REMEDIAL ACTION OBSERVATIONS AND AS-BUILT DOCUMENTATION

0016

UNOCAL SERVICE STATION No. 4652

W. 15th Avenue & "C" Street
Anchorage, Alaska

Prepared For

UNOCAL

A-1204-8

January, 1990

RITTENHOUSE-ZEMAN & ASSOCIATES

Geotechnical & Environmental Consultants

RZA

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0017

10 January 1990

A-1204-8

Unocal
3131 Elliott Avenue
Seattle, Washington 98121

PRELIMINARY
Subject To
Revision

Attention: Mr. Gary Gunderson

Subject: Remediation Status Report & As-Built Documentation
Unocal Station No 4652
15th Avenue and C Street
Anchorage, Alaska

Gentlemen:

In accordance with your authorization RZA has prepared this report to document the as-built construction of remediation systems installed on the above referenced site. This report also contains information developed from a test pit program and trenching observations performed on the Rader property, south of 15th Avenue.

As of the date of this report the mechanical systems of the remediation system have undergone initial testing and are being prepared for full scale operation. The results of our start up testing and some of the initial air and water discharge monitoring data is also included with this report.

RZA is pleased to be of service to you on this project. if you have any questions regarding the enclosed information, or if we may be of any further assistance please feel free to contact us.

Respectfully submitted,

RZA, INC.

Daniel S. Whitman
Senior Environmental Geologist

REMEDIAL ACTION OBSERVATIONS AND AS-BUILT DOCUMENTATION

Prepared for

Unocal Service Station No. 4652
W. 15th Avenue & "C" Street
Anchorage, Alaska

Prepared by

Rittenhouse-Zeman & Associates, Inc.
1400 - 140th Avenue NE
Bellevue, Washington 98005

January 1990

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1.0 PROJECT BACKGROUND

The site history and a summary of data obtained regarding site conditions has been presented in previous RZA reports, including the January 1989 Contamination Assessment Report and a March 1989 Supplemental Assessment Report. A first phase remedial action plan detailing our proposed remediation systems was also prepared in March 1989. After ADEC review, comment and approval this remedial action program began. Contractors were selected in September 1989 and prefabricated mechanical systems were constructed, then shipped to the site for installation.

2.0 SITE EXCAVATION

As proposed in our remedial action plan, excavations on the site consisted of: removal and stockpiling of approximately 300 cubic yards of soil from the area of the former waste oil tank and septic system; trenching for installation of groundwater collection galleries along the west, south, and part of the east site boundaries; trenching along the south side of 15th Avenue for installation of a groundwater collection gallery and trenching for installation of piping for a soil-vapor venting system network over approximately 2/3 of the site. Excavation observations and testing are summarized in the following sections.

All excavations were performed by BC Excavating, in accordance with the approved remedial action plan. All excavations were observed by an experienced RZA geologist in order to provide as-built documentation of the remediation systems.

2.1 Waste Oil Tank Area

On-site remedial actions began on 24 October 1989, with the excavation of the former location of the waste oil tank and septic system. Approximately 300 cubic yards of material were removed and stockpiled. The excavation extended to a depth of approximately 8 feet at its deepest point, directly beneath the former tank location.

The septic tank from the former station was encountered at the south end of the excavation . The configuration of the tank indicated that the septic tank had been used as a holding tank which was plumbed to the Municipal sanitary sewer. During demolition of the service station in 1987, the sanitary sewer connection had been plugged by the contractor at a point between the station and the septic tank, therefore the sanitary

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connection from the AWWU main to the site was intact. During all on-site excavation work this sewer connection was preserved and is currently used as a discharge connection and conduit for lines extending to the off-site groundwater collection gallery. Details of the proposed sanitary sewer connection were submitted to the Anchorage Water and Wastewater Utility and the hook-up was inspected and approved at the time of construction.

Soil conditions encountered during the excavation consisted of approximately 6 feet of silty sand fill containing gravel, cobbles and debris overlying an approximately 1 foot thick horizon of organic soil containing roots, branches and fibrous material; a topsoil horizon, indicating the former ground surface prior to fill placement. Below the buried topsoil layer, natural soils were encountered consisting of a greenish to gray silty fine sand. Groundwater conditions were encountered in the buried topsoil horizon and underlying silty fine sand.

During excavation some obviously stained or odorous soils were encountered in the immediate vicinity of the former waste oil tank location, beginning at a depth of approximately 4 feet below ground surface, and extending to the topsoil horizon. Groundwater conditions encountered in the topsoil had an oily sheen.

The septic tank was crushed and removed, and the contents of the tank and seepage water in the adjacent excavation were removed by a septic pumper. Seepage water continued to infiltrate into the excavation until it was backfilled with other on-site material.

All soils removed from this excavation were stockpiled on a double thickness of reinforced visqueen in the north-central portion of the site. The pile was tested for disposal characterization and covered with additional visqueen. The stockpile will be maintained until disposal, treatment or alternative use plans are prepared.

A composite sample from the stockpile was tested in accordance with the "Municipality of Anchorage Contaminated Soil and Spill Residue Disposal Policy". Analyses included BTEX by EPA Method 8020, Total Petroleum Hydrocarbons (TPH) by EPA Method 418.1, total halogens, arsenic, chromium and lead. The laboratory report of analytical results is included in the Appendix of this report. From these analyses, xylenes were

encountered a concentration of 6.1 mg/kg, (units equivalent to parts per million). TPH was noted at a concentration of 1,438 mg/kg and arsenic, chromium and lead were found at concentrations of 4.8, 17.2 and 48.8 mg/kg, respectively. The TPH concentration found in the soils is in excess of the 1000 ppm acceptance criteria established by the Municipality, precluding disposal in the Anchorage Regional Landfill.

2.2 West Boundary Collection Gallery

On 25 October 1989 the main site isolation and groundwater collection system was begun, by trenching approximately 110 feet along the western property boundary, starting in the southwest corner of the site. At the southwest property corner the trench extends to a depth of approximately 12 feet; into the clayey Bootlegger Cove Formation underlying the identified seepage zones in this area. The base of the trench slopes up to the north, along the property boundary, generally dug 1 to 2 feet into the top of the Bootlegger Cove clay. During excavation, seepage zones could be noted in the buried topsoil layer, silty fine sand and gravelly seams overlying the clay unit. Some gasoline odors could be detected, particularly near the southwest property corner.

The location and dimensions of the west boundary collection gallery are indicated in Figures 1 and 2. A 4-inch diameter ADS slotted drain pipe wrapped in a filter fabric was installed along the base of the trench and was surrounded by pea gravel backfill to a level above the seepage horizons which could be seen in the sidewalls of the excavation. The pea gravel backfill was overlain by a layer of 2-inch rigid polystyrene insulation, then the remainder of the trench was backfilled. A 60-foot portion of the trench was backfilled with clean, imported granular fill. The remaining segment of the trench was filled with on-site excavation spoils, some of which exhibited petroleum contamination. Other excavation spoils from this trench were used to backfill the waste oil tank excavation in the southeastern portion of the site.

The western boundary groundwater collection gallery is intended to collect on-site seepage and upgradient groundwater infiltration from beneath C Street. During subsequent excavation the gallery was noted to be successfully collecting groundwater and allowing drainage to the adjacent sump constructed at the southwest corner of the site.

2.3 South Boundary Collection Gallery and Membrane Cut-off Wall

On 30 October 1989 construction began on the southern boundary collection gallery and low permeability membrane cut-off wall. Initially, a groundwater collection sump was constructed in the southwest property corner, at the location indicated on Figure 1, to provide a connection to the western boundary collection gallery. Construction details, typical of all three of the groundwater collection sumps are indicated on Figure 3. Sump No. 1, in the southwest property corner, was excavated to a depth of approximately 13.5 feet below the ground surface, several feet below the level of the western boundary collection gallery, to allow retention of collected groundwater. The sump base was socketed approximately 3.5 feet into the Bootlegger Cove clay, below all observed seepage zones.

From this sump, the trench was extended to the east, with the base of the excavation sloping to the southeast property corner. Sump No. 2 was dug in the southeast corner of the site, extending to a depth of approximately 16 feet below ground surface.

Laboratory samples LS-1 through LS-4 were obtained from the excavation base at four locations along the southern boundary. The samples were analyzed for TPH by EPA Method 8015 (modified). All four samples indicated no detectable total petroleum hydrocarbons by this test method, indicating that the trench had been extended to a depth below petroleum impacts. Laboratory analyses are summarized in Table 1 and laboratory reports are included in the Appendix. Overlying soils in the seepage zones along the trench walls showed obvious signs of petroleum contamination, including strong gasoline odors upon excavation.

Beginning at a point approximately 30 feet north of Sump No. 1, a low permeability HDPE membrane was installed the reduced down-gradient transmission of collected groundwater. The membrane was backed by a nonwoven felt construction fabric to prevent punctures and was sealed at the base of the trenches using powdered bentonite above and below the edge of the membrane. The HDPE membrane was placed as a single sheet with no seams, 8 feet wide by 125 feet long. The membrane extends across the bottom of the trench and up the side wall, to a level above any observed seepage zones to cut off any down-gradient seepage which may occur from the accumulation of groundwater in the collection gallery. Four-inch ADS perforated pipe with a filter fabric

wrap was laid in the trench base and pea gravel backfill was placed to a level of approximately 6 feet below ground surface. The sumps were plumbed, using 4-inch PVC conduit for electrical connections and a 1-inch PVC water line extending down the length of the trench, stubbing up at the location of the equipment container. Piping was overlying by a layer of 2-inch rigid foam insulation, then the remainder of the trench was backfilled using on-site spoil material. Details of the south boundary trench are shown on Figures 1, 2 and 3.

At the southeast corner of the property the trenching encountered a former septic system, consisting of a log crib, unrelated to any of the known systems associated with the former service station building. The log crib was pumped out by a septic pumper and the crib was dismantled and disposed of with the racked concrete, asphalt and other construction debris from the site.

2.4 East Boundary Collection Gallery

From the southeast property corner, a collection gallery was extended approximately 50 feet up the eastern property boundary. This gallery was constructed in a manner similar to the western property boundary, including a subsurface drain and pea gravel backfill to a level above all observed seepage zones. During excavation, significant seepage zones were noted, particularly related to the buried top soil horizon. The walls of the trench were generally unstable through this zone. The trench extended to a depth of approximately 11 feet at its northern end, sloping to a depth of 16 feet at the location of Sump No. 2. All plumbing connections from Sump No. 1, Sump No. 2 and the sanitary sewer were extended along the length of the trench, above the pea gravel backfill, to the location of the equipment container where all piping stubbed up to the ground surface.

2.5 Off-Site Collection Gallery And Membrane Cut-Off Wall

On 15 November 1989 excavation began on the off-site collection gallery, located south 15th Avenue, as indicated on Figure 1. The trench was constructed in approximately 20-foot sections by excavating; sampling; rolling out a portion of the membrane; installing base seals and drainage pipe; then backfilling with pea gravel. The trench base was constructed to slope towards the location of Sump No. 3, located east of the sanitary sewer and storm drain utility easement.

In the utility easement area the trench was extended to a depth of approximately 14 feet below ground surface, approximately four feet below the base of utilities in this area. The utility crossing detail of the trench is indicated on Figure 3. The storm drain and sanitary sewer lines were undermined and the membrane installed beneath the lines. The upper edge of the membrane was cut at the location of the sewers and bentonite was used to form a seal around the pipes and membrane connection. Construction of the trench through this area was performed under the observation of AWWU personnel.

Some significant seepage was noted in the utility easement, attributed to bedding material in the area of the utility lines. This area was dewatered during construction by recycling water into a portion of the trench which had already been constructed with the membrane liner.

West of the utility easement, the 4-inch sanitary sewer connection from the Unocal site was encountered. Some seepage was noted in the soils surrounding the sewer line. At this location the sewer line was spliced to act as a conduit for electrical and water connections for groundwater pumping to the equipment container located on the Unocal site. The reconstructed sewer also serves as the discharge line for treated groundwater to the sewer main. A sample of the seepage water from this location was analyzed for BTEX by EPA Method 602.

Soil samples were obtained from the side walls and base along the length of the excavation to provide information regarding the distribution and magnitude of petroleum impacts. The sample locations are indicated on Figure 1 and laboratory results are summarized in Table 1. The laboratory reports of analytical results are included in the Appendix of this report. Sample A-1, obtained from the extreme eastern end of the trench indicated no detectable BTEX or total petroleum hydrocarbons, suggesting the trench was extended to a point beyond the impacted area. Sidewall samples obtained at other points along the trench wall indicate that some contamination by volatile organic compounds has occurred, particularly sample A-8 along the sanitary sewer backfill material. Analyses for TPH by EPA Method 8015 (modified) did not detect significant petroleum concentrations, with a detection limit of 10 mg/kg. Excavation base samples A-3, A-7, A-9, A-10 and A-12 were tested for TPH by EPA Method 418.1. All samples indicated TPH concentrations ranging from 19.2 to 30.7 mg/kg, reflecting background

conditions. Other information regarding soil conditions on the property south of 15th Avenue is summarized in Section 5.0.

2.6 Soil-Vapor Vent System Trenching

After completion of the groundwater collection galleries, a soil-vapor venting network was constructed on-site. The general configuration of the vapor venting network is indicated on Figure 4. Trenches were dug approximately 15 feet on center, extending to the depth of the buried top soil horizon on-site. This depth ranged from approximately 4 to 8 feet below ground surface at various locations. Trenches were extended into the backfill material overlying the groundwater collection gallery to withdraw vapors from the backfill soil.

The soil-vapor venting network was laid out in two arrays, manifolding to central piping which stubs up to the ground surface at the container location. Each leg of the vapor venting system is equipped with a regulating valve to control air flow to individual sections of the system. The vapor extraction piping consists of 4-inch diameter ADS slotted drain pipe surrounded by pea gravel. The main line consists of 4 inch solid PVC piping, equipped with several clean out risers to allow dewatering or defrosting during routine maintenance of the system.

3.0 EQUIPMENT INSTALLATION

On 28 November 1989 the prefabricated equipment container was mobilized to the site. The container holds prefabricated soil-vapor venting and air stripping systems, ready for connection to the stubbed-up piping. The layout of the container is indicated in Figure 5. The container and treatment systems were fabricated by H^2 Oil Recovery Equipment, Inc. of Bend, Oregon.

3.1 Water Treatment System

Submersible pumps and water level sensors were installed in the three collection gallery sumps. The pumps are Grundfos submersible pumps with stainless steel impellers which have been retrofitted with Teflon seals and explosion proof connections in order to provide resistance to petroleum hydrocarbons. Each pump operates independently based on the water level sensor located in the sump.

Plumbing from the three wells enters a manifold inside the container where the three flow streams are merged. An influent water sampling port is located on the manifold. The influent water flow passes through a water meter issued by AWWU for discharge metering, then passes through the air stripping column. A discharge effluent sampling port is located at the base of the tower on the connection to the sanitary sewer. The air stripping tower uses a 600 cubic foot per minute blower to counterflow air past the cascading influent water to volatilize groundwater contaminants. The blower uses air from within the container which has been heated to approximately 80 degrees for efficient stripping. Effluent water is discharged to the sanitary sewer on a permit basis from AWWU. A strict discharge monitoring schedule has been established and followed during start up testing of this groundwater treatment system.

3.2 Soil-Vapor Venting System

The vapor venting system consist of two 100 cubic foot per minute regenative blower units which draw on the north and south piping arrays. Vapors withdrawn from the ground enter two condensate tanks, equipped with dilution valves, then pass through the blowers. The condensate tanks help avoid moisture damage to the blower units. Discharge then occurs through a 4-inch diameter PVC emission stack provided with an emissions sampling port and combustible gas sensor for monitoring purposes. Air emissions are continuously monitored by a Toxgard (tm) combustible gas monitor which provides a automatic shut-off should discharges exceed a pre-programmed level. For the purposes of this site work a discharge limit of 20 % of the Lower Explosive Limit (LEL) will result in a system shut-down.

4.0 START UP TESTING AND MONITORING

As of the date of this report the groundwater treatment systems and soil-vapor venting systems have undergone a series of start-up tests to determine the influent and effluent water concentrations, stripper efficiency and initial vapor discharge concentrations. The water and vapor discharge monitoring data is summarized in Tables 2 and 3, respectively.

4.1 Groundwater Treatment System

The groundwater collection gallery has retained a significant volume water requiring treatment, thus the actual seepage rates and anticipated long-term treatment volumes cannot be determined at this time. Once the system has operated long enough to treat the retained volume, long-term monitoring will assist in determining the necessary daily treatment volume.

Initial effluent samples indicate that groundwater treatment has typically resulted in water concentrations of approximately 92 to 353 part per billion total BTEX by EPA Method 602. One influent sample has been taken for comparison purposes, with a total BTEX concentration of 15,324 parts per billion, indicating a stripping efficiency of approximately 95 percent. Although this represents relatively good treatment efficiency, the discharge limitations established by AWWU require total BTEX to be less then 0.1 mg/l. Based on our initial discharge monitoring various heat sources and treatment rates have been attempted to increase efficiency. In the near future two in-line water heater units are to be installed to raise the influent water temperature. Water discharge monitoring results are summarized in Table 2. Laboratory analytical reports are included in the Appendix. The results of continued monitoring will be summarized in subsequent reports.

4.2 Soil-Vapor Venting Monitoring

The soil-vapor venting system was initially started on 8 January 1990. Initial vapor venting monitoring data is summarized in Table 3. Start-up levels activated the automatic shut-off systems of the Toxgard combustible gas monitor, indicating concentrations in excess of 20 % of the Lower Explosive Limit would be exceeded. The vapor dilution valves were opened for discharge, and the system has operated at levels of approximately 19 to 10 % LEL. For correlation purposes measurements have also been obtained at the stack and at various downwind locations, using an organic vapor meter (OVM), and colorimetric tubes. Vacuum canister samples have been obtained from the discharge stack and a downwind sampling location as outlined in our initial monitoring plan. Vapor discharge monitoring data is summarized in Table 3. No off-site odors or OVM detectable concentrations have been found. One downwind point on the sidewalk adjacent to the site has indicated OVM measurements of 2.9 and 1.3 ppm. Background OVM measurements upwind of the site, before systems were started,

ranged from 0.6 to 0.9 ppm, probably attributable to traffic at the intersection of 15th Avenue and "C" Street.

Laboratory analyses of the canister samples are included in Table 3. BTEX was analyzed by EPA Method 8020. Stack Concentrations were determined to be: benzene 29.8 ug/L: toluene 51.6 ug/L: ethylbenzene 5.1 ug/L and xylenes 40.5 ug/L. Downwind concentrations were found to be: benzene 2.45 ug/L: toluene 7.52 ug/L: ethylbenzene 0.44 ug/L and xylenes 3.78 ug/L, indicating significant dispersion of the discharges. Both samples were taken at near-worst case discharge levels; since that time discharges have significantly reduced. Additional samples and monitoring data will be obtained as the system continues to operate.

5.0 TEST PITS ON ADJACENT PROPERTY

On 24 October 1989 a series of additional test pits were dug on the Rader property, south of 15th Avenue. These test pits were dug to provide further information regarding the distribution and magnitude of down-gradient contamination migration and to check other potential contaminant sources on the property. Seven test pits were dug, observed by an RZA geologist and by Mr. Rader, the property owner. Soil samples were obtained from seepage zones or areas along the test pit sidewalls which indicated the potential for contamination. All test pit samples were submitted to the analytical laboratory for analyses for BTEX by EPA Method 8020 and Total Petroleum Hydrocarbons by EPA Method 8015 (modified). Test pit sample analytical results are summarized in Table 4.

The locations of all monitoring wells, test pits and soil probes on the Rader property are indicated on Figure 6. The current test pits were dug at locations which were considered representative of typical site conditions and to provide more information regarding areas which have not been explored during previous work during 1988. Test pit TP-7 and TP-8 were dug in an area where groundwater seepage to the ground surface was suspected, in order to evaluate the seepage zones. Test pits TP-11 and TP-12 were dug east of any suspected impacts, adjacent to the Butler Aviation petroleum pipeline easement, to evaluate the potential for alternate impacts to the property.

Test pit logs for each of the explorations and laboratory analytical results are included in the Appendix of this report. Of the samples obtained, only the soil sample from TP-6 indicated any detectable petroleum impacts. This test pit is the furthest removed from the Unocal site, in an area of where miscellaneous fill containing debris had been placed over the former top soil surface. Sample TP-6 from this test pit was obtained from a seepage zone at a depth of approximately 6 feet below ground surface. Concentrations of 0.8 mg/kg toluene, 0.19 mg/kg ethylbenzene and 0.06 mg/kg xylenes were detected.

TP-7 and TP-8 were dug in an area of a small escarpment where groundwater seepage had been suspected. During excavation, wet surficial soils were noted in TP-7. A wet zone was encountered in TP-8 at a depth of approximately 7 feet, corresponding to a similar elevation to the wet soil encountered in TP-7. Based on this, a trench was dug connecting the two test pits which clearly showed the wet zone in TP-8 connecting to groundwater seepage at the location of TP-7. Soil samples were obtained in both test pits from the seepage area and a water sample was obtained from TP-8. All laboratory analyses were below detection limits.

The laboratory analytical results obtained from these test pits, the sidewall samples of the cut-off trench on the north property boundary and test pits TP-2 through TP-5 dug in 1988, indicate that some relatively limited soil and groundwater impacts have occurred on the Rader property, primarily limited to relatively shallow soils near the north property boundary, and in the north-south utility easement crossing the property. TP-6 performed during this series of test pits indicate some slight petroleum impacts which could be related, however no clear connection or migration pathway between this location and the Unocal site has been found. Monitoring well MW-16, located in the utility corridor northwest of TP-6 has shown little to suggest petroleum contamination extends this distance beyond the Unocal site boundary. Soil and groundwater conditions at other points between the Unocal site and this test pit do not demonstrate petroleum contamination, suggesting these low level impacts may be associated with the miscellaneous fill and debris placed at this location.

6.0 CLOSURE

The conclusions presented in this report are professional opinions based on the observations of RZA representatives in the field, and upon data from laboratory analyses from this and previous studies. RZA will continue to monitor the performance of the remediation systems and will prepare progress reports to summarize the data obtained. We appreciate the opportunity to be of service to you on this project. If you have any questions, or if we may be of any further assistance, please feel free to contact us.

Respectfully submitted,

RITTENHOUSE-ZEMAN & ASSOCIATES, INC.

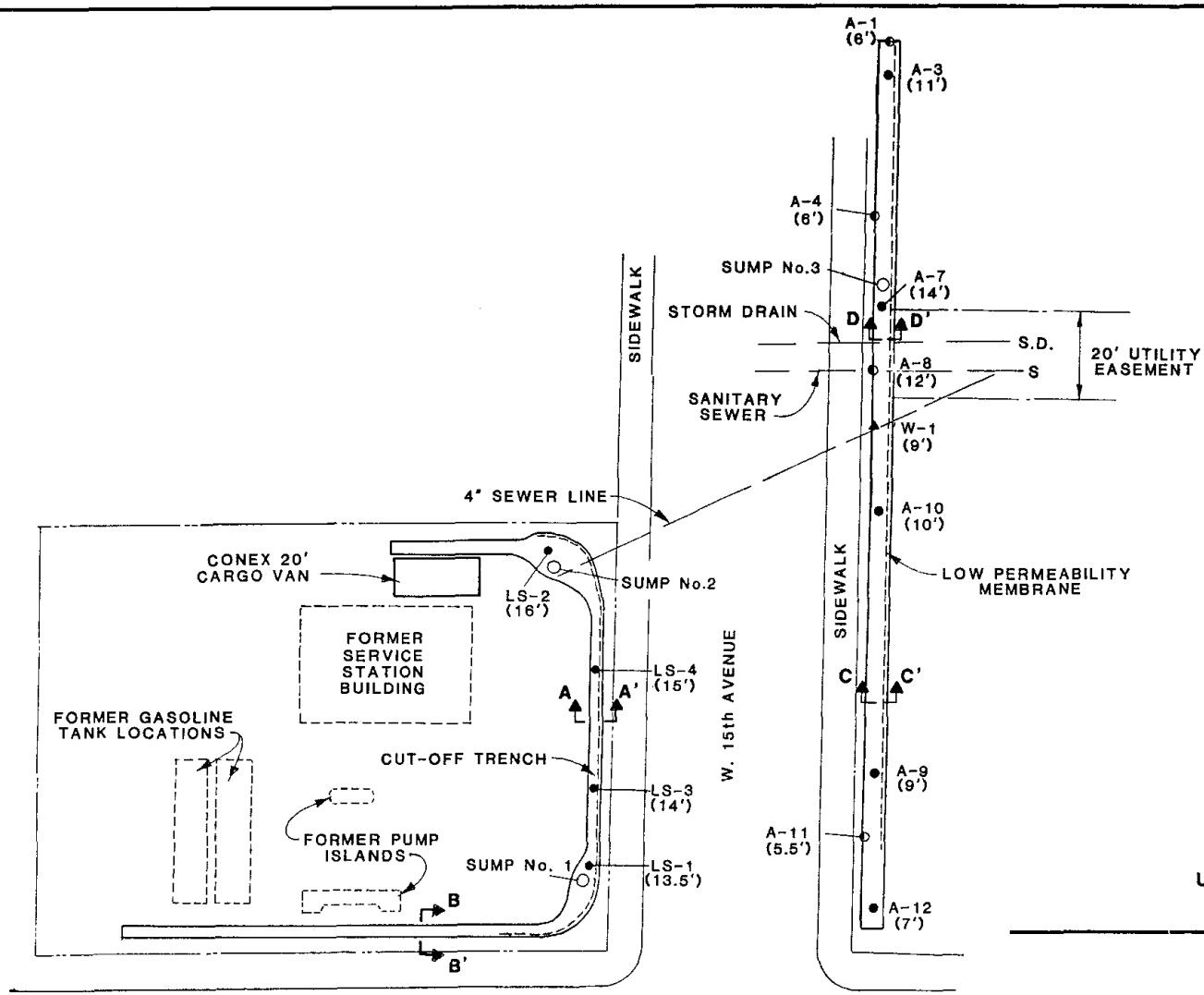
Daniel S. Whitman
Senior Environmental Geologist

Alvin R. Zeman
Principal

Enclosures:
Figure 1: Site Isolation and Groundwater Collection System
Figure 2: Groundwater Collection System As-Built Construction Details
Figure 3: " " " " " "
Figure 4: As-Built Soil-Vapor Venting System Configuration
Figure 5: Contaminated Groundwater Treatment and Vapor-Venting Equipment
Figure 6: Monitoring Well and Test Pit Location Plan

Table 1: Excavation Soil Sample Analyses
Table 2: Treated Groundwater Discharge Monitoring
Table 3: Soil-Vapor Venting System Monitoring
Table 4: Test Pit Sample Analyses

Test Pit Logs
Appendix



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APPROXIMATE SCALE IN FEET

KEY

- ○ 36" PERFORATED CMP COLLECTION SUMP
- LOW PERMEABILITY MEMBRANE
- CUT-OFF TRENCH SYSTEMS (SEE DETAILS FIGURES 2 & 3)
- A-14 (7') ◐ INDICATES SIDEWALL SAMPLE NUMBER, DEPTH AND APPROXIMATE LOCATION
- A-10 (10') ● INDICATES BASE SAMPLE NUMBER, DEPTH AND APPROXIMATE LOCATION
- W-1 (9') ▲ INDICATES WATER SAMPLE NUMBER, DEPTH AND APPROXIMATE LOCATION

UNOCAL SERVICE STATION No. 4652
W. 15th AVENUE & "C" STREET
ANCHORAGE, ALASKA

SITE ISOLATION AND GROUNDWATER COLLECTION SYSTEM

FIGURE 1

W.O. A-1204-8
BY CAM
DATE JAN 1990
SCALE NOTED

RZA, INC.
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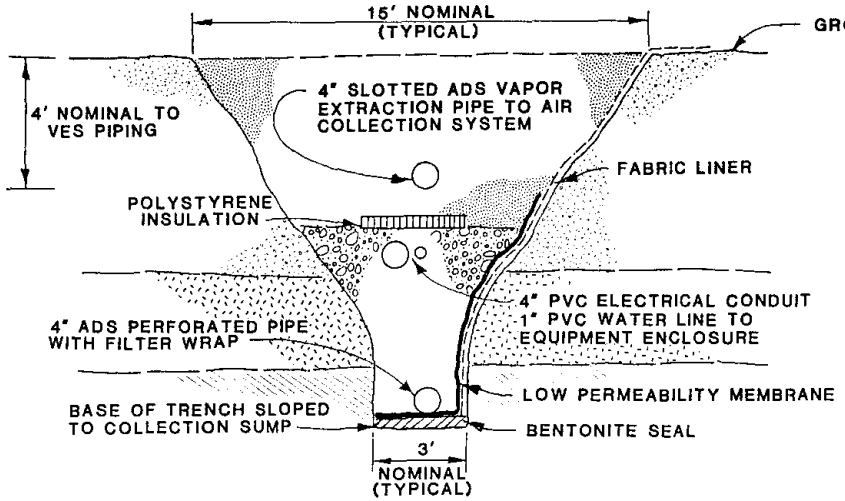
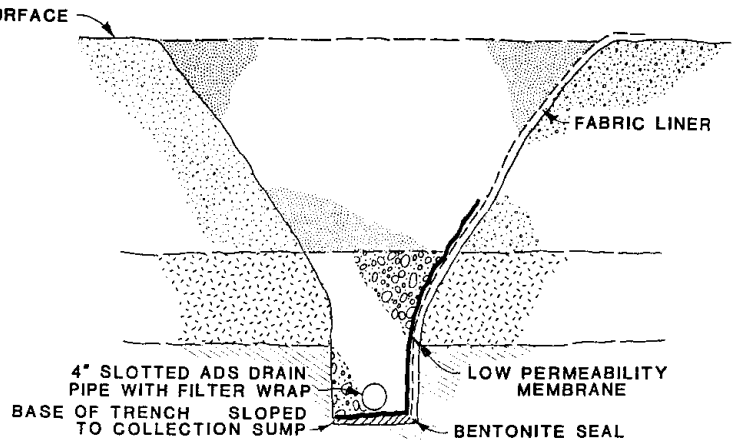
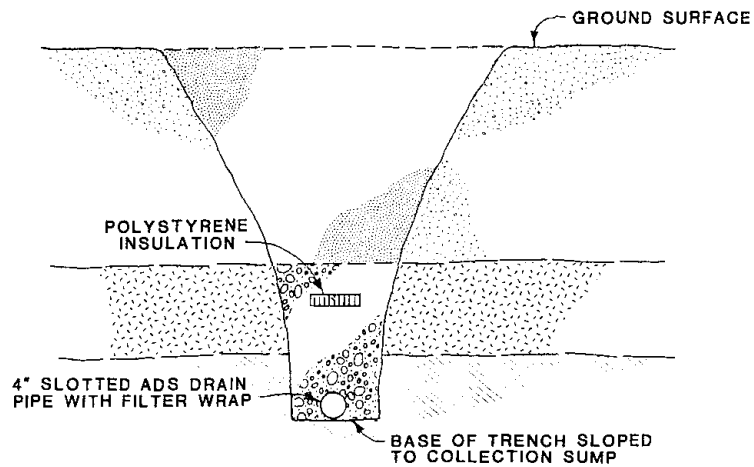
711 'H' Street, Suite 450
Anchorage, Alaska 99501



VAPOR EXTRACTION/GROUNDWATER COLLECTION DETAIL A-A'
(TOTAL DEPTH RANGES FROM 13.5 TO 16 FEET)



TYPICAL GROUNDWATER COLLECTION DETAIL C-C'
(TOTAL DEPTH RANGES FROM 7 TO 14 FEET)



GROUNDWATER COLLECTION DETAIL B-B'
(TOTAL DEPTH RANGES FROM 8 TO 13.5 FEET)

LEGEND

- UNCOMPACTED DISTURBED NATIVE SOILS
- PEA GRAVEL
- SANDY FILL
- SILTY OUTWASH DEPOSIT (SEEPAGE ZONE)
- SILTY CLAY (BOOTLEGGER FORMATION)

UNOCAL SERVICE STATION No.4652
W. 15th AVENUE & "C" STREET
ANCHORAGE, ALASKA

GROUNDWATER COLLECTION SYSTEM
AS-BUILT CONSTRUCTION DETAILS

FIGURE 2

W.O. A-1204-8
BY CAM
DATE JAN 1990
SCALE N.T.S.

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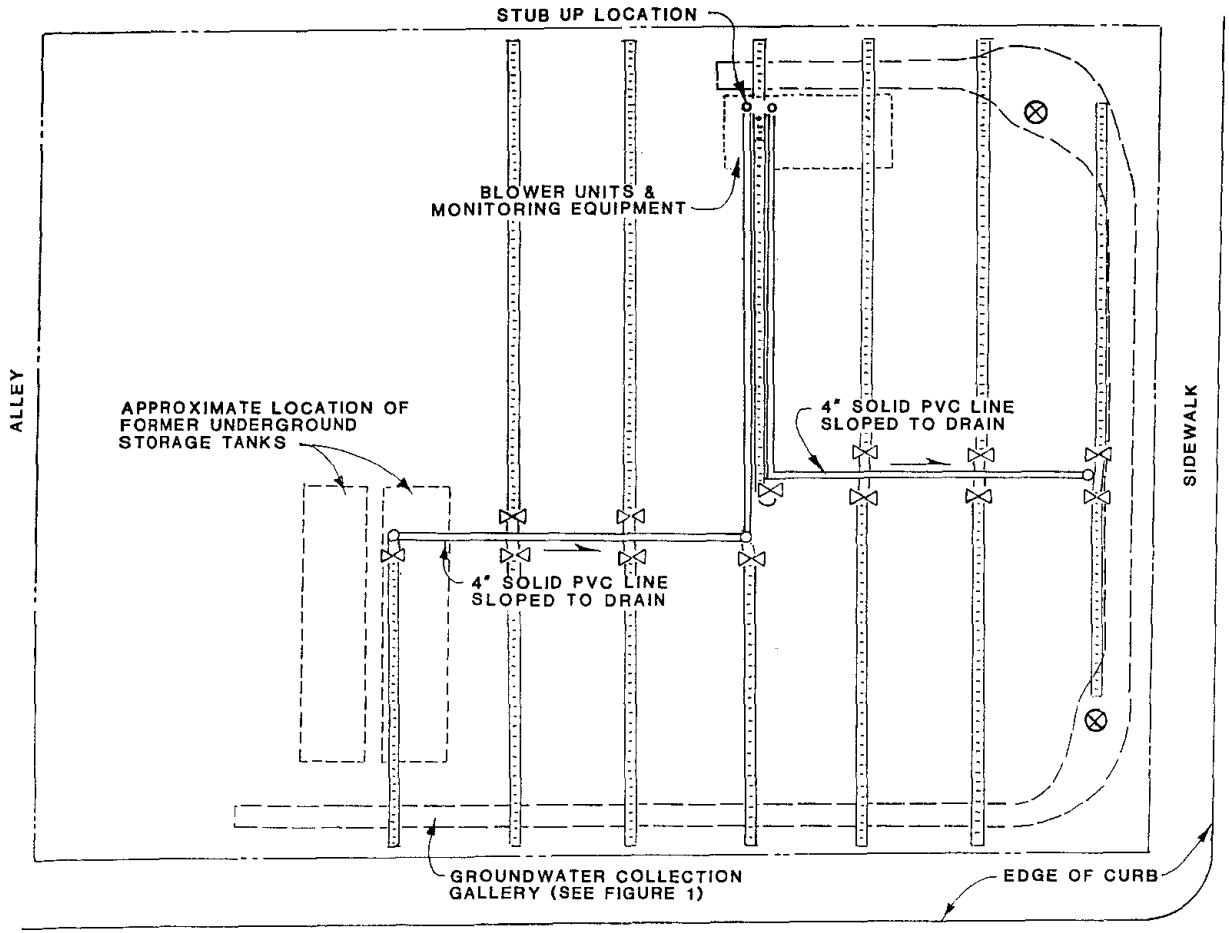


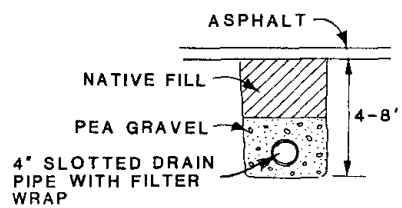
0034

0 15 30

APPROXIMATE SCALE IN FEET

KEY

- SOLID VACUUM LINE
- SLOTTED DRAIN PIPE
- 4" REGULATING GATE VALVE
- 4" PVC CLEANOUT
- 36" PERFORATED CMP COLLECTION SUMP



TYPICAL VENTING TRENCH CROSS SECTION
N.T.S.

UNOCAL SERVICE STATION No.4652
W. 15th AVENUE & C STREET
ANCHORAGE, ALASKA

AS BUILT SOIL VAPOR - VENTING SYSTEM CONFIGURATION

FIGURE 4

W.O. A-1204-8
BY DSW
DATE JAN 1990
SCALE NOTED

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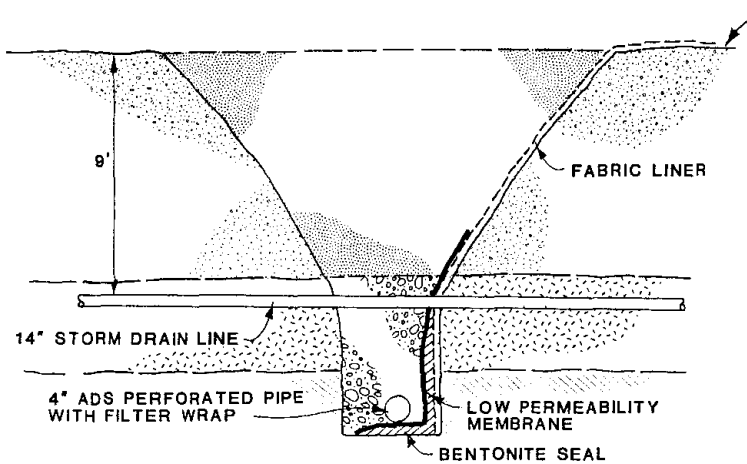
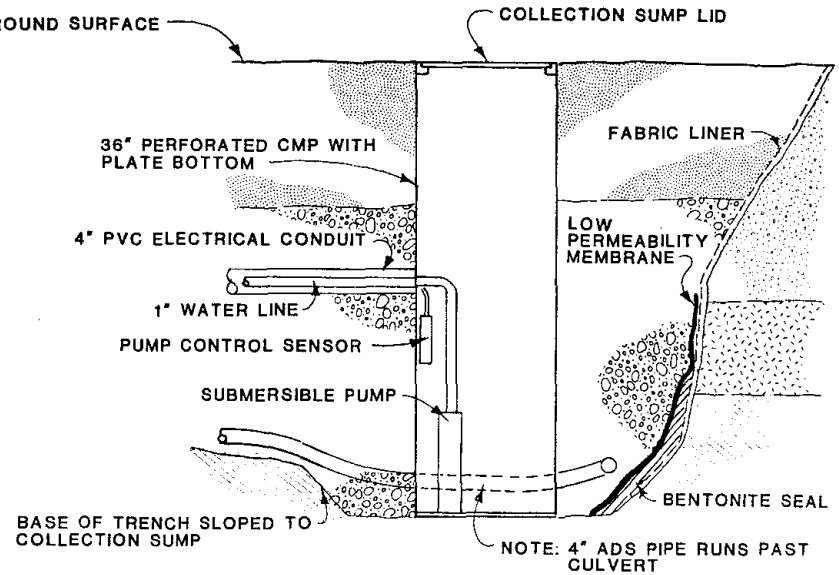


UTILITY CROSSING DETAIL D-D'
(TOTAL DEPTH 14 FEET)



COLLECTION SUMP DETAIL

TOTAL SUMP DEPTHS

No. 1	13.5 FEET
No. 2	16 FEET
No. 3	14 FEET

LEGEND

- UNCOMPACTED DISTURBED NATIVE SOILS
- PEA GRAVEL
- SANDY FILL
- SILTY OUTWASH DEPOSIT (SEEPAGE ZONE)
- SILTY CLAY (BOOTLEGGER COVE FORMATION)

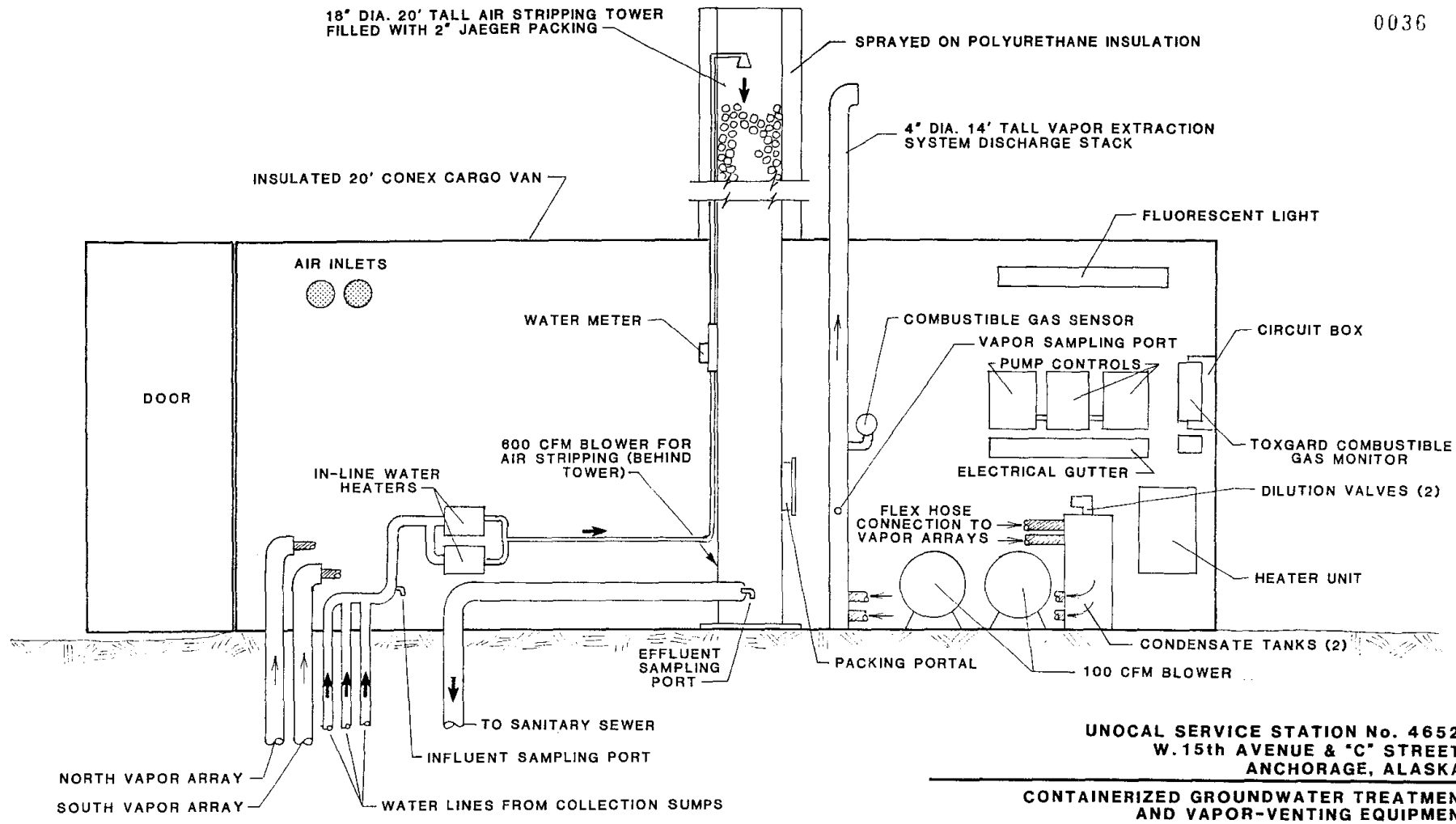
UNOCAL SERVICE STATION No.4652
W. 15th AVENUE & "C" STREET
ANCHORAGE, ALASKA

GROUNDWATER COLLECTION SYSTEM
AS-BUILT CONSTRUCTION DETAILS

FIGURE 3

W.O. A-1204-8
BY CAM
DATE JAN 1990
SCALE N.T.S.

RZA
RZA, INC.
Geotechnical & Environmental Consultants
711 'H' Street, Suite 450
Anchorage, Alaska 99501



NOTE:

← WATER FLOW

← VAPOR FLOW

WIRING AND PLUMBING OMITTED, OR SIMPLIFIED FOR CLARITY.

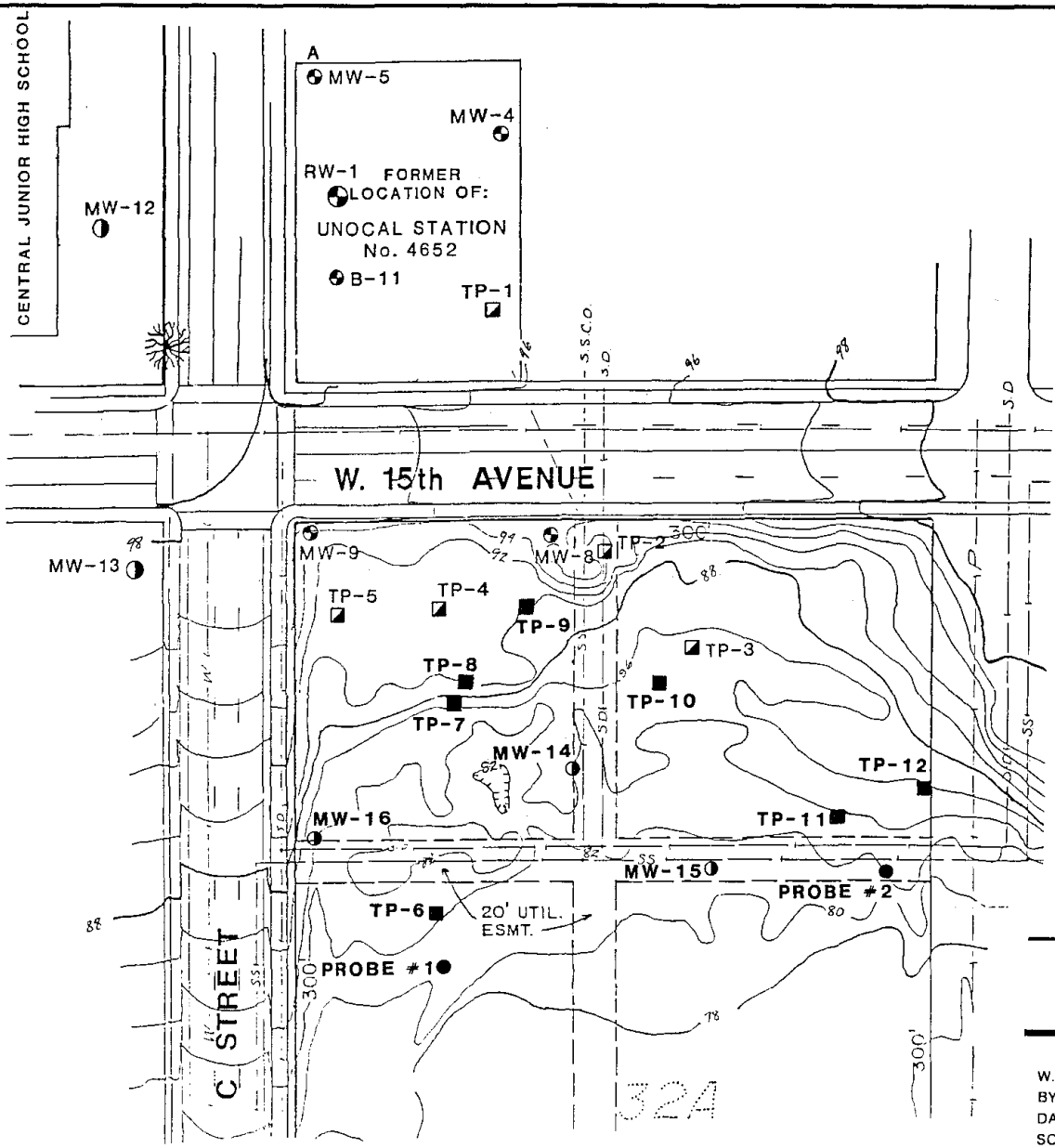
UNOCAL SERVICE STATION No. 4652
W.15th AVENUE & "C" STREET
ANCHORAGE, ALASKA

CONTAINERIZED GROUNDWATER TREATMENT AND VAPOR-VENTING EQUIPMENT

FIGURE 5

W.O. A-1204-8
BY DSW
DATE JAN 1990
SCALE N.T.S.

RZA
RZA, INC.
Geotechnical & Environmental Consultants
711 'H' Street, Suite 450
Anchorage, Alaska 99501



N

0037

0 50 100

APPROXIMATE SCALE IN FEET

LEGEND

- EXISTING MONITORING WELLS (1986)
- CONTAMINATION ASSESSMENT WELLS (1988-1989)
- SOIL PROBES (1988)
- TEST PITS (1988)
- TEST PITS (1989)

NOTE: SURFACE ELEVATIONS ARE RELATIVE TO AN ASSIGNED DATUM.

UNOCAL SERVICE STATION No. 4652
W. 15th AVENUE & "C" STREET
ANCHORAGE, ALASKA

MONITORING WELL & TEST PIT LOCATION PLAN

FIGURE 6

W.O. A-1204-8
BY DSW
DATE JAN 1990
SCALE NOTED

RZA, INC.
Geotechnical & Environmental Consultants
711 'H' Street, Suite 450
Anchorage, Alaska 99501

TABLE 1

EXCAVATION
SOIL SAMPLE ANALYSES

Job Name: UNOCAL #4652, Job Number: A-1204-8
Address: 15TH & C ST.
ANCHORAGE, ALASKA

PARAMETER :	BENZENE (mg/kg)	TOLUENE (mg/kg)	ETHYL-BENZENE (mg/kg)	XYLENES, TOTAL (mg/kg)	TOTAL PETROLEUM HYDROCARBONS (mg/kg) *
ON - SITE COLLECTION GALLERY SAMPLES					
LS-1 BASE AT SUMP 1	--	--	--	--	<10*
LS-2 BASE AT SUMP 2	--	--	--	--	<10*
LS-3 BASE 20' E. OF SUMP 1	--	--	--	--	<10*
LS-4 BASE AT OLD WATER LINE TRENCH	--	--	--	--	<10*
OFF - SITE COLLECTION GALLERY SAMPLES					
A-1 E. END SIDEWALL	<0.05	<0.05	<0.05	<0.05	<10*
A-3 E. END BASE	--	--	--	--	19.2
A-4 N. SIDEWALL	0.47	0.05	<0.05	<0.05	<10*
A-7 BASE AT SUMP 3	--	--	--	--	24.3
A-8 N. SIDEWALL AT UTILITY CROSSING	2.04	0.08	1.18	4.41	<10*
W-1 WATER SEEPAGE AT 4" SEWER LINE	0.275	0.196	<0.001	0.401	<10*
A-9 NEAR FORMER MW-10 LOCATION	--	--	--	--	30.7
A-10 BASE AT MID-PT	--	--	--	--	20.2
A-11 W. END SIDEWALL	0.27	<0.05	0.32	1.35	<10*
A-12 W. END BASE	--	--	--	--	22.6
WASTE OIL TANK AREA EXCAVATED SOILS					
W-1	<0.05	<0.05	<0.05	6.10	1438

	LEAD, TOTAL (mg/kg)	CHROMIUM, TOTAL (mg/kg)	ARSENIC, TOTAL (mg/kg)	HALOGENS, TOTAL (mg/kg)
W-1	48.8	17.2	4.8	<10

NOTES: * - TOTAL PETROLEUM HYDROCARBONS BY EPA METHOD 8015 (MODIFIED)
OTHER TPH TESTING BY EPA METHOD 418.1

BTEX DETERMINED BY EPA METHOD 8020

-- NOT ANALYZED

TABLE 2

WATER DISCHARGE MONITORING
EFFLUENT SAMPLE ANALYSES

Job Name: UNOCAL #4652, Job Number: A-1204-8
Address: 15TH & C ST.
ANCHORAGE, ALASKA

SAMPLE NO.	DATE	BENZENE (mg/l)	TOLUENE (mg/l)	ETHYL-BENZENE (mg/l)	XYLENES, TOTAL (mg/l)	TOTAL BTEX (mg/l)	TOTAL OIL & GREASE (mg/l)	COMMENTS	CUMULATIVE DISCHARGED VOLUME (gals)
S-1	12/12/89	0.027	0.035	0.002	0.028	0.092	0.7	(1)	0
EFL-1	12/15/89	0.049	0.075	0.008	0.116	0.248	9.0	(1)	4000
EFL-2	12/18/89	0.078	0.130	0.005	0.140	0.353	0.5	(1)	9540
EFL-3	12/20/89	0.037	0.120	0.011	0.170	0.338	<0.5	(2)	11700
EFL-4	12/22/89	0.014	0.032	0.003	0.048	0.097	<0.5	(2,3)	17910
EFL-5	01/05/90	0.030	0.048	0.004	0.072	0.154	0.6	(2,3)	23100
EFL-6	01/08/90	0.041	0.067	0.005	0.072	0.185	--	(3,4)	31080
EFL-7	01/09/90	0.001	0.010	0.001	0.038	0.050	--	(3,5)	32820
INFLUENT GROUNDWATER SAMPLE	12/22/89	5.830	6.000	0.114	3.380	15.324	--	(2)	18000

NOTES:

ANALYTICAL RESULTS REPORTED IN mg/L, UNITS EQUIVALENT TO PARTS PER MILLION (PPM).

BENZENE, TOLUENE, ETHYLBENZENE AND XYLENES ANALYZED BY EPA METHOD 602.

TOTAL OIL & GREASE ANALYZED BY EPA METHOD 413.2 OR SM 503B.

-- INDICATES SAMPLE NOT ANALYZED FOR THIS PARAMETER.

COMMENTS:

(1) COMBINED PUMPING RATE FROM SUMPS 1 AND 3 APPROXIMATELY 11.1 GALLONS PER MINUTE (GPM)

(2) COMBINED PUMPING RATE FROM SUMPS 1 AND 3 APPROXIMATELY 4.6 GPM.

(3) ADDITIONAL HEAT SUPPLIED TO STRIPPING TOWER AIR INTAKE.

(4) PUMPING FROM SUMP 1 ONLY, AT APPROXIMATELY 3 GPM.

(5) PUMPING FROM SUMP 3 ONLY AT APPROXIMATELY 3 GPM.

TABLE 3

SOIL-VAPOR VENTING SYSTEM
DISCHARGE MONITORING

Job Name: UNOCAL #4652, Job Number: A-1204-8
Address: 15TH & C ST.
ANCHORAGE, ALASKA

		EXHAUST STACK MEASUREMENTS			DOWNWIND MEASUREMENTS (1)			
DATE	TIME	TOXGARD READING (% LEL)	ORGANIC VAPOR METER - PID (ppm-v)	COLORIMETRIC TUBE (ppm-v)	ORGANIC VAPOR METER - PID (ppm-v)	WIND DIRECTION (ESTIMATED SPEED) (mph)	TEMPERATURE (degrees F)	COMMENTS
01/08/90	1150	--			BACKGROUND			
	1151	70.7*	1315		MEASUREMENTS			
	1154	58.7*	755		0.6 TO 0.9			
	1158	51.3*	429					
	1206	44.6*	743					
	1220	39.5*	1840					
	1254	34.5*	2125					
	1415	29.5*	1199					
	1425	19.9*	1872					CANISTER
	1440	19.6*	2070	>10 BENZENE	2.9	NE (5)	0	SAMPLES
	1800	17.4*	884	>10 BENZENE		NNW (10)	0	
01/09/90	0620	13.5	1574	>10 BENZENE	1.3	CALM	-10	(2)
	1100	12.8	1556	>10 BENZENE		CALM	5	(2)
	1610	12.1	1601	>10 BENZENE		CALM	-5	(2)
01/10/90	0725	10.4	1628	>10 BENZENE		CALM		(2)
	1020	10.2	1521	>10 BENZENE		CALM		(2)

NOTES: * - DENOTES UNDILUTED EXHAUST CONCENTRATION. DILUTION VALVES OPENED TO REACH ALLOWABLE DISCHARGE LEVELS. TOXGARD MONITOR PROGRAMMED FOR AUTOMATIC SHUT-OFF AT 20% LEL.

(1) DOWNWIND SURVEY LOCATIONS NOT YET FULLY ESTABLISHED. NO OVM DETECTABLE CONCENTRATIONS HAVE BEEN NOTED AT ANY LOCATION BEYOND THE SITE BOUNDARY.

(2) UNDER CALM AIR CONDITIONS A VISIBLE STEAM EXHAUST PLUME CAN BE SEEN RISING STRAIGHT INTO THE AIR.

CANISTER SAMPLE ANALYSES
BTEX BY EPA METHOD 8020

SAMPLE NO.	DATE	TIME	BENZENE (ug/L)	TOLUENE (ug/L)	ETHYLBENZENE (ug/L)	XYLENES,TOTAL (ug/L)
STACK-1	01/08/90	1440	29.8	51.6	5.1	40.5
DOWNWIND-1	01/08/90	1445	2.5	7.5	0.4	3.8

TABLE 4

TEST PITS ON RADER PROPERTY
SAMPLE ANALYSES

Job Name: UNOCAL #4652, Job Number: A-1204-8
Address: 15TH & C ST.
ANCHORAGE, ALASKA

PARAMETER :	BENZENE (mg/kg)	TOLUENE (mg/kg)	ETHYL-BENZENE (mg/kg)	XYLENES, TOTAL (mg/kg)	TOTAL PETROLEUM HYDROCARBONS (mg/kg)
TP-6	<0.05	0.08	0.19	0.06	<10
TP-7	<0.05	<0.05	<0.05	<0.05	<10
TP-8 SOIL	<0.05	<0.05	<0.05	<0.05	<10
TP-8 GROUNDWATER	<0.001	<0.001	<0.001	<0.001	--
TP-9	<0.05	<0.05	<0.05	<0.05	<10
TP-10	<0.05	<0.05	<0.05	<0.05	<10
TP-11	<0.05	<0.05	<0.05	<0.05	<10
TP-12	<0.05	<0.05	<0.05	<0.05	<10

NOTES:

TOTAL PETROLEUM HYDROCARBONS BY EPA METHOD 8015 (MODIFIED)

BTEX BY EPA METHOD 8020

-- NOT ANALYZED

TEST PIT LOGS

PROJECT UNOCAL 15th & C, Anchorage, AK W.O. A-1204-8

TEST PIT NO. TP-6 0043

DEPTH (feet)	SOIL DESCRIPTION Approximate ground surface elevation:	SAMPLE NUMBER	CAVING	SEEPAGE	MOISTURE CONTENT Plastic limit — Natural — Liquid limit 0 20 40 60 80 100	TESTING
0	Brown sandy SILT with some gravels, damp, includes organics, FILL.					
2						
4						
6	Dark brown fibrous PEAT, wet.	TP-6				1,2
8	Gray silty SAND to sandy SILT, damp Gray silty CLAY, damp, includes occasional fine gravel.					
10						
12						
14	Test pit completed at a depth of approximately 9.5 feet on October 24, 1989. No petroleum odors noticed at the time of excavating.					
16						
18						
20						
22						
24						

LEGEND

1) Indicates EPA Method 8020.

2) Indicates EPA Method 8015.

RZA

RITTENHOUSE-ZEMAN & ASSOCIATES, INC.
Geotechnical & Environmental Consultants

Test pit excavated: B.C. Excavating

Logged by: C. Morrison

PROJECT UNOCAL 15th & C, Anchorage, AK W.O. A-1204-8

0044

TEST PIT NO. TP-7

DEPTH (feet)	SOIL DESCRIPTION Approximate ground surface elevation:	SAMPLE NUMBER	CAVING	SEEPAGE	MOISTURE CONTENT Plastic limit — Natural — Liquid limit 0 20 40 60 80 100	TESTING
0	Dark brown PEAT, wet, soft.	TP-7				1,2
2	Brown silty SAND to sandy SILT, moist.					
4	Gray silty CLAY, damp.					
6						
8						
10						
12						
14						
16	Test pit completed at a depth of approximately 5 feet on October 24, 1989.					
18	No petroleum odors noticed at the time of excavating.					
20						
22						
24						

LEGEND

1) Indicates EPA Method 8020.

2) Indicates EPA Method 8015.

RZA
RITTENHOUSE-ZEMAN & ASSOCIATES, INC.
Geotechnical & Environmental Consultants

Test pit excavated: B.C. Excavating

Logged by: C. Morrison

PROJECT UNOCAL 15th & C, Anchorage, AK W.O. A-1204-8

TEST PIT NO. TP-8

0045

DEPTH (feet)	SOIL DESCRIPTION Approximate ground surface elevation:	SAMPLE NUMBER	CAVING	SEEPAGE	MOISTURE CONTENT Plastic limit — Natural — Liquid limit 0 20 40 60 80 100	TESTING
0	Dark brown organic SILT and PEAT, moist.					
2	Brown sandy SILT to silty SAND, damp, includes occasional gravel.					
4						
6						
8	Brown sandy GRAVEL with trace silt, wet.	TP-8				1,2, 3
	Gray silty fine SAND, damp.					
10	Gray silty CLAY, damp.					
12						
14						
16	Test pit completed at a depth of approximately 10 feet on October 24, 1989.					
	No petroleum odors noticed at the time of drilling.					
18						
20						
22						
24						

LEGEND

1) Indicates EPA Method 8020.

2) Indicates EPA Method 8015.

3) Indicates EPA Method 602 (water).

RZA

RITTENHOUSE-ZEMAN & ASSOCIATES, INC.
Geotechnical & Environmental Consultants

Test pit excavated: B.C. Excavating

Logged by: C. Morrison

PROJECT UNOCAL 15th & C, Anchorage, AK W.O. A-1204-8

TEST PIT NO. TP-9

0046

DEPTH (feet)	SOIL DESCRIPTION Approximate ground surface elevation:	SAMPLE NUMBER	CAVING	SEEPAGE	MOISTURE CONTENT Plastic limit — Natural — Liquid limit 0 20 40 60 80 100	TESTING
0	Dark brown organic SILT and PEAT, moist.					
2	Brown gravelly SAND, damp, includes layers of SILT.					
4						
6						
8	Brown sandy GRAVEL to gravelly SAND, wet.	TP-9				1,2
10	Gray silty CLAY, damp.					
12						
14	Test pit completed at a depth of approximately 9 feet on October 24, 1989.					
16	No petroleum odors noticed at the time of excavating.					
18						
20						
22						
24						

LEGEND

1) Indicates EPA Method 8020.

2) Indicates EPA Method 8015.

RZA

RITTENHOUSE-ZEMAN & ASSOCIATES, INC.
Geotechnical & Environmental Consultants

Test pit excavated: B.C. Excavating

Logged by: C. Morrison

PROJECT UNOCAL 15th & C, Anchorage, AK W.O. A-1204-8

0047

TEST PIT NO. TP-10

DEPTH (feet)	SOIL DESCRIPTION Approximate ground surface elevation:	SAMPLE NUMBER	CAVING	SEEPAGE	MOISTURE CONTENT Plastic limit — Natural — Liquid limit 0 20 40 60 80 100	TESTING
0	Dark brown organic SILT and PEAT, moist.					
2	Brown SILT, damp, includes organics	TP-10				1,2
4	Brown sandy GRAVEL to gravelly SAND, wet.					
	Gray silty CLAY, damp.					
6						
8						
10						
12						
14	Test pit completed at a depth of approximately 4 feet on October 24, 1989.					
16	No petroleum odors noticed at the time of excavating.					
18						
20						
22						
24						

LEGEND

1) Indicates EPA Method 8020.

2) Indicates EPA Method 8015.

RZA

RITTENHOUSE-ZEMAN & ASSOCIATES, INC.
Geotechnical & Environmental Consultants

Test pit excavated: B.C. Excavating

Logged by: C. Morrison

PROJECT UNOCAL 15th & C, Anchorage, AK W.O. A-1204-8

TEST PIT NO. TP-11 0048

DEPTH (feet)	SOIL DESCRIPTION Approximate ground surface elevation:	SAMPLE NUMBER	CAVING	SEEPAGE	MOISTURE CONTENT Plastic limit — Natural — Liquid limit 0 20 40 60 80 100	TESTING
0	Dark brown organic SILT and PEAT, moist.					
2	Brown SILT, damp, includes organics.					
	Brown sandy GRAVEL to gravelly SAND, wet.	TP-11				1,2
4	Gray silty CLAY, damp.					
6						
8						
10						
12						
14	Test pit completed at a depth of approximately 4 feet on October 24, 1989.					
16	No petroleum odors noticed at the time of excavating.					
18						
20						
22						
24						

LEGEND

1) Indicates EPA Method 8020.

2) Indicates EPA Method 8015.

RZA

RITTENHOUSE-ZEMAN & ASSOCIATES, INC.
Geotechnical & Environmental Consultants

Test pit excavated: B.C. Excavating

Logged by: C. Morrison

PROJECT UNOCAL 15th & C, Anchorage AK W.O. A-1204-8

TEST PIT NO. TP-12 0049

DEPTH (feet)	SOIL DESCRIPTION Approximate ground surface elevation:	SAMPLE NUMBER	CAVING	SEEPAGE	MOISTURE CONTENT Plastic limit — Natural — Liquid limit 0 20 40 60 80 100	TESTING
0	Dark brown PEAT, moist, soft.					
2	Brown fine SAND, moist, includes occasional gravel.					
	Becomes wet.	TP-12				1,2
4	Gray silty CLAY, damp.					
6						
8						
10						
12						
14						
16	Test pit completed at a depth of approximately 5 feet on October 24, 1989.					
18	No petroleum odors noticed at the time of excavating.					
20						
22						
24						

LEGEND

1) Indicates EPA Method 8020.

2) Indicates EPA Method 8015.

RZA

RITTENHOUSE-ZEMAN & ASSOCIATES, INC.
Geotechnical & Environmental Consultants

Test pit excavated: B.C. Excavating

Logged by: C. Morrison

APPENDIX

LABORATORY ANALYTICAL REPORTS

WASTE OIL TANK AREA EXCAVATED SOILS

SOUND ANALYTICAL SERVICES, INC.

SPECIALIZING IN INDUSTRIAL & TOXIC WASTE ANALYSIS
4630 PACIFIC HIGHWAY EAST, SUITE B-14, TACOMA, WASHINGTON 98424 - TELEPHONE (206)922-2310 - FAX (206)922- 5047

Report To: Rittenhouse-Zeman Date: November 13, 1989

Report On: Analysis of Soil Lab No.: 8433

IDENTIFICATION:
Samples Received on 11-08-89
Project: A-1204-8 Unocal 15th & C Street

ANALYSIS:

WASTE OIL TANK
EXCAVATED SOILS

Lab Sample No. 1 Client ID: W-1

Benzene, mg/kg	< 0.05
Toluene, mg/kg	< 0.05
Ethyl Benzene, mg/kg	< 0.05
Xylenes, mg/kg	6.10

BTEX by EPA SW-846 Method 8020

Total Petroleum Hydrocarbons, mg/kg by EPA Method 418.1	1,438
Total Halogens, mg/kg	< 10

Arsenic, mg/kg	4.8
Chromium, mg/kg	17.2
Lead, mg/kg	48.8

SOUND ANALYTICAL SERVICES

STAN P. PALMQUIST

The report is issued solely for the use of the person or company to whom it is addressed. This laboratory accepts responsibility only for the due performance of analysis in accordance with industry acceptable practice. In no event shall Sound Analytical Services, Inc. or its employees be responsible for consequential or special damages in any kind or in any amount.

DUPLICATES

Lab No: 8433
Date: November 13, 1989
Client: Rittenhouse-Zeman

Client ID: W-1
Matrix: Soil
Units: mg/kg

Compound	Sample(S)	Duplicate(D)	RPD*	
Total Petroleum Hydrocarbons	1,438	1,424	1.0	

*RPD = relative percent difference
= [(S - D) / ((S + D) / 2)] x 100

ON-SITE EXCAVATION BASE SAMPLES

Report On: Analysis of Soil Lab No.: 8432

IDENTIFICATION:
Samples Received on 11-08-89
Project: A-1204-8 Unocal 15th & C Street

ANALYSIS:

Laboratory Sample No.	Client Identification	Total Petroleum Fuel Hydrocarbons by EPA SW-846 Modified Method 8015
1	Sump #1 Base	< 10
2	Base of Sump #2	< 10
3	17' East of Sump #1 Base	< 10
4	Base 5' West of Key Box	< 10

SOUND ANALYTICAL SERVICES

STAN P. PALMQUIST

OFF-SITE TRENCH SAMPLES

Report On: Analysis of Soil & Water Lab No.: 8723

IDENTIFICATION:
Samples Received on 11-30-89
Project: A-1204-8 Unocal 15th & C

ANALYSIS:

Lab Sample No.	Rush 1	Rush 2	Rush 3
Client ID	A-1	A-4	A-8
Matrix/Units	Soil mg/kg	Soil mg/kg	Soil mg/kg
Benzene, mg/kg	< 0.05	0.47	2.04
Toluene, mg/kg	< 0.05	0.05	0.08
Ethyl Benzene, mg/kg	< 0.05	< 0.05	1.18
Xylenes, mg/kg (BTEX by EPA SW-846 Method 8020	< 0.05	< 0.05	4.41
Total Petroleum Fuel Hydrocarbons, mg/kg by EPA SW-846 Modified Method 8015	< 10	< 10	< 10

Continued . . . .

Lab No. 8723
December 1, 1989

Lab Sample No.	6	7	8
Client ID	A-13	A-11	W-1
Matrix/Units	Soil mg/kg	Soil mg/kg	Water mg/l
Benzene, mg/kg	0.19	0.27	0.275
Toluene, mg/kg	0.21	< 0.05	0.196
Ethyl Benzene, mg/kg	< 0.05	0.32	< 0.001
Xylenes, mg/kg (BTEX by EPA SW-846 Method 8020	0.55	1.35	0.401
Total Petroleum Fuel Hydrocarbons, mg/kg by EPA SW-846 Modified Method 8015	< 10	< 10	< 10

Continued . . .

Lab No. 8723
December 1, 1989

Lab Sample No.	Client ID	Total Petroleum Hydrocarbons, mg/kg
RUSH 4	A-3	19.2
RUSH 5	A-7	24.3
9	A-9	30.7
10	A-10	20.2
11	A-12	22.6

(TPH by EPA Method 418.1)

SOUND ANALYTICAL SERVICES

C. LARRY ZURAW

TEST PIT SAMPLES

Report On: Analysis of Soil & Water Lab No.: 8249
Page 1 of 2

IDENTIFICATION:
Samples Received on 10-27-89
Project: A-1204-8A Unocal 15th & C

ANALYSIS:

Lab Sample No.	1	2	3	4
Client Identification	TP-6	TP-7	TP-8	TP-9
Matrix/Units	Soil mg/kg	Soil mg/kg	Soil mg/kg	Soil mg/kg
Benzene	< 0.05	< 0.05	< 0.05	< 0.05
Toluene	0.08	< 0.05	< 0.05	< 0.05
Ethyl Benzene	0.19	< 0.05	< 0.05	< 0.05
Xylenes	0.06	< 0.05	< 0.05	< 0.05
BTEX by EPA SW-846 Method 8020				
Total Petroleum Fuel Hydrocarbons	< 10	< 10	< 10	< 10
TPH by EPA SW-846 Modified Method 8015				

November 2, 1989

Lab Sample No.	5	6	7	8
Client Identification	TP-10	TP-11	TP-12	TP-8W
Matrix/Units	Soil mg/kg	Soil mg/kg	Soil mg/kg	Water mg/l
Benzene	< 0.05	< 0.05	< 0.05	< 0.001
Toluene	< 0.05	< 0.05	< 0.05	< 0.001
Ethyl Benzene	< 0.05	< 0.05	< 0.05	< 0.001
Xylenes	< 0.05	< 0.05	< 0.05	< 0.001
BTEX by EPA SW-846 Method 8020				
Total Petroleum Fuel Hydrocarbons	< 10	< 10	< 10	NT
TPH by EPA SW-846 Modified Method 8015				

SOUND ANALYTICAL SERVICES

C. LARRY ZURAW

GROUNDWATER DISCHARGE MONITORING SAMPLES

Rittenhouse-Zeman & Associates
1400 140th Avenue N.E.
Bellevue, Washington 98005

Attn: Dan Whitman

Date Arrived: 12/12/89
Time Arrived: 1745
Date Sampled: 12/12/89
Time Sampled: 1735
Date Completed: 12/13/89

Source: 15th & C Street
Sample ID#: A121289-23,24

Parameter	Units	A121289-23 S-1	A121289-24 Travel Blank	Standard Detection Limit
Purgeable Aromatics: EPA Method 602				
Benzene	ug/l	27	<DL	0.2
Chlorobenzene	ug/l	<DL	<DL	0.2
1,2-Dichlorobenzene	ug/l	<DL	<DL	0.2
1,3-Dichlorobenzene	ug/l	<DL	<DL	0.2
1,4-Dichlorobenzene	ug/l	<DL	<DL	0.2
Toluene	ug/l	35	<DL	0.2
Ethylbenzene	ug/l	2.2	<DL	0.2
Xylenes	ug/l	28	<DL	0.6

Rittenhouse-Zeman & Associates
1400 140th Avenue, N.E.
Bellevue, Washington 98005

Attn: Dan Whitman

Date Arrived: 12/12/89
Time Arrived: 1745
Date Sampled: 12/12/89
Time Sampled: 1735
Date Completed: 12/13/89

Source: 15th & C Street
Sample ID#: A121289-23

Parameter	Unit	A121289-23 S-1
Oil & Grease	mg/l	0.7
Total Dissolved Solids	mg/l	820/820

Quality Control Report

Client: RZA
ID#: A121289-23,24

Listed below are quality control assurance reference samples with a known concentration prior to analysis. The acceptable limits represent a 95% confidence interval established by the Environmental Protection Agency or by our laboratory through repetitive analyses of the reference sample. The reference samples indicated below were analyzed at the same time as your sample, ensuring the accuracy of your results.

Standard ID#	Parameter	Unit	Result	Acceptable Limit
NTL CCC5	Benzene	ug/l	5.4	4.1 - 6.1
	Toluene	ug/l	6.7	5.1 - 7.6
	Chlorobenzene	ug/l	6.4	5.8 - 8.8
	Ethylbenzene	ug/l	7.0	5.0 - 7.5
	p,m-Xylene	ug/l	11.3	8.7 - 13.1
	o-Xylene	ug/l	9.0	7.0 - 10.5
	1,3-Dichlorobenzene	ug/l	8.8	8.0 - 12.0
	1,4-Dichlorobenzene	ug/l	20.6	14.8 - 22.2
EPA WP379-1	Oil & Grease	mg/l	20.1	16.6 - 23.4
NTL STD	Total Dissolved Solids	mg/l	298	270 - 330

Report On: Analysis of Water Lab No.: 9029

IDENTIFICATION:
Samples Received on 12-21-89
Project No : A-1204-8 Unocal 15th & C

ANALYSIS:

Lab Sample No: RUSH 1 ELF-1

Benzene, mg/l	0.049
Toluene, mg/l	0.075
Ethyl Benzene, mg/l	0.008
Xylenes, mg/l	0.116

(BTEX by EPA 8020)

Oil and Grease, mg/l	9.0

Test Method: Standard Method 503B

SOUND ANALYTICAL SERVICES

C. LARRY ZURAW

Report On: Analysis of Water Lab No.: 9029

IDENTIFICATION:
Samples Received on 12-21-89
Project No : A-1204-8 Unocal 15th & C

ANALYSIS:

Lab Sample No: RUSH 1 ELF-1

Benzene, mg/l	0.049
Toluene, mg/l	0.075
Ethyl Benzene, mg/l	0.008
Xylenes, mg/l	0.116

(BTEX by EPA 8020)

Oil and Grease, mg/l	9.0

Test Method: Standard Method 503B

SOUND ANALYTICAL SERVICES

C. LARRY ZURAW

Rittenhouse,Zehman & Associates
711 H. Street, Suite 450
Anchorage, AK. 99501

Attn: Cliff Morrison

Date Arrived: 12/19/89
Time Arrived: 1009
Date Sampled: 12/18/89
Time Sampled: 1705
Date Completed: 12/19/89

Source: Unocal 15th & C
Sample ID#: A121989-4

Parameter	Units	A121989-4 ELF-2	Standard Detection Limit
Purgeable Aromatics: EPA Method 602			
Benzene	ug/l	78	0.2
Chlorobenzene	ug/l	<DL	0.2
1,2-Dichlorobenzene	ug/l	<DL	0.2
1,3-Dichlorobenzene	ug/l	<DL	0.2
1,4-Dichlorobenzene	ug/l	<DL	0.2
Toluene	ug/l	130	0.2
Ethylbenzene	ug/l	4.9	0.2
Xylenes	ug/l	140	0.6

Also present: 1,2-Dichloroethane, Ethylene Dibromide

Rittenhouse,Zenman & Associates
711 H. Street, Suite 450
Anchorage, AK. 99501

Attn: Cliff Morrison

Date Arrived: 12/19/89
Time Arrived: 1009
Date Sampled: 12/18/89
Time Sampled: 1705
Date Completed: 12/19/89

Source: Unocal 15th & C
Sample ID#: A121989-4

Parameter	Unit	A121989-4 ELF-2
Oil & Grease, Total Recoverable: EPA Method 413.2		
Oil & Grease	mg/l	0.5

Quality Control Report
==========

Client: RZA
ID#: A121989-4

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Standard ID#	Parameter	Unit	Result	Acceptable Limit
NTL CCC5	Benzene	ug/l	5.6	4.1 - 6.1
	Toluene	ug/l	7.2	5.1 - 7.6
	Chlorobenzene	ug/l	7.9	5.8 - 8.8
	Ethylbenzene	ug/l	6.2	5.0 - 7.5
	p,m-Xylene	ug/l	11.9	8.7 - 13.1
	o-Xylene	ug/l	9.4	7.0 - 10.5
	1,3-Dichlorobenzene	ug/l	9.0	8.0 - 12.0
	1,4-Dichlorobenzene	ug/l	21.7	14.8 - 22.2
	1,2-Dichlorobenzene	ug/l	9.7	8.3 - 12.5
EPA WP379-1	Oil & Grease	mg/l	19.4	16.6 - 23.4

NORTHERN TESTING LABORATORIES, INC.

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2505 FAIRBANKS STREET, ANCHORAGE, ALASKA 99503, 907-277-8378

Rittenhouse,Zehman & Associates
711 H. Street, Suite 450
Anchorage, AK. 99501

Attn: Cliff Morrison

Date Arrived: 12/20/89
Time Arrived: 1700
Date Sampled: 12/20/89
Time Sampled: 1650
Date Completed: 12/20/89

Source: Unocal 15th & C, Ground Water
Sample ID#: A122089-10

Parameter	Units	A122089-10 ELF-3	Standard Detection Limit
Purgeable Aromatics: EPA Method 602			
Benzene	ug/l	37	0.2
Chlorobenzene	ug/l	<0.5	0.2
1,2-Dichlorobenzene	ug/l	<0.5	0.2
1,3-Dichlorobenzene	ug/l	<0.5	0.2
1,4-Dichlorobenzene	ug/l	<0.5	0.2
Toluene	ug/l	120	0.2
Ethylbenzene	ug/l	11	0.2
Xylenes	ug/l	170	0.6

Reported By: [signature] Date: 12/21/89

Francois Rodigari, Anchorage Operations Manager

NORTHERN TESTING LABORATORIES, INC.

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2505 FAIRBANKS STREET, ANCHORAGE, ALASKA 99503, 907-277-8378

0073

Rittenhouse,Zehman & Associates
711 H. Street, Suite 450
Anchorage, AK. 99501

Attn: Cliff Morrison

Date Arrived: 12/20/89
Time Arrived: 1700
Date Sampled: 12/20/89
Time Sampled: 1650
Date Completed: 12/21/89

Source: Unocal 15th & C, Ground Water
Sample ID#: A122089-10

Parameter	Unit	A122089-10 ELF-3
Oil & Grease, Total Recoverable: EPA Method 413.2		
Oil & Grease	mg/l	<0.44

Reported By: [signature] Date: 12/21/89

Francois Rodigari, Anchorage Operations Manager

NORTHERN TESTING LABORATORIES, INC.

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Quality Control Report

Client: RZA
ID#: A122089-10

Listed below are quality control assurance reference samples with a known concentration prior to analysis. The acceptable limits represent a 95% confidence interval established by the Environmental Protection Agency or by our laboratory through repetitive analyses of the reference sample. The reference samples indicated below were analyzed at the same time as your sample, ensuring the accuracy of your results.

Standard ID#	Parameter	Unit	Result	Acceptable Limit
NTL CCC5	Benzene	ug/l	5.7	4.1 - 6.1
	Toluene	ug/l	7.1	5.1 - 7.6
	Chlorobenzene	ug/l	8.1	5.8 - 8.8
	Ethylbenzene	ug/l	6.4	5.0 - 7.5
	p,m-Xylene	ug/l	13.0	8.7 - 13.1
	o-Xylene	ug/l	9.9	7.0 - 10.5
	1,3-Dichlorobenzene	ug/l	10.1	8.0 - 12.0
	1,2-Dichlorobenzene	ug/l	12.0	8.3 - 12.5
EPA 379-1	Oil & Grease	mg/l	19.1	16.6 - 23.4

Reported By: Date: 12/21/89

Francois Rodigari, Anchorage Operations Manager

NORTHERN TESTING LABORATORIES, INC.

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2505 FAIRBANKS STREET, ANCHORAGE, ALASKA 99503, 907-277-8378

Rittenhouse,Zehman & Associates
711 H. Street, Suite 450
Anchorage, AK. 99501

Attn: Cliff Morrison

Date Arrived: 12/22/89
Time Arrived: 1147
Date Sampled: 12/22/89
Time Sampled: 1130
Date Completed: 12/22/89

Source: Unocal 15th & C EFL-4
Sample ID#: A122289-2

Parameter	Units	A122289-2	Standard Detection Limit
Purgeable Aromatics: EPA Method 602			
Benzene	ug/l	14	0.2
Chlorobenzene	ug/l	<DL	0.2
1,2-Dichlorobenzene	ug/l	<DL	0.2
1,3-Dichlorobenzene	ug/l	<DL	0.2
1,4-Dichlorobenzene	ug/l	<DL	0.2
Toluene	ug/l	32	0.2
Ethylbenzene	ug/l	3	0.2
Xylenes	ug/l	48	0.6

Reported By: W. E. Bud Date: 01/03/90

For: Francois Rodigari, Anchorage Operations Manager

NORTHERN TESTING LABORATORIES, INC.

600 UNIVERSITY PLAZA WEST, SUITE A — FAIRBANKS, ALASKA 99709 — 907-479-3115
2505 FAIRBANKS STREET — ANCHORAGE, ALASKA 99503 — 907-277-8378

Rittenhouse, Zehman & Associates
711 H. Street, Suite 450
Anchorage, AK. 99501

Attn: Cliff Morrison

Date Arrived: 12/22/89
Time Arrived: 1147
Date Sampled: 12/22/89
Time Sampled: 1130
Date Completed: 01/02/90

Source: Unocal 15th @ C EFL-4
Sample ID#: A122289-1

NTL ID#	Client ID	Oil & Grease mg/L
Oil & Grease:	EPA Method 413.2	<0.44

Reported By: W. E. Buck Date: 01/03/90

For: Francois Rodigari, Anchorage Operations Manager

NORTHERN TESTING LABORATORIES, INC.

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Quality Control Report

Client: RZA
ID#: A122289-1,2

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Standard ID#	Parameter	Unit	Result	Acceptable Limit
NTL CCC5	Benzene	ug/l	5.7	4.1 - 6.1
	Toluene	ug/l	6.6	5.1 - 7.6
	Chlorobenzene	ug/l	7.7	5.8 - 8.8
	Ethylbenzene	ug/l	5.9	5.0 - 7.5
	p,m-Xylene	ug/l	11.5	8.7 - 13.1
	o-Xylene	ug/l	9.2	7.0 - 10.5
	1,3-Dichlorobenzene	ug/l	9.3	8.0 - 12.0
	1,4-Dichlorobenzene	ug/l	20.7	14.8 - 22.2
EPA WP379-1	Oil & Grease	mg/l	19.7	16.6 - 23.4

Reported By: W. E. Ewell Date: 01/03/90

For Francois Rodigari, Anchorage Operations Manager

NORTHERN TESTING LABORATORIES, INC.

600 UNIVERSITY PLAZA WEST, SUITE A — FAIRBANKS, ALASKA 99709 — 907-479-3115
2505 FAIRBANKS STREET — ANCHORAGE, ALASKA 99503 — 907-277-8378

Rittenhouse,Zehman Associates
711 H. Street, Suite 450
Anchorage, AK. 99501

Attn: Cliff Morrison

Date Arrived: 01/05/90
Time Arrived: 1005
Date Sampled: 01/05/90
Time Sampled: 0950
Date Completed: 01/05/90

Source: Unocal 15th & C/Ground Water
Sample ID#: A010590-8

Parameter	Units	A010590-8 EFL-5	Standard Detection Limit
Purgeable Aromatics: EPA Method 602			
Benzene	ug/l	30	0.2
Chlorobenzene	ug/l	<DL	0.2
1,2-Dichlorobenzene	ug/l	<DL	0.2
1,3-Dichlorobenzene	ug/l	<DL	0.2
1,4-Dichlorobenzene	ug/l	<DL	0.2
Toluene	ug/l	48	0.2
Ethylbenzene	ug/l	4.2	0.2
Xylenes	ug/l	72	0.6

Reported By: Allison M. Mattson FOR FRANCOIS RODIGARI Date: 01/09/90

Francois Rodigari, Anchorage Operations Manager

NORTHERN TESTING LABORATORIES, INC.

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0078

Rittenhouse,Zehman Associates
711 H. Street, Suite 450
Anchorage, AK. 99501

Attn: Cliff Morrison

Date Arrived: 01/05/90
Time Arrived: 1005
Date Sampled: 01/05/90
Time Sampled: 0950
Date Completed: 01/09/90

Source: Unocal 15th & C/Ground Water
Sample ID#: A010590-8

Parameter	Unit	A010590-8 EFL-5
Oil & Grease	mg/l	0.6

Reported By: Dawn M. Matson FOR FRANCOIS RODIGARI Date: 01/09/90

Francois Rodigari, Anchorage Operations Manager

NORTHERN TESTING LABORATORIES, INC.

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2505 FAIRBANKS STREET — ANCHORAGE, ALASKA 99503 — 907-277-8378

Quality Control Report

Client: RZA
ID#: A010590-8

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Standard ID#	Parameter	Unit	Result	Acceptable Limit
NTL CCC5	Benzene	ug/l	5.3	4.1 - 6.1
	Toluene	ug/l	6.8	5.1 - 7.6
	Chlorobenzene	ug/l	7.0	5.8 - 8.8
	Ethylbenzene	ug/l	5.5	5.0 - 7.5
	p,m-Xylene	ug/l	10.9	8.7 - 13.1
	o-Xylene	ug/l	8.5	7.0 - 10.5
	1,3-Dichlorobenzene	ug/l	8.6	8.0 - 12.0
	1,4-Dichlorobenzene	ug/l	18.5	14.8 - 22.2
	1,2-Dichlorobenzene	ug/l	9.3	8.3 - 12.5
EPA WP379-1	Oil & Grease	mg/l	20.7	16.6 - 23.4

Reported By: [signature] Date: 01/09/90

For: Francois Rodigari, Anchorage Operations Manager

NORTHERN TESTING LABORATORIES, INC.

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Rittenhouse-Zeman & Associates
711 H. Street, Suite 450
Anchorage, AK. 99501

Attn: Cliff Morrison

Date Arrived: 01/08/90
Time Arrived: 1505
Date Sampled: 01/06/90
Time Sampled: 1445
Date Completed: 01/08/90

Source: Unocal 15th & C.
Sample ID#: A010890-10

Parameter	Units	A010890-10 EFL-6	Standard Detection Limit
Purgeable Aromatics: EPA Method 602			
Benzene	ug/l	41	0.2
Chlorobenzene	ug/l	<DL	0.2
1,2-Dichlorobenzene	ug/l	<DL	0.2
1,3-Dichlorobenzene	ug/l	<DL	0.2
1,4-Dichlorobenzene	ug/l	<DL	0.2
Toluene	ug/l	67	0.2
Ethylbenzene	ug/l	4.9	0.2
Xylenes	ug/l	72	0.6

Reported By: W. E. Beck Date: 01/09/90

For: Francois Rodigari, Anchorage Operations Manager

NORTHERN TESTING LABORATORIES, INC.

600 UNIVERSITY PLAZA WEST, SUITE A, FAIRBANKS, ALASKA 99709, 907-479-3115
2505 FAIRBANKS STREET, ANCHORAGE, ALASKA 99503, 907-277-8378

Quality Control Report

Client: RZA
ID#: A010890-10

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Standard ID#	Parameter	Unit	Result	Acceptable Limit
NTL CCC5	Benzene	ug/l	5.3	4.1 - 6.1
	Toluene	ug/l	6.0	5.1 - 7.6
	Chlorobenzene	ug/l	7.4	5.8 - 8.8
	Ethylbenzene	ug/l	5.2	5.0 - 7.5
	p,m-Xylene	ug/l	10.1	8.7 - 13.1
	o-Xylene	ug/l	8.5	7.0 - 10.5
	1,3-Dichlorobenzene	ug/l	8.5	8.0 - 12.0
	1,4-Dichlorobenzene	ug/l	20.5	14.8 - 22.2
	1,2-Dichlorobenzene	ug/l	9.4	8.3 - 12.5

Reported By: G.E. Bull Date: 01/09/90

For: Francois Rodigari, Anchorage Operations Manager

RZA
RITTENHOUSE-ZEMAN & ASSOCIATES, INC.
Geotechnical & Environmental Consultants
7409 S.W. Tech Center Drive Suite 135
Portland, Oregon 97223-8024
(503) 639-3400 / FAX (503) 620-7892

Report Date: January 3, 1990
Lab Report #: 1089 kn/cmw

Job Number: A1204-8
Item: 1 Water Sample

Client: 15th and C Street
Attn: Dan Whitman

Date Ran: December 27, 1989

ANALYSIS

METHOD: BETX by EPA 8020
Results in ug/L (ppb)

	Influent	Blank
Benzene	5830	nd
Ethylbenzene	114	nd
Toluene	6000	< 200
m/p-Xylene	2200	< 200
o-Xylene	1180	nd
Detection Limit:	10	10

Average Surrogate Recovery of a,a,a-Trifluorotoluene: 91.4 %

Respectfully Submitted,

Rittenhouse-Zeman & Associates, Inc.

Kathy Newell

Kathy Newell, Chemist

Reviewed by: C Mitch Walker