02	SAT	*2.7E+01*
			Hazard	SAT	7.0E+00	1.3E+07	SAT			*2.7E+01*
		Commercial/ Industrial	Carcinogenic					1.0E-01	SAT	*2.7E+01*
			Hazard	SAT	4.6E+01	SAT	SAT			*2.7E+01*
Groundwater [mg/l]	Inhalation of Indoor Air Vapors	Residential	Carcinogenic					>SOL	>SOL	
			Hazard		>SOL	>SOL	>SOL			>SOL
		Commercial/ Industrial	Carcinogenic					>SOL	>SOL	
			Hazard		>SOL	>SOL	>SOL			>SOL
	Inhalation of Outdoor Air Vapors	Residential	Carcinogenic					>SOL	>SOL	
			Hazard		>SOL	>SOL	>SOL			>SOL
		Commercial/ Industrial	Carcinogenic					>SOL	>SOL	
			Hazard		>SOL	>SOL	>SOL			>SOL
	Ingestion of Groundwater	Residential	Carcinogenic					2.2E-03	>SOL	*7.0E-01*
			Hazard	>SOL	3.1E-01	1.6E+00	>SOL			*7.0E-01*
		Commercial/ Industrial	Carcinogenic					9.2E-03	>SOL	*7.0E-01*
			Hazard	>SOL	2.0E+00	1.0E+01	>SOL			*7.0E-01*
Water Used for Recreation [mg/l]	Ingestion/ Dermal	Residential	Carcinogenic					6.4E-02	>SOL	
			Hazard	>SOL	2.7E+00	7.3E+00	2.1E-03			3.6E+00

*Italicized concentrations based on California MCLs

SAT: RBSL exceeds saturated soil concentration of chemical

>SOL: RBSL exceeds solubility of chemical in water

Table 8. Oakland Tier 2 SSTLs for Clayey Silts

Medium	Exposure Pathway	Land Use	Type of Risk	Methyl-napthalene (2-)	MTBE	Naphthalene	Nickel	Nitro-benzene	PCBs	Phenan-threne	Phenol
Surficial Soil [mg/kg]	Ingestion/ Dermal/ Inhalation	Residential	Carcinogenic				5.7E+05	3.8E+03	3.6E-01		
			Hazard	1.6E+03	2.0E+02	1.6E+03	1.4E+03		9.8E-01	1.2E+04	2.3E+04
		Commercial/ Industrial	Carcinogenic				2.1E+06	1.0E+04	1.1E+00		
			Hazard	7.4E+03	9.3E+02	7.4E+03	2.0E+04		5.8E+00	5.6E+04	1.1E+05
Subsurface Soil [mg/kg]	Inhalation of Indoor Air Vapors	Residential	Carcinogenic					SAT	1.6E+03		
			Hazard	SAT	1.4E+04	SAT			SAT	SAT	SAT
		Commercial/ Industrial	Carcinogenic					SAT	SAT		
			Hazard	SAT	SAT	SAT			SAT	SAT	SAT
	Inhalation of Outdoor Air Vapors	Residential	Carcinogenic					SAT	SAT		
			Hazard	SAT	SAT	SAT			SAT	SAT	SAT
		Commercial/ Industrial	Carcinogenic					SAT	SAT		
			Hazard	SAT	SAT	SAT			SAT	SAT	SAT
	Ingestion of Groundwater Impacted by Leachate	Residential	Carcinogenic		*3.5E-02*	*4.0E+00*	*3.3E+01*	1.1E+01	*1.5E+01*		
			Hazard	5.3E+02	*3.5E-02*	*4.0E+00*	*3.3E+01*		*1.5E+01*	SAT	4.1E+01
		Commercial/ Industrial	Carcinogenic		*3.5E-02*	*4.0E+00*	*3.3E+01*	4.6E+01	*1.5E+01*		
			Hazard	3.5E+03	*3.5E-02*	*4.0E+00*	*3.3E+01*		*1.5E+01*	SAT	2.7E+02
Groundwater [mg/l]	Inhalation of Indoor Air Vapors	Residential	Carcinogenic					>SOL	3.9E-01		
			Hazard	>SOL	4.3E+04	>SOL			>SOL	>SOL	>SOL
		Commercial/ Industrial	Carcinogenic					>SOL	>SOL		
			Hazard	>SOL	>SOL	>SOL			>SOL	>SOL	>SOL
	Inhalation of Outdoor Air Vapors	Residential	Carcinogenic					>SOL	>SOL		
			Hazard	>SOL	>SOL	>SOL			>SOL	>SOL	>SOL
		Commercial/ Industrial	Carcinogenic					>SOL	>SOL		
			Hazard	>SOL	>SOL	>SOL			>SOL	>SOL	>SOL
	Ingestion of Groundwater	Residential	Carcinogenic		*1.3E-02*	*2.0E-02*	*1.0E-01*	1.3E+00	*5.0E-04*		
			Hazard	6.3E-01	*1.3E-02*	*2.0E-02*	*1.0E-01*		*5.0E-04*	>SOL	9.4E+00
		Commercial/ Industrial	Carcinogenic		*1.3E-02*	*2.0E-02*	*1.0E-01*	5.7E+00	*5.0E-04*		
			Hazard	4.1E+00	*1.3E-02*	*2.0E-02*	*1.0E-01*		*5.0E-04*	>SOL	6.1E+01
Water Used for Recreation [mg/l]	Ingestion/ Dermal	Residential	Carcinogenic					2.8E+01	1.6E-05		
			Hazard	6.1E-01	1.5E+00	1.5E+00	7.9E+00		4.4E-05	>SOL	1.5E+02

*Italicized concentrations based on California MCLs

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>SOL: RBSL exceeds solubility of chemical in water

Table 8. Oakland Tier 2 SSTLs for Clayey Silts

Medium	Exposure Pathway	Land Use	Type of Risk	Toluene	Trichloro-ethane (1,1,1-)	Trichloro-ethane (1,1,2-)	Trichloro-ethylene (TCE)	Vanadium	Vinyl Chloride	Xylenes	Zinc
Surficial Soil [mg/kg]	Ingestion/ Dermal/ Inhalation	Residential	Carcinogenic			2.7E+01	1.3E+02		3.6E+00		
			Hazard	7.4E+03	1.4E+03	1.5E+02	2.3E+02	5.0E+02		6.1E+04	2.1E+04
		Commercial/ Industrial	Carcinogenic			7.1E+01	3.4E+02		9.3E+00		
			Hazard	3.5E+04	6.5E+03	7.3E+02	1.1E+03	7.2E+03		3.0E+05	3.1E+05
Subsurface Soil [mg/kg]	Inhalation of Indoor Air Vapors	Residential	Carcinogenic			1.5E+01	2.7E+01		3.0E-02		
			Hazard	9.3E+02	6.6E+02	8.4E+01	3.2E+01			SAT	
		Commercial/ Industrial	Carcinogenic			2.9E+02	5.4E+02		5.9E-01		
			Hazard	SAT	SAT	3.0E+03	1.2E+03			SAT	
	Inhalation of Outdoor Air Vapors	Residential	Carcinogenic			1.8E+03	SAT		4.5E+00		
			Hazard	SAT	SAT	SAT	SAT			SAT	
		Commercial/ Industrial	Carcinogenic			SAT	SAT		1.7E+01		
			Hazard	SAT	SAT	SAT	SAT			SAT	
	Ingestion of Groundwater Impacted by Leachate	Residential	Carcinogenic	*3.0E+00*	*2.6E+00*	*3.3E-02*	*9.1E-02*		*1.9E-03*	*4.5E+01*	
			Hazard	*3.0E+00*	*2.6E+00*	*3.3E-02*	*9.1E-02*	5.5E+02	*1.9E-03*	*4.5E+01*	1.5E+03
		Commercial/ Industrial	Carcinogenic	*3.0E+00*	*2.6E+00*	*3.3E-02*	*9.1E-02*		*1.9E-03*	*4.5E+01*	
			Hazard	*3.0E+00*	*2.6E+00*	*3.3E-02*	*9.1E-02*	3.6E+03	*1.9E-03*	*4.5E+01*	9.6E+03
Groundwater [mg/l]	Inhalation of Indoor Air Vapors	Residential	Carcinogenic			2.0E+01	1.4E+01		7.5E-02		
			Hazard	4.4E+02	4.9E+02	1.1E+02	1.7E+01			>SOL	
		Commercial/ Industrial	Carcinogenic			3.9E+02	2.8E+02		1.5E+00		
			Hazard	>SOL	>SOL	4.0E+03	6.0E+02			>SOL	
	Inhalation of Outdoor Air Vapors	Residential	Carcinogenic			>SOL	>SOL		3.0E+01		
			Hazard	>SOL	>SOL	>SOL	>SOL			>SOL	
		Commercial/ Industrial	Carcinogenic			>SOL	>SOL		1.1E+02		
			Hazard	>SOL	>SOL	>SOL	>SOL			>SOL	
	Ingestion of Groundwater	Residential	Carcinogenic	*1.5E-01*	*2.0E-01*	*5.0E-03*	*5.0E-03*		*5.0E-04*	*1.8E+00*	
			Hazard	*1.5E-01*	*2.0E-01*	*5.0E-03*	*5.0E-03*	1.1E-01	*5.0E-04*	*1.8E+00*	4.7E+00
		Commercial/ Industrial	Carcinogenic	*1.5E-01*	*2.0E-01*	*5.0E-03*	*5.0E-03*		*5.0E-04*	*1.8E+00*	
			Hazard	*1.5E-01*	*2.0E-01*	*5.0E-03*	*5.0E-03*	7.2E-01	*5.0E-04*	*1.8E+00*	3.1E+01
Water Used for Recreation [mg/l]	Ingestion/ Dermal	Residential	Carcinogenic			1.8E-01	4.6E-02		2.6E-02		
			Hazard	1.1E+01	4.3E+00	7.8E-01	7.2E-02	2.8E+00		6.6E+01	1.2E+02

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