

STID 851

May 27, 1996

rev'd 8-2-96

Ms. Jennifer Eberle
Hazardous Materials Specialist
Alameda County CC4580
Health Care Services Agency
Department of Environmental Health
1131 Harbor Bay Parkway, 2nd Floor
Alameda, CA 94502-6577

SUBJECT: Former Desert Petroleum Site, 2844 Mountain Boulevard
Oakland, CA 94602

Dear Ms. Eberle:

RSI requests a 45 day extension of time for the submittal of the revised corrective action plan. Additional time is required to address issues and questions from investigations by others in the early years of this project.

Further evaluation of groundwater gradient data and RBCA Tier 2 is also necessary.

It is anticipated that additional time will allow for proper response to meet final CRWQCB closure criteria.

If you have any questions please contact me at (805) 644-5892.

Sincerely,



Richard W. Pilat
Program Director

enclosure

ENVIRONMENTAL
PROTECTION
96 MAY 30 PM 1:13

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Health Care Services Agency
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Oakland, CA 94602

Dear Ms. Eberle:

Enclosed is the RBCA based supplement to the previously submitted Corrective Action Plan. **RSI recommends site closure at this time.** If there is any additional information that you require please contact me at (805) 644-5892.

Sincerely,



Richard W. Pilat
Program Director

enclosure



REMEDIATION SERVICE, INT'L.

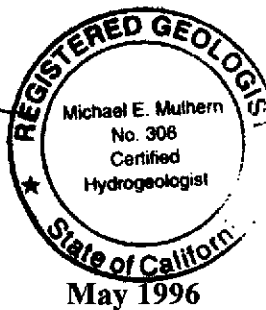
**SUPPLEMENTAL
RISK BASED CORRECTIVE ACTION REPORT
for**

**2844 Mountain Boulevard
Oakland, CA**

Prepared for:
DESERT PETROLEUM
P.O. Box 1601
Oxnard, CA 93032

Prepared by:
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December 8, 1995
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1.0 INTRODUCTION

Purpose and Scope of Report

This report presents the results of a supplemental risk based corrective action (RBCA) evaluation for the real property located on the northeast corner of the intersection of Mountain Boulevard and Werner Court at 2844 Mountain Boulevard in Oakland, Alameda County, California 94602 (Figure 1). Remediation Service, Int'l. (RSI) is under contract to Desert Petroleum, Inc. to perform limited environmental services as required by the California Regional Water Quality Control Board (CRWQCB) and the Alameda County Department of Environmental Health (ACDEH) the Local Oversight Program (LOP) for site closure.

This report is submitted to comply with the LOP letter request dated April 30, 1996 and provides application of recent RBCA guidance.

Site Description

The property is occupied by a retail gasoline station. Three underground storage tanks, two pump islands and an office/garage building are present at the site. The tanks, which have individual storage capacities of 3,000, 4,000, and 10,000 gallons, originally contained various grades of gasoline. The current owners and operators of the station use one of the underground tanks for diesel storage and distribution. The Warren Freeway, which is adjacent to Mountain Boulevard, is approximately 50 feet downgradient of the site.

2.0 REMEDIATION

After an unauthorized release was reported in 1989, the goal of Desert Petroleum's active remediation was to achieve clean-up in a manner that was cost effective, timely and protective of human health and the environment. Approximately \$250,000 has been expended for corrective action at this site, well in excess of the value of the property.

~~Since June of 1991, in excess of 1,000 pounds of hydrocarbons have been extracted from the site.~~

FHC impacted soil was originally identified by Diablo Tank & Equipment during replacement of the product lines in March 1989. Analytical results for a soil sample collected from the southern edge of the premium unleaded tank reported total petroleum hydrocarbons as gasoline (TPHg) concentration of 8,400 mg/Kg. Samples from beneath the lines near the pump islands contained TPHg concentrations of less than 100 mg/Kg. In July 1989, On-Site

history

Technologies excavated and disposed of contaminated soil from the southern end of the premium unleaded tank. Analysis of twelve soil samples collected from the sides of the excavation reported TPHg concentrations ranging between ND to 3,300 mg/Kg (Site Technologies, Soil Sampling Report dated 8/31/89).

no doc.

conc left in place?

In May 1990 RSI conducted further assessment of the site (RSI, Site Assessment Report dated July 25, 1990). Four groundwater monitoring wells (RS-1 through RS-4, Figure 2) were installed and sampled. Analysis of soil samples collected from above the water table reported TPHg concentrations ranging from 1 to 240 mg/Kg. FHCs were detected in the groundwater samples collected from all four wells.

Soil vapor extraction remediated the site from 1991 until 1994 when influent system concentrations became asymptotic. Analytical results for groundwater samples collected during previous and current groundwater monitoring are summarized in Table 2.

A Corrective Action Plan recommending passive biodegradation as the most cost effective remedial alternative was submitted to the ACDEH on February 21, 1995.

Based upon the low potential for FHC migration to beneficial use water, the plan was approved with the requirement for additional groundwater monitoring to ensure plume stability.

The past year of groundwater sampling data appears to confirm that the plume is stable.

3.0 RESIDUAL SOIL FHC CONCENTRATIONS

Maximum levels of TPHg and associated BTEX constituents measured are listed below:

~~all values are prior to excavation and disposal and the active remedial operation. Soil sample analysis from soil excavation & well installation, 1989 & 1990.~~

<u>Substance</u>	<u>Maximum Concentration Measured</u>
TPHg	8400 3,300 mg/Kg (1989, in SS325-1 @ 10' bgs, soil excavation, south of western most tank)
Benzene	6.2 mg/Kg (1990, in RS-1 @ 10 feet bgs) ✓OK
Toluene	100 mg/Kg (1989, in SS325-1 @ 10' bgs)
Ethyl benzene	30 mg/Kg (1989, in SS325-1 @ 10' bgs) same as above
Xylenes	270 mg/Kg (1989, in SS325-1 @ 10' bgs) 11

TPHg	soil to outdoor air 100% comb. 10-4	HQ	8400	3-22-89, sample # 5 tank, during pipeline sample, ~ 5' bgs
Benzene	0.13	RES	6.2 mg/Kg	(1990, in RS-1 @ 10 feet bgs) ✓OK
Toluene	13.25	RES	100 mg/Kg	(1989, in SS325-1 @ 10' bgs)
Ethyl benzene		RES	30 mg/Kg	(1989, in SS325-1 @ 10' bgs) same as above
Xylenes		RES	270 mg/Kg	(1989, in SS325-1 @ 10' bgs) 11

FHCs were only detected in soil beneath the tank location on the west portion of the property.

False -
all 4

4.0 RESIDUAL GROUNDWATER FHC CONCENTRATIONS

pipings
samples had HCs
(3-22-89). Also, all
4 boreholes had HCs.

The most recent groundwater analysis of February 1996 monitoring shows the following selected maxima:

And don't
forget w oil
VST.

TPHg	75 mg/L	Well RS-2 ✓		
Benzene	1,400 ug/L	Well RS-2 ✓	2,100	>S 5,340
Toluene	170 ug/L	Well RS-2 ✓		>S
Ethyl benzene	59 ug/L	Well RS-2 ✓		>S
Xylenes	460 ug/L	Well RS-2 ✓		>S

gwp to
casing
10-96
contamin
gwp
outside
10-9
10-6
HQ

5.0 GROUNDWATER FLOWPATH AND NEAREST WELL

The site lies east of the Alameda Bay Plain hydrologic subarea of the East San Francisco Bay hydrologic study area (Bulletin 118-80, California Dept. of Water Resources). Small lenses of perched groundwater lie beneath portions of this hydrologic area. Regional groundwater flow direction is typically southwesterly toward the Bay.

Depth to the perched water beneath the site on February 1996 ranged from 4.48 and 7.44 feet below the top of casing (approximately ground surface) (Table 1). Groundwater gradient was calculated to be approximately 0.20 ft/ft across the site with groundwater flow in a generally west-southwesterly direction. Contour maps of November 1995 and February 1996 groundwater elevations are included as Figures 4 and 5.

incorrect

Seasonal variations in groundwater flowpath have trended from southeast to southwest.

According to Alameda County Public Works, the nearest beneficial use well, which is located approximately 2,200 feet southwest of the site, draws irrigation water from a depth of 240 feet bgs (Appendix B). Between the site and the well is the Warren Freeway.

Several layers of clay create an effective aquitard which separates the FHC impacted perched water at approximately 5 feet bgs from the aquifer at 240 feet bgs where beneficial use water is presently drawn. The aquifers within the Oakland area are not used for municipal purposes. Drinking water for the Oakland area is supplied by East Bay Municipal Water which imports water exclusively from the Sierra Nevada Mountains (Telecon with Mr. Godfrey, 2/1/95).

6.0 ASTM RBCA

Recent California Regional Water Quality Control Board guidelines for low risk groundwater sites recommends the American Society of Testing and Materials' (ASTM) standard for Risked Based Corrective Action (RBCA) ASTM E-1739-95 with screening levels that are "protective of public health and environmental resources."

Based upon the acceptance of the formerly submitted Corrective Action Plan by the LOP, subsequent meetings and discussions with CRWQCB and LOP personnel, specific application of the Draft Tier One screening levels which incorporate California Maximum Concentration Levels have been additionally evaluated herein to expedite closure of the site.

The following sections apply the previously submitted data and the results of the last year of quarterly water quality monitoring data specifically to the Modified Tier One Table and the corresponding target levels. Exposure pathways with negligible applicability are identified as such.

FHC exposure occurs only when a receptor can potentially come into direct contact with a released constituent or a medium exists for released contamination to potentially be transported to a receptor. A complete pathway for exposure (with the release of contamination, a medium of transport, a point of contact and a receptor) must be in place for risk of exposure to exist. Therefore, without exposure, there is no risk.

The current land use at the site is commercial/industrial. Since foreseeable future land use is not expected to change from the commercial/industrial application, ~~exposure levels for all constituents detected in soil and groundwater are based on protection of workers' and customers' health.~~

The following includes a characterization of the exposed population, identification of receptors and exposure routes, and an estimation of toxic substances risk for the selected FHC constituents.

7.0 RISK-BASED SCREENING LEVELS FOR AIR

~~No point source to air exists from the subsurface FHC release.~~ The risk of currently existing FHC migration to indoor and outdoor air from the subsurface is therefore more logically evaluated in sections 8.0 and 9.0 below.

Typical ambient background FHC levels in air measured by RSI in other service stations similar sites has ranged as high as 2,000 PPMV measured with a hand held photo ionization detector.

8.0 RISK-BASED SCREENING LEVEL FOR SOIL

The movement of gasoline in the unsaturated zone is initially dependent on the volume discharged and soil type. In homogeneous, permeable soils, migration is primarily vertical due to gravity. Horizontal movement in this case is due to capillary adhesion of the product to soil particles. In interbedded soils, horizontal movement is more pronounced and the shape of the path is more irregular due to less permeable interbeds and greater capillary adhesion in those interbeds.

The residual FHCs in the unsaturated zone have partitioned into, dissolved and vapor phases. The following physical and chemical processes influence the partitioning of gasoline components into these phases in the unsaturated zone:

1. Capillary Forces
2. Adsorption
3. Volatilization
4. Dissolution

The subsurface is characterized by the nature of the pores and the degree to which they are filled with vapor or water. Three zones in the subsurface are usually recognized in this manner: the unsaturated (vadose) zone, the capillary zone, and the saturated zone.

The capillary zone is a transition zone between the unsaturated and saturated zones. The moisture content in the capillary zone ranges from the residual saturation at the top of the zone, to saturation at the base of the zone. The thickness of the zone varies, depending on the sizes of soil particles and the sizes of pore spaces. Finer pore spaces usually produce higher capillary forces and thicker capillary zones. Heterogeneous formations produce capillary zones which vary in thickness.

Based upon the hydrogeologic and soil characteristics of the site, the potential for migration in the unsaturated zone extends from the ground surface to the top of the capillary zone. Water exists in the unsaturated zone on the surfaces of soil particles due to adsorption and in pore

spaces due to capillary forces (adhesion and cohesion). The maximum amount of water that the soil may contain, the residual saturation, is the maximum amount of water that the soil may retain before movement of water occurs due to gravity. The remaining void space not occupied by water is occupied by vapor which moves due to forces explained below.

Soil particles are separated by a network of interconnected voids or pores through which soil vapor or moisture may move.

The density of gasoline ranges from 0.70 to 0.78 and averages approximately 0.75 grams per cubic centimeter (g/cm^3) and is less viscous than water. The aromatic components of gasoline, such as benzene, toluene, and xylenes, are usually present in concentrations of less than 0.1 weight percent.

The degree to which FHCs volatilize depends on soil conditions and the vapor pressure of the individual compounds. The vapor pressure of a compound is the pressure exerted at equilibrium by a vapor phase with respect to its liquid or solid phase. The vapor phase of a compound is directly proportional to its volatility. Environmental conditions such as temperature, wind speed, evaporation rate, and precipitation influence volatilization in the subsurface. Soil conditions such as moisture content, clay content, and the surface area of adsorbed product also impact the degree of volatilization in the subsurface.

The principal methods of vapor transport in the subsurface are diffusion and advection. Diffusion is caused by the random movement of molecules and generally results in the movement of molecules from areas of high concentrations to those of low concentrations. Advection is the movement of gases due to pressure changes in the subsurface due to the following causes:

1. Barometric Pumping - Soil vapor is typically at atmospheric pressure. A change in barometric pressure will result in a pressure gradient in the soil vapor, which will lead to movement of vapor toward or away from the surface. This effect is more pronounced at the subject site, due to shallow perched water, and may increase volatilization by disrupting equilibria at liquid/vapor interfaces in the subsurface.
2. Imposed Pressure Gradients - Pressure gradients may be caused by temperature differences between substructures such as the pipelines and tanks, and the surrounding soil vapor.
3. Density Differences - Vapor produced by volatilizing product has a different density than the surrounding soil vapor. Organic vapor is influenced by gravity and may stratify, with the dense vapor lying below the lighter vapor. This effect also

encourages mixing of vapors of different densities, which results in a larger area more uniformly impacted by soil vapor.

8.1 Soil Volatization to Outdoor Air

Because the entire subject area is paved and due to the high clay content of the soil beneath the site the potential for horizontal migration is low. The high clay content of subsurface soils causes the air permeability for vadose zone transport to be in the range of $10E-7$ CM/S (as the coefficient of permeability). The of movement of released FHCs on this site is impeded by three factors:

1. The residual saturation of the formation
2. Relatively impermeable interbed(s)
3. The perched water table

8.2 Soil Vapor Intrusion from Soil to Buildings

As with soil volatization to outdoor air, soil vapor intrusion to buildings is considered insignificant. The concrete slab provides added protection from any migrating vapors. In addition, the normal foot traffic into the front of the building will augment active and passive ventilation to effectively minimize any vapor buildup which receptors could be exposed to.

8.3 Surficial Soil Ingestion/Dermal/Inhalation

The site is paved. There is no current risk. FHC impacted soil is located at approximate depths of 3-15 feet bgs; the soil is not a current exposure medium. If the site is excavated to these depths in the future, construction workers could potentially be exposed through dermal and inhalation exposure routes.

Excavation of soils beyond 3 feet bgs will require additional exposure evaluation with the proper OSHA monitoring and procedures. Workers with the potential for soil and groundwater exposure should follow health and safety guidelines outlined in 29CFR1910.120.

Normal exposure to typical surface spills during customer fueling at the station may represent a more viable health risk. Touching gasoline without skin protection may allow hydrocarbons to be absorbed into fatty tissues in the skin. Customers and workers may also be exposed by ingestion of the contaminants when they accidentally consume small amounts of FHCs during

hand to mouth activity (such as smoking or eating after exposure without washing hands or the utilization of protective gloves).

8.4 Soil Leachate to Protect Groundwater Ingestion

FHCs present in the capillary zone with high clay and moisture content present minimal potential for exposure or further vertical migration.

The groundwater contains dissolved FHCs that have negligible potential for exposure. This risk is more appropriately discussed in section 9.0 below.

9.0 RISK-BASED SCREENING LEVEL FOR GROUNDWATER

Absorption, the bonding of a solute to a site on a solid surface, occurs in the subsurface by many mechanisms, including: van der Waals forces, hydrophobic bonding, hydrogen bonding, charge transfer, ligand exchange, ion exchange, ion/dipole interactions, magnetic interactions, and chemisorption. The extent to which a particular gasoline component will adsorb to soil particles can be assessed based on the absorption potential of the component, and the carbon content, texture, bulk density, clay content, moisture content, cation exchange capacity, and pH of the soil.

Compounds such as naphthalene have low organic carbon partition coefficient (K_{oc}) values and are expected to be adsorbed readily in the soil. Aromatic compounds such as benzene, toluene, and xylenes have higher K_{oc} values, are more mobile in the unsaturated zone, and would be expected to appear in higher concentration as dissolved or vapor phases. It should be noted that the aromatics components may be selectively retarded during transport by dissolving in soil moisture in the unsaturated zone.

The perched water beneath the site has been impacted by one or more of the following processes:

1. Infiltrating water passed through gasoline-impacted unsaturated zone, leaching soluble compounds as it passed. These compounds were carried to the perched water.
2. FHCs reached groundwater and soluble compounds dissolved into groundwater
3. FHCs present as residual saturation in the unsaturated zone were leached during a rise in the water table. Capillary forces binding the product to the soil particles resist

buoyant forces which tend to push the product toward the surface.

When soluble compounds entered the saturated zone, the movement was governed by advection and dispersion. Advection is the bulk movement of solutes with the flow of groundwater. Hydrodynamic dispersion is a mechanical mixing process which produce spreading of the dissolved compound normal to and in the direction of flow. It is responsible for the dilution of solutes away from the source. Molecular diffusion of the solute also occurs at this time, and may be a significant factor in the extent of dissolved phase hydrocarbons in the low velocity system beneath the site.

9.1 Groundwater Volatization to Outdoor Air

The perched groundwater in the area of RS-2 contains dissolved FHCs. Although the potential for exposure to volatized constituents in outside air above ground surface is considered minimal, this exposure pathway is considered the most likely to pose any potential health risk.

The presence of clayey, low permeability subsurface soils inhibit the upward migration of any volatized FHC components. The existing pavement and surface expression also further inhibit migration.

9.2 Groundwater Ingestion

As discussed above, the nearest beneficial use well, which is located approximately 2,200 feet southwest of the site, draws irrigation water from a depth of 240 feet bgs (Appendix B).

Dissolution occurs when a soluble component comes into contact with water in the saturated zone. The degree to which a compound enters the aqueous phase is a function of the compounds aqueous solubility. More soluble compounds tend to have lower adsorption coefficients and also tend to be more easily biodegraded.

In addition to the physical processes that influence the concentrations and movement of gasoline compounds in the subsurface, chemical processes may significantly reduce the concentrations of the compounds after their release. Biotic processes and chemical (abiotic) processes are the most important of these processes.

There are two primary biotic processes, biodegradation and biotransformation, by which microorganisms (bacteria, fungi, and yeasts) consume gasoline compounds in

oxidation/reduction reactions. Biodegradation is the complete mineralization of the compound into water, carbon dioxide, and energy for growth and reproduction. Biotransformation produces simpler compounds which may be more or less soluble and/or toxic than the original compound.

Degradation of compounds by oxidation/reduction reactions often produces compounds such as peroxides, primary alcohols, and monocarboxylic acids which are more readily mineralized by biotic processes. These processes will effectively mitigate the potential for exposure in this medium.

9.3 Groundwater Vapor Intrusion from Groundwater to Buildings

There are no known pathways for vapor transport to potential receptors. The nearest building is built on a concrete slab. The most proximate groundwater well to the building contains no benzene at the minimum reporting limit.

10.0 CONCLUSIONS AND RECOMMENDATIONS

Based upon the preceding evaluation of all known sources for potential FHC exposure, pathway(s) and applicable receptor(s) **the corresponding RBCA Screening Value most likely to exist for evaluation of potential risk at the site under present conditions is the potential for groundwater volatilization to outdoor air in the vicinity of RS-2 (commercial/industrial automotive fueling station).**

what tables Tier 1?
Current or decreasing levels of FHCs as listed in section 4.0 and 8.1 fall within the acceptable levels of the ASTM guidelines. The maximum cancer risk from benzene using the data provided in the Table is 1E-5. This value meets or exceeds the generally accepted risk allowable by the SFCRWCB. *why?*

As previously discussed the potential for off-site migration by air, soil or water is very low. The remaining FHCs are considered stable.

Any remaining FHCs do not present unacceptable risk to the health and safety of workers or the general public.

RSI recommends that Site Closure be implemented and that proper abandonment of the existing groundwater monitoring wells be initiated.

11.0 LIMITATIONS

The discussion, conclusion and any recommendations presented in this report are based on the professional performance of the personnel who conducted the investigations, the observations of the field personnel, the results of laboratory analyses performed by a state certified laboratory, any referenced documents and our understanding of the regulations of the State of California; also, if applicable, other local regulations.

Variations in the soil and groundwater conditions may exist beyond the points explored in this and prior investigations.

The services performed by Remediation Service, Int'l. have been conducted in a manner consistent with the level of care and skill ordinarily exercised by members of our profession currently practicing under similar conditions in the State of California. No other warranty, expressed or implied, is made.

12.0 REFERENCES

California Air Resources Board, July 1991, Soil Decontamination Manual.

California Regional Water Quality Control Board, December 1994, Interim Guidance For Remediation of VOC Impacted Sites.

California Regional Water Quality Control Board, November 1994, Interim Guidance For Remediation of Petroleum Impacted Sites, Soil Screening Levels.

California Regional Water Quality Control Board, San Francisco Bay Area, October 21, 1994, Memorandum, Implementation of Ground Water Non-Attainment Areas.

Environmental Protection Agency, April 1988, Cleanup of Releases from Petroleum USTs: Selected Technologies.

Environmental Protection Agency, April 1991, Handbook Remediation of Contaminated sediments.

Environmental Protection Agency, November 1991, Seminar Publication: Site Characterization for Subsurface Remediation.

RBCA Report
May 1996

2844 Mountain Blvd.
Oakland, CA

National Fire Protection Association, 1980, Material Safety Data Sheet for British Petroleum Oil.

On-Site Technologies, August 31, 1989, Soil Sampling Report for Desert Petroleum (ARCO Station), Oakland, CA.

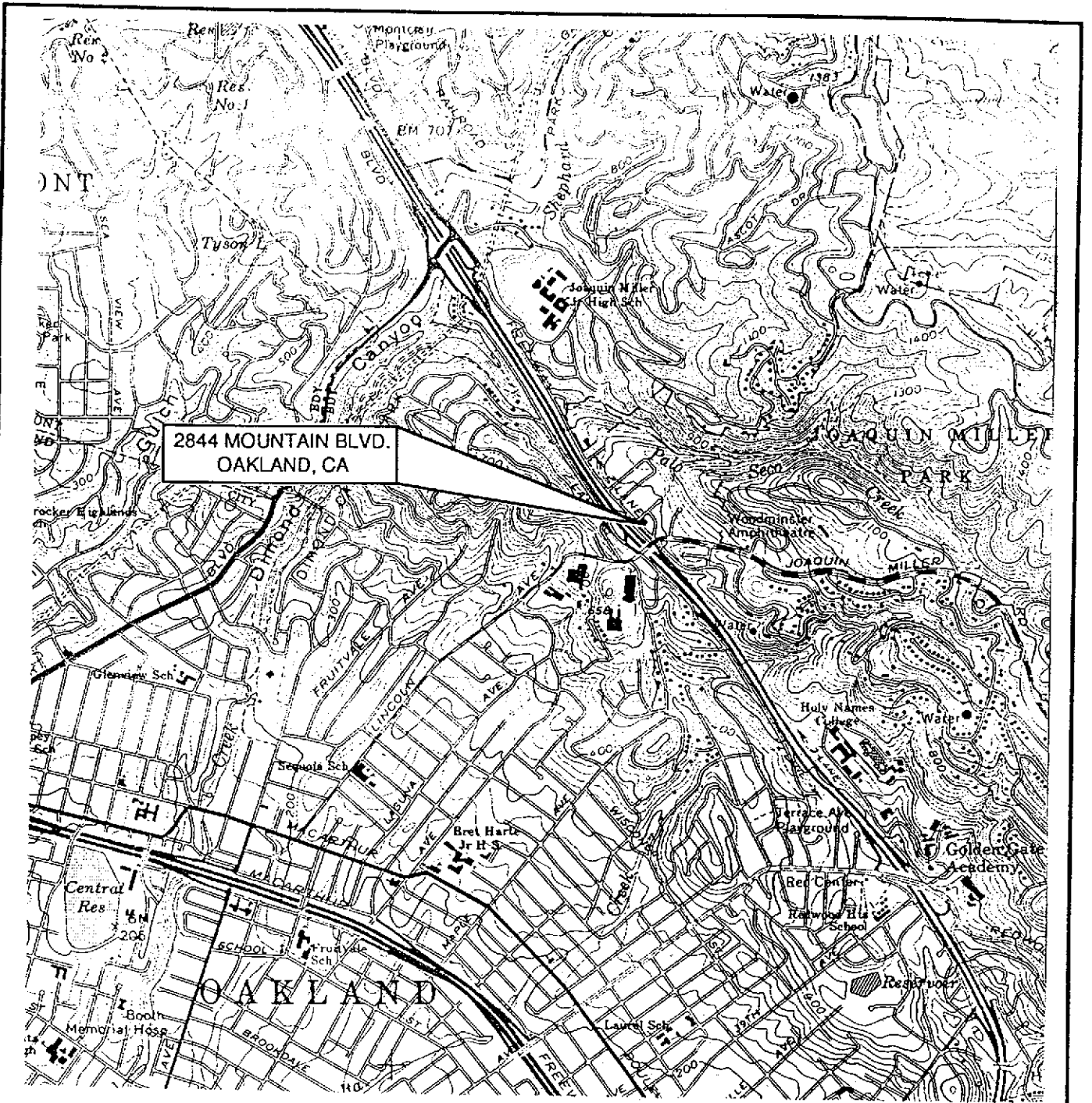
Remediation Service Int'l., February 3, 1995, Corrective Action Plan for Desert Petroleum Inc., Station No. 796, Oakland, CA.

Remediation Service Int'l., July 25, 1990, Site Assessment Report for Desert Petroleum Inc., Station No. 796, Oakland, CA.

Remediation Service Int'l., July 25, 1990, Site Assessment Report for Desert Petroleum Inc., Station No. 796, Oakland, CA. U.S. Geologic Survey Topographic 7.5 Minute Series, East Oakland Quadrangle.

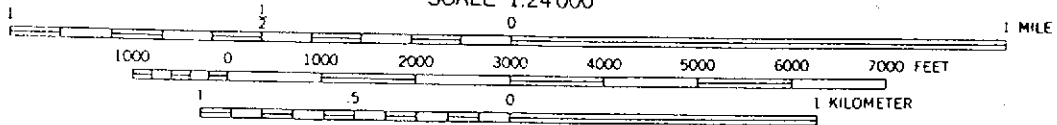
Remediation Service Int'l., January 4, 1996, Quarterly Report for Desert Petroleum Inc., Station No. 796, Oakland, CA. RSI

Remediation Service Int'l., March, 1996, Quarterly Report for Desert Petroleum Inc., Station No. 796, Oakland, CA. RSI

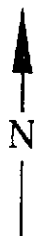


2844 MOUNTAIN BLVD.
OAKLAND, CA

SCALE 1:24 000



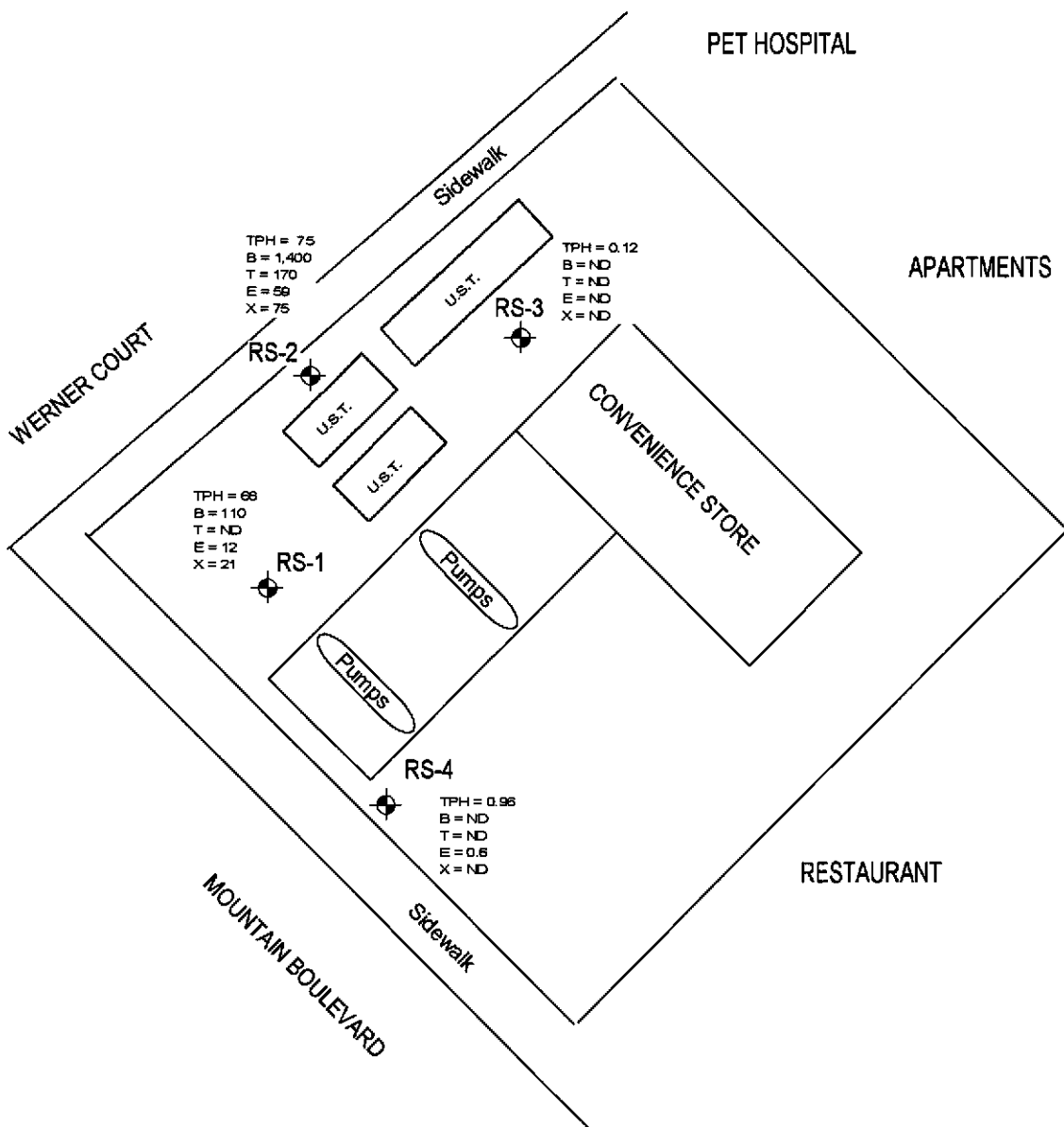
FROM U.S.G.S. 7.5' TOPOGRAPHIC
QUADRANGLE "OAKLAND EAST,
CALIFORNIA," 1959, PHOTOREVISED
1980




2844 MOUNTAIN BLVD.
OAKLAND, CA

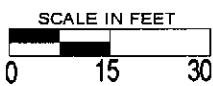
FIGURE 1: LOCATION MAP

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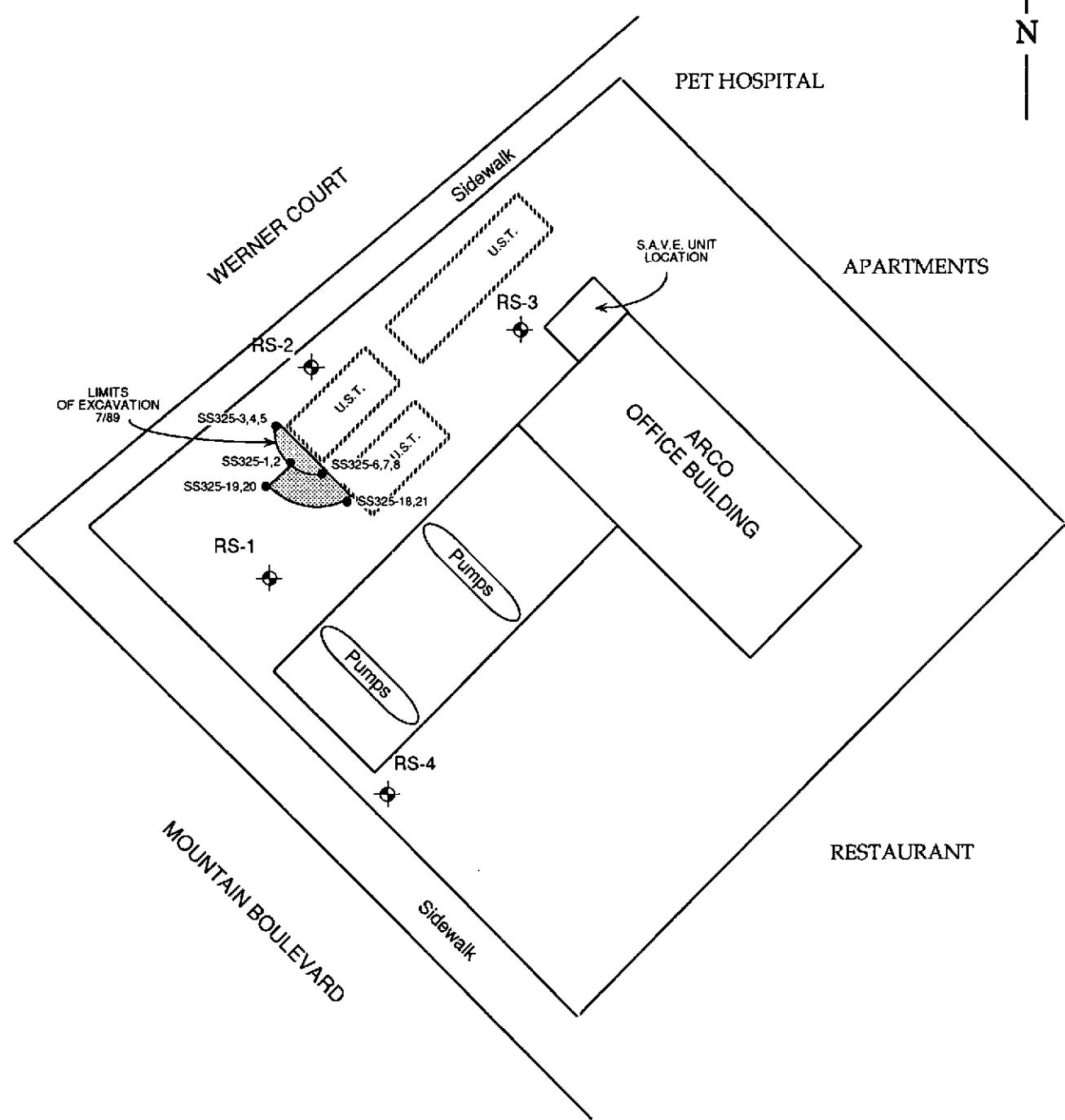
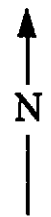
LEGEND

-  MONITORING WELL LOCATION
- TPH = mg/L
- B = ug/l
- T = ug/L
- E = ug/L
- X = ug/L



2844 MOUNTAIN BLVD.
OAKLAND, CALIFORNIA
SITE MAP WITH GROUNDWATER ANALYTICAL
RESULTS
FEBRUARY 1996

RSI REMEDIATION SERVICE, INT'L.



LIMITS OF EXCAVATION
7/89

WERNER COURT

PET HOSPITAL

APARTMENTS

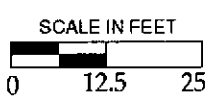
ARCO
OFFICE BUILDING

RESTAURANT

MOUNTAIN BOULEVARD


LEGEND

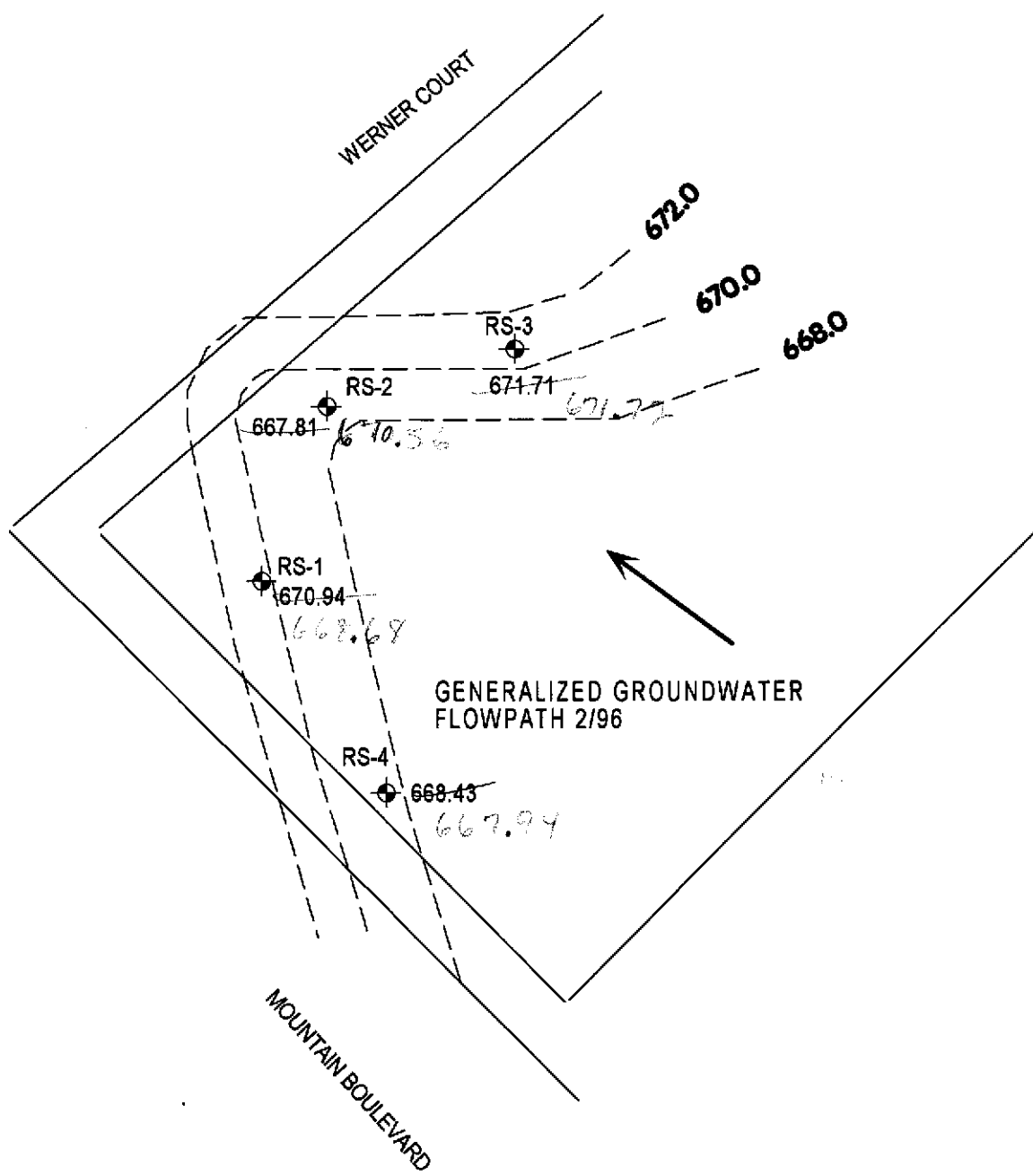
 MONITORING WELL LOCATION





2844 MOUNTAIN BLVD.
OAKLAND, CALIFORNIA

FIGURE 3: SITE MAP SHOWING HISTORIC
SOIL SAMPLE LOCATIONS





LEGEND

-  MONITORING WELL LOCATION
-  LINES OF POTENTIOMETRIC GROUNDWATER SURFACE ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL

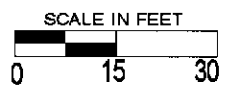
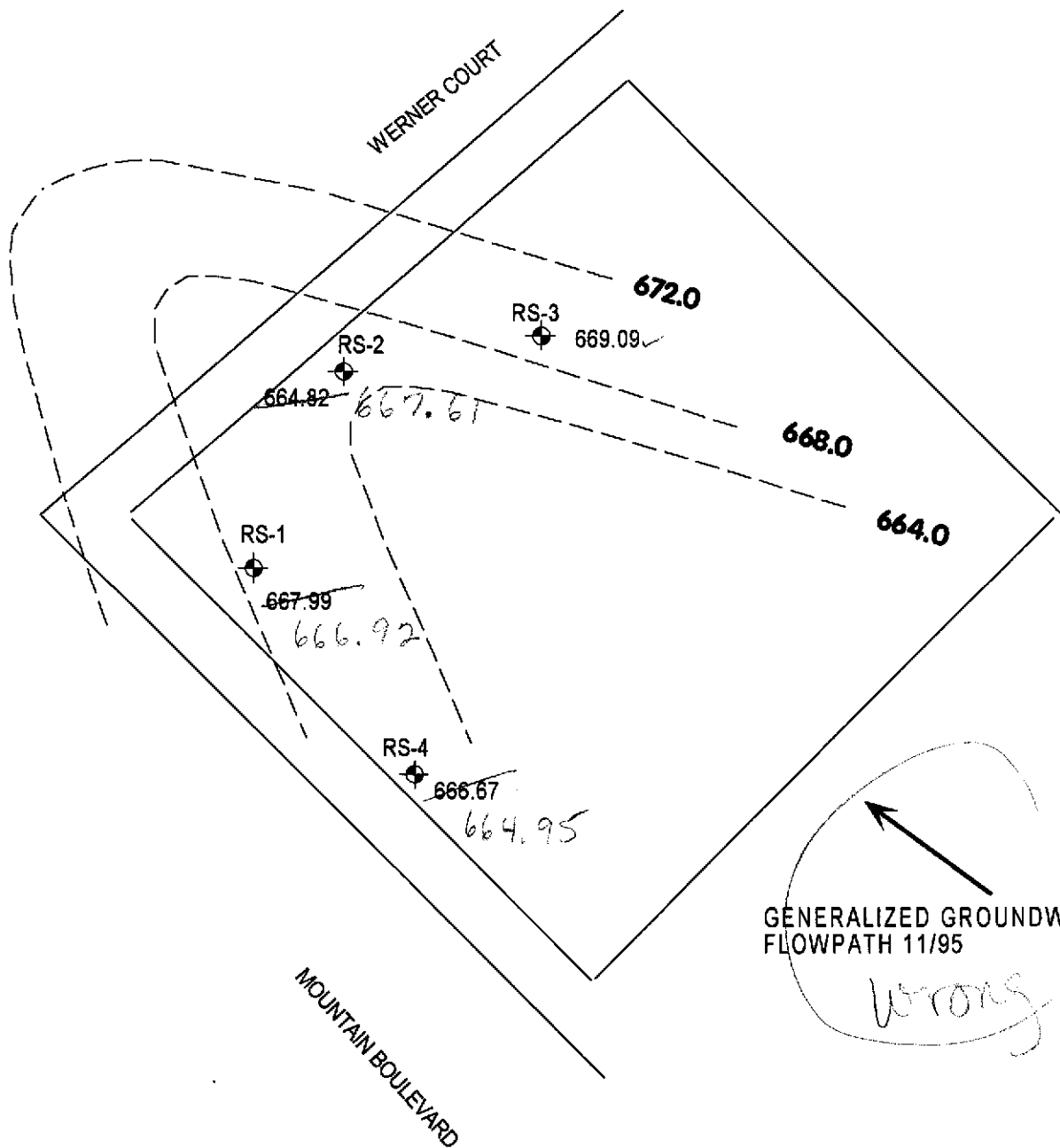


Fig 4



2844 MOUNTAIN BLVD.
OAKLAND, CALIFORNIA

SITE MAP WITH GROUNDWATER FLOWPATH
FEBRUARY 1996

RSI REMEDIATION SERVICE, INT'L.



LEGEND

-  MONITORING WELL LOCATION
-  LINES OF POTENTIOMETRIC GROUNDWATER SURFACE ELEVATIONS IN FEET ABOVE MEAN SEA LEVEL

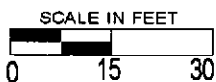


Fig 5

2844 MOUNTAIN BLVD.
OAKLAND, CALIFORNIA

SITE MAP WITH GROUNDWATER FLOWPATH
NOVEMBER 1995

RSI REMEDIATION SERVICE, INT'L.

Table 1**Summary of Groundwater Elevations****2844 Mountain Boulevard Oakland CA**

Well	Date Measured	Depth to Water*	Casing Elevation**	Water Table Elevation**	Change in Elevation
RS-1	May-90	7.20	689.25	682.05	
	May-91	8.35		680.90	-1.15
	Oct-91	10.22	689.17	678.95	
	Jan-92	8.06		681.11	2.16
	Jan-93	5.30		683.87	2.76
	Aug-93	8.56		680.61	-3.26
	Nov-93	8.44		680.73	0.12
	Jan-94	6.88		682.29	1.56
	May-94	7.87	675.63	667.76	
	Aug-94	16.28		659.35	-8.41
	Nov-94	8.02		667.61	8.26
	Feb-95	6.51		669.12	1.51
	Jun-95	7.34		668.29	-0.83
	Nov-95	8.71		667.99	-0.30
	Feb-96	6.95		670.94	2.95
RS-2	May-90	7.06	689.00	681.94	
	May-91	7.14		681.86	-0.08
	Oct-91	8.84	688.89	680.05	
	Jan-92	7.34		681.55	1.50
	Jan-93	4.10		684.79	3.24
	Aug-93	7.32		681.57	-3.22
	Nov-93	7.34		681.55	-0.02
	Jan-94	5.52		683.37	1.82
	May-94	6.40	675.25	668.85	
	Aug-94	22.11		653.14	-15.71
	Nov-94	9.82		665.43	12.29
	Feb-95	4.81		670.44	5.01
	Jun-95	5.80		669.45	-0.99
	Nov-95	7.64		664.82	-4.63
	Feb-96	4.69		667.81	2.99

CONTINUED

*Depth of water measured from top of well cover.

**Elevations are in feet above mean sea level.

Table 1 (cont.)**Summary of Groundwater Elevations****2844 Mountain Boulevard Oakland CA**

Well	Date Measured	Depth to Water*	Casing Elevation**	Water Table Elevation**	Change in Elevation
RS-3	May-90	6.00	690.00	684.00	
	May-91	6.76		683.24	-0.76
	Oct-91	8.98		681.02	-2.22
	Jan-92	6.81		683.19	2.17
	Jan-93	4.05		685.95	2.76
	Aug-93	7.19		682.81	-3.14
	Nov-93	7.12		682.88	0.07
	Jan-94	5.42		684.58	1.70
	May-94	5.78	676.20	670.42	_____
	Aug-94	5.86		670.34	-0.08
	Nov-94	5.08		671.12	0.78
	Feb-95	4.51		671.69	0.57
	Jun-95	5.29		670.91	-0.78
	Nov-95	7.10		669.09	-1.82
	Feb-96	4.48		671.71	2.62
RS-4	May-90	8.34	689.06	680.72	
	May-91	9.50		679.56	-1.16
	Oct-91	10.82	689.10	678.28	_____
	Jan-92	9.31		679.79	1.51
	Jan-93	6.89		682.21	2.42
	Aug-93	9.68		679.42	-2.79
	Nov-93	9.83		679.27	-0.15
	Jan-94	8.17		680.93	1.66
	May-94	8.69	675.38	666.69	_____
	Aug-94	9.04		666.34	-0.35
	Nov-94	8.00		667.38	1.04
	Feb-95	7.93		667.45	0.07
	Jun-95	8.61		666.77	-0.68
	Nov-95	10.43		666.67	-0.10
	Feb-96	7.44		668.43	1.76

*Depth of water measured from top of well cover.

**Elevations are in feet above mean sea level.

Table 2

Summary of Groundwater Analytical Results

2844 MOUNTAIN BOULEVARD OAKLAND CA

**BTEX AND MTBE CONCENTRATIONS ARE IN ug/L
TPHg CONCENTRATIONS ARE IN mg/L**

WELL #	DATE SAMPLED	TPH GASOLINE	BENZENE	TOLUENE	ETHYL-BENZENE	TOTAL XYLENES	MTBE
RS-1	May-90	2.7	370	420	40	320	
	May-91	1.3	580	130	62	240	
	Oct-91	1.1	140	100	45	210	
	Jan-92	1.7	9.9	31	9.7	170	
	Jan-93	3.7	650	9.2	51	170	
	Aug-93	0.9	14	0.6	2.1	8	
	Nov-93	1.4	9.6	ND	0.9	5	
	Jan-94	4.2	95	3.1	58	130	
	May-94	7.5	270	11	37	96	
	Aug-94	0.13	12	0.5	2.6	5	
	Nov-94	0.27	4.7	0.7	0.6	15	
	Feb-95	12	81	2.3	1	12	
	Jun-95	37	460	ND	ND	ND	63,000
	Nov-95	ND	660	16	140	330	31,000
	Feb-96	66	110	ND	12	21	84,000
RS-2	May-90	23	7,200	4,800	300	3,300	
	May-91	26	14,000	1,800	750	2,900	
	Oct-91	13	4,300	910	300	2,300	
	Jan-92	8.3	1,800	920	140	1,700	
	Jan-93	41	7,000	210	1,200	4,200	
	Aug-93	19	5,300	62	810	1,600	
	Nov-93	9.3	2,400	3.9	46	800	
	Jan-94	30	4,900	ND	880	2,600	
	May-94	120	3,300	330	ND	2,200	
	Aug-94	0.51	7.3	3.8	3.5	32	
	Nov-94	0.62	6.6	3.9	1.1	47	
	Feb-95	22	228	80	2	463	
	Jun-95	49	1,300	160	200	1,600	71,000
	Nov-95	ND	670	25	150	360	65,000
	Feb-96	75	1,400	170	59	460	71,000

CONTINUED

TPHg - Total Petroleum Hydrocarbons (Gasoline)
MTBE - Methyl Tertiary Butyl Ether
ND - Not Detected at Reporting Limit

Table 2 (continued)

Summary of Groundwater Analytical Results

2844 MOUNTAIN BOULEVARD OAKLAND CA

**BTEX AND MTBE CONCENTRATIONS ARE IN ug/L
TPHg CONCENTRATIONS ARE IN mg/L**

WELL #	DATE SAMPLED	TPH GASOLINE	BENZENE	TOLUENE	ETHYL-BENZENE	TOTAL XYLENES	MTBE
RS-3	May-90	0.33	2	1	1	150	
	May-91	ND	0.4	ND	0.8	8	
	Oct-91	ND	ND	ND	ND	ND	
	Jan-92	ND	2.2	7.2	0.6	4	
	Jan-93	ND	ND	ND	ND	ND	
	Aug-93	ND	30	6	2.4	5	
	Nov-93	ND	4.8	0.4	0.6	2	
	Jan-94	0.33	25	3.2	3.9	12	
	May-94	0.67	34	4	28	70	
	Aug-94	ND	ND	ND	ND	ND	
	Nov-94	0.069	2.5	3.1	1	4	
	Feb-95	ND	0.3	0.4	ND	1	
	Jun-95	ND	ND	ND	ND	ND	66
	Nov-95	ND	ND	ND	ND	ND	44
	Feb-96	0.12	ND	ND	ND	ND	110
RS-4	May-90	0.44	9	11	9	49	
	May-91	ND	8	4	3	5	
	Oct-91	0.83	280	120	24	170	
	Jan-92	0.62	34	8.3	2.1	21	
	Jan-93	0.15	32	1.7	5.8	13	
	Aug-93	ND	0.9	0.7	ND	0	
	Nov-93	ND	ND	ND	ND	ND	
	Jan-94	ND	1.7	ND	0.81	2	
	May-94	ND	ND	ND	ND	1	
	Aug-94	0.42	6.5	4.1	1.9	40	
	Nov-94	0.13	4.1	0.7	1.7	8	
	Feb-95	ND	6	1.2	3.5	13	
	Jun-95	ND	ND	ND	ND	ND	69
	Nov-95	ND	ND	ND	ND	ND	47
	Feb-96	0.96	ND	ND	0.6	ND	80

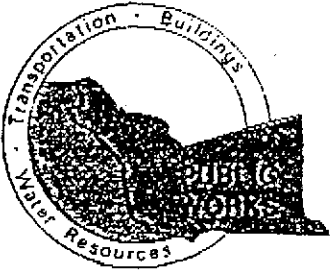
TPHg - Total Petroleum Hydrocarbons (Gasoline)

MTBE - Methyl Tertiary Butyl Ether

ND - Not Detected at Reporting Limit

Fate and Transport and Toxicity Characteristics for Selected Constituents in FHCs

Compound	Mass	Fate & Transport			Toxicity
	Maximum Weight %	Aqueous Solubility (mg/L)	Vapor Pressure (torr)	Expected Biotic Half Life (days)	Final RQ (Kg)
Benzene	<0.1	1,780	75.0	110	4.54
Toluene	<0.1	515	22.0	39	454
(o) - Xylene	<0.1	162	6.0	32	454
(m) - Xylene	<0.1	175	5.0	0.03	454
(p) - Xylene	<0.1	198	6.5	0.03	454
Ethyl benzene	<0.1	152	7.0	37	454
Naphthalene	0.13	31.1	1.0	—	4.54



COUNTY OF ALAMEDA
PUBLIC WORKS AGENCY
399 Elmhurst Street • Hayward, CA 94544-1395
(510) 670-5480
FAX (510) 670-5262

FAX TRANSMITTAL FAX TRANSMITTAL FAX TRANSMITTAL FAX TRANSMITTAL

DATE: 2-1

TO: Heather Davis

FROM: Andrews Godfrey

ATTN: (805) 654-0720

OF PAGES (INCLUDING COVER SHEET) 2

COMMENTS:

Wells within 1/2 mile of 2844 Mountain Blvd.

If you do not receive the entire transmittal, or if it is illegible, please call _____ at (510) 670-5543

Tr	Section	Address	Locality	Owner	Drilldate	Elevation	Totaldepth	Waterdepth	Diameter	Use	Log	Wq	WI	Yield
1S/3W	28N 2	4315 Lincoln Avenue	Oakland	The Head Royce School	8/89	0	260	240		IRR	D	0	0	14
1S/3W	28N 3	4315 Lincoln Avenue	Oakland	The Head Royce School	8/89	0	101	0		DES	D	0	0	0
1S/3W	28K 4	2344 Mountain Blvd	Oakland	Desert Petroleum	05/90	0	25	8		MON	D	0	0	0
1S/3W	28K 3	2344 Mountain Blvd	Oakland	Desert Petroleum	05/90	0	25	6		MON	D	0	0	0
1S/3W	28K 1	2344 Mountain Blvd	Oakland	Desert Petroleum	05/90	0	30	7		MON	D	0	0	0
1S/3W	28K 2	2344 Mountain Blvd	Oakland	Desert Petroleum	05/90	0	25	7		MON	D	0	0	0
1S/3W	28N 1	FUNSTON PLACE	Oakland	PG&E	1/75	0	120	0		CAT	D	0	0	0
1S/3W	33R 1	MONTEREY BLVD	Oakland	PG&E	7/76	0	120	0		CAT	D	0	0	0

"0" means no data

cat - cathodizprotection

Mon - monitoring

IRR - irrigation

Des - destroyed

**CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION**

2101 WEBSTER STREET, Suite 500
OAKLAND, CA 94612
Tel: (510) 286-1255
FAX: (510) 286-1380
BBS: (510) 286-0404



January 5, 1996

**To: San Francisco Bay Area Agencies Overseeing UST Cleanup
(see distribution list)**

**Subject: Supplemental Instructions to State Water Board December 8, 1995,
Interim Guidance on Required Cleanup at Low Risk Fuel Sites**

As you know, Lawrence Livermore National Laboratory (LLNL) issued its "Recommendations to Improve the Cleanup Process for California's Leaking Underground Fuel Tanks" (October 16, 1995). In response to this report, State Water Resources Control Board Executive Director Walt Pettit issued an interim guidance letter (attached) dated December 8, 1995, which discussed the regulatory implications of the conclusions and recommendations of the LLNL report. This letter is intended to further amplify the guidance contained in the State Board letter for fuel cleanup sites within the San Francisco Bay Region.

Two documents are enclosed. One we call "Supplemental Instructions", which we recommend for your use in regulating low-risk sites. The other is a fact sheet in question and answer format intended for the interested tank owner or the general public.

In general, we concur with the findings and conclusions of the LLNL study. The LLNL study is consistent with the language approved by the Regional Board in its "non-attainment zone" policy for groundwater cleanup. For both the LLNL study and the Regional Board "non-attainment zone" policy, it is recommended that fuel sites be treated differently and less stringently than solvent sites. In this region we believe that most fuel sites fall into the low-risk category, for which source removal and passive remediation are adequate. At the same time we believe that great care should be used to see that sites which are *not* low-risk receive more aggressive treatment. These judgements will always have to be made on a site-by-site basis.

Note that this guidance, like that provided in the State Board's December 8 letter, is only interim. The recommendations of the SB 1764 Scientific Advisory Committee are due this month, and these will presumably be reflected in the pending changes the State Board is considering in its update to its cleanup policy this spring.

If you have questions on the guidance or the supplemental instructions, please call Steve Morse (510-286-0304) or Kevin Graves (510-286-0435) of my staff.

Sincerely,

A handwritten signature in cursive script that reads "Loretta K. Barsamian". Below the signature is the word "for" written in a smaller, simpler font.

Loretta K. Barsamian
Executive Officer

Attachment (2)

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD**SAN FRANCISCO BAY REGION**

2101 WEBSTER STREET, Suite 500

OAKLAND, CA 94612

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January 5, 1996

MEMORANDUM**To: San Francisco Bay Area Agencies Overseeing UST Cleanup and Other Interested Parties****Subject: Regional Board Supplemental Instructions to State Water Board December 8, 1995,
Interim Guidance on Required Cleanup at Low-Risk Fuel Sites**

These supplemental instructions are intended for the regulatory and technical audience¹ to expand on the interim guidance provided in the December 8, 1995, letter from Walt Pettit, Executive Director of the State Water Resources Control Board regarding the findings of the report entitled "Recommendations to Improve the Cleanup Process for California's Leaking Underground Fuel Tanks (LUFTs)" issued by the Lawrence Livermore National Laboratory (LLNL). Mr. Pettit's letter urges cleanup agencies to proceed aggressively to close low risk soil only cases and not to require active remediation of low risk groundwater cases.

The LLNL report indicates that bioremediation of petroleum is an important factor in stabilizing plumes and may be the only remedial activity necessary in the absence of free product. After a review of existing literature, white papers submitted to the SB1764 committee, and an extensive study of leak cases statewide, the LLNL report found that petroleum plumes tend to stabilize close to the source, generally occur in shallow groundwater and rarely impact drinking water wells in the state.

It is in light of these findings and the "lessons learned" over the past ten years in San Francisco Bay Region that these supplemental instructions are written. Strategies are presented for closing low risk soil only cases and managing low risk groundwater impact cases utilizing natural bioremediation as the preferred remedial alternative.

These two classes of sites, low risk soils and low risk groundwater, are not intended to include the whole universe of petroleum leaks. There are higher risk sites that may require immediate action and remediation to protect human health and the environment. The responsibility still lies with the discharger for investigation of the subsurface to gather the data necessary to make these decisions. It is the responsibility of the regulator to only request that information which is required to make the necessary regulatory decisions regarding the site.

It is the responsibility of everyone in the process, particularly consultants and regulators, to keep up with current research on site investigation, fate and transport of contaminants, analytical methods, and other topics that affect the decision making process. Training and education should be a high priority for all parties participating in the site cleanup process. The State and Regional Boards will be providing training to the local agencies and others affected. In addition, consulting by the Regional Board's toxicologist, Dr. Ravi Arulanantham, is available on a limited basis to local agencies.

¹ Additional supplemental information is also provided from the Regional Board in the form of a Fact Sheet in a "Question and Answer" format.

LOW RISK SOILS CASE

Definition:

- 1) The leak has been stopped and ongoing sources, including free product, removed or remediated.**

The tank or appurtenant structure that leaked must be repaired or permanently closed per Chapter 7, Section 2672 of the UST regulations. Free product shall be removed to the extent practicable per Chapter 5, Section 2655 of the UST regulations.

Free product or soil which contains sufficient mobile constituents (leachate, vapors, or gravity flow) to degrade groundwater quality above water quality objectives or result in a significant threat to human health or the environment should be considered a source.

For old releases, the absence of current groundwater impact is often a good indication that residual concentrations present in the soil are not a source of pollution. In general, if impacted soil is not in contact, or expected to come in contact, with or very close to the groundwater, it is unlikely that it is a significant source of pollution.

- 2) The site has been adequately characterized.**

The extent of the subsurface impact should be defined to the degree that is necessary to determine if the site poses a threat to human health, the environment, or other sensitive nearby receptors. The level of detail required at a given site will depend upon the presence or absence of potential receptors and exposure pathways. Delineating plumes to non-detect levels is not required at all sites.

It is assumed that subsurface conditions are highly variable and that there is always some uncertainty associated with evaluating data at a site. However, the cost of obtaining additional data must be weighed against the benefit of obtaining that data and the effect the data may have on the certainty of decisions to be made at the site.

- 3) Little or no groundwater impact currently exists and no contaminants are found at levels above established MCLs or other applicable water quality objectives.**

By definition, soils only cases do not have significant groundwater impacts.

- 4) No water wells, deeper drinking water aquifers, surface water, or other sensitive receptors are likely to be impacted.**

- 5) The site presents no significant risk to human health.**

The American Society of Testing and Materials' (ASTM) standard for Risked Based Corrective Action (RBCA), ASTM E-1739-95, details a framework and provides a methodology to perform a tiered risk analysis at petroleum release sites. This methodology incorporates EPA risk assessment practices to determine non-site specific (tier 1 look up table which provides generic risk based screening levels) and site specific (tier 2 and tier 3) clean up levels that are protective of public health and environmental resources.

In addition to the various methods of contaminant transport described in the ASTM standard, other methods may also be acceptable in determining health and environmental protective levels.

When using the ASTM lookup table risk based screening levels (RBSLs) one has to multiply the RBSL value for benzene by a factor of 0.29 to obtain the corrected value for California (CAL EPA has a higher toxicity value of 0.1 as compared to the USEPA value of 0.029 for benzene). All other values in the table remain the same.

6) The site presents no significant risk to the environment.

RBCA has no specific guidance for evaluating environmental risk although the basic framework is appropriate if site specific exposure pathways and ecological receptors are included. If the site has a potential to significantly impact surface water, wetlands, other sensitive receptors, it should not be considered low risk.

Management Strategy

Low risk soils cases should be closed when it is determined that site conditions conform to the above criteria. Further remediation or monitoring is not required. If the highest permitted use (e.g., residential) is not protected by the chosen cleanup levels, then land use restrictions or notifications for the site may be appropriate.

LOW RISK GROUNDWATER CASE

Definition

- 1) The leak has been stopped and ongoing sources, including free product, have been removed or remediated (see Low Risk Soils Case Definition #1).**
- 2) The site has been adequately characterized (see Low Risk Soils Case Definition #2).**

The presence or absence of horizontal and vertical conduits which could act as preferential pathways for the dissolved plume should be evaluated as a part of the site characterization process.

- 3) The dissolved hydrocarbon plume is not migrating.**
The LLNL report found that petroleum plumes in the subsurface tend to stabilize once the source is removed. Natural biodegradation of hydrocarbons is the main reason why this stability occurs.

Chemical concentrations of hydrocarbons in groundwater that decrease or do not change with time are the best indicators of a stable plume. Comparison of background and hydrocarbon plume concentrations of inorganic ions such as oxygen, iron, nitrate, sulfate, and others, can provide evidence of biodegradation at a given site. These data may not be required to determine plume stability but can supplement other lines of evidence.

Stable or decreasing plumes often display short term variability in groundwater concentrations. These effects are due to changes in groundwater flow, degradation rates, sampling procedures, and other factors which are inherently variable. This behavior should not necessarily be construed as evidence of an unstable plume but may be the natural variations of a stable plume in the environment.

- 4) No water wells, deeper drinking water aquifers, surface water, or other sensitive receptors are likely to be impacted.**
- 5) The site presents no significant risk to human health.**

For this analysis, the groundwater ingestion pathway need not be considered if the groundwater is not currently used as a source of drinking water or projected to be used within the life of the plume. (See Low Risk Soils Case Definition #5)

- 6) The site presents no significant risk to the environment.**

RBCA has no specific guidance for evaluating environmental risk although the basic framework is appropriate if site specific exposure pathways and ecological receptors are included. If the site has a potential to significantly impact surface water, wetlands, other sensitive receptors, it should not be considered low risk. (See Low Risk Soils Case Definition #6)

Management Strategy

- 1) Passive bioremediation should be the preferred remedial alternative unless there is a compelling reason to do otherwise.**

A partial list of reasons that may justify active remediation are listed below:

- Groundwater within the plume is likely to be used before natural biodegradation is projected to complete the cleanup.
- Sensitive receptors have been identified and are projected to be adversely impacted.
- The plume is migrating significantly.
- Another remedial alternative is shown to be more cost effective.

Generally, if any of these conditions or others deemed to be compelling are met, a more aggressive remedial approach may be appropriate.

- 2) Monitor the site to determine plume stability and the effectiveness of the remedial strategy.**

Monitoring is necessary to determine if site conditions will remain stable or improve over time. One hydrologic cycle (four quarters) of monitoring data is usually considered to be the minimum necessary to determine site conditions. This assumes depth to groundwater has significant seasonal variation and that no longer term variation occurs. If little seasonal fluctuation is expected, then one year of monitoring may not be required. Conversely, if depth to groundwater is expected to change significantly from year to year due to droughts, adjacent pumping, or other factors, then one year of monitoring may not be adequate.

Data from adjacent or nearby sites may be useful in determining groundwater fluctuations and other regional aquifer characteristics. Frequency of monitoring and the number of monitoring points may be adjusted after site characterization is completed. At many existing sites, these data may already have been collected.

Coordinated &

Prepared by:  Kevin L. Graves, P.E.

Associate Water Resources Control Engineer

January 5, 1996

 Stephen I. Morse, P.E.

Chief, Toxics Cleanup Division

January 5, 1996

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

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Fact Sheet Questions and Answers on the

"Interim Guidance on Low-Risk Petroleum Hydrocarbon Cleanups"

Lawrence Livermore National Laboratory (LLNL) issued its "Recommendations to Improve the Cleanup Process for California's Leaking Underground Fuel Tanks" (October 16, 1995). In response to this report, State Water Resources Control Board Executive Director Walt Pettit issued an interim guidance letter dated December 8, 1995, which discussed the regulatory implications of the conclusions and recommendations of the LLNL report.

From the December 8, 1995, letter:

"In the interim and in light of the findings and recommendations in the LLNL report, we believe cleanup oversight agencies should proceed aggressively to close low risk soil only cases. For cases affecting low risk groundwater (for instance, shallow groundwater

with maximum depth to water less than 50 feet and no drinking water wells screened in the shallow groundwater zone within 250 feet of the leak) we recommend that active remediation be replaced with monitoring to determine if the fuel leak plume is stable. Obviously good judgment is required in all of these decisions. However, that judgment should now include knowledge provided by the LLNL report."

This Fact Sheet is intended to further amplify the guidance contained in the State Board letter for fuel cleanup sites within the San Francisco Bay Region through the form of "Answers" to frequently asked questions regarding implementation of the new petroleum cleanup interim guidance.

Q What is considered a "source" when completing source removal?

A Leaking tanks and appurtenant structures must be removed or repaired. Free product or soil which contains sufficient mobile constituents (leachate, vapors, or gravity flow) to degrade groundwater quality above water quality objectives or provide a significant threat to human health or the environment should be considered a source.

Gasoline or diesel free product fits this definition at virtually all sites. Oil and grease, degraded crude oil, and degraded diesel may not be soluble enough to be considered a significant source and often do not degrade water quality or present a significant risk to human health or the environment.

Many factors need to be considered when determining if a given petroleum release constitutes a source.

- Depth of the affected soil below ground surface
- Depth to groundwater below ground surface
- Soil type and physical properties
- Presence of preferential pathways (i.e. old wells, utility trenches, etc.)
- Type of petroleum released
- Infiltration rate
- Spatial distribution of petroleum concentrations
- Total mass of petroleum released
- Trends in monitoring data
- Chemical and physical properties of any residual hydrocarbons

Good judgment must be used when weighing these and other factors. For old releases, the absence of current groundwater degradation often is a good indication that residual concentrations present in the soil are not a source of pollution. In general, if impacted soil is not in contact or

expected to come in contact with the groundwater, it is unlikely that it is a significant source of pollution.

Q What is meant by "low risk groundwater sites"?

A An example of a low risk groundwater site is described in the State Board letter as a site with maximum depth to groundwater less than 50 feet and no drinking water wells screened in the shallow groundwater zone within 250 feet of the leak. In addition, there should be no surface water or other sensitive habitat that may be adversely impacted by the release.

These criteria are not hard and fast rules. They are meant to recognize that shallow groundwater is rarely used as a drinking water source, that biodegradation in most cases will stabilize a plume within 250 feet of the leak, and that the plume will likely remediate itself due to natural biodegradation. However, if the plume is not stable, preferential pathways exist at the site, or sensitive receptors are near the end of the plume, then the site should not be considered low risk.

Q How do we determine if there is a significant risk to human health at a site?

A The American Society of Testing and Materials (ASTM) standard for Risk Based Corrective Action, ASTM E-1739-95, (RBCA) provides look up tables for various exposure pathways that contains conservative screening levels (when modified for California's benzene standard) for comparison with values existing at the site. The standard also contains a methodology for determining site specific levels that are protective of public health and the environment. The SWRCB/RWOCB is now offering two day classes for all interested parties in risk-based decision making at soil and groundwater impacted sites. Please contact the UC

Riverside Extension at 909-787-4105 to obtain further information on upcoming classes.

Q What is a sensitive receptor?

A Water wells, deeper drinking water aquifers, surface water bodies, sensitive habitats such as wetlands, marshes, or mudflats, human beings, aquatic plants and animals, and other wildlife are all sensitive receptors. Property lines and other political or administrative boundaries are not considered to be sensitive receptors for the purposes of this guidance.

Q How do we determine if there is significant ecological risk at the site?

A There is not currently a standard method for determining potential threats to the environment or aquatic receptors. When appropriate, ASTM RBCA would identify this as a potential exposure pathway that is not included in the current "look up tables" and will therefore require a higher tier analysis. This analysis may require additional evaluation of migration pathways such as storm drains and other manmade conduits. Currently, evaluation protocols are being developed, and look up tables for ecological receptors may be added to ASTM RBCA in the future. The lack of a standard protocol or look up table does not eliminate the requirement to evaluate this pathway, especially in nearshore or Bay front locations.

Q The State Board letter states that active remediation should be replaced with monitoring at low risk sites. What technologies are considered "active remediation"?

A Active remediation refers to remediation of dissolved groundwater plumes. Mechanical systems that inject or remove material from the dissolved phase plume are considered active remediation. Examples of active remediation include groundwater extraction systems, air sparging systems, and hydrogen peroxide injection systems. Vapor extraction, bioslurping and other source removal systems are not considered active remediation if they are removing a source of pollution as defined in Question 1 above.

Q What technologies for free product removal are currently considered practicable?

A Appropriate excavation of the impacted material surrounding the leak is one of the best source removal technologies available. Manual bailing, passive skimming, and pumping of groundwater are only marginally effective at removing free product. Vacuum enhanced free product recovery (ie. vapor extraction, bioslurping, etc.) has been shown to be a highly effective method for removing mobile free product. Each site needs a determination of the cost-effectiveness of the various techniques taking into account the soil type, amount of free product present, potential for the free product to act as a source, preferential pathways, and other factors that affect hydrocarbon movement at the site.

Q What 'reasonable justification' would be compelling enough to use active remediation on the dissolved hydrocarbon plume?

A A partial list of reasons that may be compelling are listed below:

- Groundwater within the plume is likely to be used before natural biodegradation is projected to complete the cleanup.
- Sensitive receptors have been identified and are projected to be adversely impacted.
- The plume is migrating significantly.
- Another remedial alternative is shown to be more cost effective.

Generally, if any of these conditions or others deemed to be reasonable justification are met, a more aggressive remedial approach may be appropriate.

Q What criteria are used to determine plume stability?

A The LLNL report found that petroleum plumes in the subsurface tend to stabilize once the source is removed. Natural biodegradation of hydrocarbons is the main reason this stability occurs.

Many factors influence plume stability including hydrogeology and those listed in Question 1. However, chemical concentrations of hydrocarbons in groundwater that decrease or do not change with time are the best indicator of a stable plume. Comparison of background and hydrocarbon plume concentrations of inorganic ions such as oxygen, iron, nitrate, sulfate, and others, can provide evidence of biodegradation at a given site. These data may not be required to determine plume stability, but can supplement other lines of evidence.

Stable or decreasing plumes often display short term variability in groundwater concentrations. These effects are due to changes in groundwater flow, degradation rates, sampling procedures, and other factors which are inherently variable. This behavior should not necessarily be construed as evidence of an unstable plume but may be the natural variability of a stable plume in the environment.

Q What should the monitoring frequency be?

A The frequency of monitoring should be commensurate with the need for data to make required decisions at the site. Quarterly monitoring may be appropriate in the early stages of investigation when extent of contamination, seasonal groundwater fluctuations, and other site specific factors are being evaluated. After these have been determined, monitoring frequency may be reduced to perhaps annually and number of monitoring points reduced to selected wells only. Long term monitoring should be limited to collecting only the minimum data needed to verify that site conditions are stable or improving. Much of this information has already been collected at many existing sites.

Q Can existing active remediation systems at low risk sites be turned off even though established remedial goals have not been reached?

A Yes. If the site is evaluated using the new guidance and active remediation is not indicated, then active treatment at the site should be terminated. If the extraction system is necessary to provide hydraulic control of the plume which prevents contaminants from reaching a sensitive receptor, then continued pumping may be warranted.

Q When can adjacent site data be used in lieu of site specific data?

A Local hydrogeologic data can often be inferred from data collected at adjacent sites. Depth to groundwater, depth to regional aquifer, groundwater gradient, soil types that may be present, and chemical concentrations may all be of value in directing an investigation. A conceptual model of the site may be formed using local or adjacent site data. Data collected during a site investigation should clarify the conceptual model and help to guide any further work at the site.

Q If a site is only monitoring and no active remediation is anticipated, can the site be closed?

A Regulatory agencies have broad discretion to determine whether or not regulatory action is necessary and appropriate at a given site. Under current policies, the monitoring period could be many years depending upon the magnitude of the release, remedial actions taken, and biodegradation rates at the site. Closure of low risk UST sites would be appropriate as soon as enough data supported the conclusion that the source had been removed, the plume had stabilized, and bioremediation was expected to achieve water quality objectives (e.g. MCLs) in a reasonable time.

The State Board has indicated that policies regarding petroleum cleanup standards will be reviewed in 1996 pursuant to SB1764 requirements. Changes in closure policy regarding low risk groundwater cases may be a result of that review.

Q What action should be taken if a responsible party refuses to take any action at a site and cites this guidance as the reason for inaction?

A Responsible parties are required to comply with all regulatory requirements. If they disagree with a directive or think it is in violation of current regulatory practice, they have the opportunity to appeal that directive through the proper channels. Responsible parties may face enforcement actions if they disregard regulatory requirements and do not appeal using the appropriate procedures.

Q If a responsible party wants to pursue a more aggressive remedial strategy than stated in the State Board letter, will the Cleanup Fund pay for the additional remediation?

A The Cleanup Fund manager has indicated that the Fund will only reimburse costs for those activities that are required by regulatory agencies. For low risk cases, regulatory agencies should not approve work plans for active remediation unless adequate justification is provided. Article 11, section 2727f of the Underground Storage Tank Regulations requires that responsible parties propose the most cost-effective corrective action. This will be monitoring, without active remediation, in many cases.

Q What public notification is required when implementing this guidance?

A The implementation of the LLNL recommendations suggested by the State Board letter does not change the public notification requirements already stated in the UST regulations in Chapter 11, Section 2728. That section requires that the public must be informed of the proposed activities contained in a site's corrective action plan. If a site's corrective action plan is modified to the extent that it is essentially a new corrective action plan, then it may be appropriate for the public to be notified of the new plan.

Q Will future use of an impacted property be restricted by implementation of State Boards' recommendations?

A No change in current practice is expected. Generally, sites are remediated to either residential or commercial/industrial requirements based on current and projected future land uses. If a site is cleaned up to commercial/industrial standards and the land use changes to residential, then further risk assessment and possibly mitigation or remediation may be required.

The current UST "no further action" letter requires that the implementing agency be notified if a change in land use occurs.

Q How does this guidance fit with existing and future policy?

A From the December 8, 1995 letter, "What I propose to you is not in any way inconsistent with existing policies or regulations. However, it does represent a major departure from how we have viewed the threat from leak USTs." Under the requirements of SB 1764 the legislature expects the State Water Resources Control Board to propose and make further permanent changes to the interim guidance, perhaps as early this spring. Meanwhile, the Regional Board and the local regulating agencies will be implementing the interim guidance.

For further information or questions, please contact the Regional Board. Initial contact should be Wil Bruhns, the Regional Board's Ombudsman at 510-286-0838. He can give you further general information and direct your questions to the appropriate staff persons. It should be noted that most fuel cleanup sites in the Bay Area are regulated by local agencies.

DRAFT Example ASTM RBCA (E1739-95) Tier 1 Risk-Based Screening Level (RBSL) Look-Up Table-Modified

(modifications shown in *bold italics* 2/5/96 for California Maximum Concentration Limits, etc. by SIM/RA @ SFBRWQCB Feb 26, 1996)

Exposure Pathway	Receptor Scenario	Target Level	Benzene	Ethylbenzene	Toluene	Xylene(mixed)	Naphthalene	Benzo(a)pyrene	
AIR	Indoor Air Screening Levels for Inhalation Exposure (ug/m ³)	Residential	Cancer Risk = 1E-06	<i>1.14E-01</i>				1.88E-03	
			Cancer Risk = 1E-04	<i>1.14E+01</i>				1.88E-01	
			Chronic HQ = 1		1.38E+03	5.56E+02	9.73E+03	1.95E+01	
		Commercial/Industrial	Cancer Risk = 1E-06	<i>1.43E-01</i>					2.35E-03
			Cancer Risk = 1E-04	<i>1.43E+01</i>					2.35E-01
			Chronic HQ = 1		1.48E+03	5.94E+02	1.02E+04	2.04E+01	
	Outdoor Air Screening Levels for Inhalation Exposure (ug/m ³)	Residential	Cancer Risk = 1E-06	<i>8.53E-02</i>					1.40E-03
			Cancer Risk = 1E-04	<i>8.53E+00</i>					1.40E-01
			Chronic HQ = 1		1.04E+03	4.17E+02	7.30E+03	1.48E+01	
		Commercial/Industrial	Cancer Risk = 1E-06	<i>1.43E-01</i>					2.35E-03
			Cancer Risk = 1E-04	<i>1.43E+01</i>					2.35E-01
			Chronic HQ = 1		1.48E+03	5.84E+02	1.02E+04	2.04E+01	
OSHA TWA PEL (ug/m ³)			<i>3.20E+03</i>	4.95E+05	7.53E+05	4.25E+08	5.00E+04	2.00E+02(1)	
Mean Odor Detection Threshold (ug/m ³)(2)			<i>1.95E+05</i>		5.00E+03	8.70E+04	2.00E+02		
National Indoor Background Concentration Range (ug/m ³)(3)			<i>2.25E+00 - 2.15E+01</i>	2.20E+00 - 9.70E+00	9.60E-01 - 2.31E+01	4.85E+00 - 4.75E-01			
SOIL	Soil - Volatilization to Outdoor Air (mg/kg)	Residential	Cancer Risk = 1E-06	<i>7.89E-02</i>				RES	
			Cancer Risk = 1E-04	<i>7.89E+00</i>				RES	
			Chronic HQ = 1		RES	RES	RES	RES	
		Commercial/Industrial	Cancer Risk = 1E-06	<i>1.33E-01</i>					RES
			Cancer Risk = 1E-04	<i>1.33E+01</i>					RES
			Chronic HQ = 1		RES	RES	RES	RES	
	Soil - Vapor Intrusion from Soil to Buildings (mg/kg)	Residential	Cancer Risk = 1E-06	<i>1.55E-03</i>					RES
			Cancer Risk = 1E-04	<i>1.55E-01</i>					RES
			Chronic HQ = 1		4.27E+02	2.06E+01	RES	4.07E+01	
		Commercial/Industrial	Cancer Risk = 1E-06	<i>4.90E-03</i>					RES
			Cancer Risk = 1E-04	<i>4.90E-01</i>					RES
			Chronic HQ = 1		1.10E+03	5.45E-01	RES	1.07E+02	
	Surficial Soil (0-3 ft.) Ingestion/ Dermal/ Inhalation (mg/kg)	Residential	Cancer Risk = 1E-06	<i>1.68E+00</i>					1.30E-01
			Cancer Risk = 1E-04	<i>1.68E+02</i>					1.30E+01
			Chronic HQ = 1		7.83E+03	1.33E+04	1.45E+06	9.77E+02	
		Commercial/Industrial	Cancer Risk = 1E-06	<i>2.90E+00</i>					3.04E-01
			Cancer Risk = 1E-04	<i>2.90E+02</i>					3.04E+01
			Chronic HQ = 1		1.15E+04	1.87E+04	2.08E+05	1.80E+03	
Soil - Leachate to Protect Groundwater Ingestion. Target Level (mg/kg)	Residential	MCL's	<i>5.86E-03</i>	1.10E+02	<i>2.65E+00</i>	<i>5.33E+01</i>	N/A	9.42E+00	
		Cancer Risk = 1E-06	<i>4.89E-03</i>					5.90E-01	
		Cancer Risk = 1E-04	<i>4.89E-01</i>					RES	
	Commercial/Industrial	Chronic HQ = 1		5.75E+02	1.23E+02	RES	4.20E+01		
		Cancer Risk = 1E-06	<i>1.68E-02</i>					1.65E+00	
		Cancer Risk = 1E-04	<i>1.68E+00</i>					RES	
GROUND WATER	Groundwater - Volatilization to Outdoor Air (mg/l)	Residential	Cancer Risk = 1E-06	<i>3.19E+00</i>				>S	
			Cancer Risk = 1E-04	<i>3.19E+02</i>				>S	
			Chronic HQ = 1		>S	>S	>S	>S	
		Commercial/Industrial	Cancer Risk = 1E-06	<i>5.34E+00</i>					>S
			Cancer Risk = 1E-04	<i>>S</i>					>S
			Chronic HQ = 1		>S	>S	>S	>S	
	Groundwater Ingestion (mg/L)	Residential	MCL's	<i>1.00E-03</i>	7.00E-01	<i>1.50E-01</i>	<i>1.76E+02</i>	N/A	2.00E-04
			Cancer Risk = 1E-06	<i>8.52E-04</i>					1.17E-05
			Cancer Risk = 1E-04	<i>8.52E-02</i>					1.17E-03
		Commercial/Industrial	Chronic HQ = 1		3.85E+00	7.30E+00	7.30E+01	1.48E-01	
			Cancer Risk = 1E-06	<i>2.86E-03</i>					3.92E-05
			Cancer Risk = 1E-04	<i>2.86E-01</i>					>S
	Groundwater - Vapor Intrusion from Groundwater to Buildings (mg/l)	Residential	Chronic HQ = 1		1.92E+01	2.04E+01	>S	4.09E-01	
			Cancer Risk = 1E-06	<i>6.90E-03</i>					>S
			Cancer Risk = 1E-04	<i>6.90E-01</i>					>S
		Commercial/Industrial	Chronic HQ = 1		7.75E+01	3.28E+01	>S	4.74E+00	
			Cancer Risk = 1E-06	<i>2.14E-02</i>					>S
			Cancer Risk = 1E-04	<i>2.14E+00</i>					>S
Chronic HQ = 1				>S	8.50E+01	>S	1.23E+01		

* As benzene soluble coal tar pitch volatiles.
 ** American Industrial Hygiene Association, *Odor Thresholds for Chemicals with Established Occupational Health Standards*, 1988.
 From: Shah and Singh, *Environmental Science Technology* Vol 22, No. 12; ATEOR, 1988; Toxicological Profiles, U.S. Public Health Services, 1988, and Wallace L.A., *Journal of Occupational Medicine*, Vol 28, No. 5, 1986.
 * "RES" -- selected risk level is not exceeded for pure compound present at any concentration.
 * ">S" -- selected risk level is not exceeded for all possible dissolved levels (2 pure compound solubility).
 for (1) (2) (3) see original document ASTM E 1739.