EMCON
1921 Ringwood Avenue • San Jose, California 95131-1721 • (408) 453-7300 • Fax (408) 437-9526

ITAL
ON
2:07

ENVIRONMENTAL PROTECTION
96 JUN -5 PM 2:07

Date June 3, 1996
Project 20805-131.007

To:

Ms. Juliet Shin
Alameda County Health Care Services Agency
Department of Environmental Health
1131 Harborbay Parkway, Suite 250
Alameda, California 94502-6577

EPA method 9060
McCampbell CA 798-1620

We are enclosing:

Copies	Description
1	Onsite Tier 2 Risk-Based Corrective Action Evaluation for
	ARCO service station 6002, 6235 Seminary Avenue,
	Oakland, California

For your:			Sent by:		
	X	Use			Regular Mail
		Approval			Standard Air
		Review			Courier
		Information		X	Other: FED EX

Comments:
The enclosed risk-based corrective action evaluation is being sent to you per the request of ARCO Products Company. Please call if you have questions or comments.

[signature] for
John C. Young
Project Manager

cc: Ms. Susan Hugo, ACHCSA
[redacted]
Kevin Graves, RWQCB - SFBR
Michael Whelan, ARCO Products Company
File

Waiting for 6/19
Ray Kaminsky to get
back to me re
Soil Porosity chge.

EMCON
1921 Ringwood Avenue • San Jose, California 95131-1721 • (408) 453-7300 • Fax (408) 437-9526

5249-0200

Date June 3, 1996
Project 20805-131.007

To:

Ms. Juliet Shin
Alameda County Health Care Services Agency
Department of Environmental Health
1131 Harborbay Parkway, Suite 250
Alameda, California 94502-6577

ENVIRONMENTAL PROTECTION
96 JUN -4 AM 9:14

We are enclosing:

Copies	Description
1	Onsite Tier 2 Risk-Based Corrective Action Evaluation for
	ARCO service station 6002, 6235 Seminary Avenue,
	Oakland, California

For your:		Sent by:	
	X Use		Regular Mail
	Approval		Standard Air
	Review		Courier
	Information	X	Other: FED EX

Comments:
The enclosed risk-based corrective action evaluation is being sent to you per the request of ARCO Products Company. Please call if you have questions or comments.

By manuye for
John C. Young
Project Manager

cc: Ms. Susan Hugo, ACHCSA
Ms. Medula Logan, ACHCSA
Kevin Graves, RWQCB - SFBR
Michael Whelan, ARCO Products Company
File

EMCON
1921 Ringwood Avenue • San Jose, California 95131-1721 • **(408) 453-7300** • Fax (408) 437-9526

June 3, 1996
Project 20805-131.007

Mr. Michael Whelan
ARCO Products Company
PO Box 612530
San Jose, California 95161

Re: Onsite Tier 2 Risk-Based Corrective Action Evaluation for ARCO Station 6002, 6235 Seminary Avenue, Oakland, California

Dear Mr. Whelan:

This report presents the results of the Tier 2 risk-based corrective action (RBCA) evaluation prepared for ARCO Products Company (ARCO) Station 6002, 6235 Seminary Avenue, Oakland, California (Figures 1 and 2). This report addresses potential onsite exposures to current and future workers at the station. The Tier 2 evaluation results indicate that no acceptable levels of risk are exceeded at this site.

A separate offsite RBCA evaluation will be performed following additional offsite assessment, and the two evaluations will be joined in a Corrective Action Plan (CAP) to be prepared in accordance with the Regional Water Quality Control Board's (RWQCB), San Francisco Bay Region, *Supplemental Instructions to the State Water Board December 8, 1995 Interim Guidance on Required Cleanup at Low Risk Fuel Sites.*

Based on the results of investigations performed to date for the onsite property, the site qualifies as a low risk site as defined in the RWQCB's January 1996 Supplemental Instructions. The RWQCB's requirements are bulleted as follows:

- Source must be removed

Source removal was performed in March 1996; USTs, piping and impacted soil were excavated and removed from the site.

- Site is adequately characterized

Three soil and groundwater investigations have been performed at the site and have defined the lateral and vertical onsite extent of gasoline hydrocarbons in soil and groundwater.

- Plume is stable or receding

Concentrations of gasoline and its constituents dissolved in groundwater have been decreasing in onsite monitoring wells suggesting a receding plume. In addition, the USTs were removed, thereby eliminating future source material to groundwater.

- No threat to surface water or deep aquifers

Onsite groundwater investigations have defined the vertical extent of the dissolved gasoline plume to be contained within the shallow water bearing zone. No deep aquifers or surface waters are impacted or threatened.

- No threat to human health

Based on the results of this Tier 2 RBCA evaluation, no threat to human health exists.

- No threat to the environment

No onsite ecological receptors have been identified as threatened.

This RBCA evaluation was prepared in accordance with the guidelines contained in *Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites* (American Society of Testing Materials [ASTM] E-1739-95, November, 1995). In general, the tiered approach recommended in the ASTM guidelines is designed as a step-wise process to evaluate the potential risk posed by a chemical release, determine what corrective action, if any, is needed, and tailor that action to those risks. This report uses the environmental transport models, and the formulas for assessing risk contained in the ASTM guidelines. Risk-based soil and groundwater concentrations were calculated using the ASTM RBCA companion software *Tier 2 RBCA Tool Kit* to provide computational accuracy and achieve consistency with ASTM guidelines.

The steps that make up the tiered RBCA approach are summarized in Figure 3. This report will follow these steps, and refer to information summarized in tables, figures and Tier 2 RBCA Tool Kit worksheets contained in Attachment A. This report should be read in conjunction with reviewing the worksheets contained in Attachment A.

Initial Site Assessment and Site Classification

Steps 1 and 2 of RBCA are designed to screen for the possibility that the site presents an imminent threat to public health and the environment. This refers primarily to sites where an unconfined release to the surface has taken place in which direct contact to product is a possibility. Chemical impact to soil and groundwater at this site has been characterized in several investigations. As documented in *Initial Onsite Subsurface Investigation Report* (RESNA, March 31, 1994) and summarized in Worksheet 4.2, no surface releases have taken place at this site which have not been immediately contained and cleaned. Although gasoline has been detected in the subsurface, releases do not present a potential risk of direct contact. A comparison of site-measured soil and groundwater data to conservative, nonsite-specific, health-based screening levels, in accordance with the ASTM RBCA guidelines, was undertaken at the request of Alameda County Health Care Services Agency (ACHCSA) in a February 16, 1995 meeting. This is referred to in the ASTM guidelines as a Tier 1 evaluation.

what concentrations were used?

Tier 1 Evaluation

The first step in a Tier 1 evaluation is to determine the chemical nature of the release, and to characterize the extent of the impact. Definition of the onsite impact has been established, and is documented in the soil and groundwater investigation and quarterly monitoring reports and in Worksheet 1.1. Briefly, the information contained in these reports indicates that USTs and associated piping were found to have impacted adjacent soil and groundwater located between 9 and 11 feet below grade in 1994. The USTs, piping and most of the impacted soil have since been removed. Current benzene concentrations dissolved in groundwater are summarized in Figure 4. Soil and additional analytical information is summarized in Worksheets 5.2, 5.3, 5.5, and 5.6 (Attachment A).

The next step in a Tier 1 evaluation is to identify potentially significant environmental transport pathways by which receptors may be exposed to site-related chemicals in order to determine the existence of complete exposure pathways. For a potential exposure pathway to be considered complete, it must contain the following three elements:

- a source of specific chemicals (i.e., benzene, toluene, ethyl benzene, and, xylenes [BTEX])
- a transport mechanism (e.g., groundwater migration)
- a potential receptor (e.g., groundwater must be considered potable for an exposure pathway to be considered complete)

As summarized in Worksheet 1.4 and 4.2, and 4.4 in Attachment A, the only complete potential exposure pathways at this site are:

- exposure through volatilization of chemicals in groundwater to indoor air (i.e., the service station/convenience store) and to ambient air
- exposure through volatilization of chemicals in subsurface soil to ambient air.

why not?

First encountered groundwater at this site is not considered potable, and for this reason potential exposure pathways involving groundwater (e.g., infiltration from subsurface soil to groundwater and direct groundwater ingestion) were not evaluated further. In addition, direct exposure to surface and subsurface soil at this site is not considered a complete exposure pathway because soil at this site is covered by asphalt or concrete, and institutional controls per the sales agreement with the perspective property owner limits excavation at the site. The subsurface soil-to-indoor air scenario was not evaluated because impacted soil is approximately 30 feet to the east of the building (Figure 5). As agreed in a discussion with ACHCSA (March 20, 1996), the building would have to be closer to the area of gasoline impact in order for this pathway to be considered complete.

Quarterly groundwater monitoring results have shown a decreasing trend in BTEX levels in site groundwater. In recognition of this trend and of the fact that the underground

storage tanks and piping were removed and the associated soil over-excavated (source removal) in March 1996, the ACHCSA recommended using the most recent groundwater concentrations measured upgradient of the onsite structure (i.e., from well VW-1) to represent the source of BTEX to which hypothetical indoor receptors may be exposed. Well VW-1, which is completed in the first-encountered groundwater, was sampled after well MW-1 was removed as part of the excavation of the underground tanks and piping. Analytical results from this sampling event are presented in Attachment B.

Because this evaluation is only for onsite receptors, and the site is expected to be used as a service station and a convenience store, only commercial receptors are evaluated. The exposure assumptions used in the calculations are summarized in Worksheet 4.3.

As recommended by the ACHCSA, onsite acceptable risk-based soil and groundwater levels were calculated based on a 1 $x10^{-5}$ (i.e., 1 in 100,000) cancer risk, and a hazard quotient of 1 for noncancer-causing substances.

The next step in this Tier 1 evaluation is to review the assumptions used to derive the risk-based screening levels (RBSLs) for contaminated media (i.e., soil and groundwater) and potential exposure routes (i.e., inhalation of indoor and ambient air), and determine whether they are likely to be conservative for this site. The emission and air dispersion models, and the default modeling values used in the ASTM guidelines to generate the RBSLs are suitable to generate conservative RBSLs for the following reasons:

- The soil and groundwater models assume a constant source. The recent removal of UST's and piping, and the over-excavation of soil during their removal will result in a significant diminution of the source. Since this decrease was not yet reflected in the source terms used by the models, the model results will overestimate the corresponding RBSLs.

- Losses due to biodegradation and adsorption onto soil during volatilization from the unsaturated zone are not accounted for by the models.

- Volatilization of BTEX to ambient air was considered a complete pathway for the purposes of this assessment. This assumption is extremely conservative because the site is covered by concrete and asphalt, which although not completely impermeable, limits vapor diffusion to a much greater degree than the vapor emission model can account for.

- The default parameters used for modeling assume a higher-porosity, clean sandy soil, which will result in greater exposure due to volatile emissions than would be expected for the lower porosity, clayey sands present at the site.

The assumptions used to develop RBSLs for the pertinent potential exposure pathways are judged to be appropriate for the purposes of screening. The only modification necessary to the RBSLs presented in Table X2.1 of the ASTM guidelines is to adjust the RBSLs for benzene by multiplying them by 0.29 (California Regional Water Quality Control Board,

San Francisco Bay Region, memorandum, January 5, 1996). For example, the adjusted RBSL from Table X2.1 for exposure to benzene through volatilization from groundwater to indoor air is presented below.

For Onsite Commercial/Industrial Receptor Scenario:

Vapor intrusion from groundwater into buildings (indoor air)

Target Levels from Lookup Table X2.1 for Benzene (mg/l)

- 10^{-6} risk - 1E-06 = 7.39E-02
- 10^{-4} risk - 1E-04 = 7.39E-00

Selected a RBSL corresponding to a onsite 10^{-5} risk

- 1E-05 = 7.39E-01 or 0.739 mg/l

RWQCB benzene correction

- 0.739 mg/l x 0.29
- =0.214 mg/l

RBSL = 0.214 mg/l

As shown in Worksheet 4.4, comparing the maximum soil and groundwater concentrations of benzene, toluene, ethylbenzene and xylenes to their appropriate RBSLs, only the RBSL for benzene in the groundwater-to-indoor air scenario is exceeded by concentrations detected at the site.

These results indicate that the presence of benzene in groundwater does not pose an unacceptable risk to commercial receptors via inhalation of indoor air, but that more site-specific assessment is needed based on the conservative factors inherent in a Tier 1 evaluation. This assessment is developed in the Tier 2 evaluation, described below.

Tier 2 Evaluation

In accordance with the ASTM guidelines, the same conservative volatilization models used in the Tier 1 evaluation were used to evaluate the groundwater-to-indoor air potential exposure pathway during the Tier 2 evaluation. However, site specific values were used for the model instead of the default values in the Tier 1 evaluation. Site-specific values for soil water content, bulk density and total organic carbon were measured for three samples collected during the excavation of the USTs, piping and associated soil in March, 1996, and their average values were used for the Tier 2 evaluation. The location of these samples

are shown on Figure 5, and the analytical results for these parameters are presented in Attachment C. The average water content (17 percent) and bulk density (1.72 g/cm^3) were similar to the Tier 1 default values of 12 percent and 1.7 g/cm^3, respectively. The value for soil organic carbon content (0.2 percent) was less than the default value of 1.0 percent. Soil porosity was reduced from the default value of 0.38 to 0.30 to reflect the presence of clayey sands rather than the sandy soils assumed in the Tier 1 assessment (Freeze and Cherry, Groundwater; 1979). Similarly, capillary zone thickness was increased from 5 to 30.5 cm to account for the presence of clay within soil at this site. The fraction of the foundation area assumed to be cracked was reduced from 1 to 0.5 percent with the concurrence of ACHCSA to represent a more accurate, but still conservative estimate of this parameter. Additional information necessary for the site-specific Tier 2 evaluation, such as the size of the contaminated area (17,651 m^2) and the depth of petroleum impact (9.0 feet) were determined using data collected from previous investigations, and are presented in Worksheets 5.1 and 5.3, and in Figures 5 and 6. A summary of both the default and site-specific values used for modeling are presented in Worksheets 5.1, 5.3, and 5.7.

The parameters described above were used to calculate site-specific, risk-based threshold levels (SSTL's) for the groundwater-to-indoor air pathway. The results of this evaluation are summarized in Table 1. The results for well MW-1, located downgradient of the former USTs, but abandoned prior to their excavation in March of this year, are presented along with those of vapor extraction well VW-1 for comparison. These results show that the concentrations of BTEX detected in the groundwater from well VW-1 are lower than their corresponding SSTLs. The monitoring results for benzene (0.490 mg/l) are more than 2.6-times less than the SSTL calculated for benzene (1.51 mg/l). The results for toluene, ethylbenzene, and xylenes are more than 130-times less than their respective SSTLs.

While more representative of actual site conditions than the Tier 1 results, the Tier 2 results are still conservative for several reasons, the most important of which are the following:

- As previously discussed for the Tier 1 evaluation, the source of the gasoline to the groundwater has been removed. Because the model used to estimate emission rates of BTEX from groundwater assumes a constant source of chemicals in the groundwater, and assumes no losses due to biodegradation, the SSTLs will be significantly overestimated.

- The model used to estimate BTEX concentration in indoor air is likely to overestimate these values because it assumes air exchange rates more appropriate for a modern business building with a controlled rate of makeup air rather than a service station converted to a convenience store in which the indoor air is likely to be exchanged with outdoor air at a much higher rate. In addition, the model cannot account for the presence of the double concrete slab foundation and the tiled floor present at this site which will have the effect of significantly reducing the amount of subsurface volatilization.

Summary and Conclusion

In response to a loss of gasoline from UST's and piping at ARCO Station 6002, ARCO has undertaken interim cleanup by removing the tanks and piping, and has conducted further source removal by over-excavating much of the impacted soil. The impact of residual BTEX in the soil and groundwater was evaluated to determine what risk, if any, it might present to current and future onsite receptors. This evaluation was conducted using the ASTM RBCA guidelines. The results show concentrations of BTEX detected in the soil and groundwater at this site do not exceed concentrations that correspond to acceptable levels of risk. These results indicate that no additional remedial measures are necessary to protect the health of current or future onsite receptors.

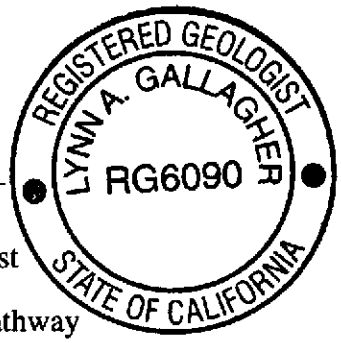
Based on the onsite Tier 2 evaluation results and the designation of the onsite property as a "low risk" site, verification groundwater monitoring and sampling has been proposed for future onsite work.

Sincerely,

EMCON

Dr. Ray Kaminsky
Environmental Chemist

John C. Young R.G.
Senior Project Geologist



Attachments: Table 1 - Tier 2 Results Groundwater to Indoor Air Pathway
Figure 1 - Site Location
Figure 2 - Site Plan
Figure 3 - Risk-Based Corrective Action Process Flowchart
Figure 4 - Groundwater Data Fourth Quarter 1995
Figure 5 - TPHG and Benzene concentrations Within Excavation
Figure 6 - Benzene Concentrations in Subsurface Soils
Attachment A - ASTM RBCA Worksheets
Attachment B - Chemical Data VW-1
Attachment C - Geotechnical Data

cc: Ms. Juliet Shin, ACHCSA
Ms. Susan Hugo, ACHCSA
Ms. Medula Logan, ACHCSA
Mr. Kevin Graves, RWQCB

TABLE 1

Tier 2 Results
Groundwater to Indoor Air Pathway

ARCO Station 6002
6235 Seminary Avenue
Oakland, California

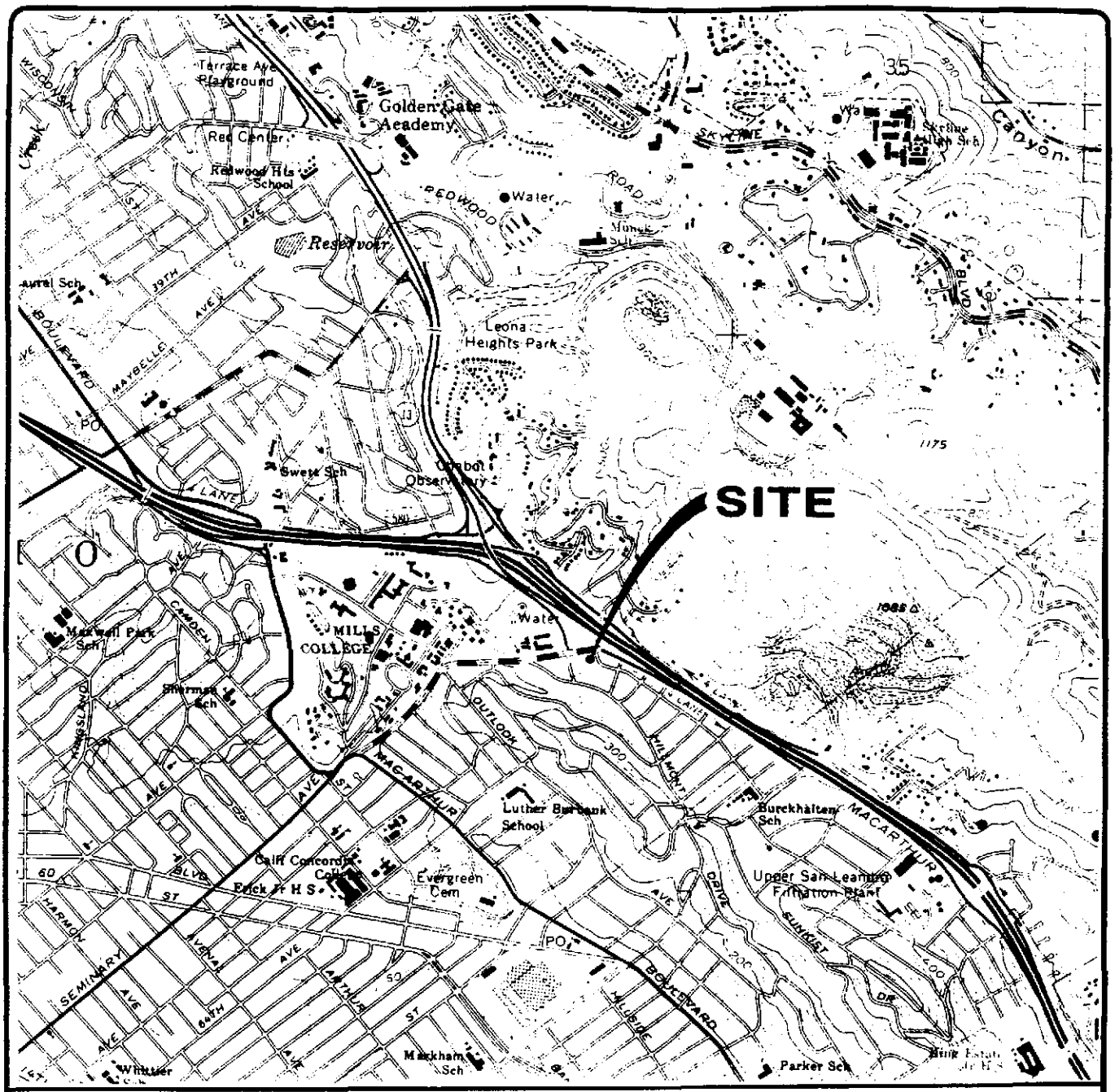
Chemical	SSTL[1] (mg/l)	Most Recent Concentration[2] (mg/l) VW-1	MW-1
Benzene	1.51	0.49	0.57
Ethylbenzene	SOL[3]	0.52	0.26
Toluene	SOL[3]	0.057	0.017
Xylenes	SOL[3]	1.5	0.41

1 Site-specific threshold level. Calculated value for benzene of 5.2E+00 mg/l was multiplied by 0.29 in accordance with Regional Water Quality Control Board guidance, see text.

2 Well VW-1 sampled 3/1/96 and well MW-1 sampled 11/13/95.

3 The software calculated a value that was greater than the solubility of these constituents. The notation "SOL" is used to indicated that a compound cannot be present in the groundwater at concentrations greater than its solubility.

152753

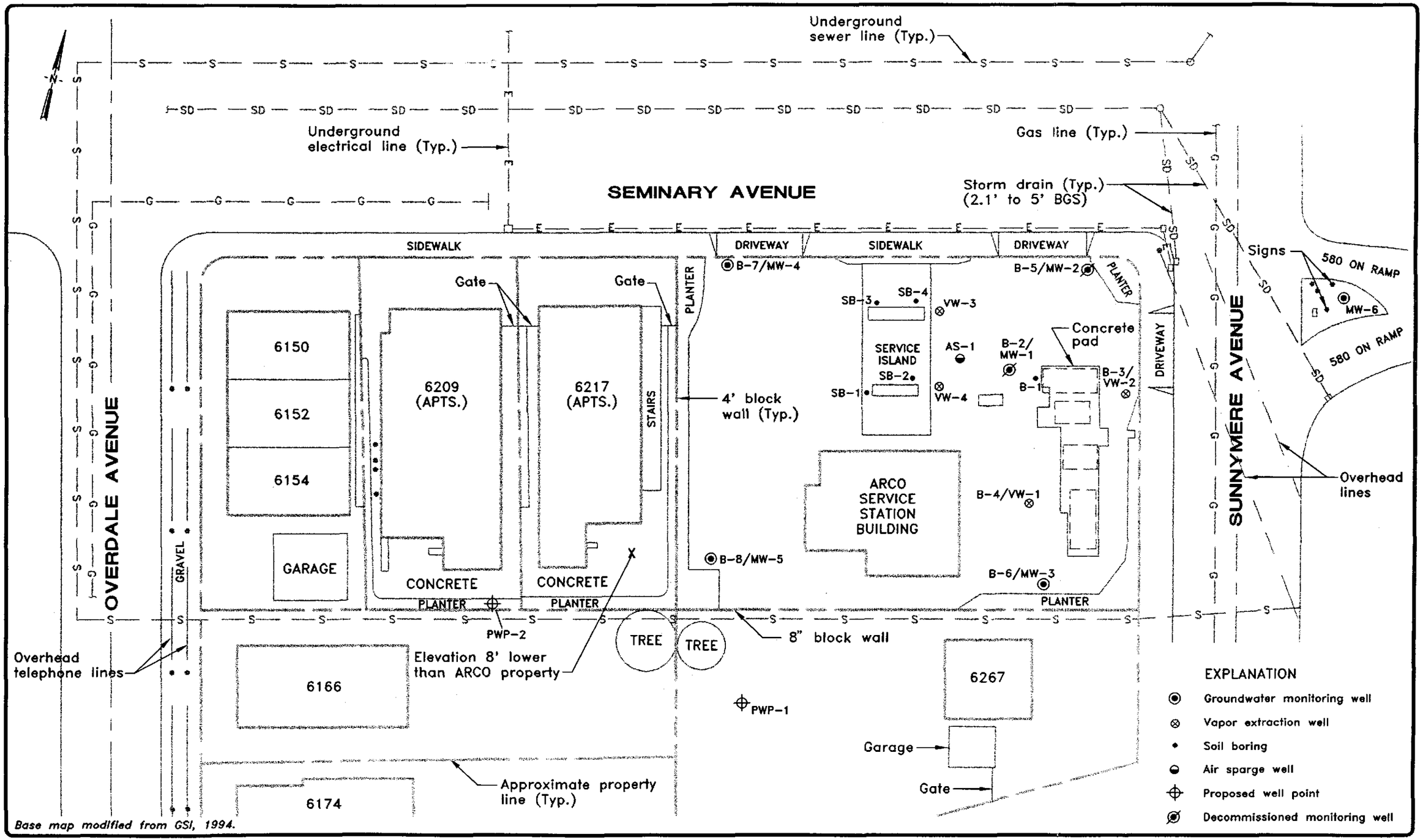


EMCON

ARCO PRODUCTS COMPANY
SERVICE STATION 6002, 6235 SEMINARY AVE.
OAKLAND, CALIFORNIA

SITE LOCATION

FIGURE
1
PROJECT NO.
805-131.07



Base map modified from GSI, 1994.

EMCON

SCALE: 0 30 60 FEET

ARCO PRODUCTS COMPANY
SERVICE STATION 6002, 6235 SEMINARY AVE.
OAKLAND, CALIFORNIA

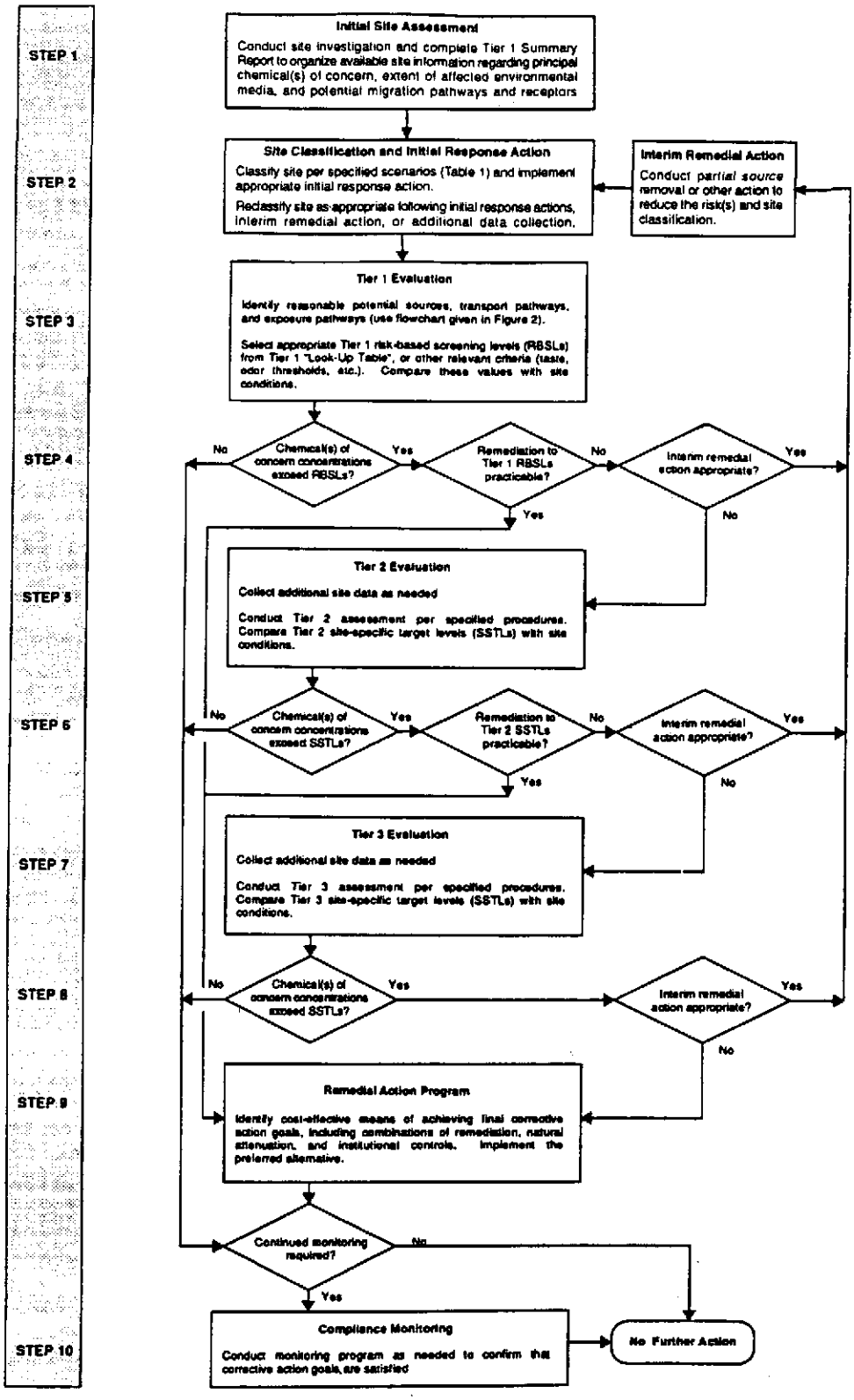
SITE PLAN

FIGURE NO. **2**

PROJECT NO. 805-131.07

G:\805-131\SITEPLAN REV 0 05/29/96 12:49:24 KAJ DJ

155812

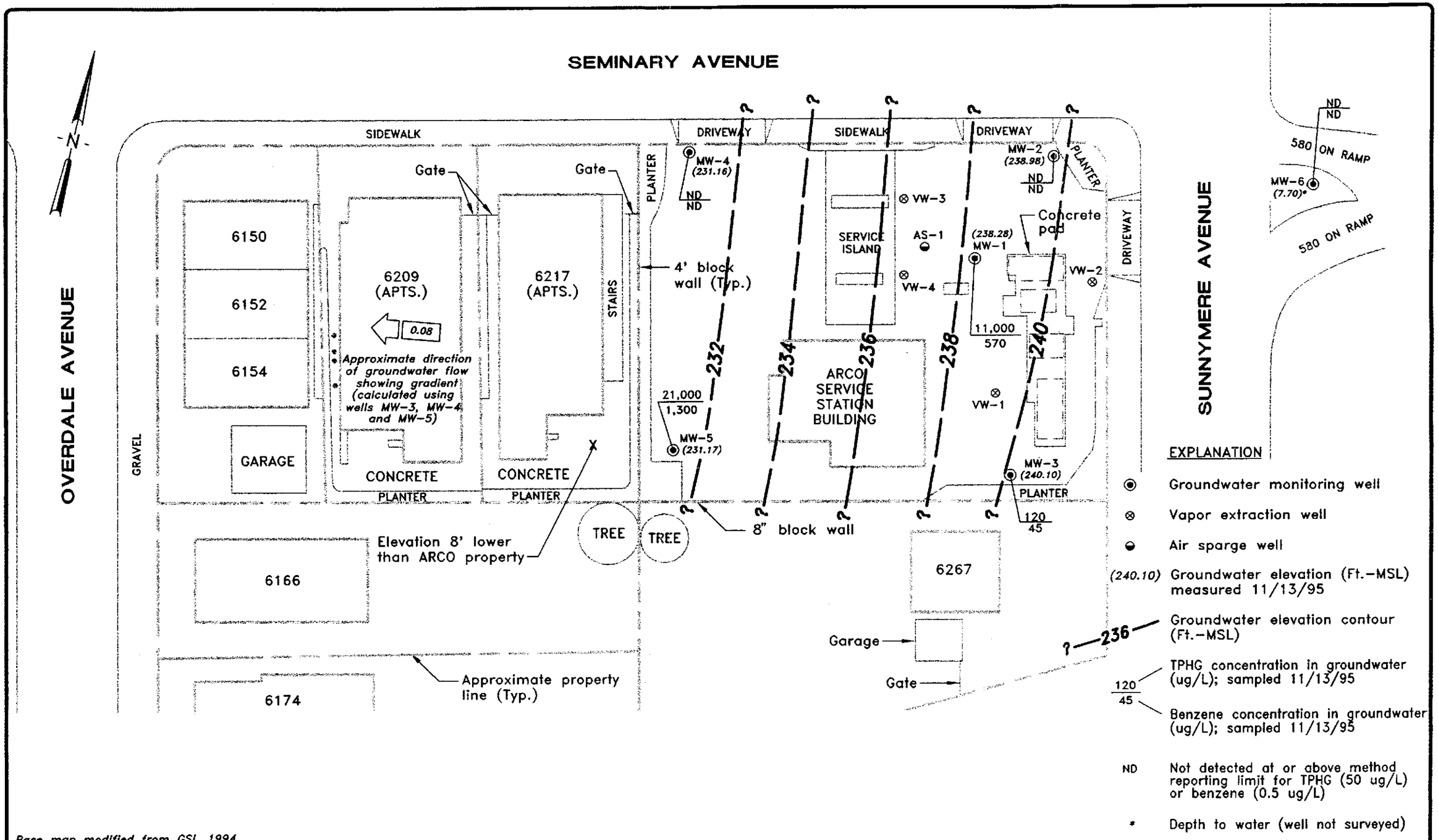


EMCON

ARCO PRODUCTS COMPANY
SERVICE STATION 6002, 6235 SEMINARY AVE.
OAKLAND, CALIFORNIA

RISK-BASED CORRECTIVE ACTION PLAN
PROCESS FLOWCHART

FIGURE
3
PROJECT NO.
805-131.07



EXPLANATION

- ⊙ Groundwater monitoring well
- ⊗ Vapor extraction well
- ◒ Air sparge well
- (240.10) Groundwater elevation (Ft.–MSL) measured 11/13/95
- Groundwater elevation contour (Ft.–MSL)
- 120 / 45 TPHG concentration in groundwater (ug/L); sampled 11/13/95 / Benzene concentration in groundwater (ug/L); sampled 11/13/95
- ND Not detected at or above method reporting limit for TPHG (50 ug/L) or benzene (0.5 ug/L)
- * Depth to water (well not surveyed)

Base map modified from GSI, 1994.

emcon

SCALE: 0 30 60 FEET

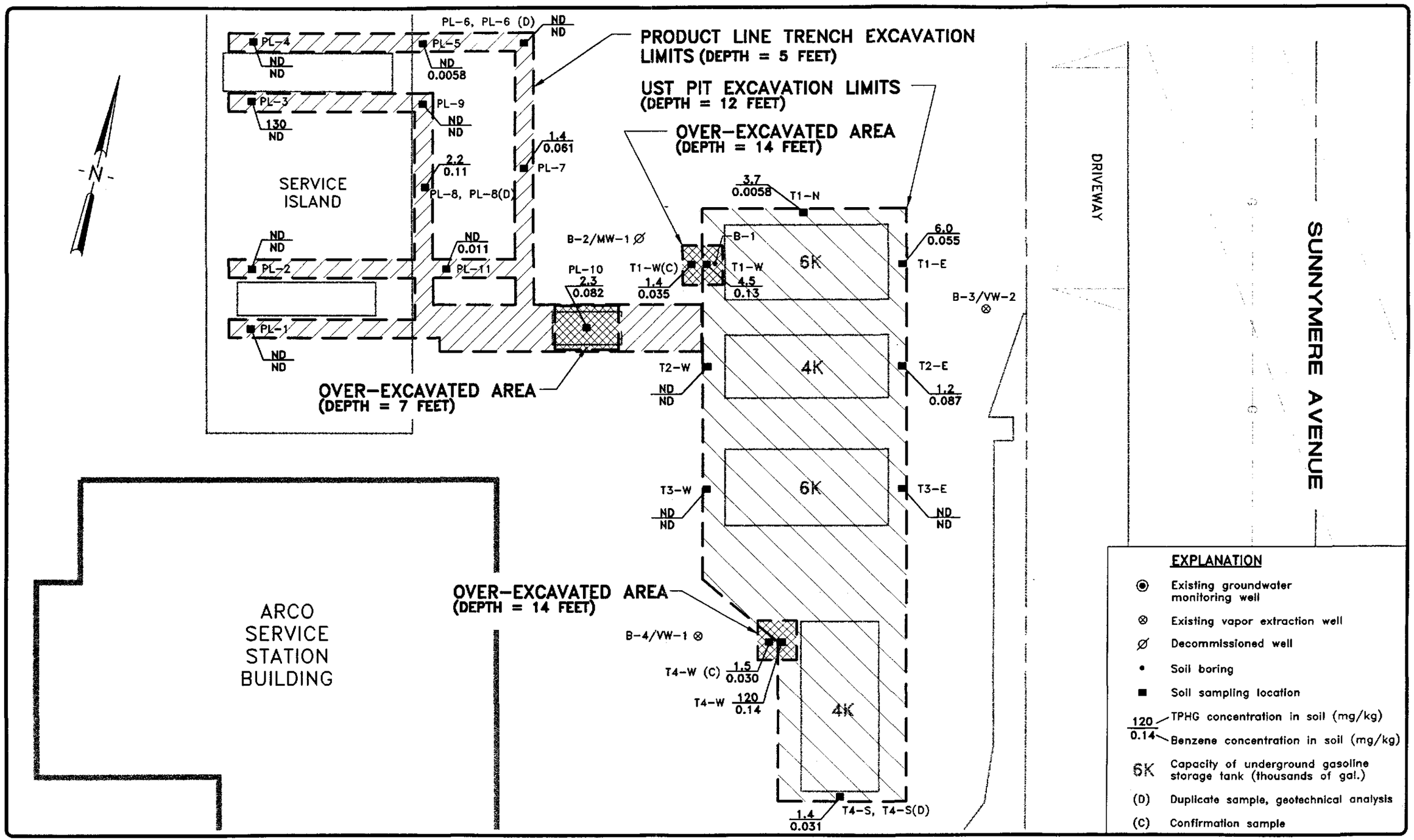
ARCO PRODUCTS COMPANY
SERVICE STATION 6002, 6235 SEMINARY AVE.
QUARTERLY GROUNDWATER MONITORING
OAKLAND, CALIFORNIA

GROUNDWATER DATA
FOURTH QUARTER 1995

FIGURE NO. 4

PROJECT NO. 805-131.07

G:\805-131\GWCHEM REV 0 02/14/96 16:07:08 KAJ DJ



EMCON

SCALE: 0 10 20 FEET

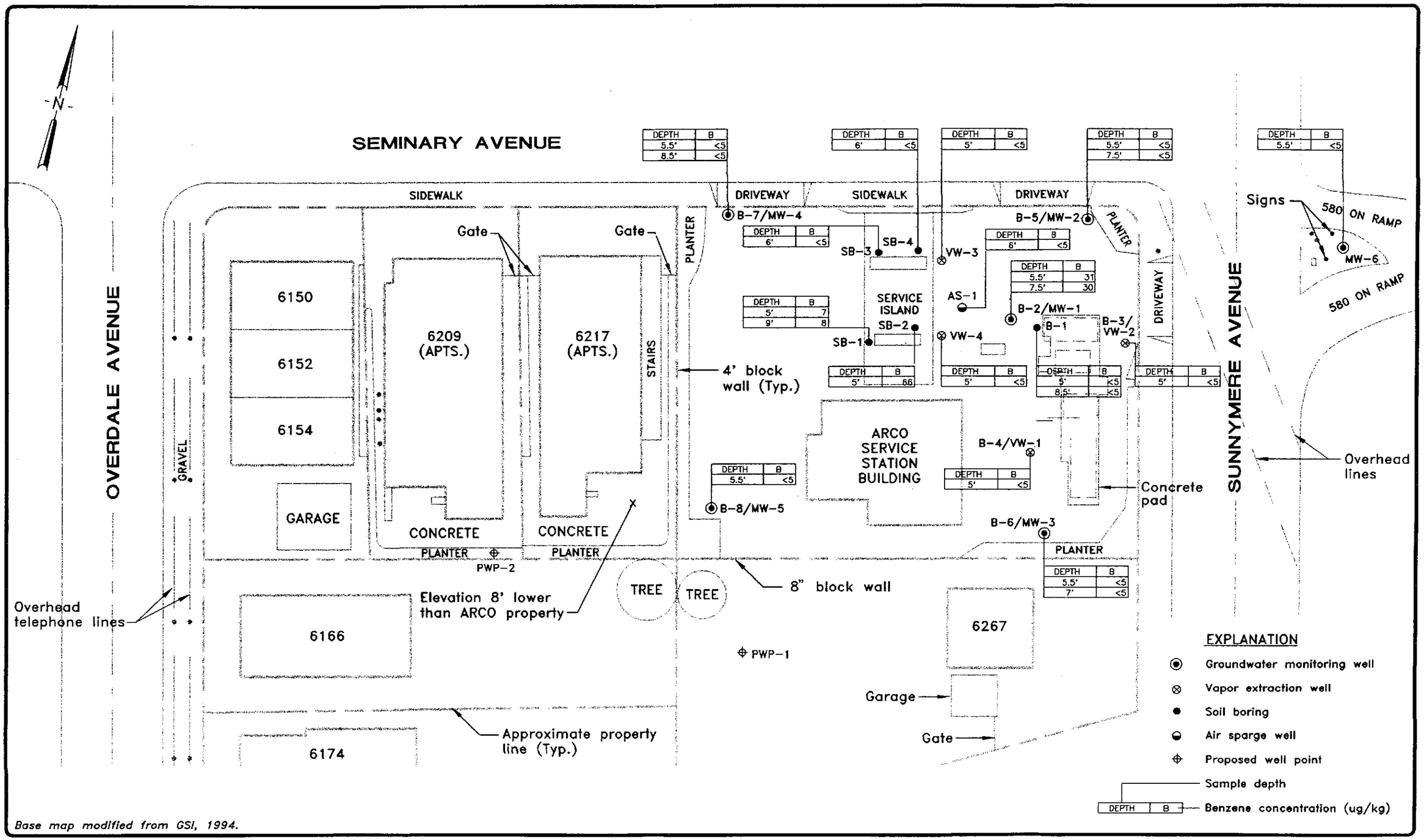
ARCO PRODUCTS COMPANY
SERVICE STATION 6002, 6235 SEMINARY AVE.
UNDERGROUND STORAGE TANK REMOVAL
OAKLAND, CALIFORNIA

TPHG AND BENZENE CONCENTRATIONS WITHIN EXCAVATION

FIGURE NO. 5

PROJECT NO. 805-131.007

G:\805-131\EXCTPHG REV 0 05/14/96 11:12:43 kmm DJ



Base map modified from GSI, 1994.

EMCON

SCALE: 0 30 60 FEET

ARCO PRODUCTS COMPANY
SERVICE STATION 6002, 6235 SEMINARY AVE.
OAKLAND, CALIFORNIA

BENZENE CONCENTRATIONS IN SUBSURFACE SOIL (3 TO 9 FEET BGS)

FIGURE NO.
6
PROJECT NO.
805-131.07

G:\805-131\BENZ REV 0 03/26/96 09:14:38 DD DJ

Site Name: ARCO 6002 | Date Completed: 3/26/96

Site Location: 6235 Seminary Ave., Oakland, CA | Completed By: EMCON

TIER 1 EXECUTIVE SUMMARY CHECKLIST

VISUAL/HISTORICAL ASSESSMENT	(■ TO SELECT)		
Site size (acres)	■ <1	❑ <10	❑ >10
Site setting	❑ undeveloped	■ industrial	❑ residential
Site access	■ capped	❑ fenced-in	❑ open
Visual evidence of environmental impact	■ none	❑ limited	❑ extensive
Current site land use	❑ undeveloped	■ indust./comm.	❑ residential
Contaminant sources	■ tanks/spills	❑ trench/drums	❑ ponds/pits
Affected environmental media	■ soil (>3 ft BGS)	■ groundwater	❑ surficial soil (≤3 ft BGS)
Types of compounds likely to be present	■ petroleum hydrocarbons		❑ metals
	❑ inorganic (nitrates)		❑ other:(pesticides)

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

TIER 1 TASKS COMPLETED

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

TIER 1 CLASSIFICATION EVALUATION

Classification No.	Scenario Description	Prescribed Interim Action	Date Implemented
3	Residual BTEX in soil following tank and piping removal. Dissolved BTEX in groundwater. Potential exposure via volatilization to indoor and ambient air.	Evaluate under Tier 2.	2/16/1996

TIER 1 CORRECTIVE ACTION CRITERIA

	Screening Level Criteria Exceeded? (■ if yes)						
Affected Medium	Risk-Based	Other (MCL)	Others: (specify)	_____	_____	_____	None Exceeded
• Surface Soil (< 3ft BGS)	❑	❑	❑	❑	❑	❑	❑
• Subsurface Soil (>3ft BGS)	❑	❑	❑	❑	❑	❑	❑
• Groundwater (potable/nonpotable)	■	❑	❑	❑	❑	❑	❑
• Surface waters	❑	❑	❑	❑	❑	❑	❑

NOTES: (List and discuss chemicals for which a Tier 1 exceedance is found.)

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.

Site Name: ARCO 6002 | Date Completed: 3/26/1996

Site Location: Oakland, Callfomia | Completed By: EMCON | *Page 1 of 1*

TIER 2 EXECUTIVE SUMMARY CHECKLIST

TIER 2 SSTL CALCULATION METHOD (■ OR ● TO SELECT)

SSTL Calculation Option

- ■ Option 1: Site-Specific Screening Levels
- ❑ Option 2: Individual Constituent SSTL Values
- ❑ Option 3: Cumulative Constituent SSTL Values

NAF Calculation Method

- ❑ Fate and Transport Modeling:
  - ○ RBCA Spreadsheet System
  - ○ Other Model(s)
- ❑ Empirical NAF Calculation

SITE DATA INVENTORY

Source Zone Investigation Complete:

- ❑ Surface Soil (e.g., ≤ 3 ft BGS)
- ■ Subsurface Soil (e.g., > 3 ft BGS)
- ■ Groundwater

Exposure Pathway Information Compiled:

- ■ Air Pathway
- ■ Groundwater Pathway
- ■ Soil Pathway
- ❑ Surface Water Pathway
- ■ Land Use Classification (on-site and off-site)

TIER 1 WORKSHEETS 1.3 - 4.2 AND 5.2 - 5.6 HAVE BEEN UPDATED TO INCLUDE NEW TIER 2 INFORMATION.

TASKS COMPLETED

- ■ Tier 1 Evaluation
- ❑ Tier 1 Interim Corrective Action
- ■ Tier 2 Evaluation
- ❑ Tier 2 Interim Corrective Action
- ❑ Tier 2 Final Corrective Action
- ❑ Tier 3 Evaluation

CURRENT SITE CLASSIFICATION

Classification No.	Scenario Description	Prescribed Interim Action	Date Implemented
4	Residual BTEX in soil and groundwater following removal of tank and piping.	Continue monitoring	3/26/1996

TIER 2 CORRECTIVE ACTION CRITERIA

Affected Medium	Tier 2 SSTL Exceeded ?		Applicable Excess Risk Limits (specify value)				Other Applicable Exposure Limit
	Yes	No	Indiv. Risk	Total Risk	Hazard Index	Hazard Quotent	*(specify, if any)*
• Surface Soil (≤ 3ft BGS)	❑	❑					
• Subsurface Soil (>3ft BGS	❑	■	1.0E-05			1	
• Groundwater	❑	■	1.0E-05			1	

PROPOSED ACTION

- ■ ***No Action:*** Tier 2 SSTLs not exceeded. Apply for closure.
- ❑ ***Interim Corrective Action:*** Address principal, near-term risks sources.
- ❑ ***Final Corrective Action:*** Remediate/control site to meet Tier 2 criteria.
- ❑ ***Tier 3 Evaluation:*** Improve baseline risk and SSTL estimates.

NOTE:

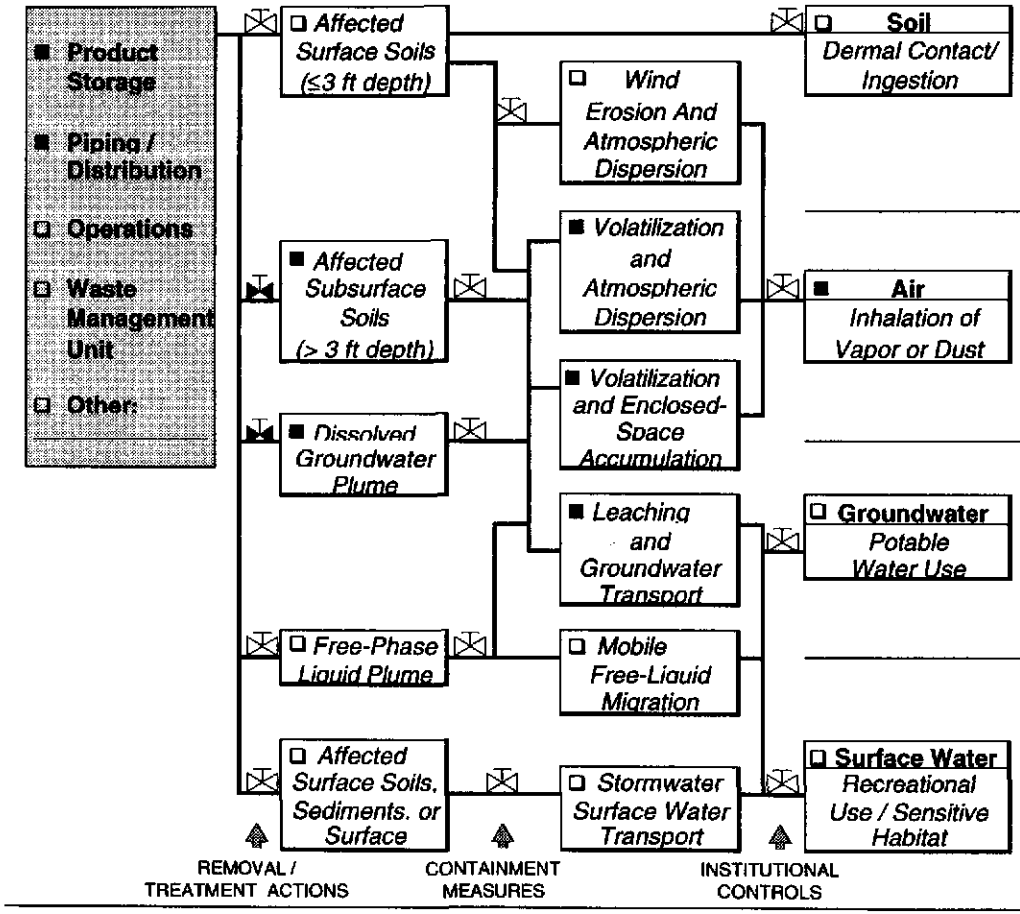
Rationale for proposed action documented on Worksheets 1.3 and 10.1-10.3.

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

Site Name: ARCO 6002
Site Location: Oakland, California
Date Completed: 3/26/1996
Completed By: EMCON

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

Exposed Receptors
On-Site: □ Residential □ Non-Resid. ■ N/A; □ Sensitive Habitat □ Recreation
Off-Site: □ Residential □ Non-Resid. ■ N/A; □ Sensitive Habitat □ Recreation

Exposed Persons
On-Site: □Residential ■ Non-Resid. □ N/A
Off-Site: □ Residential □ Non-Resid. □ N/A

Groundwater Users
On-Site: □Residential □ Non-Resid. ■ N/A
Off-Site: □Residential □ Non-Resid. ■ N/A

Surface Water Users
On-Site: □ Residential □ Non-Resid. ■ N/A; □ Sensitive Habitat □ Recreation
Off-Site: □ Residential □ Non-Resid. ■ N/A; □ Sensitive Habitat □ Recreation

REMEDIAL ACTION TECHNOLOGY OPTIONS

□ Complete Pathway: ○ *Current* ○ *Potential*
⋈ Action Required: □Yes ■ No
If yes, list technology options for ⋈:

□ Complete Pathway: ○ *Current* ○ *Potential*
⋈ Action Required: □Yes ■ No
If yes, list technology options for ⋈:

□ Complete Pathway: ○ *Current* ○ *Potential*
⋈ Action Required: □Yes ■ No
If yes, list technology options for ⋈:

□ Complete Pathway: ○ *Current* ○ *Potential*
⋈ Action Required: □Yes ■ No
If yes, list technology options for ⋈:

(■ OR ● OR ⋈ TO SELECT)

Site Name: ARCO 6002 | Date Completed: 3/26/1996

Site Location: Oakland, California | Completed By: EMCON

SITE DESCRIPTION

Location Description (see Figure 1)

Address: 6235 Seminary Ave., Oakland, California

Cross-Street: Sunnymere Ave.

City: Oakland

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: Juliet Chin

Agency: Regional Water Quality Control Board, San Francisco Bay Region

Contact: Kevin Graves

3) Other Involved Parties:

(■ *TO SELECT*) ❑ Consent order ❑ Lawsuit

Discussion:

Local Land Use (See Figure 2) — **Other Comments:**

(■ *TO SELECT*)

Discuss options for listed items (including anticipated future use)

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

Topography (See Figures 1 and 3) — **Other Comments:**

Terrain ■ Flat ❑ Steep ❑ Variable

Site Elevation Interval (ft-MSL)

High Pt. 249 Low Pt. 243

Average Ground Surface Slope

Direction west Grade (ft/ft)

Local Climate — **Other Comments:**

Average Annual Rainfall (in): 20

Annual Average Evapotranspiration (in):

Within 100 Year Floodplain?: ❑ yes / ■ no

Summer Max Temp. Range (°F): 71 -74

Winter Max Temp. Range (°F): 56 - 64

Site Name: ARCO 6002 | Date Completed: 3/26/1996

Site Location: Oakland, California | Completed by: EMCON

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.*

PRIMARY SOURCES	SECONDARY SOURCES	TRANSPORT MECHANISMS	EXPOSURE PATHWAY	POTENTIAL RECEPTORS	COMPLETE PATHWAY?
■ Product Storage ■ Piping / Distribution ☐ Operations ☐ Waste Management Unit ☐ Other:	☐ Affected Surface Soils (≤3 ft depth)	☐ Wind Erosion and Atmospheric Dispersion	☐ Soil Dermal Contact/ Ingestion	**Exposed Receptors** On-Site: ☐ Residential ☐ Non-Resid. ■ N/A ☐ Sensitive Habitat ☐ Recreation Off-Site: ☐ Residential ☐ Non-Resid. ■ N/A ☐ Sensitive Habitat ☐ Recreation	■ No ☐ Yes ○ Current ○ Potential ■ No ☐ Yes ○ Current ○ Potential
	■ Affected Subsurface Soils (≥ 3 ft depth)	■ Volatilization and Atmospheric Dispersion	■ Air Inhalation of Vapor or Dust	**Exposed Persons** On-Site: ☐ Residential ■ Non-Resid. ☐ N/A Off-Site: ☐ Residential ☐ Non-Resid. ☐ N/A	☐ No ■ Yes ● Current ○ Potential ☐ No ☐ Yes ○ Current ○ Potential
	■ Dissolved Groundwater Plume	■ Volatilization and Enclosed-Space Accumulation			
		■ Leaching and Groundwater Transport	☐ Groundwater Potable Water Use	**Groundwater Users** On-Site: ☐ Residential ☐ Non-Resid. ■ N/A Off-Site: ☐ Residential ☐ Non-Resid. ■ N/A	■ No ☐ Yes ○ Current ○ Potential ■ No ☐ Yes ○ Current ○ Potential
	☐ Free-Phase Liquid Plume	☐ Mobile Free-Liquid Migration			
	☐ Affected Surface Soils, Sediments, or Surface Water	☐ Stormwater/ Surface Water Transport	☐ Surface Water Recreational Use / Sensitive Habitat	**Surface Water Users** On-Site: ☐ Residential ☐ Non-Resid. ■ N/A ☐ Sensitive Habitat ☐ Recreation Off-Site: ☐ Residential ☐ Non-Resid. ■ N/A ☐ Sensitive Habitat ☐ Recreation	■ No ☐ Yes ○ Current ○ Potential ■ No ☐ Yes ○ Current ○ Potential

(■ OR ● TO SELECT)

Site Name: ARCO 6002 Date Completed: 3/26/1996

Site Location: Oakland, California Completed By: EMCON

EXPOSURE FACTOR CHECKLIST

Instructions: • ***Tier 1 Evaluation:*** *Indicate use of either residential or commercial / industrial Reasonable Maximum Exposure (RME) factors at on-site points of exposure (POEs) for complete exposure pathways.* • ***Tier 2 Evaluation:*** *Indicate use of either a Reasonable Maximum Exposure (RME) factor or a site-specific exposure factor for both residential and commercial / industrial points of exposure (POEs), as appropriate for each exposure pathway. For Tier 2, data is required for Global Factors and for complete pathways only (see Worksheet 4.4).*

		RESIDENTIAL POE		COMMERCIAL/ INDUSTRIAL POE	
		RME	Site-Specific	RME	Site-Specific
GLOBAL FACTORS		(■ *TO SELECT*)			
AT_C	Averaging time for carcinogens	❑ 70 yrs	❑	■ 70 yrs	❑
AT_n	Averaging time for non-carcinogens	❑ = ED	❑	■ = ED	❑
BW	Body weight -Adult	❑ 70 kg	❑	■ 70 kg	❑
	-Child (1-6 yrs)	❑ 15 kg	❑	❑ NA	❑
ED	Exposure duration	❑ 30 yrs	❑	❑ 25 yrs	❑
AIR EXPOSURE FACTORS		■ COMPLETE (provide data)		❑ NOT COMPLETE (skip)	
EF	Exposure frequency (inhalation)	❑ 350 dy/yr	❑	■ 250 dy/yr	❑
IR_{ai}	Daily indoor inhalation rate	❑ 15 m^3/dy (24-hr/dy)	❑	■ 20 m^3/dy (8-hr/dy)	❑
IR_{ao}	Daily outdoor inhalation rate	❑ 20 m^3/dy (24-hr/dy)	❑	■ 20 m^3/dy (8-hr/dy)	❑
POTABLE WATER USE EXPOSURE FACTORS		❑ COMPLETE (provide data)		■ NOT COMPLETE (skip)	
EF	Exposure frequency (ingestion/showering)	❑ 350 dy/yr	❑	❑ 250 dy/yr	❑
IR_w	Daily water ingestion rate	❑ 2 L/dy (24-hr/dy)	❑	❑ 1 L/dy (8-hr/dy)	❑
EP_{sh}	Exposure period (showering)	❑ 12 min/dy	❑	❑ 12 min/day	❑
SA_w	Skin surface area (showering) -Adult (70 kg)	❑ 0.86 m^2	❑	❑ 0.86 m^2	❑
SOIL EXPOSURE FACTORS		❑ COMPLETE (provide data)		■ NOT COMPLETE (skip)	
EF	Exposure Frequency -Dermal Contact	❑ 350 dy/yr	❑	❑ 40 dy/yr	❑
	-Soil ingestion	❑ 350 dy/yr	❑	❑ 250 dy/yr	❑
SA_s	Skin surface area (soil contact) -Adult (18 to 31 yrs, 70 kg)	❑ 0.58 m^2	❑	❑ 0.58 m^2	❑
	-Child (1 - 17 yrs, 35 kg)	❑ 0.20 m^2	❑	❑ NA	❑
M	Soil to skin adherance factor	❑ 1.0 mg/cm^2	❑	❑ 1.0 mg/cm^2	❑
IR_s	Soil ingestion rate - Age-adjusted average	❑ 114 mg-yr /kg-dy	❑	❑ NA	❑
	-Adult (7 to 31 yrs, 70 kg)	❑ 100 mg/dy (24-hr/dy)	❑	❑ 50 mg/dy (8-hr/dy)	❑
	-Child (1 - 6 yrs, 15 kg)	❑ 200 mg/dy (24-hr/dy)	❑	❑ NA	❑
SURFACE WATER EXPOSURE FACTORS		❑ COMPLETE (provide data)		■ NOT COMPLETE (skip)	
EF	Exposure Frequency -Fish consumption	❑ 350 dy/yr	❑	❑ NA	❑
	-Swimming	❑ 7 dy/yr	❑	❑ NA	❑
IR_f	Daily fish intake rate -Freshwater	❑ 10 g/dy	❑	❑ NA	❑
	-Saltwater	❑ 15 g/dy	❑	❑ NA	❑
SA_w	Skin surface area (swimming) -Adult (70 kg)	❑ 0.86 m^2	❑	❑ NA	❑
EP_{sw}	Exposure period (swimming)	❑ 2.6 hrs/dy	❑	❑ NA	❑

Site Name: ARCO 6002 | Date Completed: 3/26/1996

Site Location: Oakland, California | Completed By: EMCON

TIER 2 EXPOSURE PATHWAY SCREENING

Instructions: *Exposure pathways screening involves the following steps:*

1) ***Source Medium:*** *Compare maximum constituent concentration in relevant source medium to applicable Tier 1 RBSL value for designated pathway.*

2) ***Transport Mechanism:*** *Transport is active at site if: a) relevant source medium is affected, b) exposure medium or receptor exists, and c) constituent transport from source to receptor could occur under current or anticipated future use.*

3) ***Exposure Medium:*** *For pathways under steady-state transport conditions (e.g., air), compare measured COC concentration at POE to applicable Tier 1 exposure limit for air, groundwater, or soil. Surface water concentrations should be compared to applicable state or federal water quality criteria.*

4) ***Complete Pathway:*** *For screening, pathway considered complete if "Yes" reported in Column A and either Column B or C.*

Notes:

RBSL = Risk-Based Screening Level

POE = Point of Exposure

COC = Constituent of Concern

NM = Not Measured

PATHWAY	A) SOURCE MEDIUM: Type	A) SOURCE MEDIUM: Pathway Tier 1 RBSL Exceeded?	B) TRANSPORT MECHANISM: Type	B) TRANSPORT MECHANISM: Active at Site?	C) EXPOSURE MEDIUM: Type	C) EXPOSURE MEDIUM: Exposure Limit Exceeded at POE?	COMPLETE PATHWAY? (Check if yes & specify status)
AIR EXPOSURE PATHWAYS (■ TO SELECT)							
1) *Surface Soils:* Vapor Inhalation and Dust Ingestion	Surface Soil	☐ Yes ■ No	Volatilization /Dust Transport	■ No ☐ Yes - Current ☐ Yes - Future	Ambient Air	■ NM ☐ No ☐ Yes	☐ Current ☐ Potential
2) *Subsurface Soils:* Volatilization to Ambient Air	Subsurface Soil	☐ Yes ■ No	Volatilization	☐ No ■ Yes - Current ■ Yes - Future	Ambient Air	■ NM ☐ No ☐ Yes	■ Current ☐ Potential
3) *Subsurface Soils:* Volatilization to Enclosed Space	Subsurface Soil	☐ Yes ■ No	Volatilization	■ No ☐ Yes - Current ☐ Yes - Future	Indoor Air	■ NM ☐ No ☐ Yes	☐ Current ☐ Potential
4) *Groundwater:* Volatilization to Ambient Air	Groundwater	☐ Yes ■ No	Volatilization	☐ No ■ Yes - Current ■ Yes - Future	Ambient Air	■ NM ☐ No ☐ Yes	■ Current ☐ Potential
5) *Groundwater:* Volatilization to Enclosed Space	Groundwater	■ Yes * ☐ No	Volatilization	☐ No ■ Yes - Current ■ Yes - Future	Indoor Air	■ NM ☐ No ☐ Yes	■ Current ☐ Potential
GROUNDWATER EXPOSURE PATHWAYS							
6) *Soil:* Leaching to Groundwater: Ingestion	Surface or Subsurface Soils	☐ Yes ■ No	Leaching /Groundwater Flow	■ No ☐ Yes - Current ☐ Yes - Future	Groundwater	■ NM ☐ No ☐ Yes	☐ Current ☐ Potential
7) ***Dissolved or Free-Phase Groundwater Plume:*** Ingestion	Groundwater	☐ Yes ■ No	Groundwater Flow	■ No ☐ Yes - Current ☐ Yes - Future	Groundwater	■ NM ☐ No ☐ Yes	☐ Current ☐ Potential
SOIL EXPOSURE PATHWAY							
8) *Surface Soils:* Dermal Contact /Ingestion	Surface Soil	☐ Yes ■ No	Direct Contact	■ No ☐ Yes - Current ☐ Yes - Future	Soil	■ NM ☐ No ☐ Yes	☐ Current ☐ Potential

Site Name: ARCO 6002 | Date Completed: 3/26/1996

Site Location: Oakland, California | Completed By: EMCON

TIER 2 EXPOSURE PATHWAY SCREENING *CONTINUED*

PATHWAY	A) SOURCE MEDIUM: Type	Pathway Tier 1 RBSL Exceeded?	B) TRANSPORT MECHANISM: Type	Active at Site?	C) EXPOSURE MEDIUM: Type	Exposure Limit Exceeded at POE?	COMPLETE PATHWAY? (Check if yes & specify status)
SURFACE WATER PATHWAYS							
9) *Soil:* Leaching to Groundwater /Discharge to Surface Water: Recreation or Fish	Surface or Subsurface Soils	☐ Yes ■ No	Leaching /Groundwater Flow	■ No ☐ Yes - Current ☐ Yes - Future	Surface Water	■ NM ☐ No ☐ Yes	☐ Current ☐ Potential
10) *Groundwater Plume:* Discharge to Surface Water: Recreation or Fish	Groundwater	☐ Yes ■ No	Groundwater Flow	■ No ☐ Yes - Current ☐ Yes - Future	Surface Water	■ NM ☐ No ☐ Yes	☐ Current ☐ Potential
11) *Soil :* Leaching to Stormwater / Discharge to Surface Water: Recreation or Fish	Surface Soils	☐ Yes ■ No	Overland Flow	■ No ☐ Yes - Current ☐ Yes - Future	Surface Water	■ NM ☐ No ☐ Yes	☐ Current ☐ Potential

Additional Information: ***Provide necessary background discussion for data provided above. Also, if ecological exposure pathway identified on Worksheet 3.5, identify relevant source medium, transport mechanism, exposure medium, and receptor type below.***

*

	RBSL Groundwater to -Indoor Air (mg/l)	RBSL Groundwater-to Ambient Air (mg/l)	Maximum Site Concentration (mg/l)
Benzene	2.14 E-01	5.34 E+00	4.9 E-01
Ethylbenzene	7.75 E+01	>6.80 E+02	5.2 E-01
Toluene	3.28 E+01	>5.20 E+00	5.7 E-02
Xylenes	>2.00 E+02	>2.00 E+00	1.5 E+00

	RBSL Soil-to-Ambient Air (mg/kg)	Maximum Site Concentration (mg/kg)
Benzene	1.33 E+00	1.1 E-01
Ethylbenzene	>1.00 E+06	2.1 E-01
Toluene	>1.00 E+06	1.5 E-01
Xylenes	>1.00 E+06	2.4 E-01

NOTE: RBSLs for benzene are for $1x10^{-5}$ risk level, and have been multiplied by 0.29 to account for Calfonia modified slope factor for benzene.

Site Name: ARCO 6002 | Date Completed: 3/26/1996

Site Location: Oakland, California | Completed By: EMCON

TIER 2 EXPOSURE SCENARIOS AND RISK GOALS

Instructions: ***For each exposure pathway, indicate i) Point of Exposure (POE) location (on-site, off-site, or both), ii) applicable exposure scenario at each POE (residential or commercial / industrial), and iii) applicable risk goals. Distance from source corresponds to shortest lateral distance to applicable POE from point of maximum COC concentration in source medium along possible migration pathway. Provide exposure limit information if applicable (e.g., OSHA Limits, MCLs, etc.).*** *(■ TO SELECT)*

EXPOSURE PATHWAY	DISTANCE FROM SOURCE	EXPOSURE SCENARIO AT POE	TARGET RKSKS AT POE: Individual Constituent Effects — Indiv. Risk	Individual Constituent Effects — HQ	Cumulative Constituent Effects — Additive Risk	Cumulative Constituent Effects — HI	Other Exposure Limit (specify if applicable)
AIR EXPOSURE PATHWAYS ■ COMPLETE (provide data) ❑ NOT COMPLETE (skip to next pathway)							
■ On-Site POE	0 ft	❑ Residential / ■ Commercial /Industrial	1e-5	1			❑ PEL/TLV
❑ Off-Site POE	NA* ft	❑ Residential / ❑ Commercial /Industrial	-	1			❑ PEL/TLV
GROUNDWATER EXPOSURE PATHWAYS ❑ COMPLETE (provide data) ■ NOT COMPLETE (skip to next pathway)							
❑ On-Site POE	ft	❑ Residential / ❑ Commercial /Industrial					❑ MCL
❑ Off-Site POE	ft	❑ Residential / ❑ Commercial /Industrial					❑ MCL
SOIL EXPOSURE PATHWAY ❑ COMPLETE (provide data) ■ NOT COMPLETE (skip to next pathway)							
❑ On-Site POE: (at source)		❑ Residential / ❑ Commercial /Industrial					❑
❑ Off-Site POE (at source)		❑ Residential / ❑ Commercial /Industrial					❑
SURFACE WATER EXPOSURE PATHWAYS ❑ COMPLETE (provide data) ■ NOT COMPLETE (skip to next pathway)							
❑ On-Site POE	ft	❑ Recreational / ❑ Ecological *(specify exp. limit only)*					❑
❑ Off-Site POE	ft	❑ Recreational / ❑ Ecological *(specify exp. limit only)*					❑

ADDITIONAL INFORMATION:

* Not applicable. This evaluation covers only on-site potential receptors. Potential off-site receptors will be addressed in a seperate evaluation.

Site Name: ARCO 6002 | Date Completed: 3/26/1996
Site Location: Oakland, California | Completed By: EMCON

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	■	clayey sand	*§
Θ_T	Soil porosity	☐ 0.38 (dim)	■	0.3	§? Should be 0.35?
Θ_{ws}	water content - vadose zone	☐ 0.12 (dim)	■	0.17	§
Θ_{as}	air content - vadose zone (= Θ_T - Θ_{ws})	☐ 0.26 (dim)	■	0.13	
Θ_{wcap}	water content - capillary fringe	☐ 0.342 (dim)	■	0.25	
Θ_{acap}	air content - capillary fringe (= Θ_T - Θ_{wcap})	☐ 0.038 (dim)	■	0.05	
ρ_s	Soil density	☐ 1.7 g/cm^3	■	1.72	§
foc	mass fraction of organic carbon in soil	☐ 0.01 (dim)	■	0.002	§
Ls	Depth to contaminated soil	☐ 100 cm	■	152 cm	§
Lgw	Depth to groundwater	☐ 300 cm	■	290 cm	§
h_{cap}	capillary zone thickness	☐ 5 cm	■	30.5 cm	
hv	vadose zone thickness (= Lgw - hc)	☐ 295 cm	■	259 cm	
pH	Soil/water pH	■ 6.5	☐		
Groundwater Parameters					
I	Water infiltration rate	☐ 30 cm/yr	☐		§
V_{gw}	groundwater velocity	☐ 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	■	1,765,100 cm^2	
W	Width of Contaminated Area	☐ 1500 cm	■	762 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)	■	0.005	
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}	☐		

Site Name: ARCO 6002 Date Completed: 3/26/1996

Site Location: Completed By: EMCON

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.
• _____		❑ ❑	❑ ❑	❑ ❑	❑ ❑	❑ ❑	❑ ❑
• _____		❑ ❑	❑ ❑	❑ ❑	❑ ❑	❑ ❑	❑ ❑
• _____		❑ ❑	❑ ❑	❑ ❑	❑ ❑	❑ ❑	❑ ❑
• _____		❑ ❑	❑ ❑	❑ ❑	❑ ❑	❑ ❑	❑ ❑

DISCUSSION OF MEDIA INVESTIGATION & CHEMICAL ANALYSES

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

Items

Site Name: ARCO 6002 | Date Completed: 3/26/1996

Site Location: Oakland, California | Completed By: EMCON

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): 5 ft
- Depth to base of affected soil (ft, BGS): 9.5 ft
- Maximum areal extent (ft^2): 1,900 ft^2

(Provide COC data on Worksheet 5.5)

AFFECTED GROUNDWATER

- ■ Present
- ❑ Not Present
- ❑ Not Measured

If present, complete the following:

- Maximum areal extent (ft^2): under investigation
- Length of plume (ft): under investigation
- Width of plume (ft): 100
- Depth to top of affected water-bearing unit (ft, BGS): 9.5 ft
- Depth to base of plume (ft, BGS): 13 - 15

(Provide COC data on Worksheet 5.6)

OTHER SOURCE MEDIUM

- ❑ Present
- ■ Not Present

If present, describe nature of material and dimensions:

(Provide COC data on separate table)

Site Name: ARCO 6002 Date Completed: 3/26/1996

Site Location: Oakland, California Completed By: EMCON

SUBSURFACE SOIL CONCENTRATION DATA SUMMARY (>3 FT BGS)

Instructions: ***Indicate type and concentrations of hazardous constituents detected in subsurface soil. Provide statistical data (maximum value, mean value, upper 90% confidence limit on mean) on detectable concentrations only. Do not include non-detects from outside of source zone. Select "representative concentration" value for comparison to cleanup standard (SSTL or RBSL) and calculation of baseline risk. Provide detailed lab data table(s) as Appendix A to this report.***

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)	
	Benzene	EPA 8020	0.005	40	16	1.1E-01	6.5E-03	9.3E-03	Max
	Ethyl benzene	EPA 8020	0.005	40	16	2.1E-01	6.1E-03	8.5E-03	Max
	Toluene	EPA 8020	0.005	40	9	1.5E-01	4.6E-03	6.2E-03	Max
	Xylenes	EPA 8020	0.005	40	12	2.4E-01	1.0E-02	1.6E-02	Max

Site Name: ARCO 6002
Site Location: Oakland, California
Date Completed: 3/26/1996
Completed By: EMCON

GROUNDWATER CONCENTRATION DATA SUMMARY

Instructions: ***Indicate type and concentrations of hazardous constituents detected in groundwater. Provide statistical data (maximum value, mean value, upper 90% confidence limit on mean) on detectable concentrations only. Do not include non-detects from outside of source zone. Select "representative concentration" value for comparison to cleanup standard (SSTL or RBSL) and calculation of baseline risk. Provide detailed lab data table(s) as Appendix A to this report.***

CONSTITUENTS DETECTED		ANALYTICAL METHOD		SAMPLE POPULATION		DETECTED CONCENTRATIONS			SELECTED REPRESENTATIVE CONC. (mg/L)
CAS No.	Name	Method No.	Typical Detection Limit (mg/l	No. of Samples	No. of Detects	Max Conc. (mg/L)	Mean Conc. (mg/L)	Upper 90%CL Conc. (mg/L)	
	Benzene	EPA 8020	0.005	*	*	4.9E-01	*	*	*
	Ethyl benzene	EPA 8020	0.005	*	*	5.2E-01	*	*	*
	Toluene	EPA 8020	0.005	*	*	5.7E-02	*	*	*
	Xylenes	EPA 8020	0.005	*	*	1.5E+00	*	*	*
	* most recent, maximum, upgradient value (VW-1)								

Site Name: ARCO 6002 Date Completed: 3/26/1996

Site Location: Oakland, California Completed By: EMCON

TIER 2 EXPOSURE PATHWAY TRANSPORT PARAMETERS

Instructions: ***For complete exposure pathways, provide site-specific values for transport parameters. In absence of direct measurements, default values may be selected for some parameters, as shown below. If no default value shown, site-specific value must be provided.***

TRANSPORT PARAMETER		SITE-SPECIFIC VALUE (INPUT VALUE BELOW)	DEFAULT VALUE (■ TO SELECT)
AIR PARAMETERS			
δ_{air}	Air mixing zone height (cm)		■ 200
U_{air}	Ambient air velocity in mixing zone (cm/sec)		■ 225
Pe	Soil particulate areal emission rate (g/cm^2-sec)		❑ 2.17E-10
σ_y	Transverse air dispersion coeff. (m)		■ 100
σ_z	Vertical air dispersion coeff. (m)		■ 10
GROUNDWATER PARAMETERS			
δ_{gw}	Groundwater mixing zone depth (cm)		❑ 200
I	Water infiltration rate (cm/yr)		❑ 30
V_{gw}	Groundwater Darcy velocity (ft/yr)		
K	Saturated hydraulic conductivity (cm/sec)		
i_{grad}	Lateral groundwater flow gradient (dim)		
$(BC)_i$	Available biodegradation capacity of electron acceptors for constituent *i*		
x	Distance to POE from point of maximum COC concentration in groundwater (ft)		
α_x	Longitudinal groundwater dispersion coeff. (cm)		❑ 10% of x
α_y	Transverse groundwater dispersion coeff. (cm)		❑ 33% of α_x
α_z	Vertical groundwater dispersion coeff. (cm)		❑ 5% of α_z
SOIL PARAMETERS			
h_{cap}	Capillary zone thickness (cm)	30.48	❑ 5
h_v	Vadose zone thickness (cm)	290	
ρ_s	Soil bulk density (g/cm^3)	1.71	❑ 1.7
foc_s	Fraction organic carbon in soil leaching zone (dir	0.002	❑ 0.01
foc_{gw}	Fraction organic carbon in water-bearing unit (di		❑ 0.001
Lgw	Depth to groundwater (cm)	290	
Θ_T	Soil porosity (dim)	0.3	❑ 0.38
	Soil volumetric watecr content (dim)		
Θ_{wcap}	• Capillary zone	0.25	❑ 0.342
Θ_{ws}	• Vadose zone	0.17	❑ 0.12
Θ_{wcrack}	• Foundation crack	0.17	❑ 0.12

RBCA SUMMARY REPORT	Worksheet 5.7

Site Name: ARCO 6002 Date Completed: 3/26/1996

Site Location: Oakland, California Completed By: EMCON

TIER 2 EXPOSURE PATHWAY TRANSPORT PARAMETERS *CONTINUED*

	TRANSPORT PARAMETER	SITE-SPECIFIC VALUE *(INPUT VALUE BELOW)*	DEFAULT VALUE (■ TO SELECT)	
SOIL PARAMETERS (Continued)				
	Soil volumetric air content (dim)			
Θ_{acap}	•Capillary zone	0.05	❑ 0.038	
Θ_{as}	•Vadose zone	0.13	❑ 0.26	
Θ_{acrack}	•Foundation crack	0.13	❑ 0.26	
d	Thickness of surficial soil zone (cm)		❑ 100 cm	
BUILDING PARAMETERS				
			Resid.	Comm/ Ind.
L_b	Building volume/area ratio (cm)		❑ 200	■ 300
ER	Building air exchange rate (dy^{-1})		❑ 12	■ 20
L_{crack}	Foundation crack thickness (cm)		❑ 15	■ 15
η	Foundation crack fraction	0.005	❑ 0.01	❑ 0.01

Additional Information:

0.31 ← adds up to 1 & not 0.3 refer to WkshtS.1

these values different from previous values where are these values from & what do they represent?

Columbia Analytical Services, Inc.

March 11, 1996

Service Request No: S9600350

Mr. John Young
EMCON
1921 Ringwood Avenue
San Jose, CA 95131

Re: **6002 Oakland / 20805-131.007 / TO#19350.00**

Dear Mr. Young:

The following pages contain analytical results for sample(s) received by the laboratory on March 1, 1996. Results of sample analyses are followed by Appendix A which contains sample custody documentation and quality assurance deliverables requested for this project. The work requested has been assigned the Service Request No. Listed above -- to help expedite our service please refer to this number when contacting the laboratory.

Analytical results were produced by procedures consistent with Columbia Analytical Services' (CAS) Quality Assurance Manual (with any deviations noted). Signature of this CAS Analytical Report below confirms that pages 2 through 7, following, have been thoroughly reviewed and approved for release in accord with CAS Standard Operating Procedure ADM-DatRev3.

Please feel welcome to contact me should you have questions or further needs.

Sincerely,

Steven L. Green
Project Chemist

Cristina V. Raykman for

Greg Anderson
Regional QA Coordinator

SLG/jk

COLUMBIA ANALYTICAL SERVICES, Inc.
Acronyms

A2LA	American Association for Laboratory Accreditation
ASTM	American Society for Testing and Materials
BOD	Biochemical Oxygen Demand
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
CAM	California Assessment Metals
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
COD	Chemical Oxygen Demand
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DLCS	Duplicate Laboratory Control Sample
DMS	Duplicate Matrix Spike
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
IC	Ion Chromatography
ICB	Initial Calibration Blank sample
ICP	Inductively Coupled Plasma atomic emission spectrometry
ICV	Initial Calibration Verification sample
J	Estimated concentration. The value is less than the MRL, but greater than or equal to the MDL. If the value is equal to the MRL, the result is actually <MRL before rounding.
LCS	Laboratory Control Sample
LUFT	Leaking Underground Fuel Tank
M	Modified
MBAS	Methylene Blue Active Substances
MCL	Maximum Contaminant Level. The highest permissible concentration of a substance allowed in drinking water as established by the U. S. EPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
MS	Matrix Spike
MTBE	Methyl tert-Butyl Ether
NA	Not Applicable
NAN	Not Analyzed
NC	Not Calculated
NCASI	National Council of the paper industry for Air and Stream Improvement
ND	Not Detected at or above the method reporting/detection limit (MRL/MDL)
NIOSH	National Institute for Occupational Safety and Health
NTU	Nephelometric Turbidity Units
ppb	Parts Per Billion
ppm	Parts Per Million
PQL	Practical Quantitation Limit
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
RPD	Relative Percent Difference
SIM	Selected Ion Monitoring
SM	Standard Methods for the Examination of Water and Wastewater, 18th Ed., 1992
STLC	Solubility Threshold Limit Concentration
SW	Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Ed., 1986 and as amended by Updates I, II, IIA, and IIB.
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TPH	Total Petroleum Hydrocarbons
tr	Trace level. The concentration of an analyte that is less than the PQL but greater than or equal to the MDL. If the value is equal to the PQL, the result is actually <PQL before rounding.
TRPH	Total Recoverable Petroleum Hydrocarbons
TSS	Total Suspended Solids
TTLC	Total Threshold Limit Concentration
VOA	Volatile Organic Analyte(s)

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	ARCO	**Service Request:**	S9600350
Project:	6002 Oakland / 20805-131.007/TO#19350.00	**Date Collected:**	3/1/96
Sample Matrix:	Water	**Date Received:**	3/1/96
		Date Extracted:	N/A

BTEX, MTBE and TPH as Gasoline
EPA Methods 5030/8020/California DHS LUFT Method
Units: ug/L (ppb)

		Sample Name:	**VW-1 (13)**	**Method Blank**
		Lab Code:	S9600349-004	S9600349MB
		Date Analyzed:	3/6/96	3/6/96
Analyte	**MRL**			
TPH as Gasoline	50		21000	ND
Benzene	0.5		490	ND
Toluene	0.5		57	ND
Ethylbenzene	0.5		520	ND
Total Xylenes	0.5		1500	ND
Methyl-tert-butyl ether	3		240	ND

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO
Project: 6002 Oakland / 20805-131.007 / TO#19350.00
Sample Matrix: Water

Service Request: S9600350
Date Collected: 3/1/96
Date Received: 3/1/96
Date Extracted: NA
Date Analyzed: 3/5-6/96

Surrogate Recovery Summary
BTEX and TPH as Gasoline
EPA Methods 5030/8020/California DHS LUFT Method

Sample Name	Lab Code	PID Detector Percent Recovery 4-Bromofluorobenzene	FID Detector Percent Recovery α,α,α–Trifluorotoluene
VW-1(13)	S9600350-001	100	105
Batch MS	S9600350-MS	90	110
Batch DMS	S9600350-DMS	100	112
Method Blank	S9600350-MB	91	98
CAS Acceptance Limits:		69-116	69-116

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	ARCO	**Service Request:**	S9600350
Project:	6002 Oakland / 20805-131.007/TO#19350.00	**Date Collected:**	3/1/96
Sample Matrix:	Water	**Date Received:**	3/1/96
		Date Extracted:	NA
		Date Analyzed:	3/5/96

Matrix Spike/Duplicate Matrix Spike Summary
TPH as Gasoline
EPA Methods 5030/California DHS LUFT Method
Units: ug/L (ppb)

Sample Name: Batch QC
Lab Code: S9600349-001

	Spike Level		Sample	Spike Result		Percent Recovery		CAS Acceptance	Relative Percent
Analyte	MS	DMS	**Result**	MS	DMS	MS	DMS	Limits	**Difference**
Gasoline	250	250	ND	250	250	100	100	67-121	<1

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: ARCO
Project: 6002 Oakland / 20805-131.007/TO#19350.00

Service Request: S9600350
Date Analyzed: 3/5/96

Initial Calibration Verification (ICV) Summary
BTEX and TPH as Gasoline
EPA Methods 5030/8020/California DHS LUFT Method
Units: ppb

Analyte	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits
Benzene	25	24.1	96	85-115
Toluene	25	24.0	96	85-115
Ethylbenzene	25	23.8	95	85-115
Xylenes, Total	75	72.6	97	85-115
Gasoline	250	256	102	90-110
MTBE	50	46.0	92	85-115

ARCO Products Company
Division of AtlanticRichfieldCompany

Task Order No. 19350.00

Chain of Custody

ARCO Facility no. 6002	City (Facility) Oakland	Project manager (Consultant) John Young	Laboratory name CAS
ARCO engineer Mike Whelan	Telephone no. (ARCO)	Telephone no. (Consultant) (408) 453-7300	Fax no. (Consultant) (408) 453-0452
Consultant name EMCON	Address (Consultant) 1921 Ringwood Ave, San Jose, CA 95131		Contract number

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Matrix: Water	Matrix: Other	Preservation: Ice	Preservation: Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH EPA M602/8020/8015	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals ☐ Semi VOA ☐ VOA ☐	CAM Metals EPA 6010/7060 TTLC ☐ STLC ☐	Lead Org./DHS ☐ Lead EPA 7420/7421 ☐		
VW-1 (13)	2	2		X		X	HCL	3-1-96	1445		X											

Special detection Limit/reporting: Lowest Possible

Special QA/QC: As Normal

Remarks: 2-40ml HCL VOAs

20805-131-007

Lab number: 59600350

Turnaround time

- Priority Rush 1 Business Day ☐
- Rush 2 Business Days ☐
- Expedited 5 Business Days ☐
- Standard 10 Business Days ☐

Condition of sample:

Temperature received:

	Date	Time		Date	Time
Relinquished by sampler	3-1-96	1646	Received by		
Relinquished by			Received by		
Relinquished by			Received by laboratory	3-1-96	1646

Distribution: White copy — Laboratory; Canary copy — ARCO Environmental Engineering; Pink copy — Consultant
APPC-3292 (2-91)

ARCO Products Company
Division of AtlanticRichfieldCompany

Task Order No. 19350.00

Chain of Custody

ARCO Facility no. 6002	City (Facility) Oakland	Project manager (Consultant) John Young	Laboratory name CHS
ARCO engineer Mike Whelan	Telephone no. (ARCO)	Telephone no. (Consultant) (408) 453-7300	Fax no. (Consultant) (408) 453-0452
Consultant name EMCON	Address (Consultant) 1921 Ringwood Ave, San Jose, CA 95131		Contract number

Sample I.D.	Lab no.	Container no.	Matrix: Soil	Matrix: Water	Matrix: Other	Preservation: Ice	Preservation: Acid	Sampling date	Sampling time	BTEX 602/EPA 8020	BTEX/TPH EPA M8020/8020/8015	TPH Modified 8015 Gas ☐ Diesel ☐	Oil and Grease 413.1 ☐ 413.2 ☐	TPH EPA 418.1/SM503E	EPA 601/8010	EPA 624/8240	EPA 625/8270	TCLP Metals ☐ Semi VOA ☐ VOA ☐	CAM Metals EPA 6010/7000 TTLC ☐ STLC ☐	Lead Org./DHS ☐ Lead EPA 7420/7421 ☐
VW-1(13)	2	2		X		X	HCL	3-1-96	1445		X									

Method of shipment: Sampler, Will deliver

Special detection Limit/reporting: Lowest Possible

Special QA/QC: As Normal

Remarks: 2-40ml HCL VOA's

20505-131-007

Lab number: 9600350

Turnaround time

- Priority Rush 1 Business Day ☐
- Rush 2 Business Days ☐
- Expedited 5 Business Days ☐
- Standard 10 Business Days ☐

Condition of sample:		Temperature received:	
Relinquished by sampler: Joe [illegible]	Date 3-1-96 Time 1646	Received by	
Relinquished by	Date Time	Received by	
Relinquished by	Date Time	Received by laboratory Joanne Brown	Date 3-1-96 Time 1646

Distribution: White copy — Laboratory; Canary copy — ARCO Environmental Engineering; Pink copy — Consultant
APPC-3292 (2-91)

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA 94063, (415) 364-9600, FAX (415) 364-9233
404 N. Wiget Lane, Walnut Creek, CA 94598, (510) 988-9600, FAX (510) 988-9673
819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

EMCON Associates
1921 Ringwood Avenue
San Jose, CA 95131

Attention: David Larsen

Client Proj. ID: Various

Lab Proj. ID: 9603B61

Sampled: 03/06/96
Received: 03/18/96
Analyzed: see below

Reported: 03/22/96

LABORATORY ANALYSIS

Analyte	Units	Date Analyzed	Detection Limit	Sample Results
Lab No: 9603B61-01 Sample Desc : **SOLID,T4-S**				
Organic Carbon : Total	**mg/Kg**	**03/22/96**	**50**	**1000**

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

Vytas Ankaitis
Project Manager

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA 94063, (415) 364-9600, FAX (415) 364-9233
404 N. Wiget Lane, Walnut Creek, CA 94598, (510) 988-9600, FAX (510) 988-9673
819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

EMCON Associates
1921 Ringwood Avenue
San Jose, CA 95131

Attention: David Larsen

Client Proj. ID: Various

Lab Proj. ID: 9603B61

Sampled: 03/08/96
Received: 03/18/96
Analyzed: see below

Reported: 03/22/96

LABORATORY ANALYSIS

Analyte	Units	Date Analyzed	Detection Limit	Sample Results
Lab No: 9603B61-02 Sample Desc : **SOLID,PL-6**				
Organic Carbon : Total	**mg/Kg**	**03/22/96**	**50**	**2100**
Lab No: 9603B61-03 Sample Desc : **SOLID,PL-8**				
Organic Carbon : Total	**mg/Kg**	**03/22/96**	**50**	**2600**

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL - ELAP #1210

Vytas Ankaitis
Project Manager

Sequoia Analytical

680 Chesapeake Drive, Redwood City, CA 94063, (415) 364-9600, FAX (415) 364-9233
404 N. Wiget Lane, Walnut Creek, CA 94598, (510) 988-9600, FAX (510) 988-9673
819 Striker Avenue, Suite 8, Sacramento, CA 95834, (916) 921-9600, FAX (916) 921-0100

EMCON Associates	Client Project ID:	Various		
1921 Ringwood Avenue	Matrix:	Solid		
San Jose, CA 95131				
Attention: David Larsen	Work Order #:	9603B61	01-03	Reported: Mar 23, 1996

QUALITY CONTROL DATA REPORT

Analyte:	Total Organic Carbon
QC Batch#:	IN0322969060TCA
Analy. Method:	EPA 9060
Prep. Method:	N.A.
Analyst:	Y. Arteaga
MS/MSD #:	9603B6103
Sample Conc.:	2600
Prepared Date:	3/22/96
Analyzed Date:	3/22/96
Instrument I.D.#:	TOC1
Conc. Spiked:	5000 mg/Kg
Result:	7200
MS % Recovery:	92
Dup. Result:	7400
MSD % Recov.:	96
RPD:	2.7
RPD Limit:	0-40

LCS #:	LCS032296
Prepared Date:	3/22/96
Analyzed Date:	3/22/96
Instrument I.D.#:	TOC1
Conc. Spiked:	2000 mg/Kg
LCS Result:	2000
LCS % Recov.:	100

MS/MSD LCS Control Limits	80-120

SEQUOIA ANALYTICAL

Vytas Ankaitis
Project Manager

Please Note:
The LCS is a control sample of known, interferent-free matrix that is analyzed using the same reagents, preparation, and analytical methods employed for the samples. The matrix spike is an aliquot of sample fortified with known quantities of specific compounds and subjected to the entire analytical procedure. If the recovery of analytes from the matrix spike does not fall within specified control limits due to matrix interference, the LCS recovery is to be used to validate the batch.

** MS=Matrix Spike, MSD=MS Duplicate, RPD=Relative % Difference

MOISTURE - DENSITY TEST

ASTM D2216

EMCON

PROJECT NAME: ARCO #6002 **DATE:** 3/19/96

PROJ. NUMBER: 0805-131.006 **TESTED BY:** DGC **CORRECTED BY:**

REFERENCE NUMBER:		1	2	3	4	5	6	7
DRILL HOLE NO.:								
SAMPLE NO.:		PL-6D	PL-8D	T4-SD				
DEPTH,	(feet)							
DIAMETER,	(inches)	1.92	1.92	1.92				
LENGHT,	(inches)	4	4	4				
VOLUME,	(cu. feet)	0.006702	0.006702	0.006702				
WATER CONTENT DETERMINATION:								
TARE NUMBER:		L-7	MW-4	Z-12				
WET WT. + TARE,	(gms.)	518.10	480.8	505.7				
DRY WT. + TARE,	(gms.)	460.80	423.5	451.5				
WT. OF TARE,	(gms.)	120.40	118.2	117.0				
WT. OF WATER,	(gms.)	57.30	57.30	54.20				
WT. OF DRY SOIL,	(gms.)	340.40	305.30	334.50				
WATER CONTENT,	(%)	16.8	18.8	16.2				
DENSITY DETERMINATION:								
TOTAL WET WT.,	(gms.)	397.7	362.6	388.7				
WET DENSITY	(pcf.)	130.8	119.3	127.9				
DRY DENSITY,	(pcf.)	112.0	100.4	110.0				

USCS and or Visual Classification:

1	CLAYEY SAND, DARK BROWN WITH GRAVELS.
2	CLAYEY SAND, DARK BROWN WITH GRAVELS.
3	CLAYEY SAND, BROWN.
4	
5	
6	
7	

NOTE:

δγχ93μχδδ