RISK ASSESSMENT
and CASE CLOSURE PETITION
2801 MacARTHUR BOULEVARD
OAKLAND, CALIFORNIA
SCI 838.003

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Prepared for:

Ms. Eva Chu
Hazardous Materials Specialist
Alameda County Health Care Services Agency
1131 Harbor Bay Parkway #250
Alameda, California 94502-6577

By:

Meg Mendoza
Project Engineer

Jeriann N. Alexander
Civil Engineer 40469 (expires 3/31/99)
Registered Environmental Assessor 03130 (expires 6/30/97)

REGISTERED PROFESSIONAL ENGINEER
JERIANN N. ALEXANDER
No. C040469
Exp. _____
CIVIL
STATE OF CALIFORNIA

REGISTERED ENVIRONMENTAL ASSESSOR
JERIANN N. ALEXANDER
NO. REA-03130
Expires: _____
STATE OF CALIFORNIA

Subsurface Consultants, Inc.
3736 Mt. Diablo Blvd., Suite 200
Lafayette, California 94549
(510) 299-7960

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EXECUTIVE SUMMARY

This assessment for 2801 MacArthur Boulevard was conducted to evaluate risks to human health and the environment resulting from petroleum hydrocarbons in soil and groundwater beneath the subject site. The primary objective of the assessment was to identify completed exposure pathways for the constituents of concern and evaluate their effects on potential receptors. For the given site setting and commercial property uses, as evaluated using the ASTM E 1739-95 "Standard Guide for Risk-Based Corrective Action at Petroleum Release Sites," there appear to be no significant risks to human and ecological receptors.

The property has been commercially developed since the early 1930's. Records indicate that the site was historically occupied by a gasoline service station. Currently, the station building is being used by an auto repair business. In May 1989, three underground gasoline storage tanks were removed from the site and approximately 435 cubic yards of impacted soil were excavated and removed. Studies indicate that soil and groundwater beneath the site have been impacted by previous petroleum releases. Data generated to date has adequately defined the impacted soil and groundwater conditions on-site in terms of source areas associated with the previous and current improvements. Risks associated with these on-site sources appear to pose no significant risk to human health nor the environment for the current site conditions.

I INTRODUCTION

This report presents a preliminary evaluation of risks to human health and ecological receptors conducted by Subsurface Consultants, Inc. (SCI) for the site located at 2801 MacArthur Boulevard, in Oakland, California. This study was performed to evaluate whether or not the site could be considered for closure in accordance with Alameda County Health Care Services Agency (ACHCSA) and Regional Water Quality Control Board (RWQCB) guidelines.

This evaluation was conducted in accordance with the American Society for Testing Materials (ASTM) E1739-95, "Standard Guide for Risk-Based Corrective Action (RBCA) at Petroleum Release Sites." This guide presents a tiered decision-making process for the assessment and response to a petroleum release, based on the protection of human health and the environment.

Through the RBCA process, Site Specific Target Levels (SSTLs) are established for soil and groundwater based on site specific hydrogeology (depth to groundwater, soil type, migration rates) and building environment (use, ratio of building volume to area, air exchange rates, type of use) parameters. SSTL's were evaluated for completed volatilization exposure pathways.

Environmental risks are evaluated by identifying ecological receptors and comparing site values of constituents of concern with guidance documents which present risk based screening levels (RBSLs) to protect these receptors.

II SITE USE HISTORY

A 1928 Sanborn File Insurance Company (Sanborn) map indicated that the site and adjacent parcels were residentially developed. The 1932 Sanborn map showed that the site was occupied by a service station with a different configuration from what currently exists. Tanks were located near the station building in clusters as shown on the Site Plan, Plate 1. Pipelines extended to a pump island located just west of the existing northern pump island. A 1953 site survey map obtained from the City of Oakland building department indicates a station building configuration similar to that which currently occupies the site (Plate 1).

In May 1989, three underground tanks and approximately 435 cubic yards of petroleum hydrocarbon impacted soil were removed from the site by others. Subsequent investigations by SCI and others show that soil and groundwater beneath the site have been impacted by gasoline range hydrocarbons and volatile constituents including benzene, toluene, ethylbenzene, and total xylenes (BTEX). Vadose zone soil contamination is localized to former tank and piping areas. In areas downgradient from the former tank areas, soil within the zone of groundwater fluctuation (approximately 20 to 30 feet below site grades) is impacted where it has been coincident with the dissolved contaminant plume.

No free ~~product has been observed~~ to date; however, a sheen has been observed in piezometer 2 (P-2). The dissolved contaminant plume has migrated up to 150 feet downgradient from the former tank area, as indicated by the appearance of petroleum hydrocarbons in monitoring well M-6 when it was installed in October 1994. Contaminant concentrations detected in samples from this well have decreased significantly since its installation. With the exception of total xylenes detected at 1

microgram per kilogram (ug/kg) during the April 1996 sampling event, neither TVH nor BTEX have been detected in monitoring well M-6 above laboratory reporting limits during four sequential quarterly monitoring events conducted between January and November 1996. Historic soil and groundwater analytical data are presented in Tables 1 and 2.

III SITE DESCRIPTION

The project site occupies the western portion of a parcel bounded by MacArthur Boulevard to the north, Coolidge Avenue to the west, Georgia Street to the south and residential properties to the east. Remnants of a former gasoline service station, including the station building, canopy and pump island occupy the western portion of the parcel. Currently, the station building is being used by an auto repair business. The eastern portion of the parcel is occupied by a strip mall shopping center. The remainder of the property is covered by asphalt concrete paved parking areas.

The site is located within an upland area near the western flank of the Oakland Hills. The topography of the area is characterized by rolling terraces incised by narrow drainage channels. Locally, the site is situated on a southwest trending terrace, comprised of varying gradations of sand and gravel in a clay matrix.

The site is commercially zoned. The surrounding properties are primarily commercial; however, residential structures exist southwest of the site, across Georgia Street.

IV HYDROGEOLOGIC CONDITIONS

The site is underlain by alluvial soils consisting of interlayered stiff to very stiff sandy clays and dense clayey sands and gravels. The study of site conditions began during drought conditions for the area. Historically, groundwater depths have varied from approximately 20 to 41 feet below the ground surface (bgs). Based on data from the past year, the groundwater depth ranges from approximately 20 to 35 feet bgs and the first water bearing zone exists approximately 20 to 30 feet bgs. It is likely that the current site conditions are representative of static conditions for the site.

Based on the historic groundwater data, the groundwater flow direction has been consistently to the south and southwest at a gradient varying from approximately 2 to 8 percent. Groundwater levels fluctuate approximately 5 to 10 feet seasonally. Groundwater recharge rates vary between individual wells and piezometers; however, overall the wells recharge relatively slowly. Historic groundwater elevation data is presented in Table 3. Groundwater contours and flow paths representing data collected in October 1996 are presented on the Groundwater Gradient Plan, Plate 2.

V BENEFICIAL USE

According to a report prepared by David Keith Todd Consulting Engineers, Inc. (1986), groundwater is not used as a drinking water source in this area. Additionally, groundwater is not used for any purpose at the site.

The potential for development of groundwater for municipal use is negligible due to low transmissivities of the aquifer, low storage capacity of the aquifer, and the potential for contamination from the densely urbanized location.

Based on a study by the California Regional Water Quality Control Board and the Alameda County Flood Control and Water Conservation District (1988), the closest well to the site lies approximately 1100 feet north-northwest of the site at the northwest corner of Laguna and Scenic Avenues. This well is used for industrial purposes. The total well depth is listed as 120 feet; no information regarding the depth to groundwater was listed. No other wells are known to exist within 2000 feet of the site.

Two branches of Peralta Creek exist as underground culverts approximately 600 feet from the site. The Curran Branch is located east of the site and the Laguna Branch is located west of the site. Given their distance from the site and regional topography, it is unlikely these drainages will be impacted by sources originating at the site.

VI HEALTH RISK ASSESSMENT METHODS AND ASSUMPTIONS

A. General

This risk assessment was performed in accordance with the procedures outlined in ASTM 1739-95. Following the reasoning outlined in the ASTM guidelines, benzene, toluene, ethylbenzene and total xylenes (BTEX) were the "indicator" compounds chosen to assess risks.

SSTLs were determined for BTEX by using the ASTM spreadsheet system developed by Groundwater System, Inc. (GSI), October 1995. The SSTLs for benzene have been corrected to reflect CALEPA's more stringent toxicity value.

For this assessment, future use scenarios were evaluated for commercial/industrial and residential usages. Based on site conditions, indoor and outdoor volatilization pathways appear to govern the risk assessment as the majority of shallow soils impacted by petroleum hydrocarbons have been removed from the site. Therefore, ingestion and dermal contact pathways were not evaluated. In addition, since groundwater has already been shown to be impacted, the leaching pathway is acknowledged as completed and does not warrant further evaluation.

B. Distribution of Contaminants

Based on studies performed to date, the distribution of contaminants can be divided into the categories described below.

1. Soil in Area of Boring B-9

Boring B-9 is located near the junction of one of the station's fuel conveyance pipeline alignments and a former waste oil tank. Vadose zone soils near boring B-9 are impacted by BTEX compounds from approximately 6 to 27 feet bgs. A study presented in Dragun (1988) indicates that lateral migration of petroleum hydrocarbons in unsaturated soil is limited to about 5 feet radially within a source area. For area B-9 this limited radial extent is verified by samples obtained following waste oil tank excavation and data from nearby borings. Modeling the area of impact as a circle with a 5-foot radius results in an impacted area equivalent to approximately 80 square feet.

2. **On-site Smear Zone Soils**

An area of impacted soil exists on-site coincident with the groundwater table. The smear zone varies in thickness and depth across the site. The smear zone is up to 10 feet thick in some locations. The top of the smear zone exists approximately 20 to 30 feet below the ground surface. Contaminants of concern within the smear zone include total volatile hydrocarbons as gasoline (TVH) and BTEX.

3. **Off-site Smear Zone Soils**

An area of impacted soil, as indicated by organic vapor readings of soil in the field and analyses of soil samples, was encountered in boring M-6 from a depth of 36 feet to the bottom of the borehole at 47 feet. The contaminants of concern include TVH and BTEX. Another off-site monitoring well, M-5 did not encounter soils impacted by petroleum hydrocarbons during drilling. The area of impacted soil in boring M-6 is below the groundwater surface elevation recorded for this well in the past year. Thus, the impacted soil is likely only exposed above the groundwater surface during drought conditions.

4. **Groundwater Plume**

A groundwater plume is located beneath the property. The contaminants of concern include TVH and BTEX. The plume limits appear to be within the property boundary as no petroleum hydrocarbons have been detected in off-site monitoring well M-5, located to the west, nor monitoring well M-3 located at the eastern property boundary. Additionally, during the past 4 quarterly events (January, April, July, and November 1996), the only contaminant of concern detected in off-site well MW-6 was total xylenes at 1 microgram per liter (ug/L) during the April 1996 event.

C. **Characterization of Contaminants of Concern**

Concentrations of contaminants of concern considered to be representative of a given area were determined as outlined herein.

1. **Soil in Area of Boring B-9**

The mean value of analytical test data for soil from boring B-9 collected between depths of 6.5 and 27 feet was averaged to obtain representative values of BTEX. Data from boring B-9 used to obtain this average is presented on Table 4.

2. **On-site Smear Zone Soils**

The zone of on-site soil contamination near the groundwater table was defined in the following manner. Initially, the lateral extent of the smear zone was determined to include sampling locations M-1, M-2, M-4, P-1, P-2, P-3, B-4, B-7, and B-11. Since boring B-9 is not considered representative of conditions at the site and has been evaluated separately, it was omitted from this analysis. Groundwater depths were then averaged for the last year. This mean depth to groundwater (29 feet) was used as the base elevation of the smear zone. The top of the smear zone was assumed to lie approximately 24 feet below the ground surface. This value was obtained by averaging the depths at which petroleum hydrocarbons were first encountered in the on-site borings and subtracting 5 feet to account for the possibility of impacted soils existing between this first detected impact and the previous non-detect sampling interval. Available soil data within this defined smear zone range (24 to 29 feet below the ground surface) was averaged to obtain a representative level for the BTEX compounds. The mean value was considered a conservative representation of site conditions as the top of the smear zone was assumed to exist 5 feet shallower than indicated by existing data and many of the detection limits used for non-detect results in the calculation are high. It should be noted that if the 5 foot

interval were not subtracted from depths to first encountered impacts to soil, then the top of the smear zone would coincide with the current groundwater table and the scenario of volatilization from impacted smear zone soils to the atmosphere would not be a completed pathway, and thus this exposure pathway would not be applicable. The data representing the on-site smear zone is presented on Table 4.

3. **Off-site Smear Zone Soils**

The zone of off-site soil contamination near the groundwater table was defined in a manner similar to the manner described above. As a result, it was shown that soils impacted by petroleum hydrocarbons at well M-6 have been below the groundwater table for the past year. Hence, for the purposes of this assessment, no impacts from off-site smear zone soils have been considered.

4. **Groundwater Plume**

Data from on- and off-site wells sampled during the last 2 years were averaged to obtain representative levels of BTEX compounds. Data from piezometer P-1 was not included because is was not sampled during this time period. Data from piezometer P-2 was not included because values obtained from this location are not considered representative of site conditions. It is likely that the source of petroleum hydrocarbon compounds detected in piezometer P-2 are from the impacted soils in the area of B-9. As discussed above, it is believed this area of impact is extremely limited and hence, not representative of average site conditions. Groundwater data for the past 2 years are presented on Table 5.

VII HEALTH RISK ASSESSMENT RESULTS

A. General

Various scenarios were evaluated using the data outlined in the preceding section. The RBCA program and worksheets prepared by GSI were used to complete the analyses. RBCA worksheets and output results are presented in the Appendix. Output results are summarized in Tables 6.

B. Soil Analysis

The results of the Tier 2 RBCA analyses indicate that the concentrations of BTEX in soil are below the respective SSTLs for a target risk level of 1×10^{-5}. The acceptable cancer risk range, as set by the U. S. Environmental Protection Agency, is 1×10^{-4} to 1×10^{-6}. For commercial use, a risk level of 1×10^{-5} is commonly used.

The results of this risk analysis has shown that for the residential structure located downgradient from the site, the impacted soil and groundwater do not pose a significant risk to human health. It should be acknowledged that during well installation no organic vapors were recorded for vadose zone soils in the wells located near the existing residential properties.

C. Groundwater Analysis

The results of the Tier 2 RBCA analyses indicate that the concentrations of BTEX in groundwater are below the SSTLs for a target risk level of 1×10^{-5}. A residential structure is not currently located on-site and the site is not zoned for residential use.

D. Conclusions

The results of the RBCA Tier 2 site analyses show that for current site conditions impacted soil and groundwater pose no significant risk to human health. However, if conditions at the property change (i.e., if another building were constructed over the area immediately surrounding B-9 or if the use of the property became residential), the potential for exposure of construction workers or building occupants exposed to vapors resulting from impacted soil and/or groundwater volatilization would need to be reevaluated.

It should be acknowledged that the conclusions presented herein are partially based on limited soil data generated as much as 7 years ago. Prior to site redevelopment, additional soil analyses should be conducted to determine current concentrations since it is very likely that natural attenuation has reduced contaminant levels. Tests performed in November 1995 to assess the biotreatability of the plume indicated naturally occurring hydrocarbon degrading bacteria were fluorishing in the area of monitoring well M-4 and were active in the area of piezometer P-2. Tests performed on groundwater samples collected from monitoring wells M-4 and M-6 in November 1996 did not detect the presence of hydrocarbon degrading bacteria. Additionally, a comparison of petroleum hydrocarbon concentrations detected in monitoring well MW-4 in November 1995 and April 1996 shows a decreasing trend. These results may indicate that the food source (petroleum hydrocarbons) for the bacteria has been depleted. Test results are presented in Table 7.

VIII ECOLOGICAL ASSESSMENT

The site is currently covered by a building and paved parking areas. There is no vegetation on-site and no known animals. There are no known ecological receptors on site.

Given that petroleum hydrocarbon impacted soils and groundwater are located well below the ground surface and the site is covered, the only potential for off-site ecological impact would be through movement of contaminants from groundwater to nearby surface waters.

The Curran and Laguna branches of Peralta Creek are located approximately 500 and 550 feet east and west of the site, respectively. The plume is localized to the site and has not migrated significantly to the east or west. Based on groundwater flow direction, current extent of plume, and topography of the area, it is judged that risks to ecological habitats are negligible.

IX CLOSURE PETITION

Based on a review of analytical data and the assessment of potential risks, the site does not appear to pose a significant threat to human health nor the environment under the current conditions. Site conditions are well understood as several subsurface environmental investigations have been conducted since 1989 to characterize the extent of impacts.

In accordance with the California Regional Water Quality Control Board Memorandum (1996) and the recommendations of the Lawrence Livermore National Laboratory study (1995), we judge that the site meets the specified criteria to qualify as a "low risk site" under the currently existing conditions. These criteria include the following:

- Underground storage tanks at the site have been removed.
- The site has been adequately characterized.
- Impacts to vadose zone soil are localized.
- The dissolved hydrocarbon plume is not migrating.
- No water wells, surface waters, or other sensitive receptors are likely to be impacted.
- The site presents no significant risk to human health.
- The site presents no significant risk to the environment.

On behalf of the APA Fund, SCI requests that the site be considered for closure.

X LIMITATIONS

The assessment described herein was intended to provide a preliminary means of evaluating the risks to human health and ecological receptors resulting from petroleum hydrocarbon impacted soil and groundwater beneath the subject site. The conclusions drawn from this assessment are an expression of our professional opinion, and do not constitute a warranty or guaranty, either expressed or implied. Additional investigative work may modify the conclusions presented herein, as additional information is generated.

SCI has performed this environmental assessment in accordance with generally accepted standards of care which exist in Northern California at the time of this study. The definition and evaluation of environmental conditions are difficult and inexact. Judgments leading to conclusions and recommendations are generally made with an incomplete knowledge of the subsurface and/or historic

conditions applicable to the property. In addition, the conclusions expressed herein reflect property conditions at the time of the assessment. These conditions may change with time, and as such, our conclusions may also change.

The conclusions and opinions presented herein may also be affected by rapid changes in the field of risk assessment. The reader is advised to consult with SCI prior to relying upon the information provided.

References

List of Tables

List of Illustrations

Appendix

Distribution

2 copies: Ms. Aniko Molnar
Environmental Consultant

1 copy: Mr. Nicholas Molnar
A.P.A. Fund, Ltd.

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Table 1
Hydrocarbon Concentrations in Groundwater

Sample Location	Sample Date	TVH (ug/l)	Benzene (ug/l)	Toluene (ug/l)	Ethyl-benzene (ug/l)	Xylenes (ug/l)
P-1	1/16/92	6,700	500	4.4	80	40
	3/9/93	5,600	1,100	29	63	120
P-2	11/6/90	33,000	4,700	2,100	380	630
	1/16/92	99,000	6,500	12,000	2,000	16,000
	3/9/93	70,000	5,900	11,000	2,100	12,000
	5/17/93	87,000	6,600	13,000	2,200	13,000
	8/17/93	80,000	5,800	12,000	2,000	12,000
	12/13/93	100,000	5,600	12,000	2,200	14,000
	3/7/94	77,000	5,100	11,000	2,000	12,000
	8/23/94	70,000	3,800	8,700	1,500	9,900
	4/27/95	44,000	3,600	8,500	1,500	9,300
	10/30/95	66,000	4,600	11,000	2,100	13,600
	4/17/96	58,000	4,800	9,900	1,900	12,900
P-3	8/17/93	900	180	65	10	93
	10/30/95	2000	650	45	31	156
M-2	5/7/91	16,000	1,300	950	170	890
	1/16/92	22,000	960	570	370	1,800
	3/9/93	27,000	1,100	970	490	1,400
	5/17/93	17,000	1,200	770	480	1,300
	8/17/93	20,000	1,700	910	540	1,400
	12/13/93	51,000	2,200	1,400	700	2,600
	3/7/94	28,000	1,400	900	640	1,800
	8/23/94	21,000	1,600	540	520	1,100
	4/26/95	14,000	1,200	510	490	870
	10/30/95	16,000	1,700	830	470	1,120
	4/17/96	10,000	1,300	610	380	810
M-3	5/17/93	<50	<0.5	<0.5	<0.5	<0.5
	8/17/93	<50	<0.5	<0.5	<0.5	<0.5
	12/13/93	<50	<0.5	<0.5	<0.5	<0.5
	3/7/94	<50	<0.5	<0.5	<0.5	<0.5
	8/23/94	<50	<0.5	<0.5	<0.5	<0.5
	4/27/95	<50	<0.5	<0.5	<0.5	<0.5

Table 1
Hydrocarbon Concentrations in Groundwater

Sample Location	Sample Date	TVH (ug/l)	Benzene (ug/l)	Toluene (ug/l)	Ethyl-benzene (ug/l)	Xylenes (ug/l)
M-4	5/17/93	7,500	1,200	230	11	350
	8/17/93	13,000	3,000	330	130	700
	12/13/93	11,000	2,700	190	90	360
	3/7/94	3,800	980	33	49	140
	8/23/94	19,000	5,800	200	460	630
	4/27/95	2,300	510	40	69	120
	11/1/95	1,100	470	14	23	26
	4/17/96	550*	330	<2.5	5.9	16.1
M-5	8/23/94	<50	<0.5	<0.5	<0.5	<0.5
	4/27/95	<50	<0.5	<0.5	<0.5	<0.5
	11/1/95	<50	<0.5	<0.5	<0.5	<0.5
	4/17/96	<50	<0.5	<0.5	<0.5	<0.5
M-6	10/11/94	3,600	340	27	65	240
	4/26/95	150	9.3	<0.5	5.6	1.7
	11/1/95	170	0.6	<0.5	<0.5	0.6
	1/22/96	<50	<0.5	<0.5	<0.5	<0.5
	4/17/96	<50	<0.5	<0.5	<0.5	1
	7/12/96	<50	<0.5	<0.5	<0.5	<0.5
	11/7/96	<50	<0.5	<0.5	<0.5	<0.5

TVH = Total volatile hydrocarbons, as gasoline
ug/l = Micrograms per liter = parts per billion
<50 = Analyte not present at a concentration above the stated detection limit.
* = Sample exhibits a fuel pattern which does not resemble the standard

Table 2
Hydrocarbon Concentrations in Soil

Sample Location	Sample Depth (feet)	Sample Date	Sampler	TPH-Gasoline (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethyl-Benzene (mg/kg)	Xylenes (mg/kg)	Oil & Grease (mg/kg)
B1	20.0-20.	6/12/89	Riedel	<1.0	<0.05	<0.1	<0.1	<0.1	--
B1	25.0-25.	6/12/89	Riedel	<1.0	<0.05	<0.1	<0.1	<0.1	--
B1	30.0-30.	6/12/89	Riedel	<1.0	<0.05	<0.1	<0.1	<0.1	--
B2	5.0-5.5	7/13/89	Riedel	<1.0	<0.05	<0.1	<0.1	<0.1	--
B2	10.0-10.	7/13/89	Riedel	<1.0	<0.05	<0.1	<0.1	<0.1	--
B2	15.0-15.	7/13/89	Riedel	<1.0	<0.05	<0.1	<0.1	<0.1	--
B2	20.0-20.	7/14/89	Riedel	<1.0	<0.05	<0.1	<0.1	<0.1	--
B2	25.0-25.	7/14/89	Riedel	<1.0	<0.05	<0.1	<0.1	<0.1	--
B2	30.0-30.	7/14/89	Riedel	<1.0	<0.05	<0.1	<0.1	<0.1	--
B2	5.0-358.	7/14/89	Riedel	<1.0	<0.05	<0.1	<0.1	<0.1	--
B3	5.0-5.5	7/13/89	Riedel	<1.0	<0.05	<0.1	<0.1	<0.1	--
B3	10.0-10.	7/13/89	Riedel	<1.0	<0.05	<0.1	<0.1	<0.1	--
B3	15.0-15.	7/13/89	Riedel	<1.0	<0.05	<0.1	<0.1	<0.1	--
B3	20.0-20.	7/14/89	Riedel	<1.0	<0.05	<0.1	<0.1	<0.1	--
B3	25.0-25.	7/14/89	Riedel	<1.0	<0.05	<0.1	<0.1	<0.1	--
B3	30.0-30.	7/14/89	Riedel	<1.0	<0.05	<0.1	<0.1	<0.1	--
B3	35.0-35.	7/14/89	Riedel	72	<0.05	<0.1	<0.1	<0.1	--
B3	38.0-38.	7/14/89	Riedel	<1.0	<0.05	<0.1	<0.1	<0.1	--
B3	39.5-40.	7/13/89	Riedel	<1.0	<0.05	<0.1	<0.1	<0.1	--
B3	41.0-41.	7/13/89	Riedel	<1.0	<0.05	<0.1	<0.1	<0.1	--
B3	42.0-42.	7/13/89	Riedel	<1.0	<0.05	<0.1	<0.1	<0.1	--
B4	5.0-5.5	7/14/89	Riedel	<1.0	<0.05	<0.1	<0.1	<0.1	--
B4	10.0-10.	7/14/89	Riedel	<1.0	<0.05	<0.1	<0.1	<0.1	--
B4	15.0-15.	7/14/89	Riedel	<1.0	<0.05	<0.1	<0.1	<0.1	--
B4	20.0-20.	7/14/89	Riedel	<1.0	<0.05	<0.1	<0.1	<0.1	--
B4	25.0-25.	7/14/89	Riedel	<1.0	<0.05	<0.1	<0.1	<0.1	--
B4	30.0-30.	7/14/89	Riedel	150	<0.25	<0.5	<0.5	<0.5	--
B4	35.0-35.	7/14/89	Riedel	5300	<5.0	<10.0	<10.0	<10.0	--
B4	36.5-37.	7/14/89	Riedel	7.9	<0.05	<0.1	<0.1	<0.1	--
B4	38.0-38.	7/14/89	Riedel	<1.0	<0.05	<0.1	<0.1	<0.1	--
B4	39.0-39.	7/14/89	Riedel	71	<0.25	<0.5	<0.5	<0.5	--
B4	40.5-41.	7/14/89	Riedel	15	<0.05	<0.1	<0.1	<0.1	--
B5	20.0-20.	8/24/89	Riedel	<10	<0.025	<0.025	<0.075	<0.075	--
B5	25.0-25.	8/24/89	Riedel	<10	<0.025	<0.025	<0.075	<0.075	--
B5	30.0-30.	8/24/89	Riedel	<10	<0.025	<0.025	<0.075	<0.075	--
B5	35.0-35.	8/24/89	Riedel	<10	<0.025	<0.025	<0.075	<0.075	--
B5	40.0-40.	8/24/89	Riedel	<10	<0.025	<0.025	<0.075	<0.075	--
B5	45.0-45.	8/24/89	Riedel	<10	<0.025	<0.025	<0.075	<0.075	--
B6	20.0-20.	8/24/89	Riedel	<10	<0.025	<0.025	<0.075	<0.075	--
B6	25.0-25.	8/24/89	Riedel	<10	<0.025	<0.025	<0.075	<0.075	--
B6	30.0-30.	8/24/89	Riedel	<10	<0.025	<0.025	<0.075	<0.075	--
B6	35.0-35.	8/24/89	Riedel	<10	<0.025	<0.025	<0.075	<0.075	--
B6	40.0-40.	8/24/89	Riedel	<10	<0.025	<0.025	<0.075	<0.075	--

Table 2
Hydrocarbon Concentrations in Soil

Sample Location	Sample Depth (feet)	Sample Date	Sampler	TPH-Gasoline (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethyl-Benzene (mg/kg)	Xylenes (mg/kg)	Oil & Grease (mg/kg)
B7	15.0-15.	8/24/89	Riedel	<10	<0.025	<0.025	<0.075	<0.075	--
B7	20.0-20.	8/25/89	Riedel	<10	<0.025	<0.025	<0.075	<0.075	--
B7	25.0-25.	8/25/89	Riedel	<10	<0.025	<0.025	<0.075	<0.075	--
B7	30.0-30.	8/25/89	Riedel	<10	0.13	<0.025	<0.075	<0.075	--
B7	33.0-33.	8/25/89	Riedel	380	<0.025	3	1	3.5	--
B7	36.0-36.	8/25/89	Riedel	65	<0.025	0.12	0.19	0.44	--
B7	41.0-41.	8/25/89	Riedel	<10	<0.025	<0.025	<0.075	<0.075	--
B7	45.5-46.	8/25/89	Riedel	<10	<0.025	<0.025	<0.075	<0.075	--
B7	51.0-51.	8/28/89	Riedel	<10	<0.025	<0.025	<0.075	<0.075	--
B8	15.0-15.	8/28/89	Riedel	<10	<0.025	0.097	<0.075	<0.075	--
B8	20.0-20.	8/28/89	Riedel	21	<0.025	0.19	0.36	0.63	--
B8	25.0-25.	8/28/89	Riedel	<10	<0.025	0.05	<0.075	<0.075	--
B8	30.0-30.	8/30/89	Riedel	<10	<0.025	<0.025	<0.075	<0.075	--
B8	35.5-36.	8/30/89	Riedel	<10	<0.025	0.13	0.15	0.26	--
B8	40.5-41.	8/30/89	Riedel	<10	<0.025	0.056	<0.075	<0.075	--
B8	45.0-45.	8/30/89	Riedel	<10	<0.025	<0.025	<0.075	<0.075	--
B8	50.0-50.	8/30/89	Riedel	<10	<0.025	0.222	<0.075	<0.075	--
B9	6.5-7.0	8/30/89	Riedel	20	0.026	0.46	<0.075	0.2	--
B9	9.5-10.0	8/30/89	Riedel	<10	<0.025	<0.025	<0.075	<0.075	--
B9	16.5-17.	8/30/89	Riedel	490	0.7	0.61	2	15	--
B9	21.0-21.	8/30/89	Riedel	1500	4.1	3.4	14	62	--
B9	26.5-27.	8/30/89	Riedel	1100	3	28	13	68	--
B9	31.5-32.	8/30/89	Riedel	79	0.35	0.8	0.61	2	--
B9	35.0-35.	8/30/89	Riedel	<10	0.39	0.13	<0.075	0.2	--
B9	40.5-41.	8/30/89	Riedel	<10	<0.025	0.043	<0.075	<0.075	--
B9	45.5-46.	8/30/89	Riedel	<10	<0.025	0.066	<0.075	<0.075	--
B9	51.0-51.	8/30/89	Riedel	<10	0.31	0.046	<0.075	<0.075	--
B10	15.5-16	10/18/90	Streamborn	<2.5	<0.005	<0.005	<0.005	<0.075	<10
B10	21-21.5	10/18/90	Streamborn	<2.5	<0.005	<0.005	<0.005	<0.005	<10
B10	30.5-31	10/18/90	Streamborn	<2.5	<0.005	<0.005	<0.005	<0.005	<10
B10	45.5-46	10/18/90	Streamborn	<2.5	<0.005	<0.005	<0.005	<0.005	<10
B11	21-21.5	10/18/90	Streamborn	<2.5	<0.005	<0.005	<0.005	<0.005	<10
B11	31-31.5	10/18/90	Streamborn	230	0.15	0.47	0.88	1.6	<10
B11	36-36.5	10/18/90	Streamborn	<2.5	<0.005	<0.005	<0.005	<0.005	<10
B11	46-46.5	10/18/90	Streamborn	<2.5	<0.005	<0.005	<0.005	<0.005	<10
B12	28.5-29	4/28/93	SCI	<1	<0.005	<0.005	<0.005	<0.005	--
B12	30.5-31	4/28/93	SCI	<1	<0.005	<0.005	<0.005	<0.005	--
B12	34.5-35	4/28/93	SCI	<1	<0.005	<0.005	<0.005	<0.005	--
P1	25.5-26	10/19/90	Streamborn	<2.5	<0.005	<0.005	<0.005	<0.005	--
P1	35-35.5	10/19/90	Streamborn	7.4	0.011	<0.005	<0.005	<0.005	--
P1	40.5-41	10/19/90	Streamborn	<2.5	<0.005	<0.005	<0.005	<0.005	--

24-24H

Table 2
Hydrocarbon Concentrations in Soil

Sample Location	Sample Depth (feet)	Sample Date	Sampler	TPH-Gasoline (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethyl-Benzene (mg/kg)	Xylenes (mg/kg)	Oil & Grease (mg/kg)
P1	49.7-50.	10/19/90	Streamborn	<2.5	<0.005	<0.005	<0.005	<0.005	--
P2	20.5-21	10/19/90	Streamborn	<2.5	<0.005	<0.005	<0.005	<0.005	<10
P2	30-30.5	10/19/90	Streamborn	20	0.018	<0.005	<0.005	0.013	<10
P2	35.5-36	10/19/90	Streamborn	95	0.21	0.2	14	0.33	<10
P2	55.5-56	10/19/90	Streamborn	<2.5	<0.005	<0.005	<0.005	<0.005	<10
P3	35.5-36	3/18/91	Streamborn	990	5.8	24	11	20	--
P3	40.5-41	3/18/91	Streamborn	<1	<0.005	<0.005	<0.005	<0.005	--
M1	20.5-21	10/20/90	Streamborn	<2.5	<0.005	<0.005	<0.005	<0.005	<10
M1	25.5-26	10/20/90	Streamborn	<2.5	<0.005	<0.005	<0.005	<0.005	<10
M1	35.5-36	10/20/90	Streamborn	82	<0.005	0.019	0.028	0.026	<10
M1	45.5-46	10/20/90	Streamborn	<2.5	<0.005	<0.005	<0.005	<0.005	<10
M2	26-26.5	4/18/91	Streamborn	1.3	0.32	<0.005	0.04	0.036	--
M2	31-31.5	4/18/91	Streamborn	490	<0.005	0.41	3.4	7.5	--
M2	36-36.5	4/18/91	Streamborn	33	<0.005	0.072	0.099	0.094	--
M2	41-41.5	4/18/91	Streamborn	25	0.17	0.079	0.13	0.12	--
M2	46-46.5	4/18/91	Streamborn	<1	<0.005	<0.005	<0.005	<0.005	--
M3	22-22.5	4/28/93	SCI	<1	<0.005	<0.005	<0.005	<0.005	--
M3	27-27.5	4/28/93	SCI	<1	<0.005	<0.005	<0.005	<0.005	--
M3	30.5-31	4/28/93	SCI	<1	<0.005	<0.005	<0.005	<0.005	--
M4	31-31.5	4/27/93	SCI	<1	<0.005	<0.005	<0.005	<0.005	--
M4	33-33.5	4/27/93	SCI	130	0.43	0.49	2	4.5	--
M4	36-36.5	4/27/93	SCI	120	0.54	0.9	1.1	4.4	--
M4	39-39.5	4/27/93	SCI	<1	<0.005	<0.005	<0.005	<0.005	--
M5	29-29.5	7/26/94	SCI	<1	<0.005	<0.005	<0.005	<0.005	--
M6	36.5-37	7/28/94	SCI	330	<0.070	1.1	2.7	3	--
M6	39.5-40	7/28/94	SCI	300	0.66	0.78	4	5.8	--

Notes:
mg/kg = milligrams per kilogram
Riedel = Riedel Environmental Services, Inc.
SCI = Subsurface Consultants, Inc.
<1.0 = Analyte not present at a concentration above the stated detection limit

Table 3
Groundwater Elevation Data

Well	TOC[1] Elevation (feet)	Date	Groundwater Depth (feet)	Groundwater Elevation (feet)
M1	1000	10/24/90	36.1	963.9
		10/25/90	36.1	963.9
		11/2/90	36.4	963.6
		11/6/90	36.8	963.2
		11/16/90	36.8	963.2
		11/23/90	36.9	963.1
		11/28/90	37.0	963.0
		12/5/90	37.2	963.0
		3/18/91	35.8	964.2
		3/29/91	32.4	967.6
		4/3/91	31.9	968.1
		4/9/91	31.6	968.4
		4/16/91	31.2	968.8
		1/23/92	35.5	964.5
		3/9/93	29.1	970.9
		6/1/93	27.5	972.9
		12/13/93	33.9	966.1
		3/7/94	32.3	967.7
		8/23/94	32.3	967.7
		10/11/94	34.1	965.9
		4/26/95	24.4	975.6
		10/27/95	31.3	968.7
		1/22/96	31.1	968.9
		4/15/96	25.6	974.4
		7/10/96	27.7	972.3
		10/25/96	32.3	967.7
M2	999.6	4/30/91	31.1	968.5
		5/7/91	31.3	968.3
		1/16/92	35.1	964.5
		3/9/93	33.6	966.0
		5/17/93	27.2	972.4
		6/1/93	27.6	972.0
		8/17/93	30.4	969.2
		12/13/93	34.0	965.6
		3/7/94	30.1	969.5

Table 3
Groundwater Elevation Data

Well	TOC[1] Elevation (feet)	Date	Groundwater Depth (feet)	Groundwater Elevation (feet)
M2		8/23/94	32.3	967.3
		10/11/94	34.2	965.4
		4/26/95	24.4	975.2
		10/27/95	31.4	968.2
		1/22/96	31.2	968.4
		4/15/96	25.6	974.0
		7/10/96	27.8	971.8
		10/25/96	33.3	966.3
M3	992.8	5/17/93	22.2	970.6
		6/1/93	23.3	969.5
		8/17/93	25.0	967.8
		12/13/93	25.8	967.0
		3/7/94	23.1	969.7
		8/23/94	25.8	967.0
		10/11/94	27.4	965.4
		4/26/95	19.6	973.2
		10/27/95	25.4	967.4
		1/22/96	24.2	968.6
		4/15/96	20.9	971.9
		7/10/96	22.9	969.9
		10/25/96	25.9	966.9
M4	999.6	5/17/93	33.8	965.8
		6/1/93	32.5	965.7
		12/13/93	36.8	962.8
		3/7/94	33.0	966.6
		8/23/94	35.4	964.2
		10/11/94	37.1	962.5
		4/26/95	29.8	969.8
		10/27/95	34.2	965.4
		1/22/96	30.1	969.5
		4/15/96	30.1	969.5
		7/10/96	32.0	967.6
		10/25/96	34.2	965.4

Table 3
Groundwater Elevation Data

Well	TOC[1] Elevation (feet)	Date	Groundwater Depth (feet)	Groundwater Elevation (feet)
M5	992.9	8/23/94	31.8	961.1
		10/11/94	33.6	959.3
		4/26/95	20.5	972.4
		10/27/95	31.5	961.4
		1/22/96	25.6	967.3
		4/15/96	21.7	971.2
		7/10/96	26.8	966.1
		10/25/96	32.2	960.7
M6	997.7	8/23/94	41.2	956.6
		10/11/94	38.2	959.5
		4/26/95	27.8	969.9
		10/27/95	34.9	962.8
		1/22/96	22.0	975.7
		4/15/96	28.5	969.2
		7/10/96	32.6	965.1
		10/25/96	35.6	962.1
P1	999.6	10/24/90	37.9	961.7
		10/25/90	38.0	961.6
		11/2/90	38.4	961.2
		11/6/90	38.7	960.9
		11/16/90	38.3	961.3
		11/23/90	38.1	961.5
		11/28/90	38.3	961.3
		12/5/90	38.2	961.4
		3/18/91	37.8	961.8
		3/29/91	36.9	962.7
		4/3/91	36.8	962.8
		4/9/91	36.9	962.7
		4/16/91	36.7	962.9
		4/18/91	36.8	962.8
		4/30/91	36.3	963.3
		5/7/91	36.2	963.4
		1/16/92	36.6	963.0
		3/9/93	32.8	966.8

Table 3
Groundwater Elevation Data

Well	TOC[1] Elevation (feet)	Date	Groundwater Depth (feet)	Groundwater Elevation (feet)
P1		6/1/93	30.0	969.6
		12/13/93	33.7	965.9
		3/7/94	32.6	967.0
		8/23/94	32.7	966.9
		10/11/94	33.5	966.1
		4/26/95	27.6	972.0
		10/27/95	31.8	967.8
		1/22/96	33.3	966.3
		4/15/96	28.2	971.4
		7/10/96	29.3	970.3
		10/25/96	32.6	967.0
P2	997.8	10/24/90	41.1	956.7
		10/25/90	40.6	957.2
		11/2/90	38.4	959.4
		11/6/90	37.0	960.8
		11/16/90	37.4	960.4
		11/23/90	35.9	961.9
		11/28/90	35.4	962.4
		2/5/90	35.03	962.83
		3/18/91	31.43	966.43
		3/29/91	28.23	969.63
		4/3/91	26.83	971.03
		4/9/91	26.53	971.33
		4/16/91	26.53	971.33
		4/18/91	26.53	971.33
		4/30/91	26.73	971.13
		5/7/91	27.03	970.83
		1/16/92	33.73	964.13
		3/9/93	23.63	974.2
		5/17/93	23.73	974.1
		6/1/93	24.43	973.4
		8/17/93	28.33	969.5
		12/13/93	31.03	966.8
		3/7/94	25.43	972.4
		8/23/94	30.3	967.5

Table 3
Groundwater Elevation Data

Well	TOC[1] Elevation (feet)	Date	Groundwater Depth (feet)	Groundwater Elevation (feet)
P2		10/11/94	32.3	965.5
		4/26/95	19.9	977.9
		10/27/95	29.6	968.2
		1/22/96	27.4	970.4
		4/15/96	21.3	976.5
		7/10/96	25.0	972.8
		10/25/96	30.2	967.6
P3	999.1	3/29/91	24.7	974.4
		4/3/91	25.1	974
		4/9/91	25.9	973.2
		4/16/91	26.2	972.9
		4/18/91	26.2	972.9
		4/30/91	26.8	972.3
		5/7/91	27.4	971.7
		1/23/92	32.5	966.6
		3/9/93	24.8	974.3
		6/4/93	23.9	975.2
		8/17/93	28.5	970.6
		12/13/93	29.3	969.8
		3/7/94	25.0	974.1
		8/23/94	30.1	969
		10/11/94	32.0	967.1
		4/26/95	20.5	978.6
		10/27/95	27.8	971.3
		1/22/96	26.7	972.4
		4/15/96	21.4	977.7
		7/10/96	25.1	974.0
		10/25/96	31.0	968.1

Note 1 - Elevations relative to site-specific datum. Temporary Bench Mark No. 1, top of concrete at west corner of northernmost pump island. Assumed elevation of site specific datum is 1,000.0 feet.

Table 4
Hydrocarbon Concentrations in Vadose Zone Soil

Sample Location	Depth (feet)	Benzene (mg/kg)	Toluene (mg/kg)	Ethyl-benzene (mg/kg)	Xylenes (mg/kg)	Average Groundwater Depth for past year (feet)	Groundwater Depth Range for Past Year Minimum (feet)	Groundwater Depth Range for Past Year Maximum (feet)	Historic Groundwater Depth Ranges Minimum (feet)	Historic Groundwater Depth Ranges Maximum (feet)
B4	25	*0.05*	*0.10*	*0.10*	*0.10*	(approx. 29-31')				
B7	25	*0.025*	*0.025*	*0.075*	*0.075*	(approx. 30-31')				
B9	6.5	0.026	0.046	*0.075*	0.2	(approx. 26-28')				
B9	9.5	*0.025*	*0.025*	*0.075*	*0.075*					
B9	16.5	0.7	0.61	2	15					
B9	21	4.1	3.4	14	62					
B9	26.5	3	28	13	68					
B11						(approx. 29-30')				
P1	25.5	*0.005*	*0.005*	*0.005*	*0.005*	30.9	28.2	33.3	27.6	38.7
P2						26	21.3	30.2	19.9	41.1
P3	no shallow data available for P-3					26.1	21.4	31	20.5	32.5
M1	25.5	*0.005*	*0.005*	*0.005*	*0.005*	29.2	25.6	32.3	24.4	37.2
M2	26	0.32	*0.005*	0.04	0.036	29.5	25.6	33.3	24.4	35.1
M4						31.6	30.1	34.2	29.8	37.1

AREA B-9 REPRESENTATION (in mg/kg):

1.6	6.4	5.8	29.1
B	T	E	X

ON-SITE SMEAR ZONE REPRESENTATION (in mg/kg):

0.081	0.028	0.045	0.044
B	T	E	X

can these two be segregated and evaluated separately?

is this w/in 95% UCL?

Notes:
mg/kg = milligrams per kilogram
italicized value = Analyte not present at a concentration above the stated laboratory detection limit.

Table 5
Current Hydrocarbon Concentrations in Groundwater

Sample Location	Sample Date	Benzene (ug/l)	Toluene (ug/l)	Ethyl-benzene (ug/l)	Xylenes (ug/l)
P-2	4/27/95	3,600	8,500	1,500	9,300
	10/30/95	4,600	11,000	2,100	13,600
	4/17/96	4,800	9,900	1,900	12,900
P-3	10/30/95	650	45	31	156
M-2	4/26/95	1,200	510	490	870
	10/30/95	1,700	830	470	1,120
	4/17/96	1,300	610	380	810
M-3	4/27/95	*0.5*	*0.5*	*0.5*	*0.5*
M-4	4/27/95	510	40	69	120
	11/1/95	470	14	23	26
	4/17/96	330	*2.5*	5.9	16.1
M-5	4/27/95	*0.5*	*0.5*	*0.5*	*0.5*
	11/1/95	*0.5*	*0.5*	*0.5*	*0.5*
	4/17/96	*0.5*	*0.5*	*0.5*	*0.5*
M-6	4/26/95	9.3	*0.5*	5.6	1.7
	11/1/95	0.6	*0.5*	*0.5*	0.6
	1/22/96	*0.5*	*0.5*	*0.5*	*0.5*
	4/17/96	*0.5*	*0.5*	*0.5*	1
	7/12/96	*0.5*	*0.5*	*0.5*	*0.5*
	11/7/96	*0.5*	*0.5*	*0.5*	*0.5*

Should other sample location be included to determine representative values is this within 95% UCL

GROUNDWATER PLUME REPRESENTATIVE VALUES (in ug/l):

415	119	85	191
B	T	E	X

Notes:
ug/l = micrograms per liter = parts per billion
italicized value = Analyte not present at a concentration above the stated detection limit.

Table 6
Commercial RBCA Calculations
Risk Factor = 10^{-5}

Applicable Exposure Pathway	Site Specific Target Level for Constituents of Concern		Representative On-Site Concentration
	Volatilization to Indoor Air Year-Round Exposure mg/kg	Volatilization to Outdoor Air Year-Round Exposure mg/kg	Values mg/kg
Subsurface Soil			
Area B-9			
Benzene	NA	154	1.6
Ethylbenzene	NA	>Res	5.8
Toluene	NA	>Res	6.4
Xylenes	NA	>Res	29.1
On-Site Smear Zone			
Benzene	0.29	73	0.08
Ethylbenzene	>Res	>Res	0.05
Toluene	120	>Res	0.03
Xylenes	>Res	>Res	0.04
Groundwater			
On-Site Groundwater	**mg/l**	**mg/l**	**mg/l**
Benzene	1.39	>Sol	0.42
Ethylbenzene	>Sol	>Sol	0.09
Toluene	>Sol	>Sol	0.12
Xylenes	>Sol	>Sol	0.19

Notes:

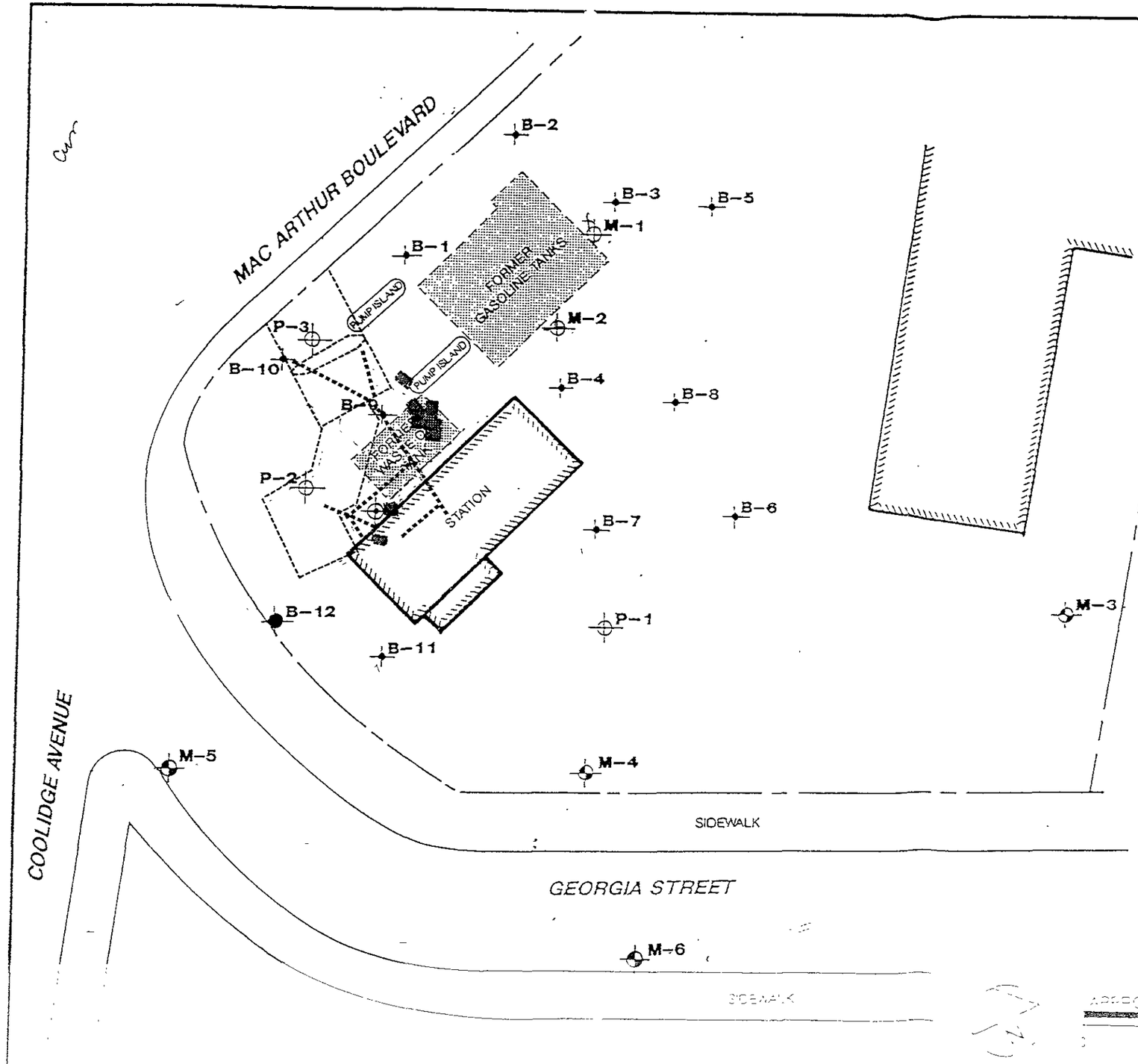
Site specific target levels for benzene have been corrected per EPA standards. for california
mg/kg = milligrams per kilogram
mg/l = milligrams per liter
>Res = site specific target level exceeds maximum soil saturation - therefore cannot be reached or exceeded.
>Sol = site specific target level exceeds pure solubility in groundwater - therefore cannot be reached or exceeded
NA = not applicable, exposure pathway not complete

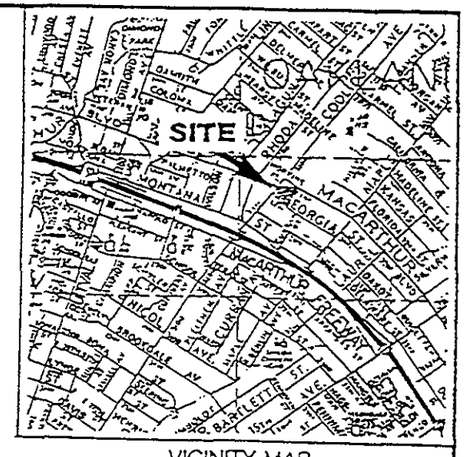
Table 7
Hydrocarbon-Degrading Bacteria Plate Enumeration Assay Results

Sample ID Number	Sample Date	Dissolved Oxygen (mg/l)	Ammonia (mg/l)	Nitrate (mg/l)	Phosphate (mg/l)	pH	Hydrocarbon Degraders (cfu/ml)
P-2	11/1/95	8.2-8.4	0.40	<0.01	0.40	8.7	$1.3x10^3$
M-4	11/1/95	3.0-4.0	0.25	<0.01	0.25	6.9	$1.2x10^5$
	11/7/96	3.4	0.4	0.0	0.0	7.09	$<1.5x10^2$
M-6	11/7/96	6.3	0.2	0.0	0.4	7.14	$<1.5x10^2$

Notes:

mg/l = milligrams per liter
cfu/ml = colony forming units per milliliter
<0.01 = Not detected above reporting limit stated





VICINITY MAP

- TEST BORING BY SCI
- MONITORING WELL BY SCI
- TEST BORING BY OTHERS
- MONITORING WELL BY OTHERS
- FORMER TANK EXCAVATION (1989)
- PROPERTY BOUNDARY
- EXISTING BUILDING
- PIPELINES REMOVED IN 1989
- CIRCA 1930–1950 STATION IMPROVEMENTS
- CIRCA 1930–1950 TANKS

APPROXIMATE SCALE 1"=60'

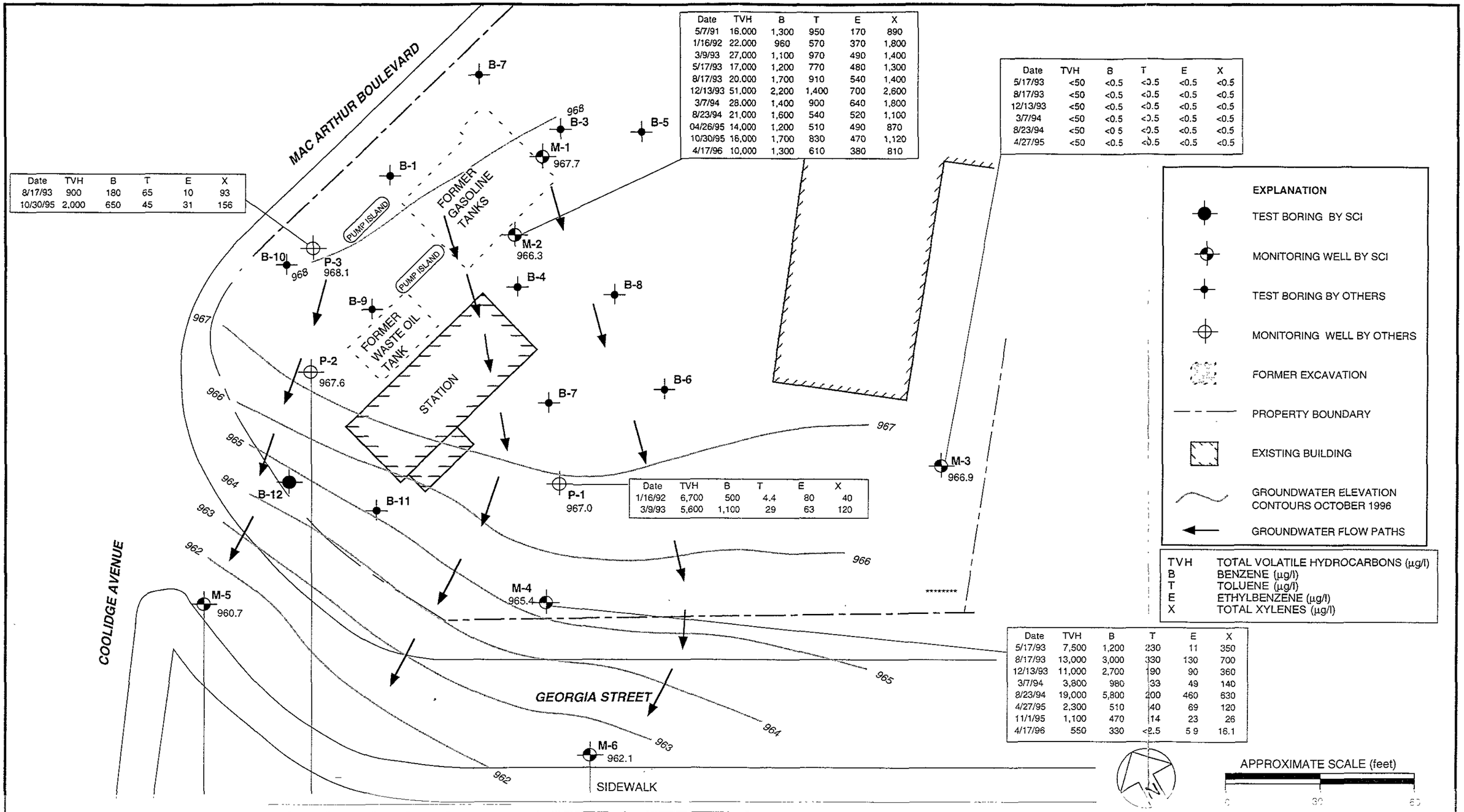
0 60 120

SITE PLAN

Subsurface Consultants

2811 MAC ARTHUR BLVD - OAKLAND CA

JOB NUMBER	DATE	APPROVED	PLATE
838003	1/9/97		1



Date	TVH	B	T	E	X
8/17/93	900	180	65	10	93
10/30/95	2,000	650	45	31	156

Date	TVH	B	T	E	X
5/7/91	16,000	1,300	950	170	890
1/16/92	22,000	960	570	370	1,800
3/9/93	27,000	1,100	970	490	1,400
5/17/93	17,000	1,200	770	480	1,300
8/17/93	20,000	1,700	910	540	1,400
12/13/93	51,000	2,200	1,400	700	2,600
3/7/94	28,000	1,400	900	640	1,800
8/23/94	21,000	1,600	540	520	1,100
04/26/95	14,000	1,200	510	490	870
10/30/95	16,000	1,700	830	470	1,120
4/17/96	10,000	1,300	610	380	810

Date	TVH	B	T	E	X
5/17/93	<50	<0.5	<0.5	<0.5	<0.5
8/17/93	<50	<0.5	<0.5	<0.5	<0.5
12/13/93	<50	<0.5	<0.5	<0.5	<0.5
3/7/94	<50	<0.5	<0.5	<0.5	<0.5
8/23/94	<50	<0.5	<0.5	<0.5	<0.5
4/27/95	<50	<0.5	<0.5	<0.5	<0.5

Date	TVH	B	T	E	X
1/16/92	6,700	500	4.4	80	40
3/9/93	5,600	1,100	29	63	120

Date	TVH	B	T	E	X
5/17/93	7,500	1,200	230	11	350
8/17/93	13,000	3,000	330	130	700
12/13/93	11,000	2,700	190	90	360
3/7/94	3,800	980	33	49	140
8/23/94	19,000	5,800	200	460	630
4/27/95	2,300	510	40	69	120
11/1/95	1,100	470	14	23	26
4/17/96	550	330	<2.5	5.9	16.1

GROUNDWATER GRADIENT PLAN OCTOBER 1996

Subsurface Consultants, Inc.
Geotechnical & Environmental Engineers

2801 MAC ARTHUR BLVD - OAKLAND CA

JOB NUMBER	DATE	APPROVED
838.003	11.22.96	

PLATE 2

APPENDIX

RBCA OUTPUT TABLES AND WORKSHEETS

RBCA SITE ASSESSMENT

Tier 2 Worksheet 9.2

Site Name: APA Fund/Comm./Area B-9
Site Location: 2801 MacArthur Blvd

Completed By: Meg Mendoza
Date Completed: 12/6/1996

Target Risk (Class A & B) 1.0E-5
Target Risk (Class C) 1.0E-5
Target Hazard Quotient 1.0E+0

☐ MCL exposure limit?
☐ PEL exposure limit?

Calculation Option: 1

SUBSURFACE SOIL SSTL VALUES (> 3 FT BGS)

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

CONSTITUENTS OF CONCERN		Representative Concentration	Soil Leaching to Groundwater			Soil Volatilization to Indoor Air		X Soil Volatilization to Outdoor Air		Applicable SSTL	SSTL Exceeded ?	Required CRF
CAS No.	Name	(mg/kg)	Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)	Residential: (on-site)	Commercial: (on-site)	Residential: (on-site)	Commercial: (on-site)	(mg/kg)	"■" If yes	Only if "yes" left
71-43-2	Benzene	0.0E+0	NA	NA	NA	NA	NA	NA	5.3E+2	5.3E+2	☐	<1
100-41-4	Ethylbenzene	0.0E+0	NA	NA	NA	NA	NA	NA	>Res	>Res	☐	<1
108-88-3	Toluene	0.0E+0	NA	NA	NA	NA	NA	NA	>Res	>Res	☐	<1
1330-20-7	Xylene (mixed isomers)	0.0E+0	NA	NA	NA	NA	NA	NA	>Res	>Res	☐	<1

Software: GSI RBCA Spreadsheet
Version: v 1.0

Serial: 0

530 x 0.29 = 154

For Area B-9 only

RBCA TIER 1/TIER 2 EVALUATION

Output Table 1

Site Name: APA Fund/Comm./Area B-9 Job Identification: 838.003
Site Location: 2801 MacArthur Blvd Date Completed: 12/6/96
Completed By: Meg Mendoza

Software: GSI RBCA Spreadsheet
Version: v 1.0

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

DEFAULT PARAMETERS

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

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

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

Matrix of Target Risks		Individual	Cumulative
TRab	Target Risk (class A&B carcinogens)	***1.0E-05***	
TRc	Target Risk (class C carcinogens)	1.0E-05	
THQ	Target Hazard Quotient	1.0E+00	
Opt	Calculation Option (1, 2, or 3)	1	
Tier	RBCA Tier	2	

Surface Parameters	Definition (Units)	Residential	Commercial/Industrial Chronic	Commercial/Industrial Construction
t	Exposure duration (yr)	30	25	1
A	Contaminated soil area (cm^2)	***7.3E+04***		***7.3E+04***
W	Length of affected soil parallel to wind (cm)	***3.0E+02***		***3.0E+02***
W gw	Length of affected soil parallel to groundwater (c	***9.1E+02***		
Uair	Ambient air velocity in mixing zone (cm/s)	2.3E+02		
delta	Air mixing zone height (cm)	2.0E+02		
Lss	Definition of surficial soils (cm)	1.0E+02		
Pe	Particulate areal emission rate (g/cm^2/s)	2.2E-10		

Groundwater	Definition (Units)	Value
delta.gw	Groundwater mixing zone depth (cm)	2.0E+02
I	Groundwater infiltration rate (cm/yr)	3.0E+01
Ugw	Groundwater Darcy velocity (cm/yr)	2.5E+03
Ugw.tr	Groundwater Transport velocity (cm/yr)	6.6E+03
Ks	Saturated Hydraulic Conductivity(cm/s)	
grad	Groundwater Gradient (cm/cm)	
Sw	Width of groundwater source zone (cm)	
Sd	Depth of groundwater source zone (cm)	
BC	Biodegradation Capacity (mg/L)	
BIO?	Is Bioattenuation Considered	FALSE
phi.eff	Effective Porosity in Water-Bearing Unit	3.8E-01
foc.sat	Fraction organic carbon in water-bearing unit	1.0E-03

Soil	Definition (Units)	Value		
hc	Capillary zone thickness (cm)	***9.1E+01***		
hv	Vadose zone thickness (cm)	***7.3E+02***		
rho	Soil density (g/cm^3)	1.7		
foc	Fraction of organic carbon in vadose zone	0.01		
phi	Soil porosity in vadose zone	0.38		
Lgw	Depth to groundwater (cm)	***8.2E+02***		
Ls	Depth to top of affected soil (cm)	***1.8E+02***		
Lsubs	Thickness of affected subsurface soils (cm)	***6.4E+02***		
pH	Soil/groundwater pH	6.5		
		capillary	vadose	foundation
phi.w	Volumetric water content	0.342	0.12	0.12
phi.a	Volumetric air content	0.038	0.26	0.26

Building	Definition (Units)	Residential	Commercial
Lb	Building volume/area ratio (cm)	2.0E+02	3.0E+02
ER	Building air exchange rate (s^-1)	1.4E-04	2.3E-04
Lcrk	Foundation crack thickness (cm)	1.5E+01	
eta	Foundation crack fraction	0.01	

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

RBCA SITE ASSESSMENT

Tier 2 Worksheet 9.2

Site Name: APA Fund/Com/on-site soil
Site Location: 2801 MacArthur Blvd

Completed By: Meg Mendoza
Date Completed: 7/29/1996

SUBSURFACE SOIL SSTL VALUES (> 3 FT BGS)

Target Risk (Class A & B) 1.0E-5
Target Risk (Class C) 1.0E-5
Target Hazard Quotient 1.0E+0

☐ MCL exposure limit?
☐ PEL exposure limit?

Calculation Option: 1

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

CONSTITUENTS OF CONCERN		Representative Concentration	☐ Soil Leaching to Groundwater			X Soil Volatilization to Indoor Air		X Soil Volatilization to Outdoor Air		Applicable SSTL	SSTL Exceeded ?	Required CRF
CAS No.	Name	(mg/kg)	Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)	Residential: (on-site)	Commercial: (on-site)	Residential: (on-site)	Commercial: (on-site)	(mg/kg)	"■" if yes	Only if "yes" left
71-43-2	Benzene	0.0E+0	NA	NA	NA	NA	1.0E+0	NA	2.5E+2	1.0E+0	☐	<1
100-41-4	Ethylbenzene	0.0E+0	NA	NA	NA	NA	>Res	NA	>Res	>Res	☐	<1
108-88-3	Toluene	0.0E+0	NA	NA	NA	NA	1.2E+2	NA	>Res	1.2E+2	☐	<1
1330-20-7	Xylene (mixed isomers)	0.0E+0	NA	NA	NA	NA	>Res	NA	>Res	>Res	☐	<1

Software: GSI RBCA Spreadsheet
Version: v 1.0
Serial: 0

1 x .29 = .29

250 x .29 = 73

APA4a.com

RBCA TIER 1/TIER 2 EVALUATION

Output Table 1

Site Name: APA Fund/Com/on-site soil
Site Location: 2801 MacArthur Blvd
Job Identification: 838.003
Date Completed: 7/29/96
Completed By: Meg Mendoza

Software: GSI RBCA Spreadsheet
Version: v 1.0

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

DEFAULT PARAMETERS

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

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

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

Matrix of Target Risks		Individual	Cumulative
TRab	Target Risk (class A&B carcinogens)	***1.0E-05***	
TRc	Target Risk (class C carcinogens)	1.0E-05	
THQ	Target Hazard Quotient	1.0E+00	
Opt	Calculation Option (1, 2, or 3)	1	
Tier	RBCA Tier	2	

Surface Parameters	Definition (Units)	Residential	Commercial/Industrial Chronic	Commercial/Industrial Construction
t	Exposure duration (yr)	30	25	1
A	Contaminated soil area (cm^2)	***9.2E+06***		***9.2E+06***
W	Length of affected soil parallel to wind (cm)	***2.7E+03***		1.0E+03
W gw	Length of affected soil parallel to groundwater (c	***1.1E+03***		
Uair	Ambient air velocity in mixing zone (cm/s)	2.3E+02		
delta	Air mixing zone height (cm)	2.0E+02		
Lss	Definition of surficial soils (cm)	1.0E+02		
Pe	Particulate areal emission rate (g/cm^2/s)	2.2E-10		

Groundwater	Definition (Units)	Value
delta gw	Groundwater mixing zone depth (cm)	2.0E+02
I	Groundwater infiltration rate (cm/yr)	3.0E+01
Ugw	Groundwater Darcy velocity (cm/yr)	2.5E+03
Ugw.tr	Groundwater Transport velocity (cm/yr)	6.6E+03
Ks	Saturated Hydraulic Conductivity(cm/s)	
grad	Groundwater Gradient (cm/cm)	
Sw	Width of groundwater source zone (cm)	
Sd	Depth of groundwater source zone (cm)	
BC	Biodegradation Capacity (mg/L)	
BIO?	Is Bioattenuation Considered	FALSE
phi eff	Effective Porosity in Water-Bearing Unit	3.8E-01
foc.sat	Fraction organic carbon in water-bearing unit	1.0E-03

Soil	Definition (Units)	Value		
hc	Capillary zone thickness (cm)	***6.1E+01***		
hv	Vadose zone thickness (cm)	***8.2E+02***		
rho	Soil density (g/cm^3)	1.7		
foc	Fraction of organic carbon in vadose zone	0.01		
phi	Soil porosity in vadose zone	0.38		
Lgw	Depth to groundwater (cm)	***8.8E+02***		
Ls	Depth to top of affected soil (cm)	***7.3E+02***		
Lsubs	Thickness of affected subsurface soils (cm)	***1.5E+02***		
pH	Soil/groundwater pH	6.5		
		capillary	vadose	foundation
phi.w	Volumetric water content	0.342	0.12	0.12
phi.a	Volumetric air content	0.038	0.26	0.26

Building	Definition (Units)	Residential	Commercial
Lb	Building volume/area ratio (cm)	***2.5E+02***	3.0E+02
ER	Building air exchange rate (s^-1)	1.4E-04	2.3E-04
Lcrk	Foundation crack thickness (cm)	1.5E+01	
eta	Foundation crack fraction	0.01	

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

RBCA SITE ASSESSMENT

Tier 2 Worksheet 9.3

Site Name: APA Fund/Com/GW plume
Site Location: 2801 MacArthur Blvd

Completed By: Meg Mendoza
Date Completed: 12/9/1996

GROUNDWATER SSTL VALUES

Target Risk (Class A & B) 1.0E-5
Target Risk (Class C) 1.0E-5
Target Hazard Quotient 1.0E+0

☐ MCL exposure limit?
☐ PEL exposure limit?

Calculation Option: 1

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

CONSTITUENTS OF CONCERN		Representative Concentration	Groundwater Ingestion			X Groundwater Volatilization to Indoor Air		X Groundwater Volatilization to Outdoor Air		Applicable SSTL	SSTL Exceeded ?	Required CRF
CAS No.	Name	(mg/L)	Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)	Residential: (on-site)	Commercial: (on-site)	Residential (on-site)	Commercial: (on-site)	(mg/L	"■" If yes	Only if "yes" left
71-43-2	Benzene	0.0E+0	NA	NA	NA	NA	4.8E+0	NA	>Sol	4.8E+0	☐	<1
100-41-4	Ethylbenzene	0.0E+0	NA	NA	NA	NA	>Sol	NA	>Sol	>Sol	☐	<1
108-88-3	Toluene	0.0E+0	NA	NA	NA	NA	>Sol	NA	>Sol	>Sol	☐	<1
1330-20-7	Xylene (mixed isomers)	0.0E+0	NA	NA	NA	NA	>Sol	NA	>Sol	>Sol	☐	<1

Software: GSI RBCA Spreadsheet
Version: v 1.0

Serial: G-289-DJX-518

4.8 x 0.29 = 1.39

GWAPA.XLS

RBCA TIER 1/TIER 2 EVALUATION

Output Table 1

Site Name: APA Fund/Com/GW plume
Site Location: 2801 MacArthur Blvd
Job Identification: 838.003
Date Completed: 12/9/96
Completed By: Meg Mendoza

Software: GSI RBCA Spreadsheet
Version: v 1.0

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

DEFAULT PARAMETERS

Exposure Parameter	Definition (Units)	Residential			Commercial/Industrial	
		Adult	(1-6yrs)	(1-16 yrs)	Chronic	Constrctn
ATc	Averaging time for carcinogens (yr)	70				
ATn	Averaging time for non-carcinogens (yr)	30	6	16	25	1
BW	Body Weight (kg)	70	15	35	70	
ED	Exposure Duration (yr)	30	6	16	25	1
EF	Exposure Frequency (days/yr)	350			250	180
EF.Derm	Exposure Frequency for dermal exposure	350			250	
IRgw	Ingestion Rate of Water (l/day)	2			1	
IRs	Ingestion Rate of Soil (mg/day)	100	200		50	100
IRadj	Adjusted soil ing. rate (mg*yr/kg*d)	1.1E+02			8.4E+01	
IRa in	Inhalation rate indoor (m^3/day)	15			20	
IRa.out	Inhalation rate outdoor (m^3/day)	20			20	10
SA	Skin surface area (dermal) (cm^2)	5.8E+03		2.0E+03	5.8E+03	5.8E+03
SAadj	Adjusted dermal area (cm^2*yr/kg)	2.1E+03			1.7E+03	
M	Soil to Skin adherence factor	1				
AAFs	Age adjustment on soil ingestion	FALSE			FALSE	
AAFd	Age adjustment on skin surface area	FALSE			FALSE	
tox	Use EPA tox data for air (or PEL based)	TRUE				
gwMCL?	Use MCL as exposure limit in groundwater?	FALSE				

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

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

Matrix of Target Risks		Individual	Cumulative
TRab	Target Risk (class A&B carcinogens)	***1.0E-05***	
TRc	Target Risk (class C carcinogens)	1.0E-05	
THQ	Target Hazard Quotient	1.0E+00	
Opt	Calculation Option (1, 2, or 3)	1	
Tier	RBCA Tier	2	

Surface Parameters	Definition (Units)	Residential	Commercial/Industrial Chronic	Commercial/Industrial Construction
t	Exposure duration (yr)	30	25	1
A	Contaminated soil area (cm^2)	2.2E+06		1.0E+06
W	Length of affected soil parallel to wind (cm)	1.5E+03		1.0E+03
W.gw	Length of affected soil parallel to groundwater (c	1.5E+03		
Uair	Ambient air velocity in mixing zone (cm/s)	2.3E+02		
delta	Air mixing zone height (cm)	2.0E+02		
Lss	Definition of surficial soils (cm)	1.0E+02		
Pe	Particulate areal emission rate (g/cm^2/s)	2.2E-10		

Groundwater	Definition (Units)	Value
delta.gw	Groundwater mixing zone depth (cm)	2.0E+02
I	Groundwater infiltration rate (cm/yr)	3.0E+01
Ugw	Groundwater Darcy velocity (cm/yr)	2.5E+03
Ugw.tr	Groundwater Transport velocity (cm/yr)	6.6E+03
Ks	Saturated Hydraulic Conductivity(cm/s)	
grad	Groundwater Gradient (cm/cm)	
Sw	Width of groundwater source zone (cm)	
Sd	Depth of groundwater source zone (cm)	
BC	Biodegradation Capacity (mg/L)	
BIO?	Is Bioattenuation Considered	FALSE
phi.eff	Effective Porosity in Water-Bearing Unit	3.8E-01
foc sat	Fraction organic carbon in water-bearing unit	1.0E-03

Soil	Definition (Units)	Value		
hc	Capillary zone thickness (cm)	***6.1E+01***		
hv	Vadose zone thickness (cm)	***8.2E+02***		
rho	Soil density (g/cm^3)	1.7		
foc	Fraction of organic carbon in vadose zone	0.01		
phi	Soil porosity in vadose zone	0.38		
Lgw	Depth to groundwater (cm)	***8.8E+02***		
Ls	Depth to top of affected soil (cm)	1.0E+02		
Lsubs	Thickness of affected subsurface soils (cm)	2.0E+02		
pH	Soil/groundwater pH	6.5		
		capillary	vadose	foundation
phi.w	Volumetric water content	0.342	0.12	0.12
phi a	Volumetric air content	0.038	0.26	0.26

Building	Definition (Units)	Residential	Commercial
Lb	Building volume/area ratio (cm)	2.0E+02	3.0E+02
ER	Building air exchange rate (s^-1)	1.4E-04	2.3E-04
Lcrk	Foundation crack thickness (cm)	1.5E+01	
eta	Foundation crack fraction	0.01	

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

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