SOILS AND GROUNDWATER

CONTAMINANT INVESTIGATION

FOR THE

FORMER NIELSEN FREIGHT LINES SITE

IN

EMERYVILLE, CALIFORNIA

Prepared for:

Alameda County
Hazardous Materials Unit

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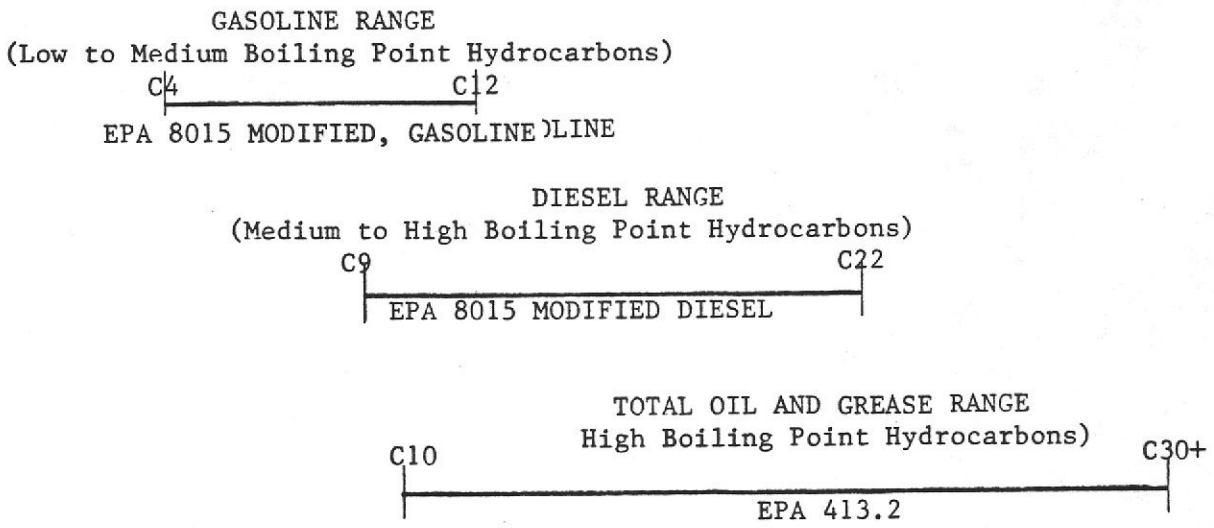
1. EXECUTIVE SUMMARY

This report summarizes past and current contamination investigations of the former Nielsen Freight Lines site in Emeryville, California. Current issues to be resolved concern the disposition of stockpiled soil, which remains following April 1987 underground tank removals, and disposition of oil and grease ladened soil in the southern sector.

This current report recommends backfilling after aeration and biodegration of the soils which were excavated during tank removal. This report also recommends encapsulation of the tar which is mixed into soil in the southern sector. Alternative actions are addressed in Section 5.

In any event, all soils on the site can be encapsulated during proposed site development with a movie theater. The proposed theater concrete foundation paved parking area, and landscaped areas filled with 18 inches of clean loam would serve as an effective encapsulation layer.

Section 4 discusses all past and current test results for the Nielsen site. In particular, the subject of tar is addressed because previous Total Fuel Hydrocarbon tests (Brown and Caldwell) may have been mistakenly interpreted as indicating the presence of spilled diesel fuel. Interpretation of tar and diesel results depend on an understandiing of carbon detection ranges (see Figure 1). These ranges overlap and make interpretation difficult. Tar and diesel contain certain higher boiling point hydrocarbons, both detectable by the infrared spectroscopy and gas chromatography methods used previously that does not always differentiate between diesel and oil and grease. Tar in the Nielsen site originated from a historic asphalt roof paper manufacturing plant located on the Marketplace site.



NOTE: There is some variation between environmental labs in regard to these ranges, and also in regard to various terminology refer to Appendix E, Table E-1.

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FIGURE 1.
APPROXIMATE ANALYTICAL DETECTION RANGE
FOR VARIOUS EPA TESTS

2. NIELSEN FREIGHT LINES SITE HISTORY AND PREVIOUS CONTAMINANT INVESTIGATION RESULTS

The former Nielsen Freight Lines site is located immediately north of the Marketplace site, south of 64th Street in Emeryville. Early development as the Nielsen Freight Lines site occurred contemporareously with development of the Marketplace site. Between 1935 and 1937, the portion of the Nielsen site north of 63rd Street was filled five years after the Marketplace had been filled and occupied. Early industrial uses of the Nielsen site included installation of four large above ground storage tanks, construction of a building, and creation of a storage yard. These early uses were part of the manufacturing operation on the Marketplace site, making roofing products and paint.

Development as a trucking facility occurred later, in the 1960s. For its use as a trucking terminal, several diesel, gasoline, and waste oil underground storage tanks were installed in the 1960s. There were: one (1) 500 gallon waste oil tank, one (1) 500 gallon lube oil tank, one (1) 10,000 gallon gasoline tank, and one (1) 10,000 gallon diesel fuel tank, all underground.

Additional historic trucking uses or activities of potential concern are surface storage of solvents and degreasers, buried gasoline and diesel fuel manifolds (pipes). Historic manufacturing uses of potential concern are the paint and roofing products manufacturing uses which predate the trucking uses. The history of the Marketplace former roofing materials manufacture has been well documented in the Draft Work Plan (Earth Metrics Incorporated, 1987).

UNDERGROUND TANK CLOSURE

The gasoline, diesel, waste oil, and lube oil tanks and manifolds were removed and disposed off site on April 7 and April 8, 1987. Removal was supervised by Woodward-Clyde Consultants and observed by representatives of the Emeryville Fire Department.

The nomenclature for describing various petroleum hydrocarbons used previously by Woodward-Clyde Consultants is not the same as current nomenclature used by the Regional Water Quality Control Board (RWQCB) and Earth Metrics Incorporated. A table of terminology is found in Appendix E, Table E-1. Earth Metrics Incorporated has adopted the RWQCB terminology.

In particular, WCC has grouped both gasoline and diesel fuel constituents into a total fuel hydrocarbon category whereas the RWQCB and Earth Metrics Incorporated use total petroleum hydrocarbons (TPH) and separate the TPH into low and higher boiling point categories. Table A-2 in Appendix A and Table 2 on page 3-3 illustrate these differences.

Soil samples from the tank pits were collected on April 8 or 9, 1987 and tested for Total Fuel Hydrocarbons (TFH). Soil samples, particularly beneath the former diesel and gasoline manifolds and product lines, contained TFH in excess of the State of California 100 ppm (TFH) criterion, and in some instances contained over 1000 ppm (TFH). Soil samples from the oil storage tank pits contained less than 100 ppm (TFH).

Excavation spoils remain stockpiled beside the tank and manifold excavations. Since the date of excavation, eight groundwater monitoring wells have been installed and developed, as discussed in the following.

PREVIOUS CONTAMINANT INVESTIGATION

The original exploratory borings were drilled at 15 locations (refer to Figure 2) during March and April, 1987. Ten borings were drilled to a total depth of 11.5 to 16 feet. Eight of these ten borings were converted to groundwater monitoring wells (denoted by a "W" prefix in Figure 2). Five borings were shallow borings drilled to a total depth of 4 to 6.5 feet.

All eight wells were developed during April 9, 1987 through April 17, 1987. Additionally, floating asphalt and groundwater from Boring No. 5M was sampled on April 16, 1987. Boring No. 5M is actually located in the northeast corner of the Marketplace site.

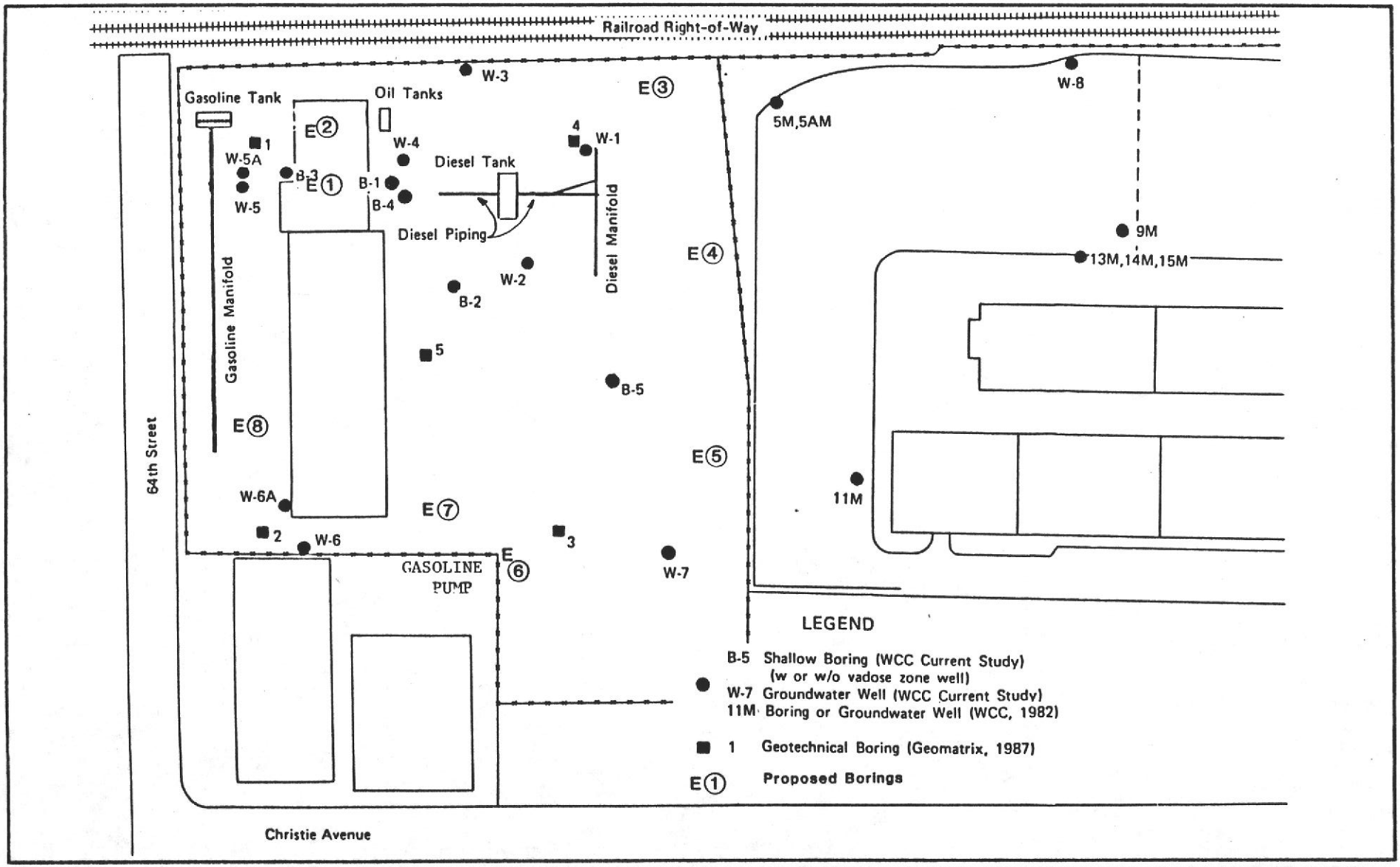
Previous Soil Samples. Twelve soil samples were collected and submitted to a laboratory for testing. Soil samples were generally discretionary, being collected from the tank pits or from borings drilled to check for groundwater contamination in the vicinity and downgradient of former fuel and oil tanks. Test parameters included selectively: fourteen (14) metals or four (4) "indicator" metals (lead, nickel, total chromium, and zinc); PCBs; Total Fuel Hydrocarbons (TFH); and priority organics (EPA Method, 624 and/or 625).

Additional soil samples were collected earlier in April 1987 during the fuel and oil tank excavation and removal. A total of twenty six (26) soil samples were collected. All samples were analyzed by EPA Method 8015 for Total Petroleum Hydrocarbons.

Previous Soil Test Results. No significant PCB concentrations (less than 0.05 ppm) were found in the soils. All soil samples were tested for "indicator" metals, and contained less than the respective California TTLC for each indicator metal. Priority organics were not detected.

Hydrocarbons in eight soil samples from Borings No. W1, W2, W3, W4, W5, W6A, and B5 (refer to Figure 1) were tested. One of two test protocols was employed by the test laboratory. Either Total Fuel Hydrocarbons (TFH) by EPA Method 8015 or Oil and Grease Hydrocarbons by EPA Method 418.1. Results are listed below:

Boring No.	Oil and Grease Hydrocarbons (mg/kg)
W1	78
W2	<50 (TFH)
W2	40
W3	<50
W4	160 to 650
W5	<50
W6A	170
W8	130
B5	570



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SCALE
1" = 100'

FIGURE 2. FORMER NIELSON TRUCK LINES SITE DETAILING BORING LOCATIONS AND FORMER UNDERGROUND TANK LOCATIONS

EPA Method 8015 is a gas chromatographic method which detects and quantifies petroleum hydrocarbons (TFH) having boiling points which are less than 100 degrees (Celsius). EPA Method 418.1 is an infrared spectroscopy method which detects and quantifies petroleum hydrocarbons having boiling points which are greater than 70 degrees (Celsius).

Additional TFH tests of soil samples were performed earlier in April during tank excavation and removal. These are summarized in Appendix C.

Previous Water Test Results. Eight groundwater samples, one from each of eight wells, were tested. Test parameters included selectively: four (4) "indicator" metals (lead, nickel, total chromium, and zinc); Total Fuel Hydrocarbons (TFH); and priority organics (EPA Methods 624 and/or 625).

Metals were generally undetected in the groundwater or, if detected, existed in concentrations below the Safe Drinking Water Standards. Exceptions are listed below:

Well	Metal	Concentration (ppm)	Drinking Water Standard (ppm)
6	Lead	0.1	0.05
7	Lead	0.7	0.05
7	Chromium	0.08	0.05
4	Chromium	0.11	0.05

Total Fuel Hydrocarbons (EPA Method 8015) indicated no fuel or diesel contamination (less than 1 mg/liter) in groundwater samples from Wells No. 5, 6, and 6A. Diesel (determined by IR) was also less than 1 mg/liter in groundwater from Well No. 2. Toluene was detected in the sample from Well No. 2 at a trace level (80 ug/liter). Hydrocarbons (determined by IR) were less than 5 mg/liter in groundwater from Wells No. 1 and 4. Samples from Wells No. 3 and 7 were not tested for TFH.

Priority organics were not detected in any of the eight groundwater samples from the wells, except for toluene in a trace level (80 ug/liter) in Well No. 2.

Black floating product in Boring No. 5M contained a variety priority organics in low levels:

ORGANICS	mg/kg (PPM)
Acenaphthene	<100
Benzo (a) anthracene	<100
Chrysene	170
Fluorene	170
Fluoranthene	<100
Napthalene	<100
Phenanthrene	440
Pyrene	<100

3. CURRENT CONTAMINANT INVESTIGATION AND RESULTS

The current investigation was designed to supplement the archival data available from the previous site contaminant investigation. A proposed boring location plat and proposed test matrix was submitted to the Alameda County Hazardous Materials Unit on November 10, 1987.

Monitoring Well W-4 was purged and resampled on December 2, 1987. Well keys were provided by the well installers, Woodward Clyde Consultants.

CURRENT INVESTIGATION

Eight new exploratory borings were drilled at locations shown in Figure 1 on November 12, 1987. New borings are identified by the "E" prefix. New boring locations were selected nonrandomly to correspond to the "old" above ground tank site, the old refinery complex and various other locations to determine extent of total petroleum hydrocarbon concentrations and oil and grease concentrations.

Current Soil Samples. A total of 20 soil samples were collected from the eight new borings. Soil samples were collected from up to three depth levels. Seven were tested for total petroleum hydrocarbons, gasoline constituents and five were tested for total petroleum hydrocarbons - diesel constituent. Based upon visual and olfactory observations, seven soil samples (from Borings E1, E2, E3, E4, E5 and E8) also were tested for total oil and grease. Groundwater was also sampled from the diesel pit and monitoring Well W4. Diesel pit water was analyzed for total petroleum hydrocarbons (medium to high boiling point range). Water from monitoring Well W4 was analyzed for priority organics. All test results are summarized in Tables 1, 2, 3 and 4.

Current Soil Test Results. Oil and grease concentrations in the soil samples from Borings E1, E2, E3, E4, E5 and E8 ranged from 6.0 ppm to 7021 ppm. Boring E3 is located in the original vicinity of the refinery complex and exceeded 7000 ppm.

TABLE 1. OIL AND GREASE IN SOIL FROM NEW BORINGS AT THE FORMER NIELSEN FREIGHT LINES SITE IN EMERYVILLE, CALIFORNIA (PPM)

BORING NO.	SAMPLE DEPTH (FEET)	OIL AND GREASE
E1	3.0	243
E2	3.0	281
E3	1.5	142
E3	6.0	7021
E4	3.0	1016
E5	3.5	<6
E8	7.0	<6

EPA Method 413.2.

Source: Earth Metrics Incorporated, 1987.

TABLE 2. GASOLINE AND DIESEL FUEL IN SOIL FROM NEW BORINGS AT THE FORMER NIELSEN FREIGHT LINES SITE IN EMERYVILLE, CALIFORNIA (PPM)

BORING NO.	SAMPLE DEPTH (FEET)	PETROLEUM HYDROCARBONS	
		LOW BOILING POINT GASOLINE (PPM)	HIGHER BOILING POINT DIESEL (PPM)
E1	3.0	<0.14	<211
E2	3.0	<0.13 (a)	NT
	10.0	<0.14 (b)	<211
E3	6.0	NT	1736
E4	3.0	NT	<206
	7.5	NT	626
E5	NT	NT	NT
E6	3.5	0.79	NT
E7	6.0	1.8	NT
E8	6.5	<0.14	<210

NT: No Test
EPA Methods 8015 Modified Gasoline and 8015 Modified Diesel
(a) Shallow three foot depth.
(b) Deeper depth.

Source: Earth Metrics Incorporated, 1987.

TABLE 3. GASOLINE AND DIESEL FUEL IN WATER FROM EXCAVATED TANK PIT AT THE FORMER NIELSEN FREIGHT LINES SITE IN EMERYVILLE, CALIFORNIA (PPM)

PETROLEUM HYDROCARBONS	DIESEL TANK PIT
Gasoline (low boiling point)	Less than .050
Ethyl Benzene	Less than .001
Benzene	Less than .001
Toluene	Less than .001
Xylene	Less than .001
Diesel (high boiling point)	2.1 (a)

(a) Analyst commented that this did appear to be diesel fuel and not oil or other related substance.

EPA Method 8020.

Source: Earth Metrics Incorporated, 1987.

TABLE 4. PRIORITY ORGANICS IN GROUNDWATER FROM WELL NO. 4 AT THE FORMER NIELSEN FREIGHT LINES SITE IN EMERYVILLE, CALIFORNIA (PPB)

COMPOUNDS	GROUNDWATER MONITORING WELL NO.4
Acid Extractables	
4-CHLORO-3-METHYLPHENOL	ND
2-CHLOROPHENOL	ND
2,4-DICHLOROPHENOL	ND
2,4-DIMETHYLPHENOL	ND
2,4-DINITROPHENOL	ND
2-METHYL-4,6-DINITROPHENOL	ND
2-NITROPHENOL	ND
4-NITROPHENOL	ND
PENTACHLOROPHENOL	ND
PHENOL	ND
2,4,6-TRICHLOROPHENOL	ND
Base/Neutral Extractables	
ACENAPHTHENE	ND
ACENAPHTHYLENE	ND
ANTHRACENE	ND
BENZO(a)ANTHRACENE	ND
BENZO(b)FLUORANTHENE	ND
BENZO(k)FLUORANTHENE	ND
BENZO(a)PYRENE	ND
BENZO(g,h,i)PERYLENE	ND
BENZIDINE	ND
BIS(2-CHLOROETHYL)ETHER	ND
BIS(2-CHLOROETHOXY)METHANE	ND
BIS(2-ETHYLHEXYL)PHTHALATE	ND
BIS(2-CHLOROISOPROPYL)ETHER	ND
4-BROMOPHENYL PHENYL ETHER	ND
BUTYL BENZYL PHTHALATE	ND
2-CHLORONAPHTHALENE	ND
4-CHLOROPHENYL PHENYL ETHER	ND
CHRYSENE	ND
DIBENZO(a,h)ANTHRACENE	ND
DI-n-BUTYL PHTHALATE	ND
1,2-DICHLOROBENZENE	ND
1,3-DICHLOROBENZENE	ND
1,4-DICHLOROBENZENE	ND
3,3'-DICHLOROBENZIDINE	ND
DIETHYL PHTHALATE	ND
DIMETHYL PHTHALATE	ND
2,4-DINITROTOLUENE	ND
2,6-DINITROTOLUENE	ND
DIOCTYL PHTHALATE	ND
FLUORANTHENE	ND

(CONTINUED)

TABLE 4 (CONTINUED). PRIORITY ORGANICS IN GROUNDWATER FROM WELL NO. 4 AT THE FORMER NIELSEN FREIGHT LINES SITE (PPB)

COMPOUNDS	GROUNDWATER MONITORING WELL NO.4
FLUORENE	ND
HEXACHLOROBENZENE	ND
HEXACHLOROBUTADIENE	ND
FLUORANTHENE	ND
FLUORENE	ND
HEXACHLOROBENZENE	ND
HEXACHLOROBUTADIENE	ND
HEXACHLOROETHANE	ND
HEXACHLOROCYCLOPENTADIENE	ND
INDENO(1,2,3-c,d)PYRENE	ND
ISOPHORONE	ND
NAPHTHALENE	ND
NITROBENZENE	ND
N-NITROSODIMETHYLAMINE	ND
N-NITROSODI-n-PROPYLAMINE	ND
N-NITROSODIPHENYLAMINE	ND
PHENANTHRENE	ND
PYRENE	ND
1,2,4-TRICHLOROBENZENE	ND
Volatiles	
BENZENE	ND
BROMODICHLOROMETHANE	ND
BROMOFORM	ND
BROMOMETHANE	ND
CARBON TETRACHLORIDE	ND
CHLOROBENZENE	ND
CHLOROETHANE	ND
2-CHLOROETHYLVINYL ETHER	ND
CHLOROFORM	ND
CHLOROMETHANE	ND
DIBROMOCHLOROMETHANE	ND
1,2-DICHLOROBENZENE	ND
1,3-DICHLOROBENZENE	ND
1,4-DICHLOROBENZENE	ND
1,1-DICHLOROETHANE	ND
1,2-DICHLOROETHANE	ND
1,1-DICHLOROETHENE	ND
TRANS-1,2-DICHLOROETENE	ND
1,2-DICHLOROPROPANE	ND
CIS-1,3-DICHLOROPROPENE	ND
TRANS-1,3-DICHLOROPROPENE	ND
ETHYL BENZENE	ND
METHYLENE CHLORIDE	23
1,1,2,2-TETRACHLOROETHANE	ND

(CONTINUED)

TABLE 4 (CONTINUED). PRIORITY ORGANICS IN GROUNDWATER FROM WELL NO. 4 AT THE FORMER NIELSEN FREIGHT LINES SITE IN EMERYVILLE, CALIFORNIA (PPB)

COMPOUNDS	GROUNDWATER MONITORING WELL NO.4
TETRACHLOROETHENE	ND
TOLUENE	ND
1,1,1-TRICHLOROETHANE	ND
1,1,2-TRICHLOROETHANE	ND
TRICHLOROETHENE	ND
TRICHLOROFLUOROMETHANE	ND
VINYL CHLORIDE	ND

ND = Not detected Detection limit is approximately 2 µg/liter (ppb).

Testing by Gas Chromatograph/Mass Spectroscopy (Analysis by EPA Methods 624 and 625)

Source: Earth Metrics Incorporated, 1987.

4. DISCUSSION OF ALL PAST AND PRESENT CONTAMINATION CHARACTERIZATION RESULTS

METALS

Metals were well characterized in the previous testing of eight (8) soils samples (refer to Appendix C, Soils Test Matrix). Further metals tests of soil samples were not performed as part of the current investigation. Rather, oil and grease, total petroleum hydrocarbons (high and low boiling points) fuel hydrocarbons, and priority organics are the focus of the supplemental testing.

PCBs

PCBs were well characterized in the previous testing of seven (7) soils samples (refer to Appendix C, Soils Test Matrix). The seven samples which were tested for PCBs were typically shallow samples from the one to four foot depth. Any surface spills of PCBs (e.g., from historic transformers) on the Nielsen site would tend to collect in these shallow soils. Deeper sources of PCBs are not suspected.

REFINED ASPHALT

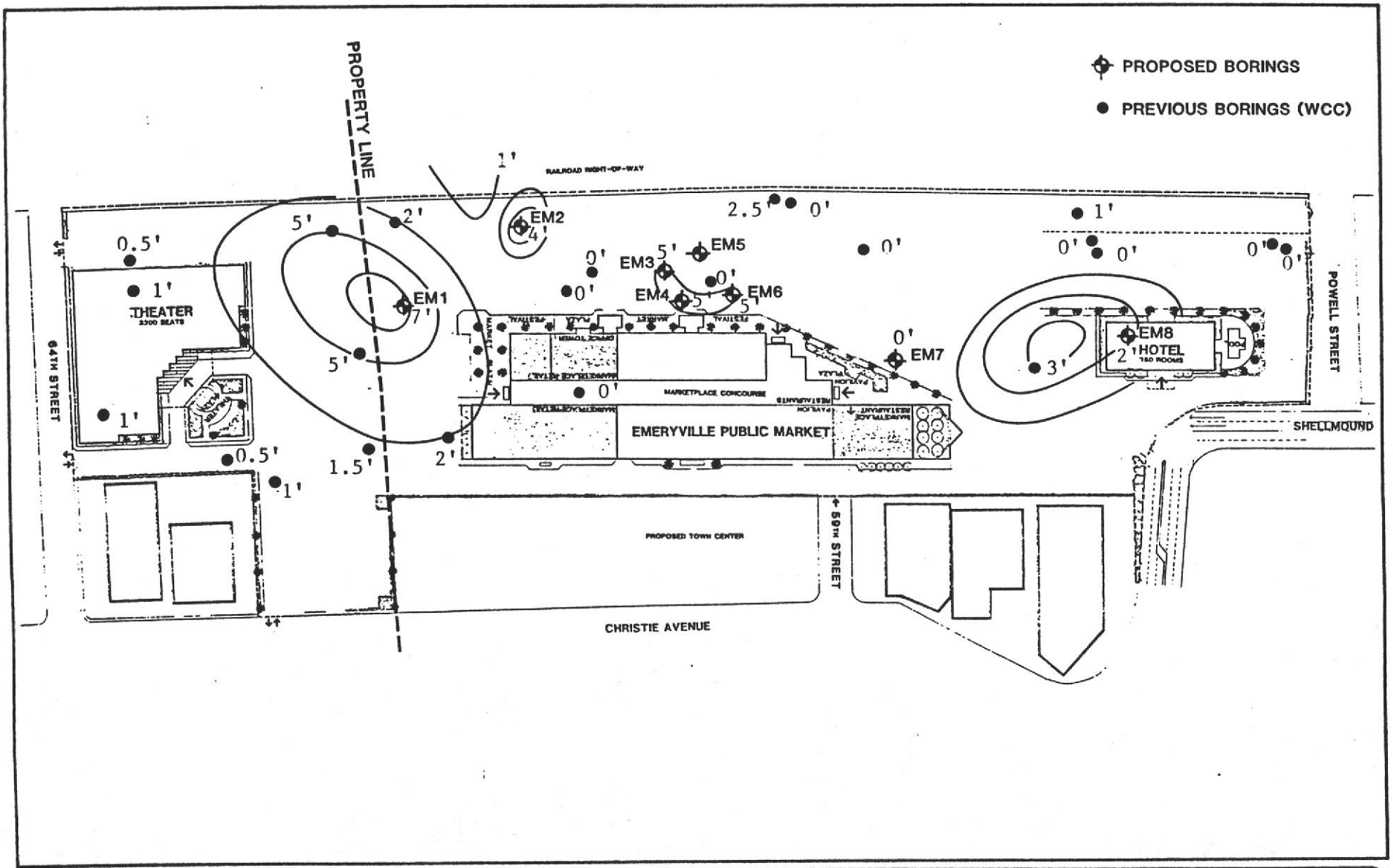
The isopach map (refer to Figure 2) illustrates an estimate of the thickness of asphaltic material over the entire site. These thicknesses are based on the boring logs (see Table 5). Thicknesses are extrapolated betweeen borings.

Since the old refinery complex was located in the southeastern corner of the site, it is probable that most of the dumping and spillage would have occurred in this area. It is not known how deposition occurred around the other areas. However, all aerials depicted six large above ground tanks (due east of the building) that may have been used to store some of this refined asphalt. Leaking may have occurred whereby some of the refined asphalt leaked into the soil.

GASOLINE AND DIESEL FUEL/OIL AND GREASE

Fuel hydrocarbons in inplace soil from borings located away from excavated product line trenches and tank pits typically are less than 100 ppm, a criterion level of the State of California. Gasoline (low boiling point fuel hydrocarbons) was retested, using EPA 8015 and found to be less than 2 ppm in each of eight soil samples. Diesel (high boiling point fuel hydrocarbons) was retested, using EPA 8015 and found to be less than 211 ppm, except in soil from Borings No. E3 and E4 which contained 600 to 1,750 ppm. Most laboratories, when testing for diesel, pick up some oil and grease, and this could in fact contribute mistakenly high concentrations of diesel (Appendix C). Oil and grease in soil from Borings No. E3 and E4 also were relatively concentrated at approximately 1,000 ppm to 7,000 ppm.

Borings No. E3 and E4 are located near the midst of the concentration of tar between the Nielsen and Marketplace sites (refer to Figure 3). Tar is a refined petroleum product that contains characteristically high boiling point hydrocarbons. Therefore, it is suspected that tar, which is visibly present in the subsurface soil around Borings No. E3 and E4, and also in the subsurface soil around Boring No. EM1 on the Marketplace site, contributes to the elevated diesel fuel test results.



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SCALE
1" = 160'

FIGURE 3. ISOPACH CONTOURS OF THE ASPHALTIC SUBSTANCE

TABLE 5. OVERALL ESTIMATED THICKNESS OF ASPHALTIC SUBSTANCE IN BORINGS AT THE FORMER NIELSEN FREIGHT LINES SITE

CURRENT BORING NUMBER (a)	TAR THICKNESS (FEET)
E1	1.0
E2	0.5
E3	5.0
E4	5.0
E5	1.5
E6	1.0
E7	0.5
E8	0.0

(a) Refer to Figure 1.

Source: Earth Metrics Incorporated, 1987

If spilled diesel fuel from the historic diesel manifold (refer to Figure 1) were the only source contributing to the elevated diesel fuel test results, then a higher concentration of diesel product should have been detected in the former tank pit and manifold excavation. But water in the pit contained only 2.1 ppm of residual diesel fuel (refer to Table 3).

Hydrocarbons previously tested using IR appeared sporadically in the eight soil samples submitted for testing by Woodward-Clyde Consultants (refer to Appendix C, Soil Text Matrix). Soil from Boring No. W6A, located downgradient of the historic gasoline manifold, contained 170 ppm. Soil from Borings No. B5 and W4, although being from a shallow depth of 1 to 2.5 feet and being somewhat remote from the former tanks and manifolds (refer to Figure 1), contained 160 to 650 ppm. Soil from Boring No. W2, the only sample previously submitted for testing of Total Fuel Hydrocarbons (TFH), was found to contain less than 50 ppm.

Whereas the previous hydrocarbon results appear sporadic, especially if one attempts to correlate all of the results with locations of historic underground storage tanks and manifolds, the previous results do fit the pattern of tar deposited around the south portion of the Nielsen site. Soil from Boring No. W1 (78 ppm) does not appear to fit the pattern, but the latter soil sample was an extremely shallow sample, from approximately the one foot depth.

GROUNDWATER

Priority organics were retested in groundwater from Well No. 4. The supplemental test confirms the near absence of priority organics except at trace levels. Methylene chloride (a volatile organic) was detected at 23 µg/liter. Volatile constituents of gasoline (including benzene, toluene, and xylene) were not detected in either of the current tests of groundwater from Well No. 4 or from the excavated diesel tank pit.

5. RECOMMENDATIONS

There are two current issues to be resolved on the Nielsen site. These concern i) the disposition of stockpiled excavation spoils, ii) further testing and removal of soil in trenches and iii) the disposition of oil and grease ladened soil in the southern sector of the site. Relatively minor issues concern the disposition of steel fuel manifolds and other lines, and disposition of a remaining oil and water separator.

OIL AND GREASE

The tar material is not a hazardous material, according to the available test results and applicable State of California Title 22 criteria defining hazardous waste. Tar may have been confused previously with residual diesel fuel, because EPA Method 418.1 detects "high boiling point" hydrocarbons. Likewise, EPA 8015 modified diesel can pick up some oil and grease.

Several optional mitigation measures are available for the tar. Earth Metrics recommends "encapsulation" in place with asphalt pavement, concrete foundation slabs, or 18 inches of clean imported loam in landscaped areas. This recommendation is consistent with the apparent nonhazardous classification of the material. This recommendation is the least cost alternative.

Other alternatives are: excavation and off site removal in a Class II or III landfill; or biodegradation. Because the tar is not localized, but extends into the Marketplace site, excavation and removal would be difficult and costly. Based upon the isopach contours, at least 1,000 cubic yards would have to be hauled. The biodegradation alternative could be explored in cooperation with the Alternative Technologies Branch of DOHS.

FUEL MANIFOLDS AND PRODUCT LINES

These should be rinsed and disposed of in a manner consistent with the prevailing State of California underground fuel storage tank regulations. If rinsed these leftover materials may have some scrap value, and also may be acceptable at a local metals recycling facility such as the one in Richmond.

STOCKPILES AND SOIL REMAINING IN TRENCHES

Earth Metrics recommends that stockpiled excavation spoils be backfilled and recompacted in the tank pits and manifold trenches. This measure could be implemented conditionally upon further testing of selected stockpiles for TPH to assure that the level of TPH is acceptable to Alameda County. This level could be between 100 ppm and 1,000 ppm. Further testing of remaining soil in trenches is necessary to insure that the TPH is also below acceptable levels.

During the backfilling procedure a standby 5,000 gallon tank, or several smaller tanks, and a pump should be available on the site. Any potential visible fuel product in the standing water in the pits or trenches should be pumped into the tank prior to backfilling. The tank contents should be tested to determine the appropriate disposal methods.

OIL AND WATER (O/W) SEPARATOR

The O/W separator is located south of the former tank repair shop. It was the final physical treatment step for a steam cleaning process used at the truck repair facility. Truck parts were steam cleaned and the waste oil/water mixture entered the O/W separator for physical separation prior to final disposal of the oil and water components. The wastewater was gravity fed to the sanitary sewer, and the waste oil remained in the concrete O/W separator until pumped out and properly disposed.

The O/W separator acted as a secondary containment to the concrete apron where the steam cleaning process was enforced. The separated waste oil was stored in the concrete sump between scheduled pump out and disposal. Since the O/W separator appeared to act as a primary containment vessel for the waste oil, Earth Metrics recommends the sump be cleaned of all residual waste oil and sludge and closed in accordance with the State and local underground storage tank regulation.

APPENDIX A

TABLE A-1. SOILS TEST MATRIX FOR PREVIOUS NIELSEN SITE CONTAMINANT INVESTIGATION

BORING NO.	SAMPLING DEPTH (FEET)	METALS	PCBs	EPA 624	EPA 625	FUEL HYDROCARBONS
W6A-2-4	4.0	X (c)	X	Not tested	Not tested	X (a)
W5-2-3	4.5	X (c)	X	Not tested	Not tested	X (a)
W6-2-3	5.0	Not tested	Not tested	Not tested	Not tested	Not tested
B5-1-3	2.5	X (c)	X	X	Not tested	X (a)
W3-1-4	2.5	X (d)	X	Not tested	Not tested	X (a)
W3-1-3	2.0	Not tested	Not tested	Not tested	Not tested	Not tested
W4-1-4	2.0	X (c)	X	Not tested	Not tested	X (a)
W4-1-2	1.5	Not tested	Not tested	Not tested	X	X (a)
W2-2-4	4.0	X (d)	X	Not tested	Not tested	X (a)
W2-4-3	9.0	Not tested	Not tested	Not tested	Not tested	X (b)
B3-2-4	3.0	X (d)	Not tested	X	X	Not tested
W1-1-4	1.0	X (c)	X	X	Not tested	X (a)

(a) Total Petroleum Hydrocarbons by IR.

(b) Total Fuel Hydrocarbons by EPA 8015.

(c) Tested for four (4) indicator metals (lead, nickel, total chromium, and zinc).

(d) Tested for fourteen (14) metals.

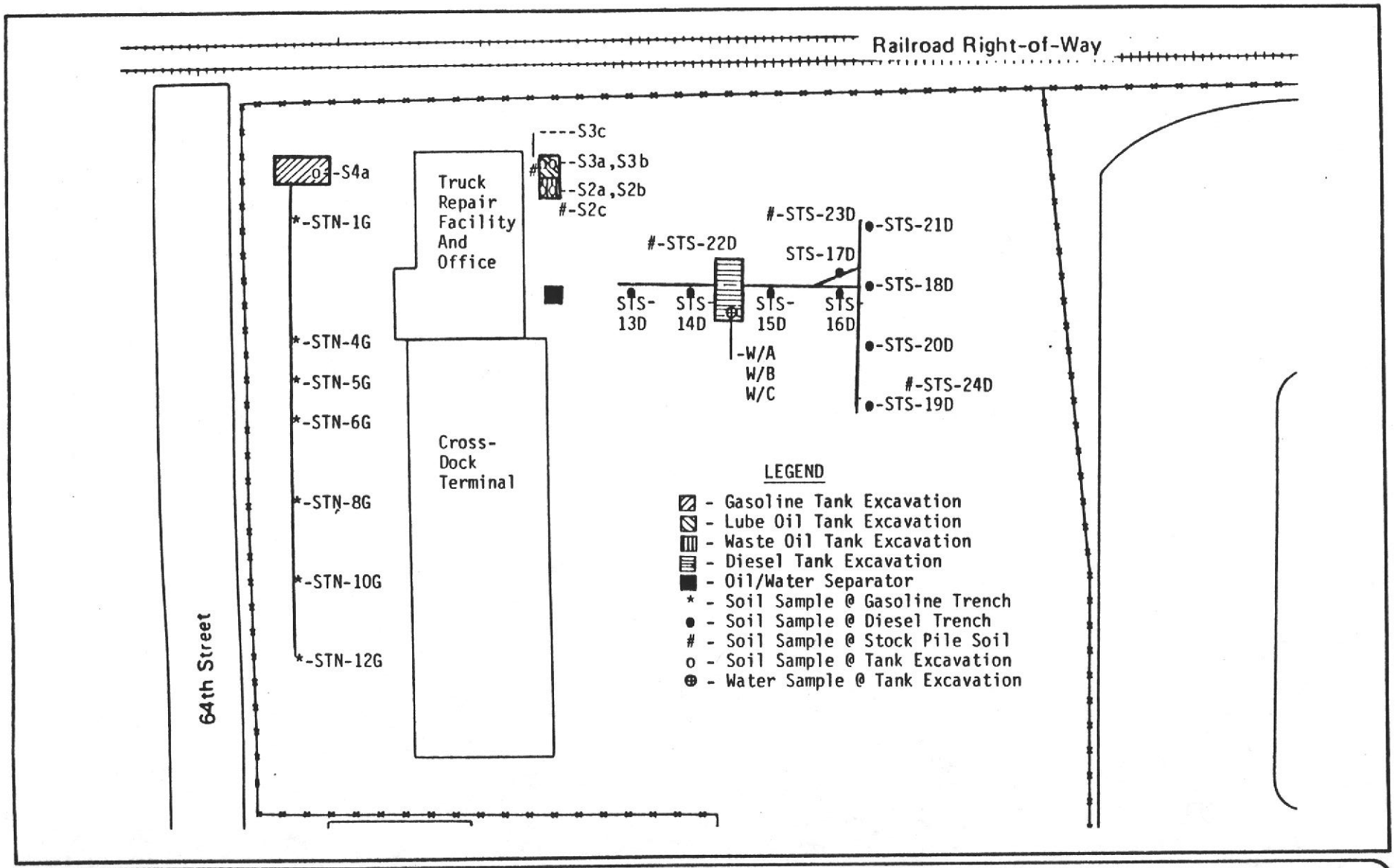
X Indicates sample was tested for the specified parameter or by the specified test method.

TABLE A-2. SUMMARY OF TANK REMOVAL SOIL TESTING FOR TOTAL FUEL HYDROCARBON (PPM)

PREVIOUS SOIL SAMPLE I.D. (a)	SUBJECT OF SAMPLING	LOCATION OF SAMPLE	TOTAL FUEL HYDROCARBONS (TFH) (ppm) (b)
S 4a	Gasoline Tank	Pit	<10
STN 1G	Gasoline Manifold	Trench	670
4G	Gasoline Manifold	Trench	32
5G	Gasoline Manifold	Trench	490
6G	Gasoline Manifold	Trench	110
10G	Gasoline Manifold	Trench	1,110
12G	Gasoline Manifold	Trench	<10
STS 21D	Diesel Manifold	Trench	<10
18D	Diesel Manifold	Trench	1,200
20D	Diesel Manifold	Trench	1,900
19D	Diesel Manifold	Trench	45
STS 24D	Diesel Manifold	Stockpile	2,600
STS 15D	Diesel Manifold	Trench	<10
16D	Diesel Manifold	Trench	<10
17D	Diesel Manifold	Trench	86
23D	Diesel Manifold	Stockpile	2,500
STS 13D	Diesel Manifold	Trench	<10
14D	Diesel Manifold	Trench	33
22D	Diesel Manifold	Stockpile	8,600
S 2a	Waste Oil Tank	Pit	<10
S 2b	Waste Oil Tank	Pit	<10
S 2c	Waste Oil Tank	Stockpile	<10
S 3a	Lube Oil Tank	Pit	<10
S 3b	Lube Oil Tank	Pit	<10
S 3c	Lube Oil Tank	Stockpile	<10

(a) Refer to Figure C-1
(b) EPA Method 8015 Modified (total gasoline and diesel)

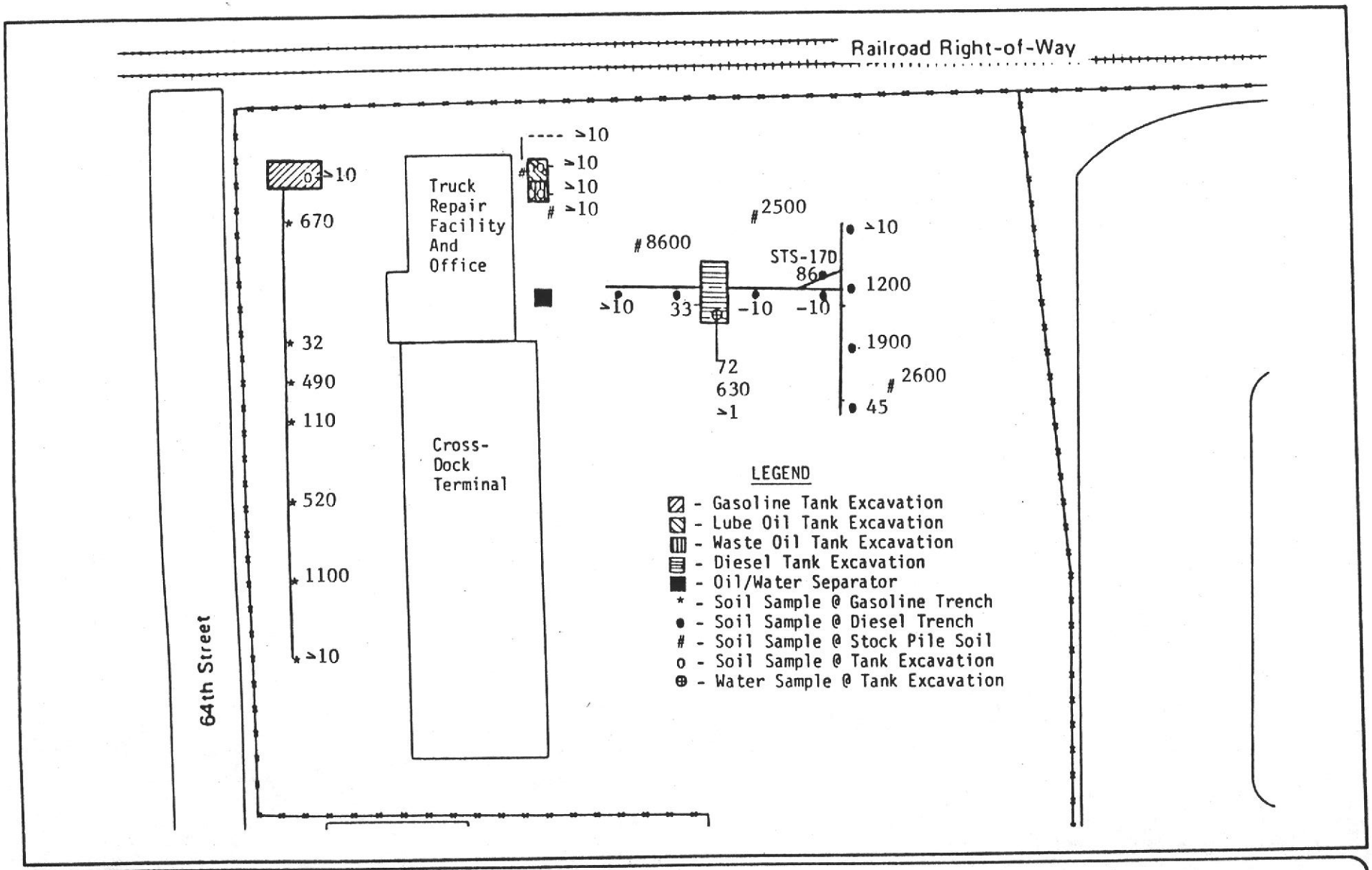
Source: Brown & Caldwell, April 8, 1987 (samples received)
April 28, 1987 (report issued)



earth metrics

SCALE
NO SCALE

FIGURE A-1. NIELSEN SITE SOIL AND GROUND WATER SAMPLING LOCATIONS DURING TANK REMOVAL APRIL 8, 1987



earth metrics

SCALE
NO SCALE

FIGURE A-2. NIELSEN SITE SOIL AND GROUND WATER SAMPLING LOCATIONS DURING TANK REMOVAL APRIL 8, 1987. THIS SITE PLAN ALSO DEPICTS THE PPM OF TOTAL PETROLEUM HYDROCARBONS (GASOLINE & DIESEL)

B. TEST PERFORMED BY EARTH METRICS INCORPORATED

ANAMETRIX, INC.
LABORATORY SERVICES
ENVIRONMENTAL • ANALYTICAL CHEMISTRY
2754 AIELLO DRIVE • SAN JOSE, CA 95111 • (408) 629-1132

December 2, 1987
Work Order Number 8711114
Date Received 11/18/87
PO No. 02815

Paul Miller
Earth Metrics Inc.
859 Cowan Road
Burlingame, CA 94010

One water sample was received for analysis of total hydrocarbons by gas chromatography, using the following EPA method(s):

ANAMETRIX I.D.	SAMPLE I.D.	METHOD(S)
8711114-01	9570.A1 E-9	8015/8020

RESULTS

See enclosed data sheet, Form 3-1.

If there is any more that we can do, please give us a call. Thank you for using ANAMETRIX, INC.

Sincerely,

Sarah Schoen

Sarah Schoen, Ph.D.
GC Supervisor

SRS/da

ANALYSIS DATA SHEET - PETROLEUM HYDROCARBON COMPOUNDS
ANAMETRIX, INC. (408) 629-1132

Sample I.D.	: 9570.A1 E-9	Anametrix I.D.	: 8711114-01
Matrix	: WATER	Analyst	: [illegible]
Date sampled	: 11-12-87	Supervisor	: [illegible]
Date anl. TVH	: 11-25-87	Date released	: 12-02-87
Date ext. TEH	: 11-20-87	Date ext. TOG	: NA
Date anl. TEH	: 11-27-87	Date anl. TOG	: NA

CAS #	Compound Name	Det. Limit (ug/L)	Amt. Found (ug/L)	Q
71-43-2	Benzene	1		U
108-88-3	Toluene	1		U
100-41-4	Ethylbenzene	1		U
	Total Xylenes	1		U
	TVH as Gasoline	50		U
	TEH as Diesel	50	2100	+
	Total Oil & Grease	10		NR

For reporting purposes, the following qualifiers (Q) are used:
+ : A value greater than or equal to the method detection limit.
U : The compound was analyzed for but was not detected.
NR: Not requested.

TVH - Total Volatile Hydrocarbons is determined by modified EPA 8015 with either headspace or purge and trap.
TEH - Total Extractable Hydrocarbons is determined by modified EPA 8015 with direct injection.
TOG - Total Oil & Grease is determined by Standard Method 503E.
BTEX- Benzene, Toluene, Ethylbenzene, and Total Xylenes are determined by modified EPA 8020.

All testing procedures follow CRWQCB Region 2 guidelines.

Form 3-1.

FIREMAN'S FUND
INSURANCE COMPANIES
Environmental Laboratory
3700 Lakeville Highway
Petaluma, CA 94952
800-227-0765
(California 800-227-5889)

ENVIRONMENTAL LABORATORY

Paul Miller
Earth Metrics
859 Cowan Road
Burlingame, CA 94010

L A B O R A T O R Y R E S U L T S

Supply/Order No.:
Client's Survey No.: 9570.A1
Contract/PO No.: 2808
Release No.:

Laboratory Job No.: 874167
Date Received: 11/16/87
Date Reported: 12/07/87
Client Code: EART2

OIL & GREASE(EPA 413.2)

MATRIX:SOIL FREON EX

LABNO SMPLNO	COMPOUND	FOUND MG/KG	CA TTLC MG/KG	DET.LIM. MG/KG
25197 E1	OIL & GREASE	243.4		6.0
25198 E2	OIL & GREASE	281.9		6.0
25200 E3	OIL & GREASE	142.9		6.0
25201 E3	OIL & GREASE	7021.9		149.40
25202 E4	OIL & GREASE	1016.4		29.90
25204 E5	OIL & GREASE	<6.0		6.0
25207 E8	OIL & GREASE	<6.0		6.0

ANALYST:DAVE BUSCH

APPROVED BY
JERRY TUMA, PH.D., CIH
LABORATORY DIRECTOR

451844-8-87

FIREMAN'S FUND
INSURANCE COMPANIES
Environmental Laboratory
3700 Lakeville Highway
Petaluma, CA 94952
800-227-0765
(California 800-227-5889)

ENVIRONMENTAL LABORATORY

L A B O R A T O R Y R E S U L T S

Laboratory Job No.: 874167

ASSAY:GASOLINE BY HEADPACE(GC/FID EPA 3810/8015)
MATRIX:SOIL

LABNO SMPLNO-ID	RESULTS	DET.LIM
25197 E1 GASOLINE	<0.140 UG/GM	0.140 UG/GM
25198 E2 GASOLINE	<0.130 UG/GM	0.130 UG/GM
25199 E2 GASOLINE	<0.140 UG/GM	0.140 UG/GM
25205 E6 GASOLINE	0.792 UG/GM	0.140 UG/GM
25206 E7 GASOLINE	1.780 UG/GM	0.130 UG/GM
25207 E8 GASOLINE	<0.140 UG/GM	0.140 UG/GM

ANALYST:JEAN M.BONITE

451844-8-87

FIREMAN'S FUND
INSURANCE COMPANIES
Environmental Laboratory
3700 Lakeville Highway
Petaluma, CA 94952
800-227-0765
(California 800-227-5889)

ENVIRONMENTAL LABORATORY

L A B O R A T O R Y R E S U L T S

Laboratory Job No.: 874167

ASSAY:DIESEL FUEL-SOIL EXTRACT (GC/FID EPA 3550/8015)
MATRIX:SOIL

LABNO SMPLNO-ID	RESULTS	DET.LIM
25197 E1 DIESEL	<210.800 UG/GM	0.210 MG/GM
25199 E2 DIESEL	<210.800 UG/GM	0.210 MG/GM
25201 E3 DIESEL	1736.400 UG/GM	0.210 MG/GM
25202 E4 DIESEL	<206.900 UG/GM	0.210 MG/GM
25203 E4 DIESEL	626.400 UG/GM	0.210 MG/GM
25207 E8 DIESEL	<209.900 UG/GM	0.210 MG/GM

ANALYST:JEAN M.BONITE

451844-8-87

ANAMETRIX, INC.
LABORATORY SERVICES
ENVIRONMENTAL • ANALYTICAL CHEMISTRY
2754 AIELLO DRIVE • SAN JOSE, CA 95111 • (408) 629-1132

December 7, 1987
Work Order Number 8712015
Date Received 12/02/87
PO No. 02832

Paul Miller
Earth Metrics, Inc.
859 Cowan Road
Burlingame, CA 94010

One water sample was received for analysis of priority pollutants by GC/MS, using the following EPA method(s):

ANAMETRIX I.D.	SAMPLE I.D.	METHOD(S)
8712015-01	9570.A1 EASTSHORE W-4	624/625

RESULTS

See enclosed data sheets, Forms 1-1 thru 2-1b.

EXTRA COMPOUNDS

None detected.

QUALITY ASSURANCE REPORTS

See enclosed data sheet, Form 5-1.

If there is any more that we can do, please give us a call. Thank you for using ANAMETRIX, INC.

Sincerely,

Burt Sutherland

Burt Sutherland
Laboratory Manager

BWS/da

ORGANICS ANALYSIS DATA SHEET - EPA METHOD 624/8240
ANAMETRIX, INC. (408) 629-1132

Sample I.D. : 9570.A1 EASTSHORE W-4
Matrix : WATER
Date sampled : 12-01-87
Date analyzed : 12-03-87
Dilution : NONE

Anametrix I.D. : 8712015-01
Analyst : ARL
Supervisor : BWS
Date released : 12-07-87
Instrument : F1

CAS #	Compound Name	Det. Limit (ug/l)	Amt. Found (ug/l)	Q
74-87-3	* Chloromethane	7		U
75-01-4	* Vinyl Chloride	7		U
74-83-9	* Bromomethane	7		U
75-00-3	* Chloroethane	7		U
75-69-4	* Trichlorofluoromethane	2		U
75-35-4	* 1,1-Dichloroethene	2		U
76-13-1	# Trichlorotrifluoroethane	2		U
67-64-1	**Acetone	20		U
75-15-0	**Carbondisulfide	2		U
75-09-2	* Methylene Chloride	2	23	+
156-60-5	* Trans-1,2-Dichloroethene	2		U
75-34-3	* 1,1-Dichloroethane	2		U
78-93-3	**2-Butanone	20		U
156-59-2	* Cis-1,2-Dichloroethene	2		U
67-66-3	* Chloroform	2		U
71-55-6	* 1,1,1-Trichloroethane	2		U
56-23-5	* Carbon Tetrachloride	2		U
71-43-2	* Benzene	2		U
107-06-2	* 1,2-Dichloroethane	2		U
79-01-6	* Trichloroethene	2		U
78-87-5	* 1,2-Dichloropropane	2		U
75-27-4	* Bromodichloromethane	2		U
110-75-8	* 2-Chloroethylvinylether	2		U
108-05-4	**Vinyl Acetate	10		U
10061-02-6	* Trans-1,3-Dichloropropene	2		U
108-10-1	**4-Methyl-2-Pentanone	10		U
108-88-3	* Toluene	2		U
10061-01-5	* cis-1,3-Dichloropropene	2		U
79-00-5	* 1,1,2-Trichloroethane	2		U
127-18-4	* Tetrachloroethene	2		U
591-78-6	**2-Hexanone	10		U
124-48-1	* Dibromochloromethane	2		U
108-90-7	* Chlorobenzene	2		U
100-41-4	* Ethylbenzene	2		U
	**Total Xylenes	2		U
100-42-5	**Styrene	2		U
75-25-2	* Bromoform	2		U
79-34-5	* 1,1,2,2-Tetrachloroethane	2		U
541-73-1	* 1,3-Dichlorobenzene	2		U
106-46-7	* 1,4-Dichlorobenzene	2		U
95-50-1	* 1,2-Dichlorobenzene	2		U

* A 624/8240 approved compound (Federal Register, 10/26/84)
** A compound on the U.S. EPA CLP Hazardous Substance List (HSL)
\# A compound added by Anametrix, Inc.

For reporting purposes, the following qualifiers (Q) are used:
+ : A value greater than or equal to the method detection limit.
U : The compound was analyzed for but was not detected.

ORGANIC ANALYSIS DATA SHEET -- EPA METHOD 625/8270
ANAMETRIX, INC. (408) 629-1132

Sample I.D. : 9570.A1 EASTSHORE W-4
Matrix : WATER
Date sampled : 12-01-87
Date extracted : 12-04-87
Date analyzed : 12-07-87
Volume extracted : 1 L

Anametrix I.D. : 8712015-01
Analyst : ARL
Supervisor : BWS
Date released : 12-07-87
Instrument : F2

CAS #	Compound Name	Det. Limit (ug/l)	Amt. Found (ug/l)	Q
62-75-9	* N-Nitrosodimethylamine	2		U
108-95-2	* Phenol	2		U
62-53-3	**Aniline	2		U
111-44-4	* bis(-2-Chloroethyl)Ether	2		U
95-57-8	* 2-Chlorophenol	2		U
541-73-1	* 1,3-Dichlorobenzene	2		U
106-46-7	* 1,4-Dichlorobenzene	2		U
100-51-6	**Benzyl Alcohol	2		U
95-50-1	* 1,2-Dichlorobenzene	2		U
95-48-7	**2-Methylphenol	2		U
39638-32-9	**bis(2-chloroisopropyl)Ether	2		U
106-44-5	**4-Methylphenol	2		U
621-64-7	* N-Nitroso-Di-n-Propylamine	2		U
67-72-1	* Hexachloroethane	2		U
98-95-3	* Nitrobenzene	2		U
78-59-1	* Isophorone	2		U
88-75-5	* 2-Nitrophenol	2		U
105-67-9	* 2,4-Dimethylphenol	2		U
65-85-0	**Benzoic Acid	10		U
111-91-1	* bis(-2-Chloroethoxy)Methane	2		U
120-83-2	* 2,4-Dichlorophenol	2		U
120-82-1	* 1,2,4-Trichlorobenzene	2		U
91-20-3	* Naphthalene	2		U
106-47-8	**4-Chloroaniline	2		U
87-68-3	* Hexachlorobutadiene	2		U
59-50-7	* 4-Chloro-3-Methylphenol	2		U
91-57-6	**2-Methylnaphthalene	2		U
77-47-4	* Hexachlorocyclopentadiene	2		U
88-06-2	* 2,4,6-Trichlorophenol	2		U
95-95-4	**2,4,5-Trichlorophenol	10		U
91-58-7	* 2-Chloronaphthalene	2		U
88-74-4	**2-Nitroaniline	10		U
131-11-3	* Dimethyl Phthalate	2		U
208-96-8	* Acenaphthylene	2		U
99-09-2	**3-Nitroaniline	10		U

* A 625 approved compound (Federal Register, 10/26/84)
** A compound on the U.S. EPA CLP Hazardous Substance List (HSL)

For reporting purposes, the following qualifiers (Q) are used :
+ : A value greater than or equal to the method detection limit.
U : The compound was analyzed for but was not detected.

Form 2-1a.

ORGANIC ANALYSIS DATA SHEET -- EPA METHOD 625/8270
ANAMETRIX, INC. (408) 629-1132

Sample I.D. : 9570.A1 EASTSHORE W-4
Matrix : WATER
Date sampled : 12-01-87
Date extracted : 12-04-87
Date analyzed : 12-07-87
Volume extracted : 1 L

Anametrix I.D. : 8712015-01
Analyst : ARL
Supervisor : BWS
Date released : 12-07-87
Instrument : F2

CAS #	Compound Name	Det. Limit (ug/l)	Amt. Found (ug/l)	Q
83-32-9	* Acenaphthene	2		U
51-28-5	* 2,4-Dinitrophenol	10		U
100-02-7	* 4-Nitrophenol	10		U
132-64-9	**Dibenzofuran	2		U
121-14-2	* 2,4-Dinitrotoluene	2		U
606-20-2	* 2,6-Dinitrotoluene	2		U
84-66-2	* Diethylphthalate	2		U
7005-72-3	* 4-Chlorophenyl-phenylether	2		U
86-73-7	* Fluorene	2		U
100-01-6	**4-Nitroaniline	10		U
534-52-1	**4,6-Dinitro-2-Methylphenol	10		U
86-30-6	* N-Nitrosodiphenylamine	2		U
122-66-7	**1,2-Diphenylhydrazine	2		U
101-55-3	* 4-Bromophenyl-phenylether	2		U
118-74-1	* Hexachlorobenzene	2		U
87-86-5	* Pentachlorophenol	10		U
85-01-8	* Phenanthrene	2		U
120-12-7	* Anthracene	2		U
84-74-2	* Di-n-Butylphthalate	2		U
206-44-0	* Fluoranthene	2		U
92-87-5	* Benzidine	10		U
129-00-0	* Pyrene	2		U
85-68-7	* Butylbenzylphthalate	2		U
91-94-1	* 3,3'-Dichlorobenzidine	5		U
56-55-3	* Benzo(a)Anthracene	2		U
117-81-7	* bis(2-Ethylhexyl)Phthalate	2		U
218-01-9	* Chrysene	2		U
117-84-0	* Di-n-Octyl Phthalate	2		U
205-99-2	* Benzo(b)Fluoranthene	2		U
207-08-9	* Benzo(k)Fluoranthene	2		U
50-32-8	* Benzo(a)Pyrene	2		U
193-39-5	* Indeno(1,2,3-cd)Pyrene	2		U
53-70-3	* Dibenz(a,h)Anthracene	2		U
191-24-2	* Benzo(g,h,i)Perylene	2		U

* A 625 approved compound (Federal Register, 10/26/84)
** A compound on the U.S. EPA CLP Hazardous Substance List (HSL)

For reporting purposes, the following qualifiers (Q) are used :
+ : A value greater than or equal to the method detection limit.
U : The compound was analyzed for but was not detected.

Form 2-1b.

WATER VOLATILE/SEMIVOLATILE SURROGATE RECOVERY SUMMARY
ANAMETRIX, INC. (408) 629-1132

ANAMETRIX WORKORDER# : 8712015
CLIENT PROJECT # : 9570.A1

ANALYST : ARL
SUPERVISOR : Bei

#	SAMPLE ID	VO1 (DCE)	VO2 (TOL)	VO3 (BFB)	A1 (2FP)	A2 (PHL)	A3 (TBP)	BN1 (NBZ)	BN2 (FBH)	BN3 (TPH)	TOTAL OUT
01	EASTSHORE W-4	94	102	95	47	32	112	76	84	48	0
02											
03											
04											
05											
06											
07											
07											
08											
09											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

ANAMETRIX PERCENT RECOVERY LIMITS
(generated from sample data)

VO1 (DCE)	= 1,2-DICHLOROETHANE-D4	82-124%
VO2 (TOL)	= TOLUENE-D8	88-117%
VO3 (BFB)	= BROMOFLUOROBENZENE	72-112%
A1 (2FP)	= 2-FLUOROPHENOL	15-70%
A2 (PHL)	= PHENOL-D5	17-73%
A3 (TBP)	= 2,4,6-TRIBROMOPHENOL	19-137%
BN1 (NBZ)	= NITROBENZENE-D5	26-101%
BN2 (FBH)	= 2-FLUOROBIPHENYL	23-95%
BN3 (TPH)	= TERPHENYL-D14	39-132%

FORM 5-1

APPENDIX C. DISCUSSION OF ASPHALT AND PETROLEUM HYDROCARBONS ANALYTICAL METHODS

Asphalt, or tar, is a distillation product of crude petroleum. Ashpalt is semi solid to solid. It contains high boiling point, high molecular weight hydrocarbons. In the manufacture, or refining, of asphalt, the gasoline fraction is vaporized, so it is absent from asphalt.

A fraction is the petroleum product that vaporizes between two temperatures during distillation. A "fraction" refers to 45 degree Fahrenheit increment (Hempel Distillation Method, U.S. Bureau of Mines), and defines a class of petroleum hydrocarbons within a given fraction. The petroleum hydrocarbons tend to have similar characteristics.

Environmental Protection Agency (EPA) test methods are available to generally quantify petroleum hydrocarbons concentrations in soil. These general methods are summarized below:

EPA Method 8015 Modified (Diesel). This method determines the concentration of total petroleum hydrocarbons (TPH) which includes the high boiling point hydrocarbonss (diesel motor fuels and commercial grade jet fuels). Laboratory analysis is performed using a gas chromatograph and a flame ionization detector.

EPA Method 8015 Modified (Gasoline). This method determines the concentration of total fuel hydrocarbons (TFH) which includes the low to medium boiling point hydrocarbons (fuel range of gasoline and may be appropriate to quantify military grade jet fuels). Laboratory analysis is performed using a gas chromatograph, flame ionization detector and a photoionization detector (for BTX distinction).

EPA Method 413.2. This method determines the concentration of total oil and grease (TOG) which includes a wide range of petroleum hydrocarbons, generally from C10 to C30 and above. Laboratory analysis is performed using infrared specroscopy. Analysis may also be performed using a gravimetric method (EPA, 413.1).

APPENDIX D

TABLE D-1. VARIOUS TERMINOLOGY USED BY RWQCB AND ENVIRONMENTAL LABORATORIES EFFECTIVE JANUARY, 1988

EPA METHOD	RWQCB	BROWN AND CALDWELL	FIREMAN'S FUND ANAMETRIX		ANATEC
8015 Modified Gasoline	TPH (Low Boiling Point)	This lab historically has combined both gasoline and diesel into Total Fuel Hydrocarbons (TFH)	Volatile Petroleum Hydrocarbons	Total Volatile Hydrocarbons (TVH)	Volatile Petroleum Hydrocarbons
8015 Modified Diesel	TPH (High Boiling Point)		Extractable Petroleum Hydrocarbons	Total Extractable Hydrocarbons (TEH)	Extractable Petroleum Hydrocarbons
413.1	Total Oil and Grease by IR (TOG)	TPH (a)	Oil and Grease (b)	Equipment not available for analysis	Equipment not available for analysis
413.2	Total Oil and Grease by gravimetric			Total Oil and Grease (c)	Total Oil and Grease (c)

(a) Determined by IR, yields Total Oil and Grease.

(b) IR or gravimetric.

(c) Determined by gravimetric method with weighing before and after freon exchange.

Source: Earth Metrics Incorporated, 1988.