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SHELL OIL COMPANY

Carson, California

BACKFILL AND FINAL PROJECT COMPLETION REPORT, RESERVOIRS 1 AND 2

UNOCAL CARSON REFINERY

VOLUME I

OCTOBER 1995

BROWN AND CALDWELL

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EXECUTIVE SUMMARY

Reservoirs 1 and 2, located at the Union Oil Company of California (Unocal) Carson Refinery, were built in the 1920s to store crude oil originating from the Signal Hill oil field. The reservoir property was previously known as the Wilmington Section of the Wilmington Manufacturing Complex, formerly owned by Shell Oil Company (Shell). Each reservoir was constructed as an excavated center depression encircled by elevated soil berms. The interior berm walls and floors of each reservoir were surfaced with steel-reinforced concrete. The top and outside perimeter of the berm walls were asphalt-covered. The reservoirs were recently dismantled.

In December of 1991, Shell sold the former Wilmington Section of the Wilmington Manufacturing Complex to Unocal. The site is now called the Unocal Los Angeles Refinery, Carson Plant. As part of the property transaction, Shell was contractually required to provide closure of the reservoirs in compliance with the Waste Discharge Requirements (WDR's) for Closure of Two Surface Impoundments (Order No. 94-112), issued by the California Regional Water Quality Control Board (CRWQCB), Los Angeles Region (File No. 85-19). The WDR's detailed in the CRWQCB Monitoring and Reporting Program No. CI 7452, dated October 1994, include guidelines for groundwater monitoring, excavation monitoring, backfill soil characterization, general provisions for sampling and analysis, and specific reporting requirements. This report documents compliance with all of the WDR's except groundwater monitoring requirements, which are addressed under separate cover in accordance with CRWQCB Cleanup and Abatement Order Number 88-69.

The purpose of this project was to:

- document hydrocarbon concentrations in the soils directly underlying the concrete liner of each reservoir (subgrade soils);
- backfill the reservoir depressions with berm soils that have hydrocarbon concentrations less than the discharge limits established in the WDR's;
- compact the backfill soil to at least 90% of the maximum laboratory-derived dry density; and
- cover the backfill soils with clay caps installed in accordance with permeability requirements specified in the WDR.

To meet these objectives, the following was accomplished:

- Soils directly underlying the concrete liner were sampled and analyzed for aromatic volatile hydrocarbons and semivolatile petroleum hydrocarbons. Samples were collected and analyzed at

a frequency of one sample per every 5,000 square feet of area. The characterization was requested by the California Regional Water Quality Control Board (CRWQCB), Los Angeles Region, for documentation purposes only and was not intended to indicate compliance with specific waste discharge limits.

- After placement, each layer of backfill soils was sampled and tested for aromatic volatile hydrocarbons and semivolatile petroleum hydrocarbons at regular intervals to demonstrate that soils placed into the reservoirs had contaminant concentrations less than the CRWQCB mandated discharge limits specified in the WDR. Fill soils were mechanically reblended and retested whenever sample test results indicated WDR limits were exceeded. Final test results indicate that final petroleum hydrocarbon concentrations in samples representative of backfill soils were below limits specified in the WDR's.

- Backfill soils were tested for compaction by a third party inspection company, as specified by the civil designer, to verify that the WDR-specified compaction objectives were achieved. Compaction test results indicate that backfill soils placed within the reservoirs were compacted to at least 90% of the maximum laboratory-determined dry density. Testing indicates soils comprising the perimeter road, placed and compacted outside of the reservoirs, were compacted to at least 95% of the maximum laboratory-determined dry density.

- A low permeability cap was placed inside each reservoir on top of the blended backfill. Four samples were collected from each cap and tested by the Falling Head method, verifying compliance with WDR limits of 1×10^{-6} cm/sec maximum permeability rate.

1

BROWN AND CALDWELL

CHAPTER 1

INTRODUCTION

Crude oil Reservoirs 1 and 2, located at the Union Oil Company of California (Unocal) Carson Refinery, were recently dismantled. The reservoirs were located at 1520 to 1622 East Sepulveda Boulevard in Carson, California (**Figure 1-1**). The reservoir property was previously known as the Wilmington Section of the Wilmington Manufacturing Complex, formerly owned by Shell Oil Company (Shell).

In December of 1991, Shell sold the former Wilmington Section of the Wilmington Manufacturing Complex to Unocal. The site is now called the Unocal Los Angeles Refinery, Carson Plant. As part of the property transaction, Shell was contractually required to provide closure of the reservoirs in compliance with the Waste Discharge Requirements (WDR's) for Closure of Two Surface Impoundments (Order No. 94-112), issued by the California Regional Water Quality Control Board (CRWQCB), Los Angeles Region (File No. 85-19). The WDR's detailed in the CRWQCB Monitoring and Reporting Program No. CI 7452, dated October 1994, included guidelines for groundwater monitoring, excavation monitoring, backfill soil characterization, general provisions for sampling and analysis, and specific reporting requirements. This report documents final dismantlement of Reservoirs 1 and 2 including compliance with all of the WDR's except groundwater monitoring requirements, which are addressed under separate cover in accordance with CRWQCB Cleanup and Abatement Order Number 88-69.

Background

The reservoirs were constructed in the 1920's by excavating native material from the center and then using the excavated soil to build berms around the outside perimeter of the excavation. The berms were constructed to an elevation of approximately 18 feet above refinery grade and had approximate slopes of 1.5:1 on both the inside and outside walls. The bottoms of the reservoirs were approximately 9 feet below refinery grade. The interior berm walls and floors of each reservoir were surfaced with steel-reinforced concrete. The top and outside perimeter of the berm walls were asphalt-covered. A roof superstructure supported by a grid of wooden posts provided a canopy over the top of both reservoirs.

Both reservoirs were originally used to store crude oil from the Signal Hill oil fields. Crude oil was piped to the reservoirs for storage prior to refinement. After the Signal Hill oil reserves were depleted, the reservoirs continued to be used primarily for storing crude oil from a variety of sources. The reservoirs were also used occasionally to store vacuum flasher feed and coker feed, which are intermediate-range hydrocarbons. Marine fuel oil was also known to be stored in Reservoir 2. The reservoirs were in continuous use until December 1991, when shutdown and dismantlement was initiated. Earlier dismantlement tasks included emptying the reservoirs of residual oil and water, and removal of the wooden roof superstructures.

Previous environmental investigations conducted at the reservoirs consisted primarily of berm and underlying soil characterization. This work is documented in four reports prepared by Brown and Caldwell (BC): "Reservoir Investigation," dated March 1989; "Berm Material Characterization of Reservoirs 1 and 2" dated September 1993; "Berm Material and Underlying Soil Characterization of Reservoirs 1 and 2," dated March 1994; and "Supplemental Investigation of the Underlying Soil of Reservoirs 1 and 2," dated July 1994.

Project Objectives

The scope of this project includes: demolition of the interior concrete liners; excavation of soils from the perimeter berms; backfill placement of soils originating from the berms into the basal depressions of both reservoirs; installation of a low permeability cap over the top of the former impoundments; and monitoring of grading and construction activities. There are currently no plans for construction on this area.

The purpose of this report is to:

- document hydrocarbon concentrations in the soils directly underlying the concrete liner of each reservoir (subgrade soils);
- demonstrate that soils placed into or onto the reservoirs have contaminant concentrations less than the following discharge limits established in the WDR's,

CONSTITUENT	LIMIT (mg/kg)
Aromatic Volatile Organic Compounds (EPA Method 8015, modified)	
benzene	0.1
ethylbenzene	2.9
toluene	4.2
xylene	1.7
Total Petroleum Hydrocarbons (EPA Method 8015, modified)	
C_4 - C_{12}	1,000
C_{13} - C_{22}	10,000
C_{23+}	15,000
Polynuclear Aromatic Hydrocarbons extracted using the Toxic Characteristic Leaching Procedure (TCLP) (EPA Method 8270)	Non-detect (mg/l) ;

- certify that backfill soil was compacted to at least 90% of the maximum laboratory-derived dry density; and
- document that the clay caps were installed in accordance with permeability requirements specified in the WDR.

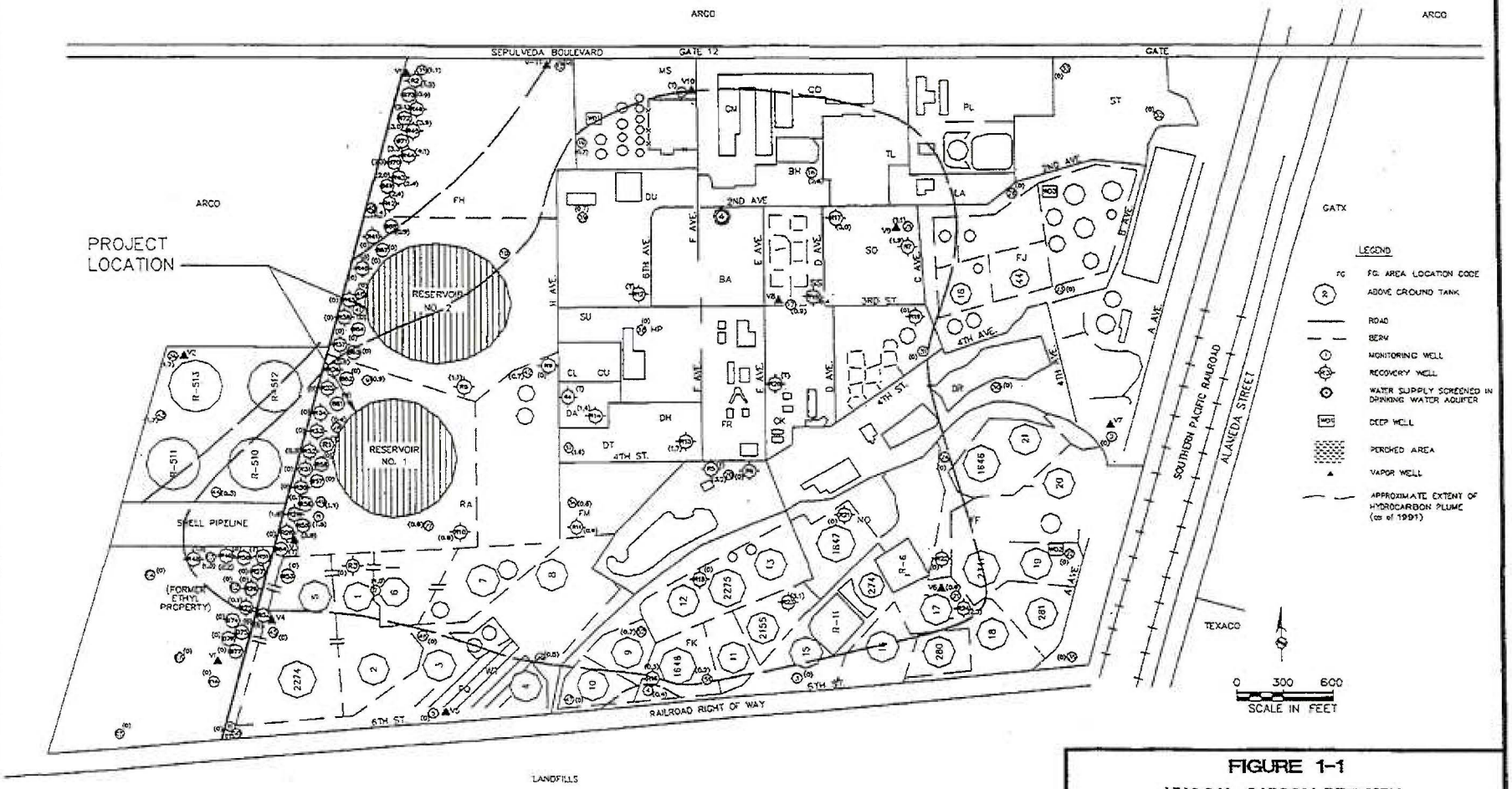


FIGURE 1-1

UNOCAL CARSON REFINERY RESERVOIR LOCATION MAP

PROJECT LOCATION	DATE	PROJECT NUMBER
1520 E. SEPULVEDA BLVD. CARSON, CALIFORNIA	9-05-95	1116-21

BROWN AND CALDWELL
IRVINE, CALIFORNIA

TM\1116-22

CHAPTER 2

SUBGRADE CHARACTERIZATION

Subgrade characterization was performed in both reservoirs to document hydrocarbon concentrations in soil directly underlying the concrete liners of the floors. The characterization was requested by CRWQCB for documentation purposes only and was not intended to indicate compliance with specific waste discharge limits.

Soil Hydrocarbon Evaluation

Access to the subgrade soils for visual evaluation and sampling was gained following removal of the concrete liners by the civil subcontractor. Liquid hydrocarbons or hydrocarbon saturated subgrade soils were not visually observed upon liner removal. The concrete liner debris was stockpiled in the centers of both reservoirs, and was later crushed and reinforcing steel was segregated from the concrete material. The crushed concrete was spread and compacted into the subgrade soils. The reinforcing steel was trucked offsite for recycling. Subgrade soils underlying the stockpiles were not accessible for evaluation and sampling until concrete crushing was nearly complete.

In accordance with the WDR's, the base of each reservoir was divided into a grid pattern with each grid node having an area of approximately 5,000 square feet. On April 3 and 4, 1995 a representative soil sample was collected from each accessible grid node. The soil samples were submitted to Brown and Caldwell Analytical Laboratories (BCA), a state certified analytical laboratory, for analysis. On May 9 and May 25, 1995, after concrete crushing was nearly complete, the final seven subgrade soil samples were collected and submitted for analysis. The total number of samples collected was 68; 30 from Reservoir 1 and 38 for Reservoir 2. The sampling grids and sample locations for Reservoirs 1 and 2 are shown on **Figure 2-1** and **Figure 2-2**, respectively.

Sampling Procedures

Hand auger drilling was performed at each sample location to a depth of 2 feet below grade using a 3-inch diameter barrel-auger equipped with a T-bar handle. Two different procedures were employed to collect samples from subgrade soils for laboratory analysis. Rationale for varying the sample procedures is addressed in a letter to the CRWQCB titled; "Confirmation of Sampling Procedures, Waste Discharge Requirements - Reservoir Closure...," dated May 2, 1995 (**Appendix C**).

The initial sample collection method consisted of collecting samples in glass jars after hand auger drilling was performed to a depth of approximately 2 feet below grade. Representative soil samples were collected directly from the hand auger barrel. Each soil sample was transferred from the hand auger barrel into a labeled, precleaned, laboratory approved, 4-oz glass jar; tightly packed; and sealed with a Teflon™ lined threaded cap. This sample collection

method was used for samples R1-A through R1-H and R1-K collected from Reservoir 1, and all samples collected from Reservoir 2 except R2-K, R2-R, R2-S, R2-Y, R2-Z, R2-GG, R2-SUMP1 and R2-SUMP2.

All other subgrade soil samples were collected directly into brass sleeves using a distinct method. After hand auger drilling was performed to a depth of approximately 2 feet below grade, in-situ soil samples were collected from the subgrade directly into sampling sleeves using a 6-inch long solid-barrel core sampler. The core sampler was equipped with two 2-inch diameter, 3-inch long brass sample sleeves. Samples were collected by driving the core sampler into the subgrade soils using a hand-driven slide hammer. The sampler was then extracted from the subgrade soils, retaining the soil sample within the core barrel. The sample sleeves containing the soil samples were removed from the core barrel sampler. Each sample sleeve was sealed at both ends with a Teflon™ sheet secured by a tight-fitting plastic cap.

Sample collection was conducted using Level D personal protective equipment including Nomex™ suit, hard hat, goggles, safety glasses, and work boots.

To prevent cross contamination, all exploration and sampling equipment was decontaminated between sampling intervals by washing in a Liquinox™ soap and water solution, and double rinsing with distilled water.

A unique sample identification (ID) number was assigned to each sample location. This ID number was pre-recorded on the site diagram, marked on the sampling container at the time of sample collection, and recorded on the Chain of Custody (COC) record. Sample identification numbers were carefully recorded so there was no uncertainty about the location and identity of each sample.

The identification numbering scheme utilized a simple alphanumeric code. The first half of the code was "R1-" or "R2-" indicating Reservoir 1 or Reservoir 2, respectively. The last half of the code was a letter or double-letter (e.g., A, X, GG) that corresponds to a specific pre-designated sample location on the sample location map.

Pre-printed, gummed, waterproof labels were used on each sample container. Each label also included initials of sampler, unique sample identification number, method of analysis required, date and time of sampling, and project number. Labels were completed using waterproof ink pens. All samples were placed in an ice-chilled cooler for delivery to the analytical laboratory following standard chain of custody procedures.

All pertinent field activities were recorded in a daily logbook. Entries included date, time of day, weather conditions, attending personnel and subcontractors, sampling locations and field observations.

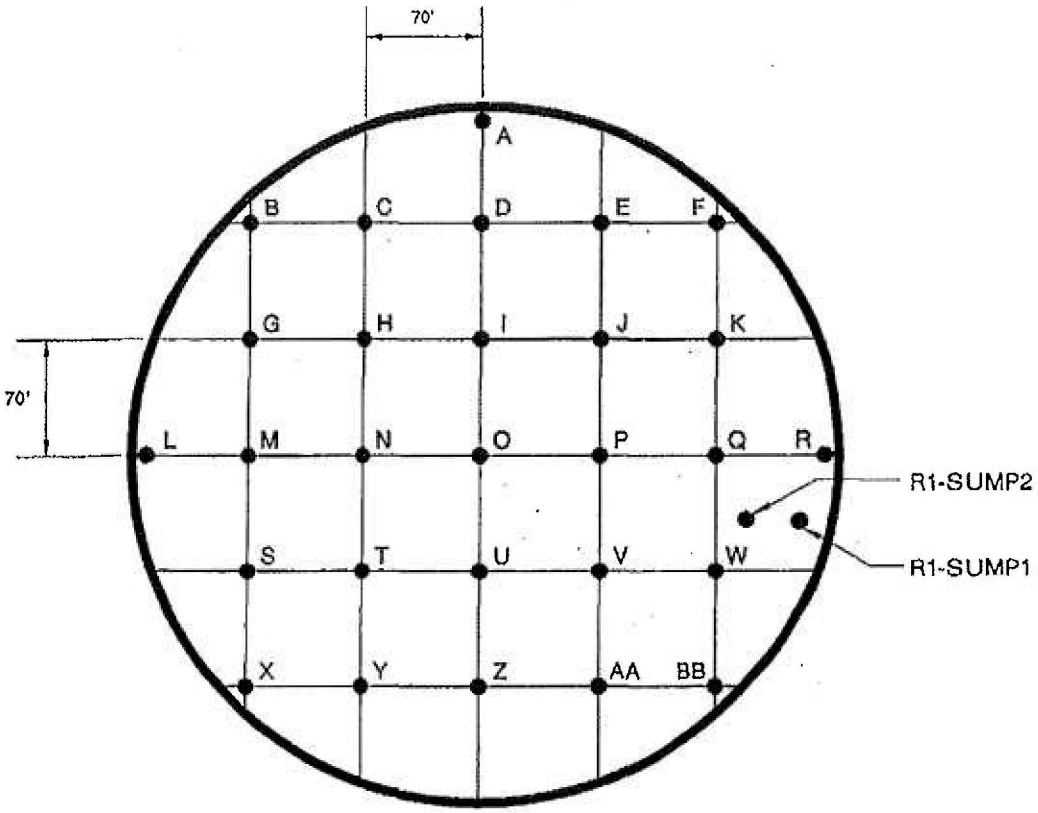
Laboratory Analyses

Each of the 68 subgrade soil samples were analyzed for aromatic volatile hydrocarbons, and semivolatile petroleum hydrocarbons including polynuclear aromatic hydrocarbons.

Laboratory testing for aromatic volatile hydrocarbons was performed by EPA Method 8015 modified using a 'purge and trap' extraction technique for gasoline-range hydrocarbons (8015m/5030). Results were reported as: Benzene, Toluene, Ethylbenzene, Total Xylenes (BTEX); and Total Petroleum Hydrocarbons (TPH) for carbon chains ranging from C_6 to C_{12}.

Laboratory testing for semivolatile hydrocarbons was performed by EPA Methods 8015 modified using a 'simulated distillation' extraction technique for diesel-range hydrocarbons (8015m) and 8270. Results for EPA Method 8015m were reported as TPH for carbon chains ranging from C_{13} to C_{22} and C_{23} to C_{28}. EPA Method 8270 results were reported as 70 individual hydrocarbon compounds including polynuclear aromatic hydrocarbons (PNA's). If PNA concentrations (as analyzed by EPA Method 8270) exceeded 20 times the Practical Quantification Limit (PQL), the Toxicity Characteristic Leaching Procedure (TCLP) with EPA Method 8270 analysis was performed on that sample. PQLs are equal to 3.3 times the Reporting Detection Limit (RDL), which is an industry standard per the American Quality Standards.

Laboratory test results for subgrade soils in Reservoir 1 and Reservoir 2 are summarized on **Table 2-1** and **Table 2-2**, respectively.



LEGEND

F ● SAMPLE LOCATION

NOTES

= 30 SAMPLES

FOR CONCEPTUAL PURPOSES ONLY

DATE	PROJECT NUMBER	RESERVOIR 1 SAMPLE GRID		
10-02-95	1116-21			
BROWN AND CALDWELL IRVINE, CALIFORNIA		PROJECT LOCATION: UNOCAL CARSON REFINERY, 1520 EAST SEPULVEDA BOULEVARD, CARSON, CALIFORNIA	NOT TO SCALE	FIGURE 2-1

TM/111A-00

TABLE 2-1
Reservoir 1
Summary of Analytical Results of Floor Material Samples (Page 1 of 4)

Sample ID	R1-A	R1-B	R1-C	R1-D	R1-E	R1-F	R1-G	R1-H
Volatile Hydrocarbons, EPA Method 8020, mg/kg								
Benzene	<1	0.18	0.17	<0.5	<0.1	0.21	<0.1	<0.5
Ethylbenzene	1.8	0.77	1.5	2.7	1.2	0.70	<0.1	1.9
Toluene	2.2	1.1	0.4	2.6	0.95	0.94	<0.1	1.1
Xylenes	7.5	4.1	6.6	12	6.0	3.6	<0.1	7.8
Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg								
C6-C12	620	230	370	810	300	240	14	1,900
C13-C22	26,000	14,000	15,000	18,000	14,000	16,000	850	13,000
C23-C28	11,000	4,400	5,800	5,600	5,600	6,800	240	3,400
Semivolatile Hydrocarbons, EPA Method 8270, mg/kg								
2-Methylnaphthalene	30	29	30	26	22	31	<0.2	24
Acenaphthene	<5	<2	<9	<2	<2	<9	<0.2	<8
Anthracene	<2	<2	<9	<2	8.7	<9	<0.2	<8
Benzo(a)anthracene	<2	<2	<9	<2	<2	<9	<0.2	<8
Chrysene	<2	<2	<9	<2	<2	<9	<0.2	<8
Dibutylphthalate	<2	<2	<9	<2	<2	<9	<0.2	<8
Fluoranthene	<2	<2	<9	<2	<2	<9	<0.2	<8
Fluorene	4.2	4.2	<9	3.0	2.8	<9	<0.2	<8
Naphthalene	7.0	7.8	<9	7.4	6.8	<9	<0.2	<8
Phenanthrene	13	11	<9	11	8.4	11	<0.2	8.1
Pyrene	3.7	2.0	<9	<2	<2	<9	<0.2	<8
Extractable Semivolatile Hydrocarbons using TCLP, EPA Method 8270, mg/L								
Acenaphthene	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	NA	NA	NA	NA	NA	NA	NA	NA

Notes: < Indicates that compound was not detected at specified detection limit.
NA = Not Analyzed
TCLP = Toxicity Characteristic Leaching Procedure

TABLE 2-1
Reservoir 1
Summary of Analytical Results of Floor Material Samples (Page 2 of 4)

Sample ID	R1-I	R1-J	R1-K	R1-L	R1-M	R1-N	R1-O	R1-P
Volatile Hydrocarbons, EPA Method 8020, mg/kg								
Benzene	7.1	<0.1	<0.1	<1	2.2	1.3	3.9	<0.1
Ethylbenzene	1.7	<0.1	<0.1	1.7	6.1	1.0	1.9	<0.1
Toluene	1.0	<0.1	<0.1	1.9	3.1	<0.5	1.1	<0.1
Xylenes	5.2	0.33	<0.1	5.7	32	3.4	4.2	<0.1
Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg								
C6-C12	720	100	<10	710	960	320	710	27
C13-C22	20,000	<100	<100	40,000	17,000	8,700	17,000	<100
C23-C28	7,100	<100	<100	23,000	6,700	3,500	5,900	<100
Semivolatile Hydrocarbons, EPA Method 8270, mg/kg								
2-Methylnaphthalene	62	0.30	<0.2	64	27	<5	28	<0.2
Acenaphthene	<5	<0.2	<0.2	<20	<20	<5	<2	<0.2
Anthracene	<5	<0.2	<0.2	<20	<20	<5	<2	<0.2
Benzo(a)anthracene	<5	<0.2	<0.2	<20	<20	<5	<2	<0.2
Chrysene	<5	<0.2	<0.2	<20	<20	<5	<2	<0.2
Dibutylphthalate	<5	<0.2	<0.2	<20	<20	<5	<2	<0.2
Fluoranthene	<5	<0.2	<0.2	<20	<20	<5	<2	<0.2
Fluorene	7.4	<0.2	<0.2	<20	<20	<5	2.7	<0.2
Naphthalene	19	<0.2	<0.2	<20	<20	<5	9.7	<0.2
Phenanthrene	21	0.46	<0.2	39	<20	<5	8.5	<0.2
Pyrene	5.2	0.25	<0.2	<20	<20	<5	2.8	<0.2
Extractable Semivolatile Hydrocarbons using TCLP, EPA Method 8270, mg/L								
Acenaphthene	<0.005	NA	NA	<0.005	<0.005	NA	<0.005	NA
Fluorene	<0.005	NA	NA	<0.005	<0.005	NA	<0.005	NA
Naphthalene	<0.005	NA	NA	<0.005	<0.005	NA	<0.005	NA
Phenanthrene	<0.005	NA	NA	<0.005	<0.005	NA	<0.005	NA

Notes: < Indicates that compound was not detected at specified detection limit.
NA = Not Analyzed
TCLP = Toxicity Characteristic Leaching Procedure

TABLE 2-1
Reservoir 1
Summary of Analytical Results of Floor Material Samples (Page 3 of 4)

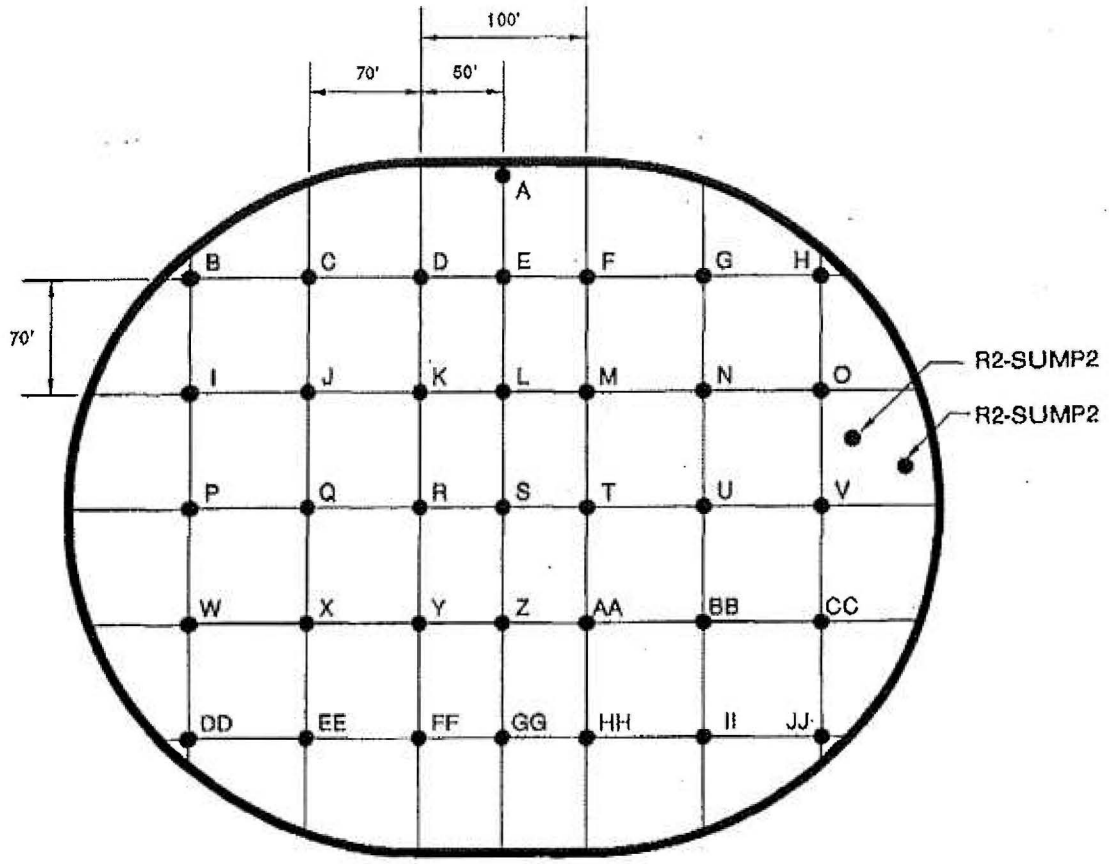
Sample ID	R1-Q	R1-R	R1-S	R1-T	R1-U	R1-V	R1-W	R1-X
Volatile Hydrocarbons, EPA Method 8020, mg/kg								
Benzene	<1	<1	0.13	<1	1.6	0.22	<1	<0.5
Ethylbenzene	1.4	1.8	1.9	2.7	2.3	1.7	1.6	2.5
Toluene	<1	2.5	0.87	2.4	0.79	1.0	2.5	2.9
Xylenes	6.1	10	5.9	12	11	5.9	7.5	13
Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg								
C6-C12	780	1,000	33	1,500	680	390	780	900
C13-C22	13,000	18,000	9,100	26,000	16,000	8,000	11,000	24,000
C23-C28	4,900	6,400	4,900	7,300	6,000	2,900	3,000	7,100
Semivolatile Hydrocarbons, EPA Method 8270, mg/kg								
2-Methylnaphthalene	6.0	29	20	42	52	26	47	50
Acenaphthene	<3	<4	<8	<10	<5	<4	<5	<10
Anthracene	<3	<4	<8	<10	<5	<4	<5	<10
Benzo(a)anthracene	<3	<4	<8	<10	<5	<4	<5	<10
Chrysene	<3	<4	<8	<10	<5	<4	<5	<10
Dibutylphthalate	<3	<4	<8	<10	<5	<4	<5	<10
Fluoranthene	<3	<4	<8	<10	<5	<4	<5	<10
Fluorene	<3	4.5	<8	<10	<5	<4	7.6	<10
Naphthalene	<3	8.8	<8	14	16	9.0	14	16
Phenanthrene	5.8	10	<8	13	16	8.4	18	15
Pyrene	3.1	<4	<8	<10	<5	<4	<5	<10
Extractable Semivolatile Hydrocarbons using TCLP, EPA Method 8270, mg/L								
Acenaphthene	NA	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Fluorene	NA	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Naphthalene	NA	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Phenanthrene	NA	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Notes: < Indicates that compound was not detected at specified detection limit.
NA = Not Analyzed
TCLP = Toxicity Characteristic Leaching Procedure

TABLE 2-1
Reservoir 1
Summary of Analytical Results of Floor Material Samples (Page 4 of 4)

Sample ID	R1-Y	R1-Z	R1-AA	R1-BB	R1-SUMP1	R1-SUMP2
Volatile Hydrocarbons, EPA Method 8020, mg/kg						
Benzene	<1	1.0	<0.5	<0.5	<1	<0.5
Ethylbenzene	1.9	2.4	2.0	0.86	1.5	<0.5
Toluene	2.7	2.9	2.3	2.0	1.8	0.65
Xylenes	9.4	12	9.2	6.0	7.9	2.8
Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg						
C6-C12	1,000	640	620	330	640	190
C13-C22	23,000	39,000	16,000	3,700	36,000	5,100
C23-C28	7,700	21,000	5,600	1,400	18,000	3,300
Semivolatile Hydrocarbons, EPA Method 8270, mg/kg						
2-Methylnaphthalene	37	69	53	24	74	26
Acenaphthene	<6	<7	<20	<3	<20	<8
Anthracene	<6	<7	<20	<3	<20	<8
Benzo(a)anthracene	<6	<7	<20	<3	<20	<8
Chrysene	<6	<7	<20	<3	<20	<8
Dibutylphthalate	<6	<7	<20	<3	<20	<8
Fluoranthene	<6	<7	<20	<3	<20	<8
Fluorene	<6	<7	<20	<3	<20	<8
Naphthalene	12	19	<20	7.0	<20	<8
Phenanthrene	11	17	<20	9.4	26	12
Pyrene	<6	<7	<20	<3	<20	<8
Extractable Semivolatile Hydrocarbons using TCLP, EPA Method 8270, mg/L						
Acenaphthene	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Fluorene	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Naphthalene	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Phenanthrene	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Notes: < Indicates that compound was not detected at specified detection limit.
NA = Not Analyzed
TCLP = Toxicity Characteristic Leaching Procedure



LEGEND

H● SAMPLE LOCATION

NOTES

= 38 SAMPLES

FOR CONCEPTUAL PURPOSES ONLY

DATE	PROJECT NUMBER	RESERVOIR 2 SAMPLE GRID		
10-02-95	1116-21			
BROWN AND CALDWELL IRVINE, CALIFORNIA		PROJECT LOCATION: UNOCAL CARSON REFINERY 1520 EAST SEPULVEDA BOULEVARD CARSON, CALIFORNIA	NOT TO SCALE	FIGURE 2-2

TABLE 2-2
Reservoir 2
Summary of Analytical Results of Floor Material Samples (Page 1 of 5)

Sample ID	R2-A	R2-B	R2-C	R2-D	R2-E	R2-F	R2-G	R2-H
Volatile Hydrocarbons, EPA Method 8020, mg/kg								
Benzene	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<1
Ethylbenzene	3.6	<0.1	<0.1	<0.1	<0.1	<0.1	2.4	4.5
Toluene	4.4	<0.1	<0.1	<0.1	<0.1	<0.1	1.7	6.5
Xylenes	19	<0.1	<0.1	<0.1	<0.1	<0.1	6.6	26
Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg								
C6-C12	990	<10	44	<10	<10	<10	510	1,300
C13-C22	16,000	<100	<100	<100	<100	<100	2,200	15,000
C23-C28	4,900	<100	<100	<100	<100	<100	1,100	3,600
Semivolatile Hydrocarbons, EPA Method 8270, mg/kg								
2-Methylnaphthalene	<2	<0.2	<0.2	<0.2	<0.2	<0.2	2.2	190
Acenaphthene	9.9	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<20
Anthracene	7.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<20
Benzo(a)anthracene	7.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<20
Benzo(a)pyrene	4.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<20
Chrysene	9.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<20
Dibutylphthalate	<2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<20
Fluoranthene	2.8	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<20
Fluorene	22	<0.2	<0.2	<0.2	<0.2	<0.2	0.57	<20
Naphthalene	30	<0.2	<0.2	<0.2	<0.2	<0.2	0.68	38
Phenanthrene	41	<0.2	<0.2	0.43	<0.2	<0.2	1.3	46
Pyrene	19	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<20
Extractable Semivolatile Hydrocarbons using TCLP, EPA Method 8270, mg/L								
Acenaphthene	0.0079	NA	NA	NA	NA	NA	NA	0.0088
Fluorene	0.0076	NA	NA	NA	NA	NA	NA	0.0095
Naphthalene	0.093	NA	NA	NA	NA	NA	NA	0.12
Phenanthrene	0.010	NA	NA	NA	NA	NA	NA	0.0085

Notes: < Indicates that compound was not detected at specified detection limit.
NA = Not Analyzed
TCLP = Toxicity Characteristic Leaching Procedure

TABLE 2-2
Reservoir 2
Summary of Analytical Results of Floor Material Samples (Page 2 of 5)

Sample ID	R2-I	R2-J	R2-K	R2-L	R2-M	R2-N	R2-O	R2-P
Volatile Hydrocarbons, EPA Method 8020, mg/kg								
Benzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ethylbenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Toluene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Xylenes	<0.1	**0.42**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg								
C6-C12	<10	**100**	<10	<10	<10	<10	<10	<10
C13-C22	<100	**160**	<100	<100	<100	<100	<100	<100
C23-C28	<100	<100	<100	<100	<100	<100	<100	<100
Semivolatile Hydrocarbons, EPA Method 8270, mg/kg								
2-Methylnaphthalene	<0.2	**4.2**	<0.2	<0.2	**0.32**	<0.2	<0.2	<0.2
Acenaphthene	<0.2	**0.37**	<0.2	<0.2	<0.2	<0.2	<0.2	**0.19**
Anthracene	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(a)anthracene	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Chrysene	<0.2	**0.18**	<0.2	<0.2	<0.2	<0.2	<0.2	**0.22**
Dibutylphthalate	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Fluoranthene	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Fluorene	<0.2	**0.71**	<0.2	<0.2	<0.2	<0.2	<0.2	**0.24**
Naphthalene	<0.2	**1.7**	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Phenanthrene	<0.2	**1.4**	<0.2	<0.2	**0.26**	<0.2	<0.2	**0.80**
Pyrene	<0.2	**0.29**	<0.2	<0.2	<0.2	<0.2	<0.2	**0.32**
Extractable Semivolatile Hydrocarbons using TCLP, EPA Method 8270, mg/L								
Acenaphthene	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	NA	NA	NA	NA	NA	NA	NA	NA

Notes: < Indicates that compound was not detected at specified detection limit.
NA = Not Analyzed
TCLP = Toxicity Characteristic Leaching Procedure

TABLE 2-2
Reservoir 2
Summary of Analytical Results of Floor Material Samples (Page 3 of 5)

Sample ID	R2-Q	R2-R	R2-S	R2-T	R2-U	R2-V	R2-W	R2-X
Volatile Hydrocarbons, EPA Method 8020, mg/kg								
Benzene	<0.1	0.97	1.1	<1	<0.1	<0.1	<0.1	<0.1
Ethylbenzene	<0.1	5.6	8.1	4.5	<0.1	<0.1	<0.1	<0.1
Toluene	<0.1	2.6	4.3	4.1	<0.1	<0.1	<0.1	<0.1
Xylenes	<0.1	18	29	12	<0.1	<0.1	<0.1	<0.1
Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg								
C6-C12	<10	780	1,100	1,200	<10	<10	<10	<10
C13-C22	<100	13,000	23,000	9,800	<100	<100	<100	<100
C23-C28	<100	1,200	4,400	2,200	<100	<100	<100	<100
Semivolatile Hydrocarbons, EPA Method 8270, mg/kg								
2-Methylnaphthalene	<0.2	150	190	94	<0.2	<0.2	<0.2	<0.2
Acenaphthene	<0.2	13	15	<30	<0.2	<0.2	<0.2	<0.2
Anthracene	<0.2	<10	11	<30	<0.2	<0.2	<0.2	<0.2
Benzo(a)anthracene	<0.2	<10	24	<30	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	<0.2	<10	8.6	<30	<0.2	<0.2	<0.2	<0.2
Chrysene	<0.2	15	39	<30	<0.2	<0.2	<0.2	<0.2
Dibutylphthalate	<0.2	<10	<8	<30	<0.2	<0.2	<0.2	<0.2
Fluoranthene	<0.2	<10	<8	<30	<0.2	<0.2	<0.2	<0.2
Fluorene	<0.2	15	24	<30	<0.2	<0.2	<0.2	<0.2
Naphthalene	<0.2	33	46	<30	<0.2	<0.2	<0.2	<0.2
Phenanthrene	<0.2	59	89	32	0.28	<0.2	<0.2	<0.2
Pyrene	<0.2	21	51	<30	<0.2	<0.2	<0.2	<0.2
Extractable Semivolatile Hydrocarbons using TCLP, EPA Method 8270, mg/L								
Acenaphthene	NA	0.0068	0.0065	<0.005	NA	NA	NA	NA
Fluorene	NA	0.0078	0.0059	<0.005	NA	NA	NA	NA
Naphthalene	NA	0.110	0.097	0.047	NA	NA	NA	NA
Phenanthrene	NA	0.015	0.0099	<0.005	NA	NA	NA	NA

Notes: < Indicates that compound was not detected at specified detection limit.
NA = Not Analyzed
TCLP = Toxicity Characteristic Leaching Procedure

TABLE 2-2
Reservoir 2
Summary of Analytical Results of Floor Material Samples (Page 4 of 5)

Sample ID	R2-Y	R2-Z	R2-AA	R2-BB	R2-CC	R2-DD	R2-EE	R2-FF
Volatile Hydrocarbons, EPA Method 8020, mg/kg								
Benzene	<0.1	<0.1	<1	<0.5	0.75	<10	<0.1	<0.1
Ethylbenzene	<0.1	<0.1	1.0	1.3	5.2	<10	<0.1	<0.1
Toluene	<0.1	<0.1	<1	0.60	8.1	12	<0.1	<0.1
Xylenes	<0.1	<0.1	5.3	3.4	24	54	<0.1	<0.1
Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg								
C6-C12	<10	<10	1,400	920	1,500	5,600	<10	<10
C13-C22	<100	<100	7,500	14,000	28,000	52,000	<100	<100
C23-C28	<100	<100	4,500	6,300	18,000	10,000	<100	<100
Semivolatile Hydrocarbons, EPA Method 8270, mg/kg								
2-Methylnaphthalene	0.36	<2	47	24	370	520	0.96	<0.2
Acenaphthene	<0.2	<2	<2	<3	<30	40	1.2	<0.2
Anthracene	<0.2	<2	<2	<3	<30	<30	0.42	<0.2
Benzo(a)anthracene	<0.2	<2	2.0	<3	<30	<30	0.40	<0.2
Benzo(a)pyrene	<0.2	<2	<2	<3	<30	<30	<0.2	<0.2
Chrysene	<0.2	2.4	2.1	<3	38	<30	0.51	<0.2
Dibutylphthalate	<0.2	<2	<2	<3	<30	<30	<0.2	<0.2
Fluoranthene	<0.2	<2	<2	<3	<30	<30	0.22	<0.2
Fluorene	<0.2	<2	3.8	<3	31	42	0.69	<0.2
Naphthalene	<0.2	<2	13	5.7	92	100	<0.2	<0.2
Phenanthrene	0.47	8.1	9.2	8.8	140	140	2.4	<0.2
Pyrene	0.22	3.2	4.0	<3	51	67	0.85	<0.2
Extractable Semivolatile Hydrocarbons using TCLP, EPA Method 8270, mg/L								
Acenaphthene	NA	NA	<0.005	NA	0.0070	0.0094	NA	NA
Fluorene	NA	NA	0.0056	NA	0.0091	0.0087	NA	NA
Naphthalene	NA	NA	0.053	NA	0.13	0.090	NA	NA
Phenanthrene	NA	NA	<0.005	NA	0.013	0.010	NA	NA

Notes: < Indicates that compound was not detected at specified detection limit.
NA = Not Analyzed
TCLP = Toxicity Characteristic Leaching Procedure

TABLE 2-2
Reservoir 2
Summary of Analytical Results of Floor Material Samples (Page 5 of 5)

Sample ID	R2-GG	R2-HH	R2-II	R2-JJ	R2-SUMP1	R2-SUMP2
Volatile Hydrocarbons, EPA Method 8020, mg/kg						
Benzene	<0.1	<0.1	<0.1	<0.1	1.3	0.59
Ethylbenzene	<0.1	<0.1	1.1	<0.1	5.9	2.8
Toluene	<0.1	<0.1	0.15	<0.1	10	4.7
Xylenes	<0.1	<0.1	1.8	<0.1	34	13
Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg						
C6-C12	14	<10	240	<10	1,200	1,000
C13-C22	<100	<100	3,600	<100	22,000	20,000
C23-C28	<100	<100	1,800	<100	4,500	3,000
Semivolatile Hydrocarbons, EPA Method 8270, mg/kg						
2-Methylnaphthalene	<2	0.35	2.4	<0.2	240	170
Acenaphthene	<2	<0.2	<1	<0.2	22	<20
Anthracene	<2	<0.2	<1	<0.2	<20	<20
Benzo(a)anthracene	<2	<0.2	<1	<0.2	<20	<20
Benzo(a)pyrene	<2	<0.2	<1	<0.2	<20	<20
Chrysene	<2	<0.2	<1	<0.2	<20	28
Dibutylphthalate	<2	<0.2	<1	<0.2	<20	<20
Fluoranthene	<2	<0.2	<1	<0.2	<20	<20
Fluorene	<2	<0.2	<1	<0.2	23	<20
Naphthalene	<2	<0.2	<1	<0.2	51	49
Phenanthrene	4.1	0.47	1.6	<0.2	81	81
Pyrene	2.0	0.20	<1	<0.2	20	27
Extractable Semivolatile Hydrocarbons using TCLP, EPA Method 8270, mg/L						
Acenaphthene	NA	NA	NA	NA	<0.05	0.007
Fluorene	NA	NA	NA	NA	<0.05	<0.005
Naphthalene	NA	NA	NA	NA	0.016	0.077
Phenanthrene	NA	NA	NA	NA	<0.05	0.0057

Notes: < Indicates that compound was not detected at specified detection limit.
NA = Not Analyzed
TCLP = Toxicity Characteristic Leaching Procedure

3

BROWN AND CALDWELL

CHAPTER 3

BACKFILL CHARACTERIZATION

Soils comprising the perimeter berms of both reservoirs were excavated and placed as backfill within the basal depressions of both reservoirs. Backfill placement within the reservoirs was monitored to verify that soils had contaminant concentrations less than the WDR's and to certify that backfill soil was compacted to at least 90% of the maximum laboratory derived dry density.

Backfill soils were sampled and tested for petroleum hydrocarbons at a specified frequency to demonstrate that soils placed into the reservoirs had contaminant concentrations less than the CRWQCB mandated discharge limits specified in the WDR. The discharge limits are summarized below:

WASTE DISCHARGE LIMITS

CONSTITUENT	LIMIT (mg/kg)
ORGANIC COMPOUNDS	
Aromatic Volatile Organic Compounds (EPA Method 8015, modified)	
benzene	0.1
ethylbenzene	2.9
toluene	4.2
xylene	1.7
Total Petroleum Hydrocarbons (EPA Method 8015, modified)	
C_4 - C_{12}	1,000
C_{13} - C_{22}	10,000
C_{23+}	15,000
Polynuclear Aromatic Hydrocarbons extracted using the Toxic Characteristic Leaching Procedure (TCLP) (EPA Method 8270)	Non-detect (mg/l)

Backfill soils were tested for compaction by NorCal Engineering, a third party inspection company, as specified by Ralph M. Parsons Company, to verify that the backfill areas were compacted to at least 90% of the maximum dry density.

Blending and Placement Procedures

Before blending and backfill, the bottoms of both reservoirs were scarified with a track loader pulling a 10-inch cutting disk, and compacted to 90%+ with a sheeps foot vibratory compactor. The crushed concrete from the floor and side liners was incorporated into the bottoms and compacted to form the base for the blending and backfill phase.

The blending of the berm soils was accomplished by pushing the berm soils from top to bottom to gaps opened in the berms, then rolling them from outside edge to inside with dozers, spreading them over the bottom in 6-inch lifts with loaders, and then turning them over with 12-inch disks pulled by dozers.

The blended soil was sampled for BTEX, TPH, and PNA's as required by the WDR's every 12-inch lift. After the blended soil complied with WDR limits, the 12-inch lift was compacted to at least 90% prior to placing the next blended lift.

The reservoirs were backfilled sequentially in halves to 12 inches high, and a new lift for each half was placed every week, or more if blending was not satisfactory and soil had to be re-blended.

Figures 3-1 and 3-2 show a generalized exploded view of fill placed into the reservoirs prior to installation of the low permeability cap.

Soil Hydrocarbon Evaluation

Berm soils were excavated, blended, placed, and compacted in thin lifts by the civil subcontractor. Soil samples were collected from throughout the area of fill placement. Samples were typically collected prior to compaction of fill soils. Soil sample locations were typically selected at random from within each 500 cubic yard area of fill. However, any areas that exhibited significant staining or other indications of hydrocarbon presence were preferentially selected over areas with no indications of hydrocarbon presence. The WDR's specified that samples be collected and analyzed at the following frequencies:

PARAMETER	SAMPLING FREQUENCY
Total Petroleum Hydrocarbons (C_4 - C_{28})	Once/500 CY
Aromatic Volatile Organic Compounds (BTEX)	Once/1,000 CY
Semivolatile Organic Hydrocarbons	Once/1,000 CY

One soil sample representative of every 500 cubic yards of blended berm material was collected for analysis. Each sample was analyzed for TPH by EPA Method 8015 Modified with results reported in ranges C_{13} to C_{22} and C_{23} to C_{28}. Each sample was also analyzed for aromatic volatile organic compounds by EPA Method 5030/8015m with results reported as both TPH in the range of C_6 to C_{12} and BTEX. Laboratory test results for BTEX were received at twice the frequency specified in the WDR's, as approved by CRWQCB personnel.

One sample representative of every 1000 cubic yards of berm material was analyzed for semivolatile organic compounds by EPA Method 8270 as specified in the WDR's. Samples which specifically had polynuclear aromatic hydrocarbon (PNA) concentrations greater than 20 times the WDR limit were submitted for analysis of semivolatiles using the TCLP. If PNA concentrations (as analyzed by EPA Method 8270) exceeded 20 times the Practical Quantification Limit (PQL), the Toxicity Characteristic Leaching Procedure (TCLP) with EPA Method 8270 analysis was performed on that sample. PQLs are equal to 3.3 times the Reporting Detection Limit (RDL), which is an industry standard per the American Quality Standards.

Sample Collection Procedures

Soil samples to be analyzed for aromatic volatile organic compounds (BTEX and TPH) were collected from every 500 cubic yards of excavated and graded fill soils prior to compaction. In situ samples were collected directly into sampling sleeves using a 6-inch long solid-barrel core sampler. The core sampler was equipped with two 2-inch diameter, 3-inch long brass or stainless steel sample sleeves. Samples were collected by driving the core sampler into the soils using a hand-driven slide hammer. The sampler was then extracted, retaining the soil sample within the core barrel. After each soil sample was hand-driven, the sample sleeves containing the soil were removed from the core barrel sampler. The lead sample sleeve (bottom 3-inch sleeve) was sealed at each end with a Teflon™ sheet secured by a tight-fitting plastic cap. Samples were generally collected from a depth of three to nine inches below surface.

Soil samples to be analyzed for semivolatile organic hydrocarbons were collected every 1,000 cubic yards into a glass jar using a pre-cleaned steel trowel. Each soil sample was transferred into a labeled, pre-cleaned, laboratory approved, 4-oz glass jar; tightly packed; and sealed with a Teflon™ lined threaded cap.

Sample collection was conducted using Level D personal protective equipment including Nomex™ suit, hard hat, goggles, safety glasses, and work boots.

To prevent cross contamination, all exploration and sampling equipment was decontaminated between sampling intervals by washing in a Liquinox™ and water solution and double rinsing with distilled water.

A unique chronologic sample identification (ID) number was assigned to each sample at the time of sample collection. This ID number was marked on the sampling container at the time of sample collection, plotted on a generalized sample location map showing all sample locations, and recorded on the Chain of Custody (COC) record. Sample identification numbers were carefully recorded so there was no uncertainty about the location and identity of each sample.

The numbering scheme was transferred into a simple uniform code for ease of reporting. The code is repeated for each lift of fill that was placed. The code simply employs an alphabetical designation indicating the general direction of section sampled (i.e., NW = Northwest, C = Center) and an "a" or "b" indicating specific subsections.

Pre-printed, gummed, waterproof labels were used on each sample container. Each label also included initials of sampler, unique sample identification number, method of analysis required, date and time of sampling, and project number. Labels were completed using waterproof ink pens. Each sample was placed in an ice-chilled cooler for delivery to the analytical laboratory following standard chain of custody procedures.

All pertinent field activities were recorded in a daily logbook. Entries included date, time of day, weather conditions, attending personnel and subcontractors, sampling locations and field observations. A generalized sample location map, showing all sample locations and corresponding sample numbers, was filled out in conjunction with the daily logbook. Data recorded on the sample map was regularly transferred to a graphics program to provide accurate tracking of all tested areas.

Laboratory Analysis

Laboratory testing for aromatic volatile hydrocarbons was performed by EPA Method 5030/8015m (modified for gasoline-range hydrocarbons). Results were reported as: Benzene, Toluene, Ethylbenzene, Total Xylenes (BTEX); and Total Petroleum Hydrocarbons (TPH) for carbon chains ranging from C_6 to C_{12}.

Laboratory testing for semivolatile hydrocarbons was performed by EPA Methods 8015m (modified for diesel-range hydrocarbons) and 8270. Results for EPA Method 8015m were

reported as TPH for carbon chains ranging from C_{13} to C_{22} and C_{23} to C_{28}. EPA Method 8270 results were reported as 70 individual hydrocarbon compounds including polynuclear aromatic (PNA's). Samples which had PNA's detected at concentrations greater than 20 times the laboratory Practical Quantification Limit (PQL) were submitted for analysis of semivolatiles using the Toxicity Characteristic Leaching Procedure (TCLP).

Final laboratory test results representative of backfill soils placed in Reservoir 1 and Reservoir 2 are summarized on **Table 3-1** and **Table 3-2**, respectively. The complete TPH and BTEX analytical results for fill placement and monitoring are tabulated chronologically in **Appendix D**.

Soil Compaction

After the blended backfill had been verified to comply with WDR limits, each 12-inch lift was watered with water trucks to provide moisture control and compacted with sheep's foot vibratory compactors, single and double drum, and smooth drum rollers in several passes to assure a compaction of 90% of maximum dry density.

After every two feet of backfill the soils were sampled and tested for compaction to verify that the 90% compaction had been achieved before placing the next lifts.

The graded soils outside the reservoirs were compacted following the same procedure, except for the perimeter road that had more compactor passes to achieve the required 95% compaction for road surfaces.

Sample Collection Procedures

As per project specifications, samples were taken for each 1000 cubic yards of backfill placed for every two feet vertical lift.

About ten percent of the samples were Sand Cone with a 4 to 6 inch hole dug to about six inches below grade. The other 90% were Drive Tube samples taken in a 3-inch tube pounded about three inches below grade.

The relative compaction was determined by the Sand Cone Method ASTM D1556-82 and by the Drive Tube Method ASTM D2937.

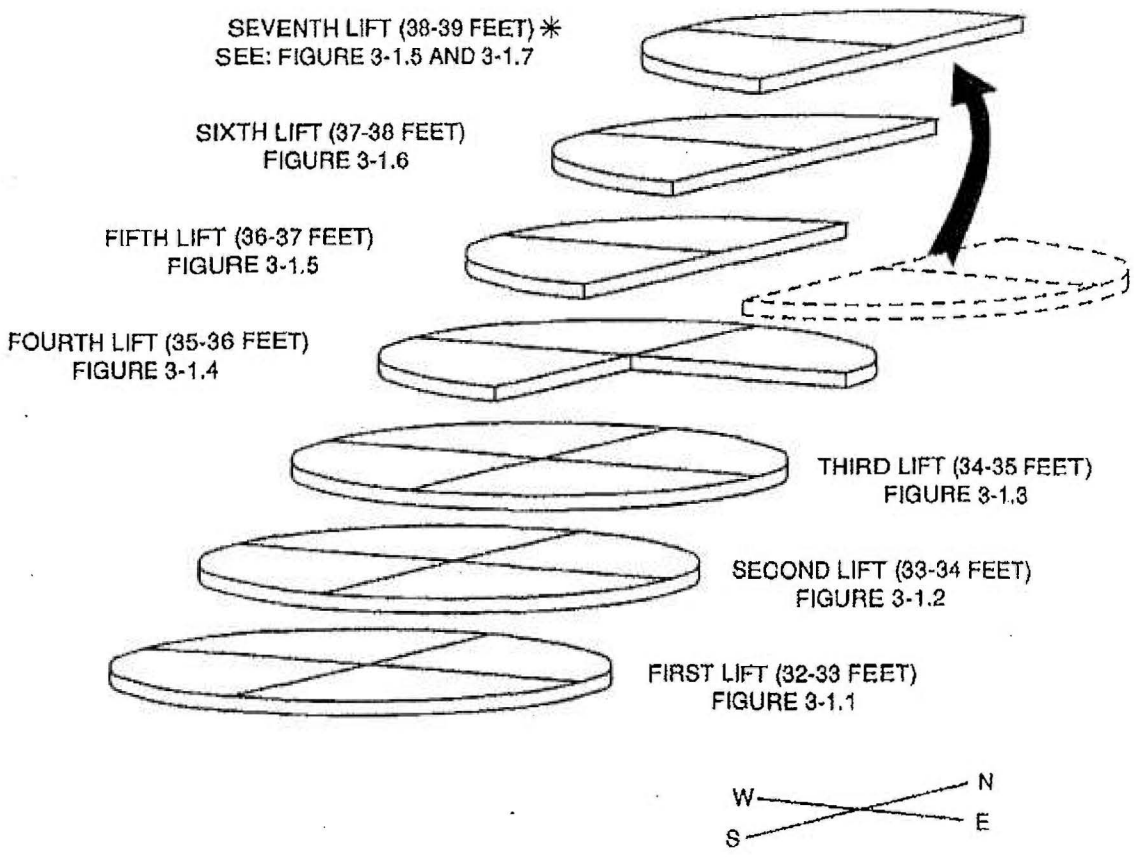
Laboratory Analysis

The maximum density of the backfill soils was obtained by the laboratory standard ASTM D1557-78 and the field in-place density tests were determined in accordance with ASTM D1556. The results were reported as: grade taken at, percent moisture, density (lbs/cu. ft.), relative compaction, soil type and location.

The relative compaction results varied from 90% to 98%. The average result was 94%, with most readings between 92% and 96%. Compaction under roads was achieved at values between 95% and 98%. The complete geotechnical results for compaction of backfill soils are included in **Appendix I**.

Final Grading

After backfill of the reservoirs was complete, a low permeability clay cap was installed to cover the blended backfill. A one foot thick final cover of local soil was placed over the clay cap to protect the cap from erosion. The final grade is shown in the "as built" drawings included as Section 7.

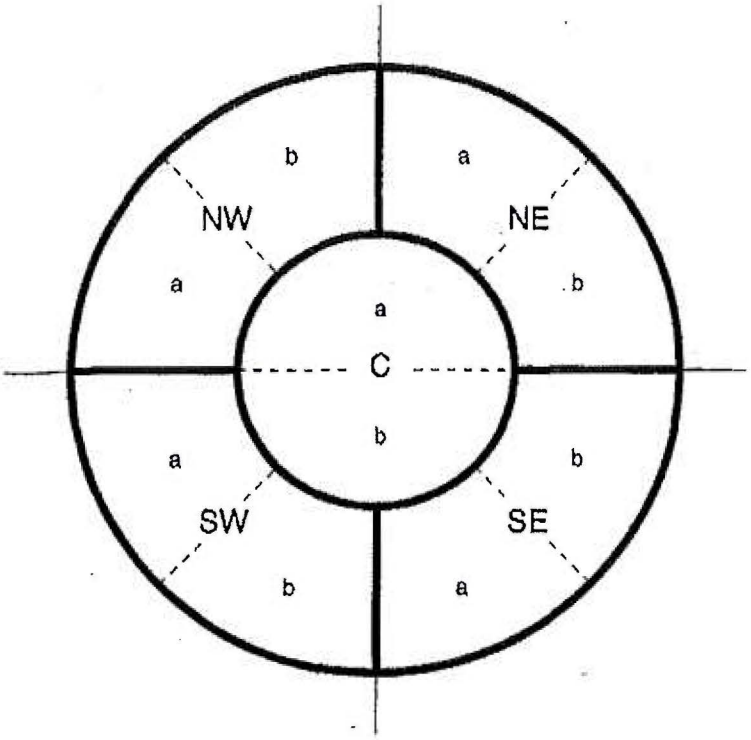


NOT TO SCALE
FOR CONCEPTUAL PURPOSES ONLY

ELEVATIONS REPORTED AS
FEET ABOVE MEAN SEA LEVEL

✳ SOILS COMPRISING THE SEVENTH LIFT WERE PLACED AND TESTED AS THE EAST HALF OF THE FIFTH LIFT AND LATER MOVED AFTER THE SIXTH LIFT WAS COMPLETED.

DATE	PROJECT NUMBER	RESERVOIR 1 FILL PLACEMENT SCHEMATIC		
9-12-95	1116-20			
BROWN AND CALDWELL IRVINE, CALIFORNIA		PROJECT LOCATION: UNOCAL CARSON REFINERY 1520 EAST SEPULVEDA BOULEVARD CARSON, CALIFORNIA	NOT TO SCALE	FIGURE 3-1



SECTIONS DESIGNATED BY BOLD OUTLINE AND ASSIGNED DIRECTION ABBREVIATIONS ARE ROUGHLY REPRESENTATIVE OF 1,000 CUBIC YARD QUANTITIES OF FILL.

SUBSECTIONS FURTHER DIVIDED BY A DOTTED LINE AND DESIGNATED WITH A LOWER CASE "A" OR "B" REPRESENT FILL QUANTITIES OF APPROXIMATELY 500 CUBIC YARDS.

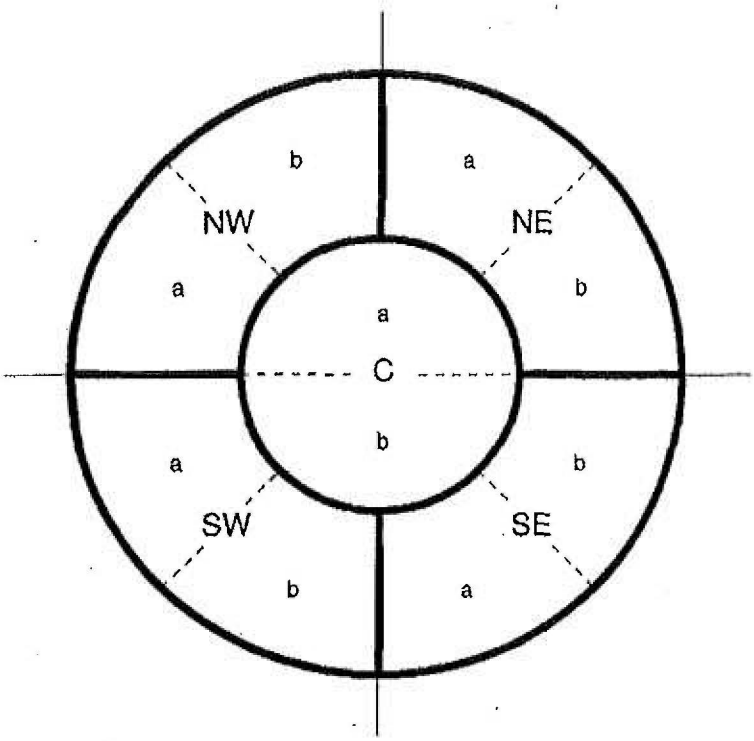
FOR CONCEPTUAL PURPOSES ONLY

DATE	PROJECT NUMBER	RESERVOIR 1 FIRST LIFT (32-33 FEET)		
9-12-95	1116-20			
BROWN AND CALDWELL IRVINE, CALIFORNIA		PROJECT LOCATION: UNOCAL CARSON REFINERY 1520 EAST SEPULVEDA BOULEVARD CARSON, CALIFORNIA	NOT TO SCALE	FIGURE 3-1.1

TABLE 3-1
Reservoir 1
Summary of Analytical Results for Fill Soils (Page 1 of 6)
First Lift
Approximately 32 to 33 Feet Above Mean Sea Level

Representative Section	NW		NE		C		SW		SE		WDR Limits
	a	b	a	b	a	b	a	b	a	b	
Volatile Hydrocarbons and Volatile Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg											
Sample Number	109-1-4	110-1-4	103-1-1	104-1-1	111-1-3/4	112-1-1/2	108-1-3	130-1-3	106-1-2	105-1-2	
Benzene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.1
Ethylbenzene	<0.10	0.12	<0.10	<0.10	0.14	<0.10	0.13	<0.10	<0.10	<0.10	2.9
Toluene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	4.2
Xylenes	0.39	0.69	0.17	0.68	1.10	0.62	0.98	<0.10	0.24	0.13	1.7
TPH C6-C12	100	120	84	100	130	140	140	11	83	55	1,000
Semivolatile Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg											
Sample Number	76-1-4	77-1-4	85-1-1	86-1-1	73-1-C	74-1-C	80-1-3	130-1-3	83-1-2	82-1-2	
TPH C13-C22	550	430	<100	2200	1500	120	830	<100	1200	1200	10,000
TPH C23-C28	780	430	<100	680	490	270	310	<100	700	410	15,000
Semivolatile Hydrocarbons, EPA Method 8270, mg/kg											
Sample Number	78-1-4		87-1-1		75-1-C		81-1-3		84-1-2		
2-Methylnaphthalene	12		13		18		15		6.9		N/A
Acenaphthene	<5		<5		<5		<5		<5		14[1]
Anthracene	<5		<5		<5		<5		<5		14[1]
Benzo(a)anthracene	<5		<5		<5		<5		<5		14[1]
Chrysene	<5		<5		<5		<5		<5		14[1]
Dibutylphthalate	<5		<5		<5		<5		<5		N/A
Fluoranthene	<5		<5		<5		<5		<5		14[1]
Fluorene	<5		<5		<5		<5		<5		14[1]
Naphthalene	<5		<5		<5		<5		<5		14[1]
Phenanthrene	5.1		<5		5.7		<5		<5		14[1]
Pyrene	<5		<5		<5		<5		<5		14[1]

Notes: < Indicates that compound was not detected at specified detection limit.
N/A = Not Applicable
WDR = Waste Discharge Requirements
TCLP = Toxicity Characteristic Leaching Procedure
[1] The WDR limit is equal to 20 times the Practical Quantification Limit. Samples with semivolatile concentrations above this value were submitted for analysis using the TCLP extraction and EPA Method 8270.
[1] 0.02 mg/L is the Practical Quantification Limit for these constituents.



SECTIONS DESIGNATED BY BOLD OUTLINE AND ASSIGNED DIRECTION ABBREVIATIONS ARE ROUGHLY REPRESENTATIVE OF 1,000 CUBIC YARD QUANTITIES OF FILL.

SUBSECTIONS FURTHER DIVIDED BY A DOTTED LINE AND DESIGNATED WITH A LOWER CASE "A" OR "B" REPRESENT FILL QUANTITIES OF APPROXIMATELY 500 CUBIC YARDS.

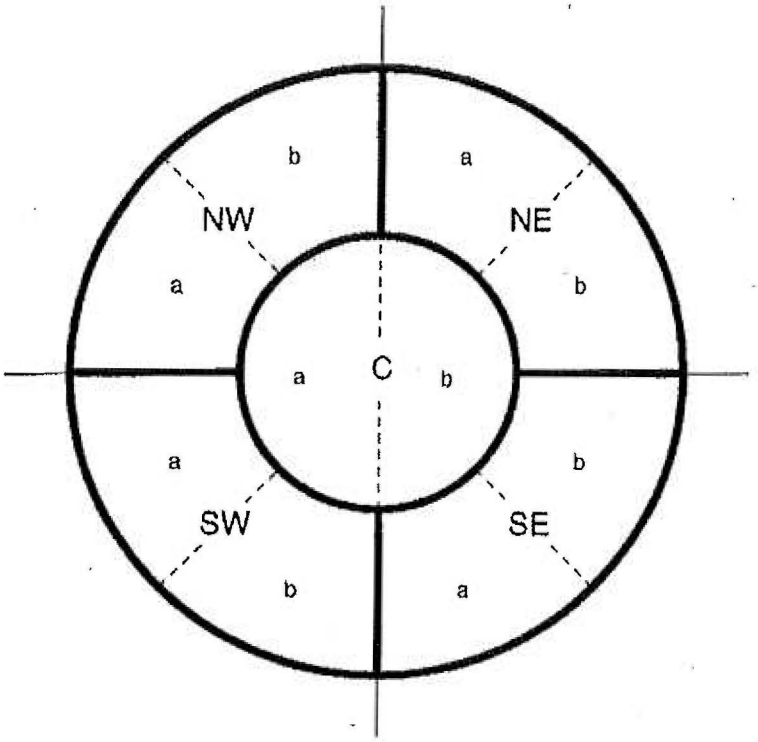
FOR CONCEPTUAL PURPOSES ONLY

DATE	PROJECT NUMBER	RESERVOIR 1 SECOND LIFT (33-34 FEET)		
9-12-95	1116-20			
BROWN AND CALDWELL IRVINE, CALIFORNIA		PROJECT LOCATION: UNOCAL CARSON REFINERY 1520 EAST SEPULVEDA BOULEVARD CARSON, CALIFORNIA	NOT TO SCALE	FIGURE 3-1.2

TABLE 3-1
Reservoir 1
Summary of Analytical Results for Fill Soils (Page 2 of 6)
Second Lift
Approximately 33 to 34 Feet Above Mean Sea Level

Representative Section	NW a	NW b	NE a	NE b	C a	C b	SW a	SW b	SE a	SE b	WDR Limits
Volatile Hydrocarbons and Volatile Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg											
Sample Number	155-1-3	156-1-4	151-1-1	132-1-1	168-1-C	135-1-C	154-1-2	138-1-1	149-1-2	133-1-2	
Benzene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.1
Ethylbenzene	0.18	0.15	0.13	0.15	<0.10	<0.10	0.13	<0.10	<0.10	<0.10	2.9
Toluene	<0.10	<0.10	<0.10	0.11	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	4.2
Xylenes	1.20	0.76	0.77	0.92	0.29	0.16	0.81	0.36	0.17	0.54	1.7
TPH C6-C12	93	88	97	71	59	120	97	74	35	44	1,000
Semivolatile Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg											
Sample Number	140-1-3	141-1-4	131-1-N	132-1-1	142-1-C	135-1-C	139-1-2	138-1-1	134-1-3	133-1-2	
TPH C13-C22	1400	1100	2500	4300	3500	4900	3500	2600	3500	890	10,000
TPH C23-C28	810	710	1200	3100	2000	2400	1800	1500	2000	600	15,000
Semivolatile Hydrocarbons, EPA Method 8270, mg/kg											
Sample Number	144-1-4		136-1-1		145-1-C		143-1-3		137-1-2		
2-Methylnaphthalene	9.5		18		8.3		8.8		8.0		N/A
Acenaphthene	<5		<8		<5		<5		<8		14[1]
Anthracene	<5		<8		<5		<5		<8		14[1]
Benzo(a)anthracene	<5		<8		<5		<5		<8		14[1]
Chrysene	<5		<8		<5		<5		<8		14[1]
Dibutylphthalate	<5		<8		<5		<5		<8		N/A
Fluoranthene	<5		<8		<5		<5		<8		14[1]
Fluorene	<5		<8		<5		<5		<8		14[1]
Naphthalene	<5		<8		<5		<5		<8		14[1]
Phenanthrene	<5		<8		<5		<5		<8		14[1]
Pyrene	<5		<8		<5		<5		<8		14[1]

Notes:
- < Indicates that compound was not detected at specified detection limit.
- N/A = Not Applicable
- WDR = Waste Discharge Requirements
- TCLP = Toxicity Characteristic Leaching Procedure
- [1] The WDR limit is equal to 20 times the Practical Quantification Limit. Samples with semivolatile concentrations above this value were submitted for analysis using the TCLP extraction and EPA Method 8270.
- [2] 0.02 mg/L is the Practical Quantification Limit for these constituents.



SECTIONS DESIGNATED BY BOLD OUTLINE AND ASSIGNED DIRECTION ABBREVIATIONS ARE ROUGHLY REPRESENTATIVE OF 1,000 CUBIC YARD QUANTITIES OF FILL.

SUBSECTIONS FURTHER DIVIDED BY A DOTTED LINE AND DESIGNATED WITH A LOWER CASE "A" OR "B" REPRESENT FILL QUANTITIES OF APPROXIMATELY 500 CUBIC YARDS.

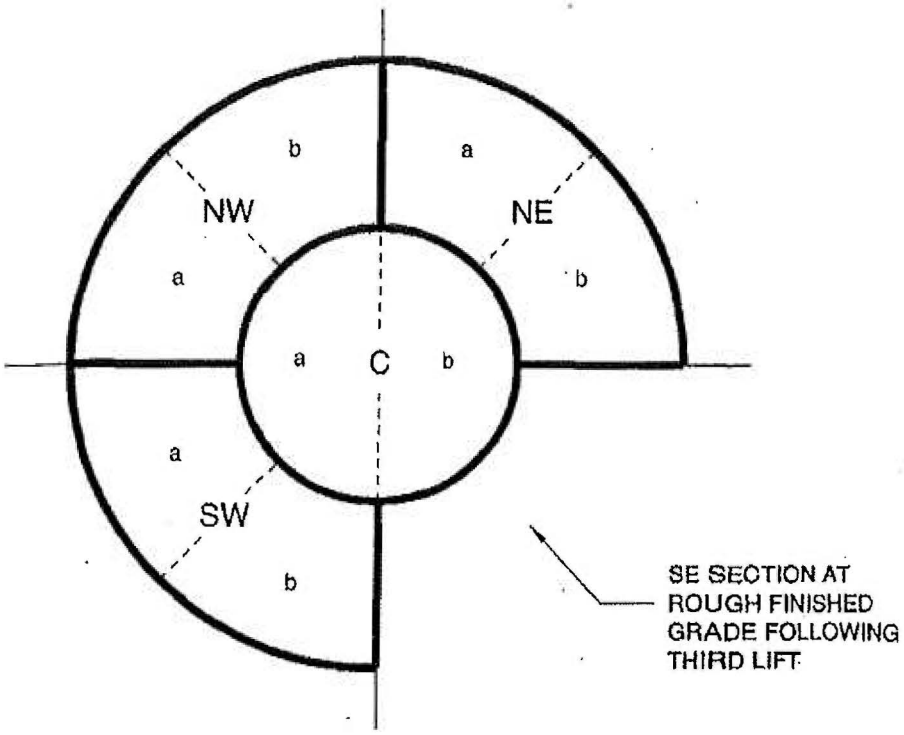
FOR CONCEPTUAL PURPOSES ONLY

DATE	PROJECT NUMBER	
9-12-95	1116-20	RESERVOIR 1 THIRD LIFT (34-35 FEET)
BROWN AND CALDWELL IRVINE, CALIFORNIA	PROJECT LOCATION: UNOCAL CARSON REFINERY 1520 EAST SEPULVEDA BOULEVARD CARSON, CALIFORNIA	NOT TO SCALE — FIGURE 3-1.3

TABLE 3-1
Reservoir 1
Summary of Analytical Results for Fill Soils (Page 3 of 6)
Third Lift
Approximately 34 to 35 Feet Above Mean Sea Level

Representative Section	NW a	NW b	NE a	NE b	C a	C b	SW a	SW b	SE a	SE b	WDR Limits
Volatile Hydrocarbons and Volatile Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg											
Sample Number	195-1-4a	196-1-4b	183-1-1a	184-1-1b	197-1-C	187-1-C	204-1-3b	193-1-3a	186-1-2b	185-1-2a	
Benzene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.1
Ethylbenzene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	2.9
Toluene	<0.10	<0.10	<0.10	0.12	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	4.2
Xylenes	0.98	<0.10	<0.10	1.10	0.85	0.38	0.57	<0.10	0.80	<0.10	1.7
TPH C6-C12	110	58	44	130	110	67	88	45	91	75	1,000
Semivolatile Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg											
Sample Number	195-1-4a	196-1-4b	183-1-1a	184-1-1b	197-1-C	187-1-C	204-1-3b	193-1-3a	186-1-2b	185-1-2a	
TPH C13-C22	1700	2200	800	1400	2700	1000	2200	2300	700	920	10,000
TPH C23-C28	780	1100	450	730	1500	600	1100	1200	440	450	15,000
Semivolatile Hydrocarbons, EPA Method 8270, mg/kg											
Sample Number	199-1-4		188-1-1		200-1-C		198-1-3		189-1-2		
2-Methylnaphthalene	<5		<5		<5		15		<5		N/A
Acenaphthene	<5		<5		<5		<5		<5		14[1]
Anthracene	<5		<5		<5		<5		<5		14[1]
Benzo(a)anthracene	<5		<5		<5		<5		<5		14[1]
Chrysene	<5		<5		<5		<5		<5		14[1]
Dibutylphthalate	<5		<5		<5		<5		<5		N/A
Fluoranthene	<5		<5		<5		<5		<5		14[1]
Fluorene	<5		<5		<5		<5		<5		14[1]
Naphthalene	<5		<5		<5		<5		<5		14[1]
Phenanthrene	<5		<5		<5		<5		<5		14[1]
Pyrene	<5		<5		<5		<5		<5		14[1]

Notes:
< Indicates that compound was not detected at specified detection limit.
N/A = Not Applicable
WDR = Waste Discharge Requirements
TCLP = Toxicity Characteristic Leaching Procedure
[1] The WDR limit is equal to 20 times the Practical Quantification Limit. Samples with semivolatile concentrations above this value were submitted for analysis using the TCLP extraction and EPA Method 8270.
[2] 0.02 mg/L is the Practical Quantification Limit for these constituents.



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SUBSECTIONS FURTHER DIVIDED BY A DOTTED LINE AND DESIGNATED WITH A LOWER CASE "A" OR "B" REPRESENT FILL QUANTITIES OF APPROXIMATELY 500 CUBIC YARDS.

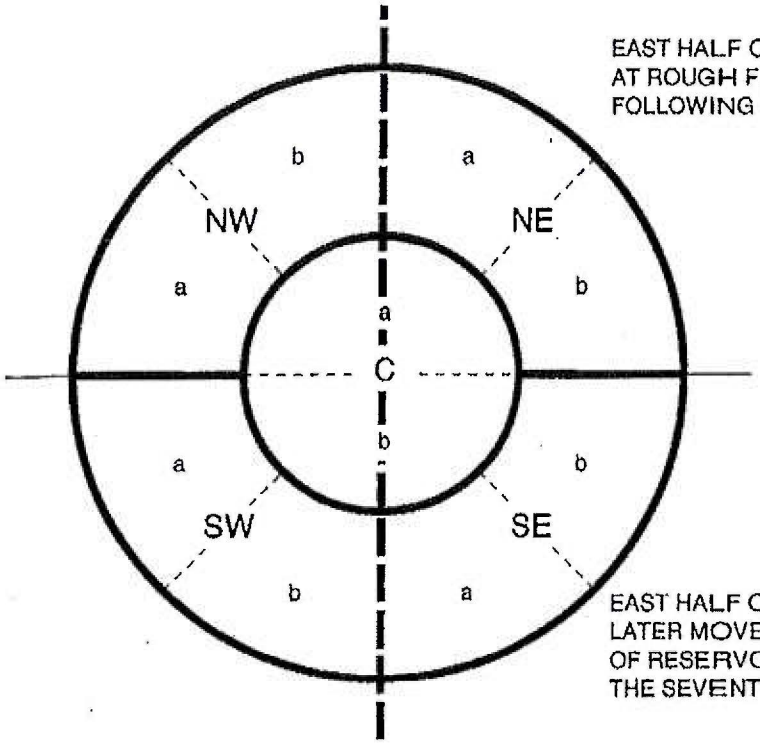
FOR CONCEPTUAL PURPOSES ONLY

DATE	PROJECT NUMBER	RESERVOIR 1 FOURTH LIFT (35-36 FEET)		
9-11-95	1116-20			
BROWN AND CALDWELL IRVINE, CALIFORNIA		PROJECT LOCATION: UNOCAL CARSON REFINERY 1520 EAST SEPULVEDA BOULEVARD CARSON, CALIFORNIA	NOT TO SCALE	FIGURE 3-1.4

TABLE 3-1
Reservoir 1
Summary of Analytical Results for Fill Soils (Page 4 of 6)
Fourth Lift
Approximately 35 to 36 Feet Above Mean Sea Level

Representative Section	NW a	NW b	NE a	NE b	C a	C b	SW a	SW b	WDR Limits
Volatile Hydrocarbons and Volatile Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg									
Sample Number	289-1-4a	275-1-4b	205-1-1a	206-1-1b	254-1-C	207-1-C	273-1-3b	250-1-3a	
Benzene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.1
Ethylbenzene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	2.9
Toluene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.11	<0.10	4.2
Xylenes	<0.10	0.81	<0.10	<0.10	0.55	<0.10	1.40	0.64	1.7
TPH C6-C12	<10	61	43	82	87	64	120	100	1,000
Semivolatile Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg									
Sample Number	258-1-4a	275-1-4b	205-1-1a	206-1-1b	224-1-C	207-1-C	221-1-3b	220-1-3a	
TPH C13-C22	3300	1300	3100	3200	7400	2300	2800	810	10,000
TPH C23-C28	1300	650	1700	1800	4100	1600	1200	460	15,000
Semivolatile Hydrocarbons, EPA Method 8270, mg/kg									
Sample Number	226-1-4		208-1-1		227-1-C		225-1-3		
2-Methylnaphthalene	17		<5		5.8		9.3		N/A
Acenaphthene	<5		<5		<5		<5		14[1]
Anthracene	<5		<5		<5		<5		14[1]
Benzo(a)anthracene	<5		<5		<5		<5		1441
Chrysene	<5		<5		<5		<5		14[1]
Dibutylphthalate	<5		<5		<5		<5		N/A
Fluoranthene	<5		<5		<5		<5		14[1]
Fluorene	<5		<5		<5		<5		14[1]
Naphthalene	<5		<5		<5		<5		14[1]
Phenanthrene	6.5		<5		<5		<5		14[1]
Pyrene	<5		<5		<5		<5		14[1]

Notes:
- < Indicates that compound was not detected at specified detection limit.
- N/A = Not Applicable
- WDR = Waste Discharge Requirements
- TCLP = Toxicity Characteristic Leaching Procedure
- [1] The WDR limit is equal to 20 times the Practical Quantification Limit. Samples with semivolatile concentrations above this value were submitted for analysis using the TCLP extraction and EPA Method 8270.
- [2] 0.02 mg/L is the Practical Quantification Limit for these constituents.



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FOR CONCEPTUAL PURPOSES ONLY

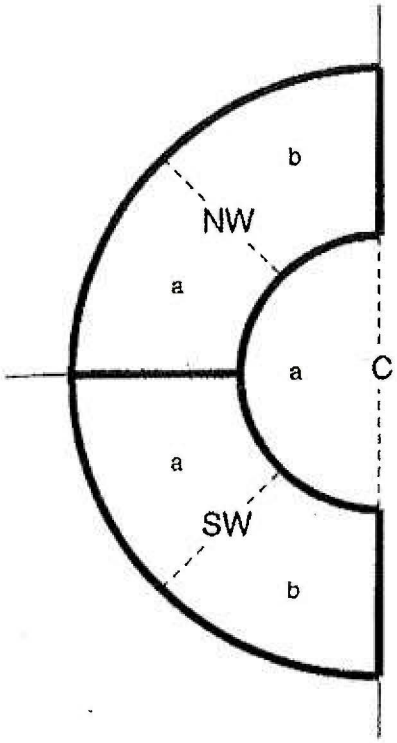
N

DATE	PROJECT NUMBER	RESERVOIR 1 FIFTH LIFT (36-37 FEET)		
9-12-95	1116-20			
BROWN AND CALDWELL IRVINE, CALIFORNIA		PROJECT LOCATION: UNOCAL CARSON REFINERY 1520 EAST SEPULVEDA BOULEVARD CARSON, CALIFORNIA	NOT TO SCALE	FIGURE 3-1.5

TABLE 3-1
Reservoir 1
Summary of Analytical Results for Fill Soils (Page 5 of 6)
Fifth Lift
Approximately 36 to 37 Feet Above Mean Sea Level

Representative Section	NW a	NW b	NE a	NE b	C a	C b	SW a	SW b	SE a	SE b	WDR Limits
Volatile Hydrocarbons and Volatile Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg											
Sample Number	315-1-4a	303-1-4b	316-1-1a	328-1-1b	306-1-NC	314-1-C	313-1-3b	330-1-3a	311-1-2b	329-1-2a	
Benzene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.1
Ethylbenzene	<0.10	<0.10	<0.10	0.16	0.20	0.17	<0.10	<0.10	0.14	<0.10	2.9
Toluene	<0.10	<0.10	<0.10	<0.10	0.17	<0.10	<0.10	<0.10	<0.10	<0.10	4.2
Xylenes	0.81	0.54	0.70	0.89	1.40	1.10	0.33	0.81	0.94	0.91	1.7
TPH C6-C12	280*	69	140*	70	140	220*	230*	100	140*	97	1,000
Semivolatile Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg											
Sample Number	302-1-4a	303-1-4b	304-1-1a	305-1-1b	306-1-NC	294-1-C	293-1-3b	292-1-3a	291-1-2b	290-1-2a	
TPH C13-C22	3200	1200	2500	4500	3600	3800	5600	1600	2900	1400	10,000
TPH C23-C28	1400	600	1400	2500	1600	1800	2800	720	1400	720	15,000
Semivolatile Hydrocarbons, EPA Method 8270, mg/kg											
Sample Number	307-1-4		308-1-1		309-1-C		296-1-3		295-1-2		
2-Methylnaphthalene	7.4		16		8.1		11		14		N/A
Acenaphthene	<5		<6		<5		<5		<5		14[1]
Anthracene	<5		<6		<5		<5		<5		14[1]
Benzo(a)anthracene	<5		<6		<5		<5		<5		14[1]
Chrysene	<5		<6		<5		<5		<5		14[1]
Dibutylphthalate	<5		<6		<5		<5		<5		N/A
Fluoranthene	<5		<6		<5		<5		<5		14[1]
Fluorene	<5		<6		<5		<5		<5		14[1]
Naphthalene	<5		<6		<5		<5		<5		14[1]
Phenanthrene	<5		<6		<5		<5		<5		14[1]
Pyrene	<5		<6		<5		<5		<5		14[1]

Notes:
- < Indicates that compound was not detected at specified detection limit.
- N/A = Not Applicable
- WDR = Waste Discharge Requirements
- TCLP = Toxicity Characteristic Leaching Procedure
- [1] The WDR limit is equal to 20 times the Practical Quantification Limit. Samples with semivolatile concentrations above this value were submitted for analysis using the TCLP extraction and EPA Method 8270.
- [2] 0.02 mg/L is the Practical Quantification Limit for these constituents.
- * indicates the reported test result was obtained from analysis of the sample reported below in the Semivolatile Total Petroleum Hydrocarbons column.



EAST HALF OF RESERVOIR
AT ROUGH FINISHED GRADE

SECTIONS DESIGNATED BY BOLD OUTLINE AND ASSIGNED DIRECTION ABBREVIATIONS ARE ROUGHLY REPRESENTATIVE OF 1,000 CUBIC YARD QUANTITIES OF FILL.

SUBSECTIONS FURTHER DIVIDED BY A DOTTED LINE AND DESIGNATED WITH A LOWER CASE "A" OR "B" REPRESENT FILL QUANTITIES OF APPROXIMATELY 500 CUBIC YARDS.

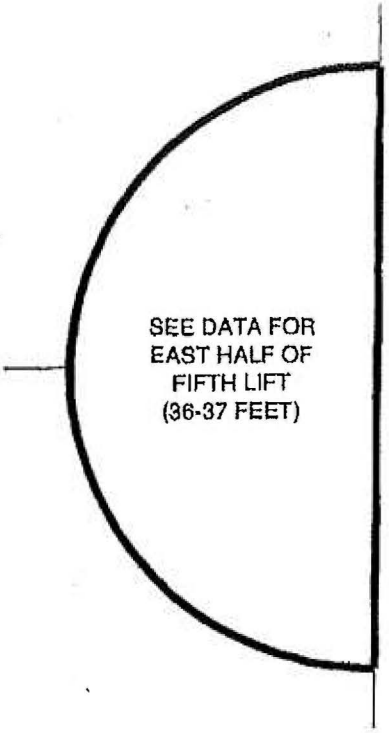
FOR CONCEPTUAL PURPOSES ONLY

DATE	PROJECT NUMBER	RESERVOIR 1 SIXTH LIFT (37-38 FEET)		
9-12-95	1116-20			
BROWN AND CALDWELL IRVINE, CALIFORNIA		PROJECT LOCATION: UNOCAL CARSON REFINERY 1520 EAST SEPULVEDA BOULEVARD CARSON, CALIFORNIA	NOT TO SCALE	FIGURE 3-1.6

TABLE 3-1
Reservoir 1
Summary of Analytical Results for Fill Soils (Page 6 of 6)
Sixth Lift
Approximately 37 to 38 Feet Above Mean Sea Level

Representative Section	NW a	NW b	C a	SW a	SW b	WDR Limits
Volatile Hydrocarbons and Volatile Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg						
Sample Number	342-1-4a	343-1-4b	344-1-NC	341-1-3b	340-1-3a	
Benzene	<0.10	<0.10	<0.10	<0.10	<0.10	0.1
Ethylbenzene	<0.10	<0.10	<0.10	0.13	<0.10	2.9
Toluene	<0.10	<0.10	<0.10	<0.10	<0.10	4.2
Xylenes	0.55	<0.10	0.22	0.91	0.20	1.7
TPH C6-C12	59	55	67	61	34	1,000
Semivolatile Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg						
Sample Number	337-1-4a	338-1-4b	339-1-C	336-1-3b	335-1-3a	
TPH C13-C22	3400	3300	1400	3100	1200	10,000
TPH C23-C28	1700	1600	740	1600	740	15,000
Semivolatile Hydrocarbons, EPA Method 8270, mg/kg						
Sample Number	333-1-4		N/A	332-1-3		
2-Methylnaphthalene	16		NA	34		N/A
Acenaphthene	<5		NA	<5		14[1]
Anthracene	<5		NA	<5		14[1]
Benzo(a)anthracene	<5		NA	<5		14[1]
Chrysene	<5		NA	<5		14[1]
Dibutylphthalate	<5		NA	<5		N/A
Fluoranthene	<5		NA	<5		14[1]
Fluorene	<5		NA	<5		14[1]
Naphthalene	<5		NA	<5		14[1]
Phenanthrene	<5		NA	13		14[1]
Pyrene	<5		NA	5.3		14[1]

Notes:
- < Indicates that compound was not detected at specified detection limit.
- N/A = Not Applicable
- NA = Not Analyzed
- WDR = Waste Discharge Requirements
- TCLP = Toxicity Characteristic Leaching Procedure
- [1] The WDR limit is equal to 20 times the Practical Quantification Limit. Samples with semivolatile concentrations above this value were submitted for analysis using the TCLP extraction and EPA Method 8270.
- [2] 0.02 mg/L is the Practical Quantification Limit for these constituents.

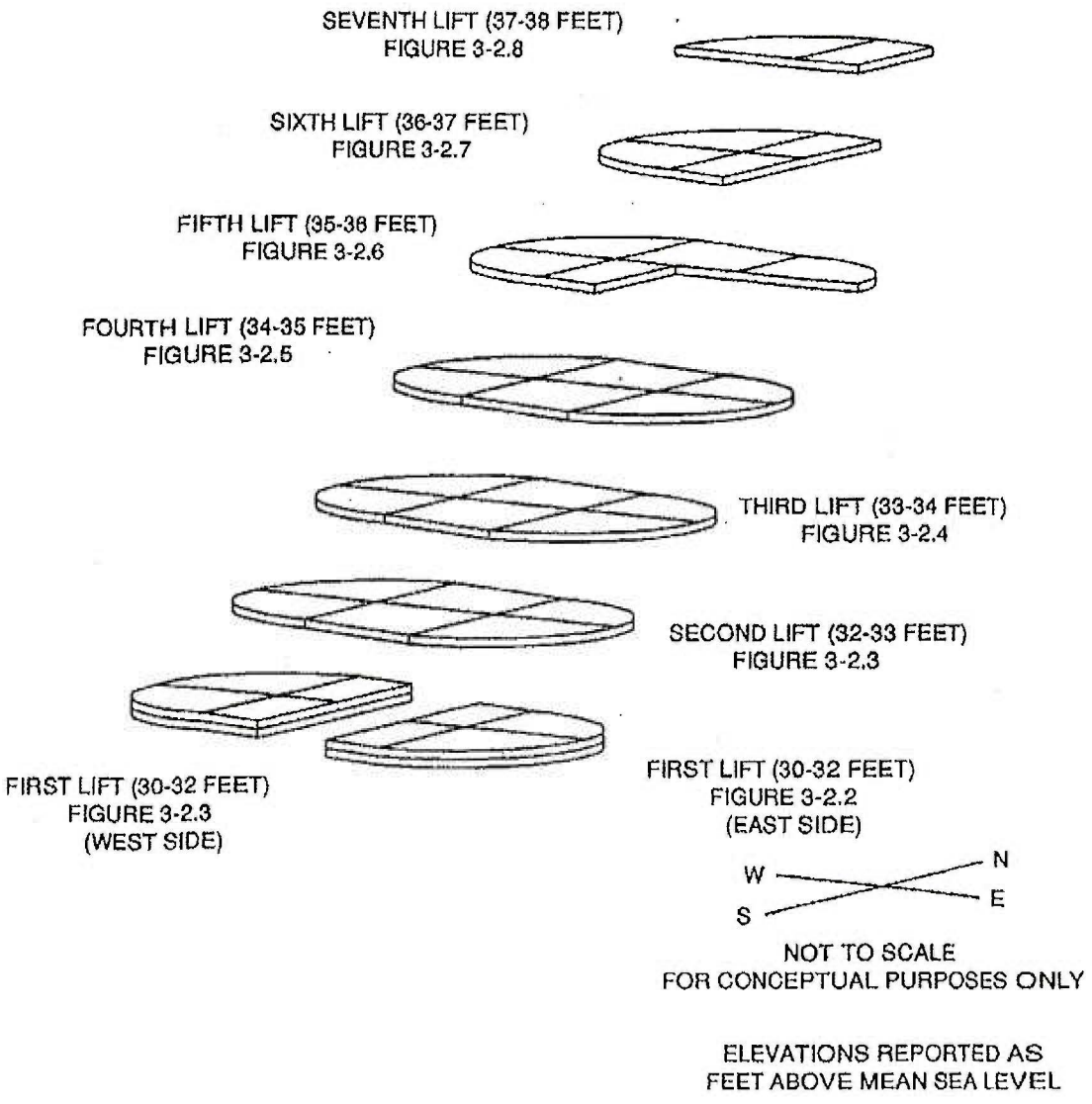


EAST HALF OF RESERVOIR
AT ROUGH FINISHED GRADE

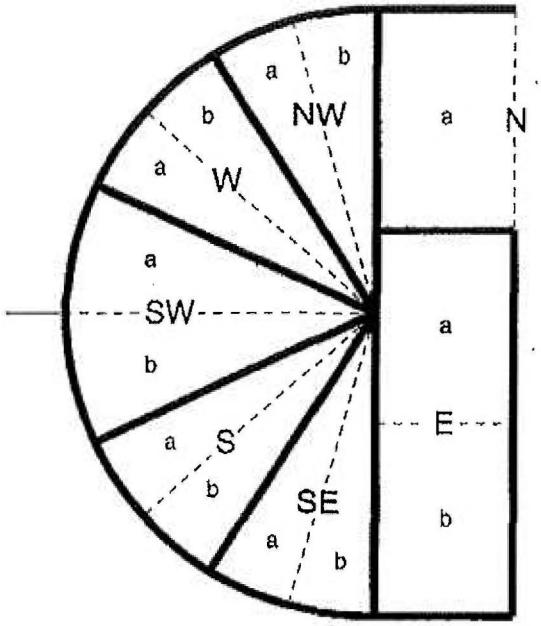
SOIL TESTED PRIOR TO PLACEMENT IN CONJUCTION WITH
TESTING THE FIFTH LIFT, WEST HALF.

FOR CONCEPTUAL PURPOSES ONLY

DATE	PROJECT NUMBER	RESERVOIR 1 SEVENTH LIFT (38-39 FEET)		
9-12-95	1116-20			
BROWN AND CALDWELL IRVINE, CALIFORNIA		PROJECT LOCATION: UNOCAL CARSON REFINERY 1520 EAST SEPULVEDA BOULEVARD CARSON, CALIFORNIA	NOT TO SCALE	FIGURE 3-1.7



DATE	PROJECT NUMBER	RESERVOIR 2 FILL PLACEMENT SCHEMATIC		
9-12-95	1116-20			
BROWN AND CALDWELL IRVINE, CALIFORNIA		PROJECT LOCATION UNOCAL CARSON REFINERY 1520 EAST SEPULVEDA BOULEVARD CARSON, CALIFORNIA	NOT TO SCALE	FIGURE 3-2



SECTIONS DESIGNATED BY BOLD OUTLINE AND ASSIGNED DIRECTION ABBREVIATIONS ARE ROUGHLY REPRESENTATIVE OF 1,000 CUBIC YARD QUANTITIES OF FILL.

SUBSECTIONS FURTHER DIVIDED BY A DOTTED LINE AND DESIGNATED WITH A LOWER CASE "A" OR "B" REPRESENT FILL QUANTITIES OF APPROXIMATELY 500 CUBIC YARDS.

FOR CONCEPTUAL PURPOSES ONLY

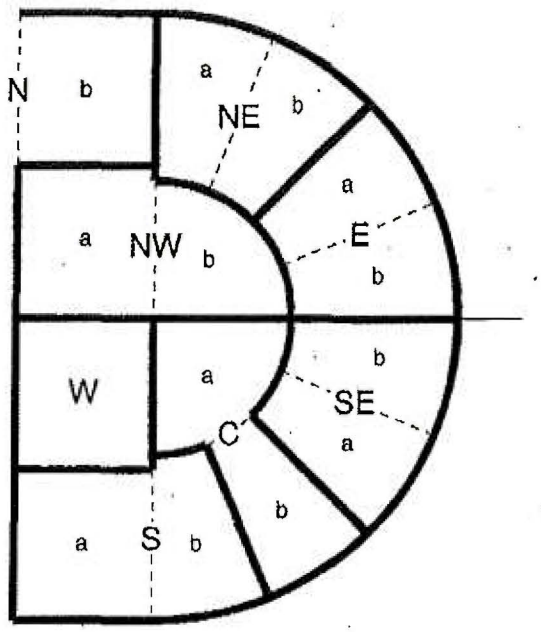
N

DATE	PROJECT NUMBER	RESERVOIR 2 FIRST LIFT - WEST SIDE (30-32 FEET)		
9-12-95	1116-20			
BROWN AND CALDWELL IRVINE, CALIFORNIA		PROJECT LOCATION: UNOCAL CARSON REFINERY 1520 EAST SEPULVEDA BOULEVARD CARSON, CALIFORNIA	NOT TO SCALE	FIGURE 3-2.1

TABLE 3-2
Reservoir 2
Summary of Analytical Results for Fill Soils (Page 1 of 8)
First Lift - West Half
Approximately 30 to 32 Feet Above Mean Sea Level

Representative Section	W		NW		N	SW		S		SE		E		WDR Limit[1]
	a	b	a	b	a	a	b	a	b	a	b	a	b	
Volatile Hydrocarbons and Volatile Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg														
Sample Number	61-2-4	60-2-4	27-2-4	59-2-4	58-2-4	62-2-4	71-2-3	64-2-3	33-2-3	34-2-3	35-2-3	66-2-3	72-2-3	
Benzene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.1
Ethylbenzene	<0.10	0.12	<0.10	0.95	0.60	<0.10	0.14	0.11	0.15	0.14	<0.10	<0.10	<0.10	2.9
Toluene	<0.10	<0.10	0.15	0.24	0.11	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	4.2
Xylenes	<0.10	0.94	0.64	1.70	0.80	<0.10	0.88	0.70	1.20	1.20	1.00	0.53	0.26	1.7
TPH C6-C12	33	170	51	200	160	11	130	160	120	120	120	130	78	1,000
Semivolatile Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg														
Sample Number	61-2-4	25-2-4	27-2-4	28-2-4	30-2-4	22-2-4	31-2-3	32-2-3	33-2-3	34-2-3	35-2-3	37-2-3	36-2-3	
TPH C13-C22	350	3,300	830	<100	2,500	3,700	2,100	1,300	120	640	260	1,600	2,100	10,000
TPH C23-C28	550	590	860	<100	550	1,200	730	290	<100	150	<100	410	340	15,000
Semivolatile Hydrocarbons, EPA Method 8270, mg/kg														
Sample Number	24-2-4		26-2-4		29-2-4	38-2-3		39-2-3		40-2-3		41-2-3		
2-Methylnaphthalene	37		18		14	19		11		20		10		N/A
Acenaphthene	<5		<5		<5	<5		<5		<5		<5		14[1]
Anthracene	<5		<5		<5	<5		<5		<5		<5		14[1]
Benzo(a)anthracene	<5		<5		<5	<5		<5		<5		<5		14[1]
Chrysene	<5		<5		<5	<5		<5		<5		<5		14[1]
Dibutylphthalate	<5		<5		<5	<5		<5		<5		<5		N/A
Fluoranthene	<5		<5		<5	<5		<5		<5		<5		14[1]
Fluorene	<5		<5		<5	<5		<5		<5		<5		14[1]
Naphthalene	9.0		<5		<5	<5		<5		<5		<5		14[1]
Phenanthrene	11		5.3		<5	6.7		<5		7.2		<5		14[1]
Pyrene	<5		<5		<5	<5		<5		<5		<5		14[1]

Notes:
- < Indicates that compound was not detected at specified detection limit.
- N/A = Not Applicable
- WDR = Waste Discharge Requirements
- TCLP = Toxicity Characteristic Leaching Procedure
- [1] The WDR limit is equal to 20 times the Practical Quantification Limit. Samples with semivolatile concentrations above this value were submitted for analysis using the TCLP extraction and EPA Method 8270.
- [2] 0.02 mg/L is the Practical Quantification Limit for these constituents.



SECTIONS DESIGNATED BY BOLD OUTLINE AND ASSIGNED DIRECTION ABBREVIATIONS ARE ROUGHLY REPRESENTATIVE OF 1,000 CUBIC YARD QUANTITIES OF FILL. (EXCEPT FOR WEST SECTION (W), WHICH IS APPROXIMATELY 500 CUBIC YARDS)

SUBSECTIONS FURTHER DIVIDED BY A DOTTED LINE AND DESIGNATED WITH A LOWER CASE "A" OR "B" REPRESENT FILL QUANTITIES OF APPROXIMATELY 500 CUBIC YARDS.

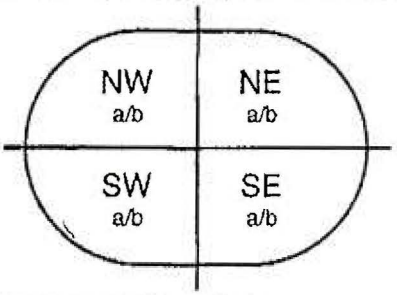
FOR CONCEPTUAL PURPOSES ONLY

DATE	PROJECT NUMBER	RESERVOIR 2 FIRST LIFT - EAST SIDE (30-32 FEET)		
9-12-95	1116-20			
BROWN AND CALDWELL IRVINE, CALIFORNIA		PROJECT LOCATION	UNOCAL CARSON REFINERY 1520 EAST SEPULVEDA BOULEVARD CARSON, CALIFORNIA	NOT TO SCALE	FIGURE 3-2.2

TABLE 3-2
Reservoir 2
Summary of Analytical Results for Fill Soils (Page 2 of 8)
First Lift - East Half
Approximately 30 to 32 Feet Above Mean Sea Level

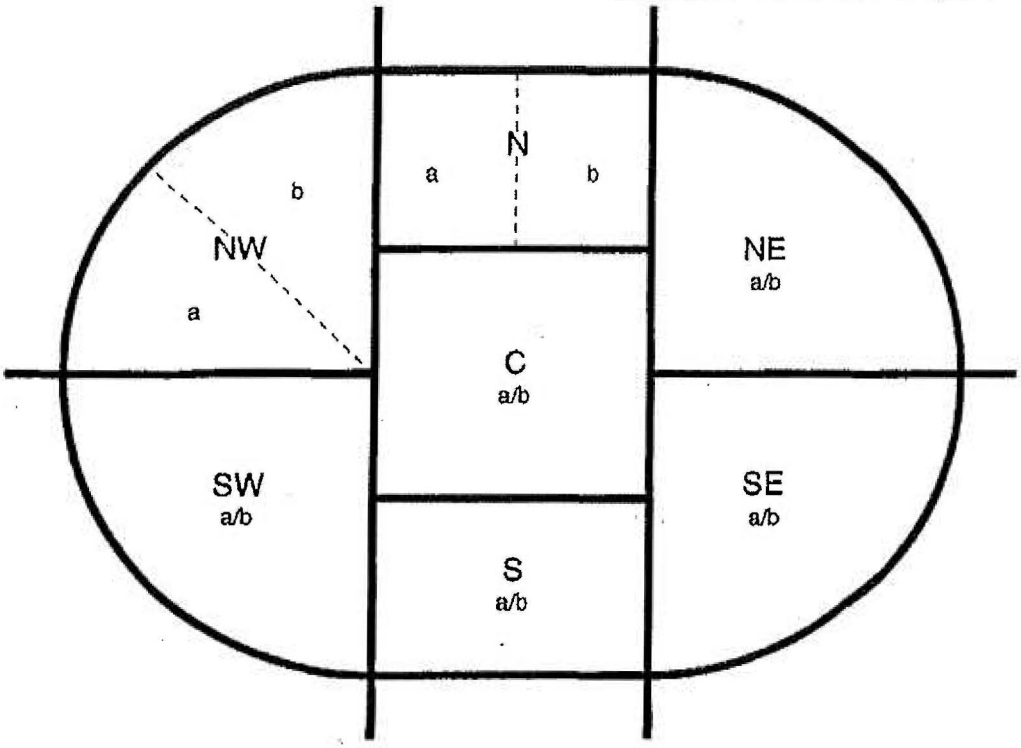
Representative Section	N	NE		NW		E		W	C		SE		S		WDR Limits
	b	a	b	a	b	a	b		a	b	a	b	a	b	
Volatile Hydrocarbonsand Volatile Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg															
Sample Number	57-2-1	56-2-1	55-2-1	21-2-1	99-2-1	54-2-1	53-2-1	7-2-2	51-2-2	48-2-2	49-2-2	67-2-2	6-2-2	47-2-2	
Benzene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.1
Ethylbenzene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.19	0.16	<0.10	<0.10	<0.10	0.20	<0.10	2.9
Toluene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.11	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	4.2
Xylenes	<0.10	<0.10	0.40	0.62	<0.10	0.16	<0.10	1.00	0.74	0.51	0.40	0.45	1.30	0.23	1.7
TPH C6-C12	22	26	120	180	25	100	21	76	120	100	110	120	65	100	1,000
Semivolatile Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg															
Sample Number	57-2-1	56-2-1	15-2-1	21-2-1	19-2-1	16-2-1	53-2-1	7-2-2	2-2-2	4-2-2	3-2-2	1-2-2	6-2-2	5-2-2	
TPH C13-C22	<100	<100	3,100	1,200	2,800	7,000	<100	<100	150	1,700	130	380	<100	<100	10,000
TPH C23-C28	<100	<100	694	370	700	5,600	<100	<100	<100	510	<100	<100	<100	<100	15,000
Semivolatile Hydrocarbons, EPA Method 8270, mg/kg															
Sample Number	29-2-1	14-2-1	20-2-1	17-2-1	8-2-2	9-2-2	10-2-2	11-2-2							
2-Methylnaphthalene	14	7.6	21	6.2	20	7.4	7.1	5.4							N/A
Acenaphthene	<5	<5	<5	<5	<5	<5	<5	<5							14[1]
Anthracene	<5	<5	<5	<5	<5	<5	<5	<5							14[1]
Benzo(a)anthracene	<5	<5	<5	<5	<5	<5	<5	<5							14[1]
Chrysene	<5	<5	<5	<5	<5	<5	<5	<5							14[1]
Dibutylphthalate	<5	<5	<5	<5	<5	<5	<5	<5							N/A
Fluoranthene	<5	<5	<5	<5	<5	<5	<5	<5							14[1]
Fluorene	<5	<5	<5	<5	<5	<5	<5	<5							14[1]
Naphthalene	<5	<5	<5	<5	<5	<5	<5	<5							14[1]
Phenanthrene	<5	<5	6.8	<5	6.0	<5	<5	<5							14[1]
Pyrene	<5	<5	<5	<5	<5	<5	<5	<5							14[1]

Notes:
- < Indicates that compound was not detected at specified detection limit.
- N/A = Not Applicable
- WDR = Waste Discharge Requirements
- TCLP = Toxicity Characteristic Leaching Procedure
- [1] The WDR limit is equal to 20 times the Practical Quantification Limit. Samples with semivolatile concentrationsabove this value were submitted for analysis using the TCLP extraction and EPA Method 8270.
- [2] 0.02 mg/L is the Practical Quantification Limit for these constituents.



EACH SUBSECTION REPRESENTS APPORXIMATELY 900 CUBIC YARDS.

KEY FOR SEMIVOLATILE HYDROCARBON TESTING



SECTIONS DESIGNATED BY BOLD OUTLINE AND ASSIGNED DIRECTION ABBREVIATIONS ARE ROUGHLY REPRESENTATIVE OF 1,000 CUBIC YARD QUANTITIES OF FILL.

SUBSECTIONS FURTHER DIVIDED BY A DOTTED LINE AND DESIGNATED WITH A LOWER CASE "A" OR "B" REPRESENT FILL QUANTITIES OF APPROXIMATELY 500 CUBIC YARDS. IN ALL SECTIONS EXCEPT NORTH (N) AND NORTHWEST (NW), "A" RERESENTS THE LOWER 6 INCH LIFT AND "B" REPRESENTS THE UPPER 6 INCH LIFT.

FOR CONCEPTUAL PURPOSES ONLY

DATE	PROJECT NUMBER	RESERVOIR 2 SECOND LIFT (32-33 FEET)		
9-12-95	1116-20			
BROWN AND CALDWELL IRVINE, CALIFORNIA		PROJECT LOCATION: UNOCAL CARSON REFINERY 1520 EAST SEPULVEDA BOULEVARD CARSON, CALIFORNIA	NOT TO SCALE	FIGURE 3-2.3

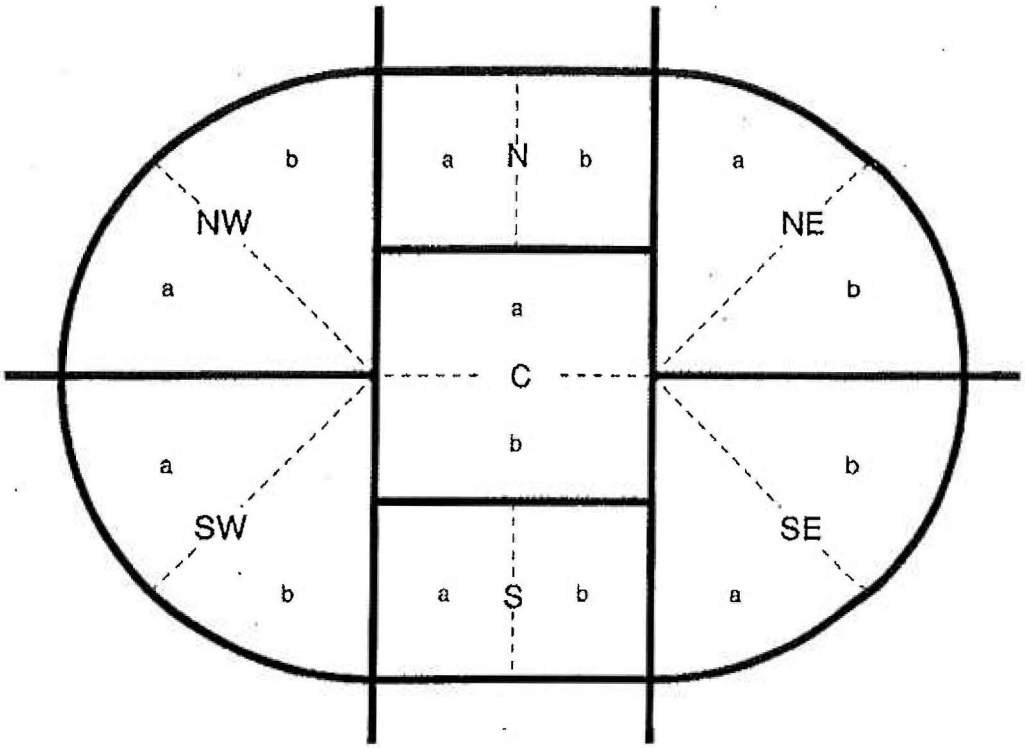
TABLE 3-2
Reservoir 2
Summary of Analytical Results for Fill Soils (Page 3 of 8)
Second Lift
Approximately 32 to 33 Feet Above Mean Sea Level

Representative Section	NW a	NW b	N a	N b	NE a	NE b	C a	C b	SW a	SW b	S a	S b	SE a	SE b	WDR Limits
Volatile Hydrocarbons and Volatile Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg															
Sample Number	124-2-4	125-2-W	148-2-4	127-2-1	89-2-1	113-2-1	100-2-C	119-2-C	92-2-3	116-2-3	93-2-S	152-2-S	88-2-2	153-2-2	
Benzene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.1
Ethylbenzene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.26	0.25	<0.10	0.16	0.11	<0.10	0.26	<0.10	2.9
Toluene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.18	<0.10	4.2
Xylenes	0.43	0.77	<0.10	0.25	0.59	0.50	1.20	1.40	0.45	1.20	0.80	0.80	1.70	0.41	1.7
TPH C6-C12	120	110	20	110	92	140	150	110	130	120	55	140	120	67	1,000
Semivolatile Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg															
Sample Number	124-2-4	125-2-W	126-2-N	127-2-1	89-2-1	113-2-1	94-2-C	119-2-C	92-2-3	116-2-3	93-2-S	128-2-S	88-2-2	129-2-2	
TPH C13-C22	1300	720	<100	1600	3,000	5,900	380	<100	2,800	1,200	1,600	3,200	1,100	5,400	10,000
TPH C23-C28	470	450	<100	480	650	2,800	250	<100	830	270	410	1,200	140	1,100	15,000

Semivolatile Hydrocarbons, EPA Method 8270, mg/kg

Representative Section	NW-a	NW-b	NE-a	NE-b	SW-a	SW-b	SE-a	SE-b	
Sample Number	98-2-4	243-2-4	95-2-1	120-2-1	97-2-3	122-2-3	96-2-2	121-2-2	
2-Methylnaphthalene	26	<5	18	12	<5	11	8.7	37	N/A
Acenaphthene	<5	<5	<5	<5	<5	<5	<5	<5	14[1]
Anthracene	<5	<5	<5	<5	<5	<5	<5	<5	14[1]
Benzo(a)anthracene	<5	<5	<5	<5	<5	<5	<5	<5	14[1]
Chrysene	<5	<5	<5	<5	<5	<5	<5	<5	14[1]
Dibutylphthalate	<5	<5	<5	<5	<5	<5	<5	<5	N/A
Fluoranthene	<5	<5	<5	<5	<5	<5	<5	<5	14[1]
Fluorene	<5	<5	<5	<5	<5	<5	<5	<5	14[1]
Naphthalene	6.2	<5	<5	<5	<5	<5	<5	7.0	14[1]
Phenanthrene	7.3	<5	9.8	12	<5	6.0	5.5	11	14[1]
Pyrene	<5	<5	5.3	7.0	<5	<5	<5	5.0	14[1]

Notes: < Indicates that compound was not detected at specified detection limit.
N/A = Not Applicable
WDR = Waste Discharge Requirements
TCLP = Toxicity Characteristic Leaching Procedure
[1] The WDR limit is equal to 20 times the Practical Quantification Limit. Samples with semivolatile concentrations above this value were submitted for analysis using the TCLP extraction and EPA Method 8270.
[2] 0.02 mg/L is the Practical Quantification Limit for these constituents.



SECTIONS DESIGNATED BY BOLD OUTLINE AND ASSIGNED DIRECTION ABBREVIATIONS ARE ROUGHLY REPRESENTATIVE OF 1,000 CUBIC YARD QUANTITIES OF FILL.

SUBSECTIONS FURTHER DIVIDED BY A DOTTED LINE AND DESIGNATED WITH A LOWER CASE "A" OR "B" REPRESENT FILL QUANTITIES OF APPROXIMATELY 500 CUBIC YARDS.

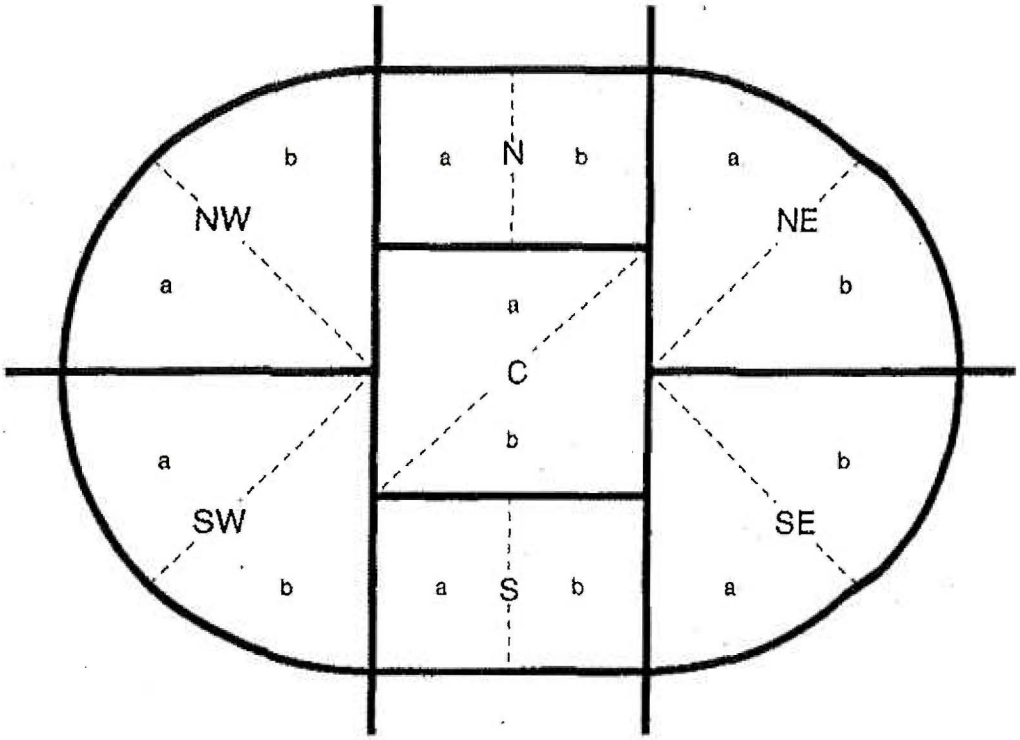
FOR CONCEPTUAL PURPOSES ONLY

DATE	PROJECT NUMBER	RESERVOIR 2 THIRD LIFT (33-34 FEET)		
9-12-95	1116-20			
BROWN AND CALDWELL IRVINE, CALIFORNIA		PROJECT LOCATION: UNOCAL CARSON REFINERY 1520 EAST SEPULVEDA BOULEVARD CARSON, CALIFORNIA	NOT TO SCALE	FIGURE 3-2.4

TABLE 3-2
Reservoir 2
Summary of Analytical Results for Fill Soils (Page 4 of 8)
Third Lift
Approximately 33 to 34 Feet Above Mean Sea Level

Representative Section	NW		N		NE		C		SW		S		SE		WDR Limits
	a	b	a	b	a	b	a	b	a	b	a	b	a	b	
Volatile Hydrocarbons and Volatile Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg															
Sample Number	161-2-4	190-2-4	163-2-N	164-2-N	191-2-1	166-2-1	192-2-C	180-2-C	179-2-4	209-2-3	182-2-SW	181-2-SE	202-2-2	201-2-1	
Benzene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.1
Ethylbenzene	0.21	<0.10	0.13	<0.10	<0.10	<0.10	<0.10	0.20	<0.10	<0.10	<0.10	<0.10	<0.10	0.16	2.9
Toluene	0.14	<0.10	0.12	<0.10	<0.10	<0.10	<0.10	0.27	<0.10	<0.10	<0.10	<0.10	<0.10	0.18	4.2
Xylenes	1.50	0.53	1.10	0.55	0.32	<0.10	<0.10	1.60	0.42	0.37	<0.10	0.22	0.45	1.10	1.7
TPH C6-C12	94	120	28	19	72	<10	38	86	35	42	32	36	79	56	1,000
Semivolatile Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg															
Sample Number	161-2-4	190-2-4	163-2-N	164-2-N	191-2-1	166-2-1	192-2-C	180-2-C	179-2-4	209-2-3	182-2-SW	181-2-SE	202-2-2	201-2-1	
TPH C13-C22	1800	680	230	120	1300	<100	<100	730	<100	570	320	1200	<100	450	10,000
TPH C23-C28	520	<100	350	260	360	<100	<100	340	<100	460	200	280	<100	250	15,000
Semivolatile Hydrocarbons, EPA Method 8270, mg/kg															
Sample Number	243-2-4		159-2-N		160-2-1		175-2-C		242-2-3		173-2-S		172-2-2		
2-Methylnaphthalene	<5		28		<5		8.5		<5		<5		9.9		N/A
Acenaphthene	<5		<5		<5		<5		<5		<5		<5		14[1]
Anthracene	<5		<5		<5		<5		<5		<5		<5		14[1]
Benzo(a)anthracene	<5		<5		<5		<5		<5		<5		<5		14[1]
Chrysene	<5		<5		<5		<5		<5		<5		<5		14[1]
Dibutylphthalate	<5		<5		<5		<5		<5		<5		<5		N/A
Fluoranthene	<5		<5		<5		<5		<5		<5		<5		14[1]
Fluorene	<5		<5		<5		<5		<5		<5		<5		14[1]
Naphthalene	<5		6.0		<5		<5		<5		<5		<5		14[1]
Phenanthrene	<5		9.9		<5		<5		<5		<5		<5		14[1]
Pyrene	<5		5.6		<5		<5		<5		<5		<5		14[1]

Notes: < Indicates that compound was not detected at specified detection limit.
N/A = Not Applicable
WDR = Waste Discharge Requirements
TCLP = Toxicity Characteristic Leaching Procedure
[1] The WDR limit is equal to 20 times the Practical Quantification Limit. Samples with semivolatile concentrations above this value were submitted for analysis using the TCLP extraction and EPA Method 8270.
[2] 0.02 mg/L is the Practical Quantification Limit for these constituents.



SECTIONS DESIGNATED BY BOLD OUTLINE AND ASSIGNED DIRECTION ABBREVIATIONS ARE ROUGHLY REPRESENTATIVE OF 1,000 CUBIC YARD QUANTITIES OF FILL.

SUBSECTIONS FURTHER DIVIDED BY A DOTTED LINE AND DESIGNATED WITH A LOWER CASE "A" OR "B" REPRESENT FILL QUANTITIES OF APPROXIMATELY 500 CUBIC YARDS.

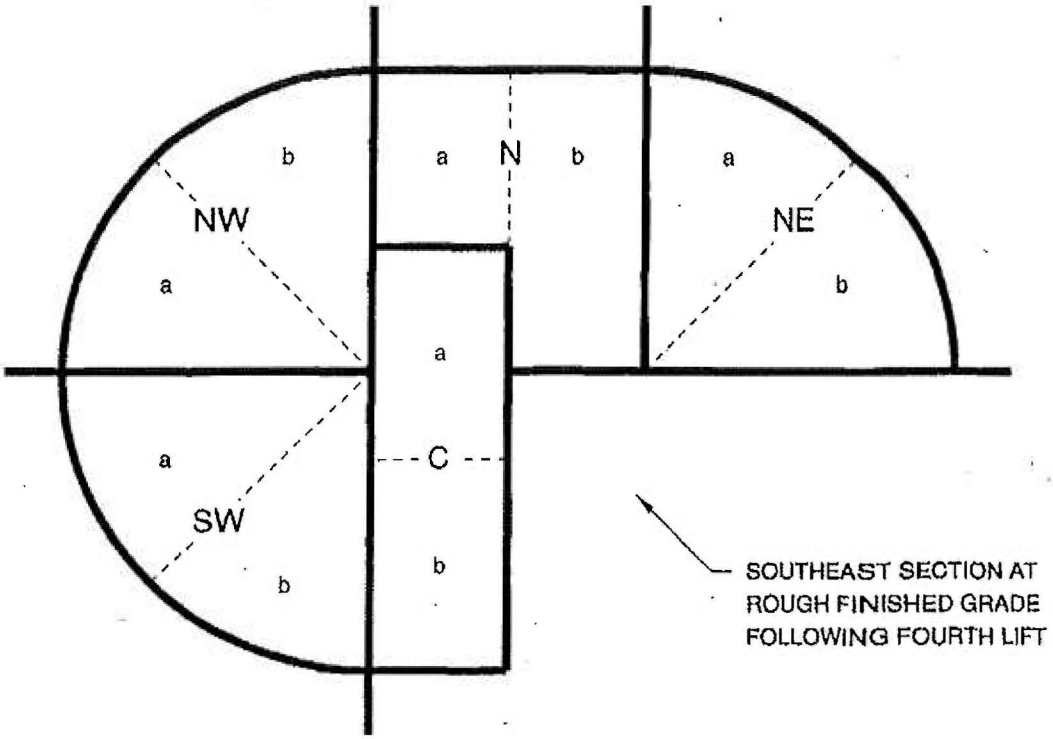
FOR CONCEPTUAL PURPOSES ONLY

DATE	PROJECT NUMBER	RESERVOIR 2 FOURTH LIFT (34-35 FEET)		
9-11-95	1116-20			
BROWN AND CALDWELL IRVINE CALIFORNIA		PROJECT LOCATION: UNOCAL CARSON REFINERY 1520 EAST SEPULVEDA BOULEVARD CARSON, CALIFORNIA	NOT TO SCALE	FIGURE 3-2.5

TABLE 3-2
Reservoir 2
Summary of Analytical Results for Fill Soils (Page 5 of 8)
Fourth Lift
Approximately 34 to 35 Feet Above Mean Sea Level

Representative Section	NW		N		NE		C		SW		S		SE		WDR Limits
	a	b	a	b	a	b	a	b	a	b	a	b	a	b	
Volatile Hydrocarbons and Volatile Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg															
Sample Number	210-2-4a	211-2-4b	212-2-NW	228-2-NE	229-2-1a	230-2-1b	216-2-C	282-2-C	233-2-3b	248-2-3a	231-2-SW	281-2-SE	260-2-2b	244-2-2a	
Benzene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.1
Ethylbenzene	<0.10	0.36	<0.10	0.27	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.20	<0.10	<0.10	<0.10	2.9
Toluene	<0.10	0.19	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.17	<0.10	<0.10	<0.10	4.2
Xylenes	<0.10	1.20	<0.10	1.20	<0.10	0.12	0.50	0.11	<0.10	<0.10	1.40	0.35	0.39	<0.10	1.7
TPH C6-C12	53	110	14	110	67	42	62	56	54	62	100	100	98	13	1,000
Semivolatile Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg															
Sample Number	210-2-4a	211-2-4b	212-2-NW	213-2-NE	214-2-1a	215-2-1b	216-2-C	247-2-C	233-2-3b	232-2-3a	231-2-SW	246-2-SE	245-2-2b	244-2-2a	
TPH C13-C22	1900	810	820	370	550	3100	1200	1000	<100	680	1000	4200	4200	<100	10,000
TPH C23-C28	560	310	1000	200	200	690	470	<100	<100	270	320	1000	840	<100	15,000
Semivolatile Hydrocarbons, EPA Method 8270, mg/kg															
Sample Number	217-2-4		218-2-N		219-2-1		256-2-SE*		239-2-3		238-2-S*		255-2-2		
2-Methylnaphthalene	16		10		<5		<5		<5		8.3		<8		N/A
Acenaphthene	<5		<5		<5		<5		<5		<5		<8		14[1]
Anthracene	<5		<5		<5		<5		<5		<5		<8		14[1]
Benzo(a)anthracene	<5		<5		<5		<5		<5		<5		<8		14[1]
Chrysene	<5		<5		<5		<5		<5		<5		<8		14[1]
Dibutylphthalate	<5		<5		<5		<5		<5		<5		<8		N/A
Fluoranthene	<5		<5		<5		<5		<5		<5		<8		14[1]
Fluorene	<5		<5		<5		<5		<5		<5		<8		14[1]
Naphthalene	<5		<5		<5		<5		<5		<5		<8		14[1]
Phenanthrene	6.5		<5		<5		<5		5.3		7.3		10		14[1]
Pyrene	<5		<5		<5		<5		<5		<5		<8		14[1]

Notes: < Indicates that compound was not detected at specified detection limit.
N/A = Not Applicable
WDR = Waste Discharge Requirements
TCLP = Toxicity Characteristic Leaching Procedure
[1] The WDR limit is equal to 20 times the Practical Quantification Limit. Samples with semivolatile concentrations above this value were submitted for analysis using the TCLP extraction and EPA Method 8270.
[2] 0.02 mg/L is the Practical Quantification Limit for these constituents.
* Sample numbers 256-2-SE and 238-2-S are representative the east and west halves, respectively, of both the south and center sections.



SECTIONS DESIGNATED BY BOLD OUTLINE AND ASSIGNED DIRECTION ABBREVIATIONS ARE ROUGHLY REPRESENTATIVE OF 1,000 CUBIC YARD QUANTITIES OF FILL.

SUBSECTIONS FURTHER DIVIDED BY A DOTTED LINE AND DESIGNATED WITH A LOWER CASE "A" OR "B" REPRESENT FILL QUANTITIES OF APPROXIMATELY 500 CUBIC YARDS.

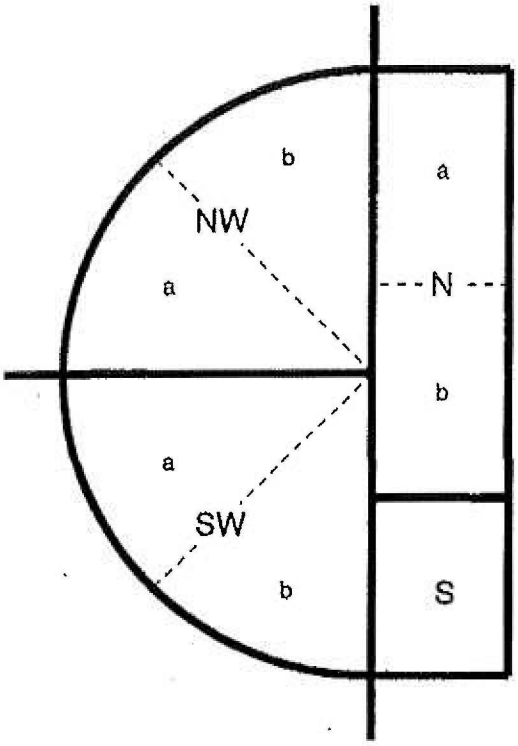
FOR CONCEPTUAL PURPOSES ONLY

DATE	PROJECT NUMBER	RESERVOIR 2 FIFTH LIFT (35-36 FEET)		
9-12-95	1116-20			
BROWN AND CALDWELL IRVINE, CALIFORNIA		PROJECT LOCATION UNOCAL CARSON REFINERY 1520 EAST SEPULVEDA BOULEVARD CARSON CALIFORNIA	NOT TO SCALE	FIGURE 3-2.6

TABLE 3-2
Reservoir 2
Summary of Analytical Results for Fill Soils (Page 6 of 8)
Fifth Lift
Approximately 35 to 36 Feet Above Mean Sea Level

Representative Section	NW a	NW b	N a	N b	NE a	NE b	C a	C b	SW a	SW b	WDR Limits
Volatile Hydrocarbons and Volatile Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg											
Sample Number	234-2-4a	249-2-4b	236-2-NW	301-2-NE	284-2-1a	285-2-1b	237-2-C	263-2-SW	268-2-3b	300-2-3a	
Benzene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.1
Ethylbenzene	<0.10	<0.10	<0.10	0.33	<0.10	<0.10	0.23	0.26	<0.10	<0.10	2.9
Toluene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.21	0.15	0.13	<0.10	4.2
Xylenes	0.42	0.52	1.20	1.20	<0.10	<0.10	1.30	1.30	0.52	<0.10	1.7
TPH C6-C12	83	130	140	87	130	130	120	140	83	83	1,000
Semivolatile Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg											
Sample Number	234-2-4a	235-2-4b	236-2-NW	283-2-NE	284-2-1a	285-2-1b	237-2-C	263-2-SW	268-2-3b	269-2-3a	
TPH C13-C22	250	4200	340	<100	970	1500	810	3100	1200	8400	10,000
TPH C23-C28	180	1300	<100	<100	220	340	250	770	300	2500	15,000
Semivolatile Hydrocarbons, EPA Method 8270, mg/kg											
Sample Number	288-2-3		241-2-N[4]		287-2-1b		286-2-1a[4]		300-2-3a		
2-Methylnaphthalene	<5		23		<5		<5		<5		N/A
Acenaphthene	<5		<5		<5		<5		<5		14[1]
Anthracene	<5		<5		<5		<5		<5		14[1]
Benzo(a)anthracene	<5		<5		<5		<5		<5		14[1]
Chrysene	<5		<5		<5		<5		<5		14[1]
Dibutylphthalate	<5		<5		<5		<5		<5		N/A
Fluoranthene	<5		<5		<5		<5		<5		14[1]
Fluorene	<5		<5		<5		<5		<5		14[1]
Naphthalene	<5		13		<5		<5		<5		14[1]
Phenanthrene	5.5		5.6		<5		<5		<5		14[1]
Pyrene	<5		<5		<5		<5		<5		14[1]

Notes:
- < Indicates that compound was not detected at specified detection limit.
- N/A = Not Applicable
- WDR = Waste Discharge Requirements
- TCLP = Toxicity Characteristic Leaching Procedure
- [1] The WDR limit is equal to 20 times the Practical Quantification Limit. Samples with semivolatile concentrations above this value were submitted for analysis using the TCLP extraction and EPA Method 8270.
- [2] 0.02 mg/L is the Practical Quantification Limit for these constituents.
- [4] Sample Numbers 286 and 241 comprise the east and west halves, respectively, of the N and C Sections.



EAST HALF AT
ROUGH FINISHED GRADE

SECTIONS DESIGNATED BY BOLD OUTLINE AND ASSIGNED DIRECTION ABBREVIATIONS ARE ROUGHLY REPRESENTATIVE OF 1,000 CUBIC YARD QUANTITIES OF FILL (EXCEPT FOR SOUTH SECTION (S), WHICH IS APPROXIMATELY 500 CUBIC YARDS).

SUBSECTIONS FURTHER DIVIDED BY A DOTTED LINE AND DESIGNATED WITH A LOWER CASE "A" OR "B" REPRESENT FILL QUANTITIES OF APPROXIMATELY 500 CUBIC YARDS.

FOR CONCEPTUAL PURPOSES ONLY

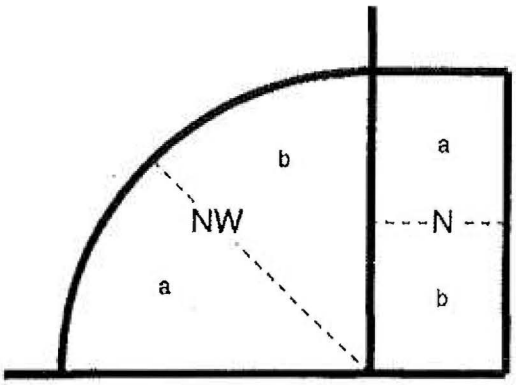
N

DATE	PROJECT NUMBER	RESERVOIR 2 SIXTH LIFT (36-37 FEET)		
9-12-95	1116-20			
BROWN AND CALDWELL IRVINE, CALIFORNIA		PROJECT LOCATION: UNOCAL CARSON REFINERY 1520 EAST SEPULVEDA BOULEVARD CARSON, CALIFORNIA	NOT TO SCALE	FIGURE 3-2.7

TABLE 3-2
Reservoir 2
Summary of Analytical Results for Fill Soils (Page 7 of 8)
Sixth Lift
Approximately 36 to 37 Feet Above Mean Sea Level

Representative Section	NW a	NW b	N a	N b	SW a	SW b	S	WDR Limits
Volatile Hydrocarbonsand Volatile Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg								
Sample Number	299-2-4a	266-2-4b	298-2-NW	297-2-W	334-2-3b	319-2-3a	318-2-SW	
Benzene	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.1
Ethylbenzene	<0.10	0.13	<0.10	<0.10	<0.10	<0.10	<0.10	2.9
Toluene	<0.10	0.18	<0.10	<0.10	<0.10	<0.10	<0.10	4.2
Xylenes	0.39	0.84	<0.10	<0.10	0.12	<0.10	<0.10	1.7
TPH C6-C12	110	39	41	69	36	55	35	1,000
Semivolatile Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg								
Sample Number	279-2-4	266-2-4b	265-2-NW	277-2-W	320-2-3b	319-2-3a	318-2-SW	
TPH C13-C22	1600	180	1500	2600	<100	1100	1200	10,000
TPH C23-C28	500	120	510	610	<100	360	530	15,000
Semivolatile Hydrocarbons, EPA Method 8270, mg/kg								
Sample Number	299-2-4a		297-2-W		325-2-3		327-2-C	
2-Methylnaphthalene	<5		<5		<5		<5	N/A
Acenaphthene	<5		<5		<5		<5	14[1]
Anthracene	<5		<5		<5		<5	14[1]
Benzo(a)anthracene	<5		<5		<5		<5	14[1]
Chrysene	<5		<5		<5		<5	14[1]
Dibutylphthalate	<5		<5		<5		<5	N/A
Fluoranthene	<5		<5		<5		<5	14[1]
Fluorene	<5		<5		<5		<5	14[1]
Naphthalene	<5		<5		<5		<5	14[1]
Phenanthrene	9.0		<5		<5		<5	14[1]
Pyrene	5.3		<5		<5		<5	14[1]

Notes:
< Indicates that compound was not detected at specified detection limit.
N/A = Not Applicable
WDR = Waste Discharge Requirements
TCLP = Toxicity Characteristic Leaching Procedure
[1] The WDR limit is equal to 20 times the Practical Quantification Limit. Samples with semivolatile concentrations above this value were submitted for analysis using the TCLP extraction and EPA Method 8270.
[2] 0.02 mg/L is the Practical Quantification Limit for these constituents.



ALL OTHER AREAS AT
ROUGH FINISHED GRADE

SECTIONS DESIGNATED BY BOLD OUTLINE AND ASSIGNED DIRECTION ABBREVIATIONS ARE ROUGHLY REPRESENTATIVE OF 1,000 CUBIC YARD QUANTITIES OF FILL (EXCEPT FOR NORTH SECTION (N), WHICH IS APPROXIMATELY 750 CUBIC YARDS).

SUBSECTIONS FURTHER DIVIDED BY A DOTTED LINE AND DESIGNATED WITH A LOWER CASE "A" OR "B" REPRESENT FILL QUANTITIES OF APPROXIMATELY 500 CUBIC YARDS.

FOR CONCEPTUAL PURPOSES ONLY

DATE	PROJECT NUMBER	
9-12-95	1116-20	RESERVOIR 2 SEVENTH LIFT (37-38 FEET)
BROWN AND CALDWELL IRVINE, CALIFORNIA	PROJECT LOCATION	UNOCAL CARSON REFINERY 1520 EAST SEPULVEDA BOULEVARD CARSON, CALIFORNIA
	NOT TO SCALE	FIGURE 3-2.8

TABLE 3-2
Reservoir 2
Summary of Analytical Results for Fill Soils (Page 8 of 8)
Seventh Lift
Approximately 37 to 38 Feet Above Mean Sea Level

Representative Section	NW a	NW b	N a	C a	WDR Limits
Volatile Hydrocarbonsand Volatile Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg					
Sample Number	321-2-4a	322-2-4b	323-2-NW	324-2-C	
Benzene	<0.10	<0.10	<0.10	<0.10	0.1
Ethylbenzene	<0.10	0.24	<0.10	<0.10	2.9
Toluene	<0.10	0.25	<0.10	<0.10	4.2
Xylenes	<0.10	1.50	<0.10	<0.10	1.7
TPH C6-C12	<10	43	31	51	1,000
Semivolatile Total Petroleum Hydrocarbons, EPA Method 8015 Modified, mg/kg					
Sample Number	321-2-4a	322-2-4b	323-2-NW	324-2-C	
TPH C13-C22	970	680	<100	710	10,000
TPH C23-C28	850	270	<100	520	15,000
Semivolatile Hydrocarbons, EPA Method 8270, mg/kg					
Sample Number	331-2-4				
2-Methylnaphthalene	28				N/A
Acenaphthene	<5				14[1]
Anthracene	<5				14[1]
Benzo(a)anthracene	<5				14[1]
Chrysene	<5				14[1]
Dibutylphthalate	<5				N/A
Fluoranthene	<5				14[1]
Fluorene	<5				14[1]
Naphthalene	<5				14[1]
Phenanthrene	12				14[1]
Pyrene	<5				14[1]

Notes:
< Indicates that compound was not detected at specified detection limit.
N/A = Not Applicable
WDR = Waste Discharge Requirements
TCLP = Toxicity Characteristic Leaching Procedure
[1] The WDR limit is equal to 20 times the Practical Quantification Limit. Samples with semivolatile concentrations above this value were submitted for analysis using the TCLP extraction and EPA Method 8270.
[2] 0.02 mg/L is the Practical Quantification Limit for these constituents.

4

BROWN AND CALDWELL

CHAPTER 4

LOW PERMEABILITY CAP CHARACTERIZATION

As required by the WDR's, a low permeability cap was placed inside the reservoirs on top of the blended backfill. This cap was sampled and tested by the Falling Head method to verify compliance with WDR limits of 1×10^{-6} cm/sec.

Cap Installation

The low permeability cap was installed with imported clay that was tested for permeability below the WDR limit. Two different sources were used to supply the accepted clay.

The clay was placed in 4-inch lifts over the blended backfill materials using graders and vibratory sheeps foot compactors with 6-inch pegs. The clay was continuously watered using a water tower and water trucks, and compacted in several passes to achieve at least 95% relative compaction and assure that the required permeability coefficient would be obtained. After three lifts were placed to complete the required one foot thick cap, the clay was compacted with a smooth drum roller to seal the moisture in the cap.

Sample Collection Procedures

As per agreement with the RWQCB staff, four samples were taken from each reservoir and tested for permeability coefficient.

The samples were taken at random locations in each quarter of the reservoir capped areas. These driven samples were taken in 3-inch sleeves at six inches below grade.

Laboratory Analysis

The coefficient of permeability was determined by the Falling Head Test Method ASTM D5084 and reported in cm/sec.

The permeability coefficient results obtained were as follows:

Reservoir 1 -	SW quadrant	2.48×10^{-7}
	SE quadrant	2.86×10^{-7}
	NE quadrant	5.73×10^{-7}
	NW quadrant	9.99×10^{-8}
Reservoir 2 -	SW quadrant	2.10×10^{-7}
	SE quadrant	1.48×10^{-7}
	NE quadrant	3.33×10^{-7}
	NW quadrant	1.32×10^{-7}

These lab reports, as well as those of the tests taken on the clay before acceptance for import are included in **Appendix J.**

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BROWN AND CALDWELL

CHAPTER 5

SHELL OIL COMPANY CLOSURE STATEMENT

REGISTERED GEOLOGIST'S CERTIFICATION

The enclosed report has been reviewed by a geologist who is registered in the State of California and whose license number and signature appear below.

Robert W. Hastings
Registered Geologist 5452

9 Oct 95
Date

12-95

FACILITY OWNER/OPERATOR CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction and supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who managed the project, to the best of my knowledge and belief the reservoirs closure was completed in accordance with the requirements and provisions of Order No. 94-112. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

T.E. Minton, Plant Manager
Carson Plant
Shell Oil Company

October 10, 1995
Date

6

BROWN AND CALDWELL

REFERENCES

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BROWN AND CALDWELL

PARSONS