SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

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October 13, 1998

Abide International, Inc.
P.O. Box 1631
Richland, Washington 99352

Attn: Mr. Craig Frantz, Project Manager

RE: PRELIMINARY PHASE 2 ENVIRONMENTAL SITE ASSESSMENT, CLOSED UST, FEDERAL BUILDING, RICHLAND, WASHINGTON

At your request, Shannon & Wilson provided environmental consulting services at the Federal Building site in Richland, Washington. A limited Phase 2 investigation was performed to collect soil and groundwater samples in the vicinity of a closed-in-place diesel fuel underground storage tank (UST). The objective of the Phase 2 investigation was to further evaluate subsurface conditions in the vicinity of the UST where subsurface soil contamination had previously been detected. The scope of services included analytical testing of samples to generate data for a possible risk-based closure of the site.

We appreciate the opportunity to work with you on this project. We would be pleased to discuss the preliminary findings and our recommendations with you. Please contact our office if you have any questions.

Sincerely,

SHANNON & WILSON, INC.

Dee J. Burrie, P.E.
Vice President

Enclosure: Preliminary Phase 2 Environmental Site Assessment Report, Federal Building, Richland, Washington

DJB/drp

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RICHLAND, WASHINGTON 99352

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

PRELIMINARY PHASE 2 ENVIRONMENTAL SITE ASSESSMENT REPORT FEDERAL BUILDING RICHLAND, WASHINGTON

1.0 PROJECT DESCRIPTION

1.1 Introduction

The Federal Building in Richland, Washington, is a multi-story office building that was constructed in the mid-1960s. It is located at 825 Jadwin Avenue, in the central business district of the City of Richland (City). The Federal Building is contiguous with the U.S. Post Office to the south, with both buildings occupying the block west of Jadwin Avenue, between Knight and Mansfield Streets.

An emergency generator at the Federal Building was formerly fueled by diesel, which was stored in a 1,000-gallon underground storage tank (UST) at the site. Reportedly, the UST was installed during the original building construction. The locations of the site and of the UST are shown in Figures 1 and 2. The UST was decommissioned by Roar Tech, Inc., in 1998 by being closed in place. The closure involved cleaning the interior of the UST and filling the UST with an inert material.

During a site assessment performed by Shannon & Wilson following UST closure, a soil sample collected from approximately 8.5 feet below the ground surface (bgs) had a diesel range total petroleum hydrocarbon (TPH) concentration of 2,600 milligrams per kilogram (mg/kg). The Model Toxics Control Act (MTCA) Method A criteria for diesel range TPH in the soil is 200 mg/kg. Therefore, the current investigation was undertaken to further assess the soil and groundwater conditions below the bottom elevation of the closed UST. Data objectives included analyses of samples for potentially toxic constituents of diesel fuel for potential use in performing a site-specific risk assessment. This preliminary report contains information regarding the field investigation and findings. Results of the risk assessment, if conducted, will be included in the final report.

1.2 Scope of Work

The objective of the current investigation was to further define the extent of subsurface contamination, and to evaluate whether or not chemicals in the subsurface environment pose a current or future risk. To accomplish this objective, Shannon & Wilson conducted a limited site characterization and may follow up with a risk assessment. If conducted, the risk assessment may be used to develop less stringent, site-specific cleanup levels, or to determine if leaving contamination in-place poses an acceptable risk.

Our scope of services for the site investigation included:

- Preparing a brief Sampling & Analysis and Health & Safety Plan (Appendix A). The conceptual basis for the sampling and analysis was to determine if contamination increases or decreases with depth, and if groundwater has been impacted. The analytical methods selected were intended to provide information necessary to evaluate the toxicity of the diesel contamination, as specified in Washington State Department of Ecology's (Ecology) Interim Interpretive and Policy Statement for Cleanup of Total Petroleum Hydrocarbons (Interim Policy) (Ecology, 1997).

- Contacting utilities with known or potential underground service lines in the vicinity of the UST. Shannon & Wilson requested that the utility companies perform detailed line location services, if possible.

- Collecting soil and groundwater samples from one location within the potentially contaminated area for site characterization and for input into a possible risk assessment. The exploration method involved use of an air rotary drill rig. The boring was finished as a 2-inch diameter groundwater monitoring well. Soil was sampled below the bottom of the UST, and selected soil samples were field screened using a Hanby® test kit for qualitative (and semi-quantitative) indications of the presence of petroleum hydrocarbons. Based on visual observations and field screening results, three soil samples were selected for submission to a subcontracted analytical laboratory. A groundwater sample was also collected and submitted.

- Preparing a preliminary report describing the field investigation and results of the analytical testing. The feasibility of proceeding with a risk assessment is also discussed in the preliminary report.

A risk assessment may be performed following review of this preliminary report by the owner.

1.3 Site Description, Topography, and Hydrogeology

The site is located in a commercial district with retail establishments, office buildings, and institutional and medical facilities in the surrounding area. The Federal Building is in the

northeast quarter of the southwest quarter of Section 11, Township 9 North, Range 28 East of the Willamette Meridian, Benton County, Washington. The site is located approximately one-quarter mile west of the Columbia River, which flows from the north toward the south in this vicinity.

The topography of the area is relatively flat. According to an elevation contour shown on the U.S. Geological Survey (USGS) topographic map of the Richland Quadrangle (1992), the approximate ground surface elevation in the vicinity of the site is 360 feet above mean sea level. The map also indicated that the normal pool elevation of the Columbia River in the vicinity of Richland is 340 feet.

A 1971 soils map prepared by the Soil Conservation Service indicated that the native soil at the site is Finley fine sandy loam with 0 to 2 percent slope. A typical profile of this soil has about one foot of very dark grayish-brown fine sandy loam over about one foot of very gravelly loam. Soils below about two feet bgs are sandy gravel and cobbles.

Reports for nearby properties were reviewed to obtain information regarding groundwater flow directions in the vicinity of the site. Reports reviewed included "Results of Site Assessment, Time Oil Property #01-056 Located at 500 George Washington Way (GWW), Richland, Washington" (Environmental Science & Engineering, Inc., 1993), and "Limited Phase II Environmental Site Assessment, City of Richland Maintenance Shops, Richland, Washington" (Huntingdon Engineering and Environmental [Huntingdon], 1994). Groundwater flow information was also available from studies conducted at Columbia Point (Shannon & Wilson. 1994) and at Washington Plaza (Shannon & Wilson, 1997). A summary of information regarding the four sites and their locations in reference to the Federal Building is shown in Table 1.

The Huntingdon report indicated that the predominant groundwater flow direction in the core of Richland is generally toward the east or southeast (Reference: Roger Wright, Engineering Manager, City of Richland). Groundwater measurements at the City shop site, however, indicated a northeasterly gradient at that location. The authors of the Huntingdon study concluded that the groundwater flow direction at the City shop site may be influenced by a drainage ditch located north and west of the site (approximately 600 to 1,200 feet). The Federal Building site is located closer to the Columbia River than the City shop site (one-quarter versus one-half mile), and the Federal Building is located more than 2,000 feet from the ditch referenced in the Huntingdon report. Therefore, it appears likely that the groundwater flow

direction at the Federal Building site would be influenced to a greater degree by the Columbia River, with the resulting gradient most likely toward the east.

2.0 FIELD EXPLORATION AND SAMPLING

2.1 Sample Location

The ability to investigate the site was constrained by several factors including the location of the Federal Building next to and in a potentially downgradient location from the UST, and the presence of multiple fiber optic and telecommunications cables in the immediate area of the UST. Large cobbles in the gravel subsurface soils limited the types of exploration methods that could be used at the site. These factors also place constraints on the ability to perform site remediation, if necessary.

The investigation was conducted by drilling one boring through the UST using an air rotary drill rig. The location was selected in order to collect samples of soil where there is the greatest potential for diesel contamination to be present, and to evaluate the potential impact to groundwater at the same location. The sampling location is shown on Figure 3.

2.2 Soil Sampling

Soil samples were collected on September 9, 1998, below the bottom elevation of the UST, beginning at a depth of 8 feet bgs. The soil between 0 and 8 feet bgs consists of inert fill material in the UST (4 to 8 feet bgs) and non-native backfill material (0 to 4 feet bgs) from the tank closure. Samples were obtained using a 3-inch diameter split spoon sampler to a depth of 11.5 feet bgs. However, beginning at 12.5 feet bgs, the sampler did not recover any material due to the coarse texture of the cobbly gravel subsoil. Therefore, samples of the drill cuttings were obtained in the interval from 12.5 to 20 feet bgs. Soil samples were placed in clean containers furnished by the analytical testing laboratory, and in sealed plastic bags for field screening. Groundwater was encountered during drilling at 14 feet bgs.

2.3 Field Screening of Soil Samples

The following test procedure for field screening of soil samples was used for this project.

- Hanby™ Kit. This is a semi-quantitative analytical process that uses a colorimetric method to estimate the concentration of petroleum hydrocarbons in a sample. The process involves extracting petroleum contaminants from the sample using a solvent.

and then adding a coloring compound and comparing the results with prepared photographs.

Field screening results and visual observations were used to select the soil samples to be submitted for laboratory analyses. Results of field screening of soil samples are shown in Table 2. Soil sample RFB-02-SL was not screened, but was selected based on visual observation.

2.4 Groundwater Sampling

The boring was completed as a 2-inch diameter groundwater monitoring well, and the well log is included in Appendix B. The static water level in the well was measured on September 9, 1998, at 12.64 feet bgs.

Groundwater samples were collected on September 10, 1998. Prior to sampling, the groundwater depth was measured at 12.65 feet bgs. Three well volumes were purged using a disposable polyethylene bailer prior to sample collection. Groundwater samples were transferred from the bailer to clean bottles furnished by the analytical laboratory. Sample containers were immediately placed on ice in a cooler and logged on the chain-of-custody form. Soil and groundwater samples were shipped by overnight delivery to OnSite Environmental, Inc., in Redmond, Washington.

3.0 ANALYTICAL TESTING

Because the UST was used to store diesel fuel, all soil and groundwater samples were analyzed for extractable petroleum hydrocarbons (EPH) and polycyclic aromatic hydrocarbons (PAHs). The soil sample with the highest concentration of TPH, based on field screening, was also tested for volatile petroleum hydrocarbons (VPH), benzene, toluene, ethylbenzene, and xylenes (BTEX), and methyl-t-butyl ether (MTBE). These tests were performed because fresh diesel contains some volatile components and the age of the release is not known.

Table 3 summarizes the results of the analytical testing of soil and groundwater samples. The laboratory report and chain-of-custody form are included in Appendix C. For reference, Table 3 also includes results of analytical testing of one soil sample collected from a depth of 8.5 feet bgs during the initial site assessment on July 13, 1998. More information regarding the site assessment is included in "Underground Storage Tank Site Assessment, Federal Building, Richland, Washington," (Shannon & Wilson, 1998).

4.0 FINDINGS AND RECOMMENDATIONS

4.1 Preliminary Findings

Based on the information obtained during the initial site assessment, a possible risk assessment was proposed. Additional findings of the current field investigation were evaluated to determine the feasibility of proceeding with a risk assessment for this site.

A preliminary evaluation of the potential for current and future exposure of human and ecological receptors was conducted. The soil contamination is located at depth, preventing current exposure by direct contact. However, exposure could occur in the future if subsurface soils are exposed or relocated. BTEX and MTBE were not detected. Although VPH was detected, the detections were of the longer-chained, less volatile fractions. Therefore, inhalation of volatile chemicals released from soil to indoor or outdoor air is unlikely to be a significant exposure pathway currently or in the future.

The site's drinking water source is the municipal water supply, and there are no plans to use the groundwater beneath the site as a future drinking water source. Therefore, current or future exposure to on-site groundwater is unlikely. Although a formal well survey was not conducted, it appears that there are no drinking water wells downgradient of the site (between the site and the Columbia River) based on information obtained by reviewing registered well logs furnished by Ecology. Future use of off-site downgradient shallow groundwater is possible, though unlikely because of the availability of City water.

Based on the location of the site in a business district, other human exposure pathways (e.g., agricultural pathways, for example) are unlikely on site. Substantial exposure of terrestrial ecological receptors is also unlikely due to the depth of the contamination and the presence of a large office building covering the site. Because the site is approximately one-quarter of a mile from the Columbia River, the likelihood is low that site contaminants would reach aquatic receptors at significant concentrations. Thus, it is assumed that no ecological risk evaluation is needed. It also appears that there are no current human exposure pathways. However, future human exposure to on-site soils or to off-site groundwater is possible.

A quantitative evaluation of risks from potential future exposure has not yet been performed. However, the analytical results for soil and groundwater were compared with estimated preliminary risk-based cleanup levels.

Noncarcinogenic PAHs were not evaluated separately because their toxicity is already accounted for in the aromatic EPH fraction. Based on the relative percentage of aromatic and aliphatic hydrocarbon fractions detected in the soil sample that was analyzed for both EPH and VPH, a preliminary cleanup level of 3,265 mg/kg was calculated for EPH + VPH . Concentrations of VPH + EPH in site soil samples ranged from 340 to 3,100 mg/kg. Thus, site concentrations of VPH + EPH were below the preliminary risk-based level. Therefore, it is unlikely that there is a non-cancer risk from possible future direct exposure to soil. BTEX and carcinogenic PAHs were analyzed in all four soil samples, but were not detected. Carcinogenic PAHs include benzo(a)pyrene, chrysene, dibenzo(a,h)-anthracene, indeno)1,2,3-cd)pyrene, benzo(k)fluoranthene, benzo(a)anthracene, and benzo(b)fluoranthene. Because no carcinogenic PAHs or benzene were detected, site soils do not pose an unacceptable cancer risk.

Concentrations decrease by an order of magnitude from the areas below the UST (8 to 11.5 feet bgs) to the groundwater/soil interface (e.g., aliphatic fractions decline from around 1,600 mg/kg to 190 mg/kg, and aromatic fractions decline from about 1,700 mg/kg to 140 mg/kg). The decrease in soil concentration with depth may indicate that less contamination has reached the deeper soils or may also indicate that less contamination is being retained in the extremely coarse cobbly gravel that is present below about 12 feet bgs. Despite the decline of concentrations with depth, migration to groundwater beneath the source area is occurring.

BTEX and MTBE were not detected in groundwater, and only very low levels of noncarcinogenic PAHs were detected. The only carcinogenic PAH detected was chrysene. It was detected at a concentration of 0.092 µg/L, which is below the MTCA Method A cleanup level of 0.1 µg/L for total carcinogenic PAHs, but above the MTCA Method B cleanup level for chrysene of 0.012 µg/L. However, chrysene is of relatively limited mobility and is unlikely to migrate far from the source area.

Under the Interim Policy, the less stringent of the MTCA Method A and the risk-based cleanup level for drinking water may be used for petroleum. If applied at the point of compliance, the risk-based cleanup level for drinking water for VPH+EPH will always be below the MTCA Method A level of 1,000 µg/L. Therefore, the MTCA Method A cleanup level of 1,000 µg/L should be used. The total VPH+EPH concentration in the groundwater sample beneath the source area is 4,900 µg/L, well above the MTCA Method A cleanup level.

Because no groundwater use on-site is planned, the owner is willing to accept deed restrictions, if necessary, and remediation may be difficult, the point of compliance may likely be at the

downgradient site boundary. Concentrations are likely to decline during migration from the source area to this site boundary, which is approximately 350 feet away. Without conducting groundwater modeling or measuring concentrations at the site boundary, it cannot be determined whether VPH+EPH and chrysene concentrations will exceed cleanup criteria at this potential point of compliance.

4.2 Recommendations

Based on the above evaluation, a phased approach to the potential risk assessment or remediation may be most cost effective, including:

- Install two downgradient monitoring wells at the site perimeter (east and southeast of the UST), and verify site-specific groundwater flow direction. Evaluate whether the location of the wells is adequate to determine if contaminants from the tank release are migrating off-site. If necessary, install an additional well once groundwater flow direction is known more precisely.

- Collect samples from all site monitoring wells (three to four) and analyze the samples for VPH, EPH, and carcinogenic PAHs by selective ion monitoring (SIM).

- Determine if concentrations in downgradient perimeter wells exceed cleanup criteria.

- If concentrations in downgradient perimeter wells exceed cleanup criteria, a risk-based approach may not be cost-effective. In this case, the next step would be to evaluate remedial alternatives for soil. Source removal (e.g., soil cleanup) is recommended rather than groundwater remediation because there appear to be no current off-site exposure pathways. On-going groundwater monitoring is likely to be required to demonstrate that source removal, once completed, has reduced contaminant concentrations in groundwater to acceptable levels.

- If concentrations in downgradient perimeter wells are below cleanup criteria, it is likely that risks will be acceptable based on this preliminary evaluation. Therefore a risk-based approach is likely to be cost-effective. In this case, the next step would be to proceed with the proposed risk assessment and pursue a risk-based closure. Because the age of the release is unknown, it will also be necessary to estimate/model the time it would take for site contaminants to reach the perimeter wells.. If site contaminants have not yet reached perimeter wells (based on the recommended sampling and analysis), some on-going monitoring may be required to ensure that contaminants do not migrate to these wells in the future.

- Regardless of whether source remediation is conducted or whether no further action can be pursued using a risk-based approach, some on-going groundwater monitoring is likely to be required by Ecology. Therefore, it is recommended that the wells be installed and

sampled before a decision to either conduct a risk assessment or to conduct source remediation is made. Then, the results can be used to determine which step is more cost-effective.

4.3 Assumptions

These findings and recommendations are based on the following assumptions:

The only source of concern is the single former diesel fuel UST. Because diesel was the only type of fuel that had been stored in the UST, only diesel-related contaminants were considered. If potential impacts from other current or former UST sources at the site need to be considered, a revision to these findings and recommendations may be needed.

- No property transfer is planned, and site usage is unlikely to change. The owner is willing or able to have deed restrictions attached to the property, if necessary.
- The only source of concern is the single former diesel fuel UST. Because diesel was the only type of fuel that had been stored in the UST, only diesel-related contaminants were considered. If potential impacts from other current or former UST sources at the site need to be considered, a revision to these findings and recommendations may be needed.
- MTCA potential cleanup criteria are conservatively based on residential use of the site (rather than industrial).
- The only human exposure routes that were addressed by the preliminary risk-based cleanup levels are ingestion of soil, ingestion of groundwater, and inhalation of volatiles released during household use of groundwater.
- The current water source on and downgradient of the site is City water, and on-site groundwater use is not occurring or expected to occur in the future. Based on a general groundwater flow direction in an assumed easterly direction, about 350 feet exists between the source and the downgradient site boundary.
- No substantial ecological exposure routes exist.

5.0 LIMITATIONS

This report was prepared for the exclusive use of Abide International, General Services Administration, and their representatives. The findings we have presented within this report are based on limited sampling, observation, and testing. The data presented in this report should be considered representative at the time of our field observations. The analyses and sampling

results can only provide you with our best judgement as to the general environmental characteristics of the property at this time and should not be construed as a definitive conclusion regarding soil and groundwater at this site. The risk-based findings included in this report are preliminary in nature and subject to change. We have prepared the attached "Important Information About Your Environmental Report" to assist you and others in understanding the use and limitations of this report. Please consider it as an integral part of this report.

SHANNON & WILSON, INC.

Donna R. Parkes
Environmental Specialist

Dee J. Burrie, P.E.
Vice President

DRP:PDB:DJB/drp

REFERENCES

Department of Ecology (Ecology), 1997. Washington Department of Ecology (Ecology), 1996a, Model Toxics Control Act cleanup regulation, Chapter 173-340 WAC: Olympia, Wash., Publication No. 94-06, amended January 1996.

_____, 1996b, Model Toxics Control Act, cleanup levels and risk calculations (CLARC II) update: Olympia, Wash., Chapter 173-162. Washington Administrative Code (WAC).

_____, 1997, Interim Interpretive and Policy Statement: Cleanup of Total Petroleum Hydrocarbons (TPH). Publication No. ECY97-600. January.

Environmental Science and Engineering, Inc., 1993, Results of Site Assessment, Time Oil Property #01-056 Located at 500 George Washington Way (GWW), Richland, Washington. November.

Huntingdon Engineering and Environmental, 1994, Limited Phase II Environmental Site Assessment, City of Richland Maintenance Shops, Richland, Washington. April.

Shannon & Wilson, Inc., 1998, Underground Storage Tank Site Assessment, Federal Building, Richland, Washington. July.

Shannon & Wilson, Inc., 1997, Washington Plaza, One Hour Cleaners, Subsurface Investigation, Richland, Washington. April.

Shannon & Wilson, Inc., 1994, Supplemental Level 2 Environmental Site Assessment, Columbia Point, Richland, Washington. December.

TABLE 1
SUMMARY OF GROUNDWATER DATA IN PROJECT AREA

Name and Address of Facility/Site	Distance and Direction from Federal Building	Approximate Groundwater Surface Elevation, feet (Date of Measurement)	Predominant Groundwater Flow Direction
Richland City Shop 1300 Mansfield Street	1,000 feet northwest	346 (3/93)	Northeast
Time Oil #01-056 500 GWW	2,000 feet southeast	343 (8/93)	East
Columbia Point South of Comstock Street	4,200 feet southeast	346 (11/94)	East
Washington Plaza 1801 GWW	7,800 feet north	348 (3/97)	Southeast

TABLE 2
RESULTS OF FIELD SCREENING, SOIL SAMPLES

Sample No.	Location, feet bgs	Hanby™ Test Color Observed	Approximate TPH, mg/kg
RFB-01-SL	8 - 9.5	Dark reddish orange	>1,000
RFB-03-SL	12.5 - 14	Pale tan	50 - 100
RFB-04-SL	16 - 17	White	0 - 5

bgs = Below ground surface
mg/kg = milligrams per kilogram
SL = Soil
TPH = Total petroleum hydrocarbons

TABLE 3
RESULTS OF ANALYTICAL TESTING

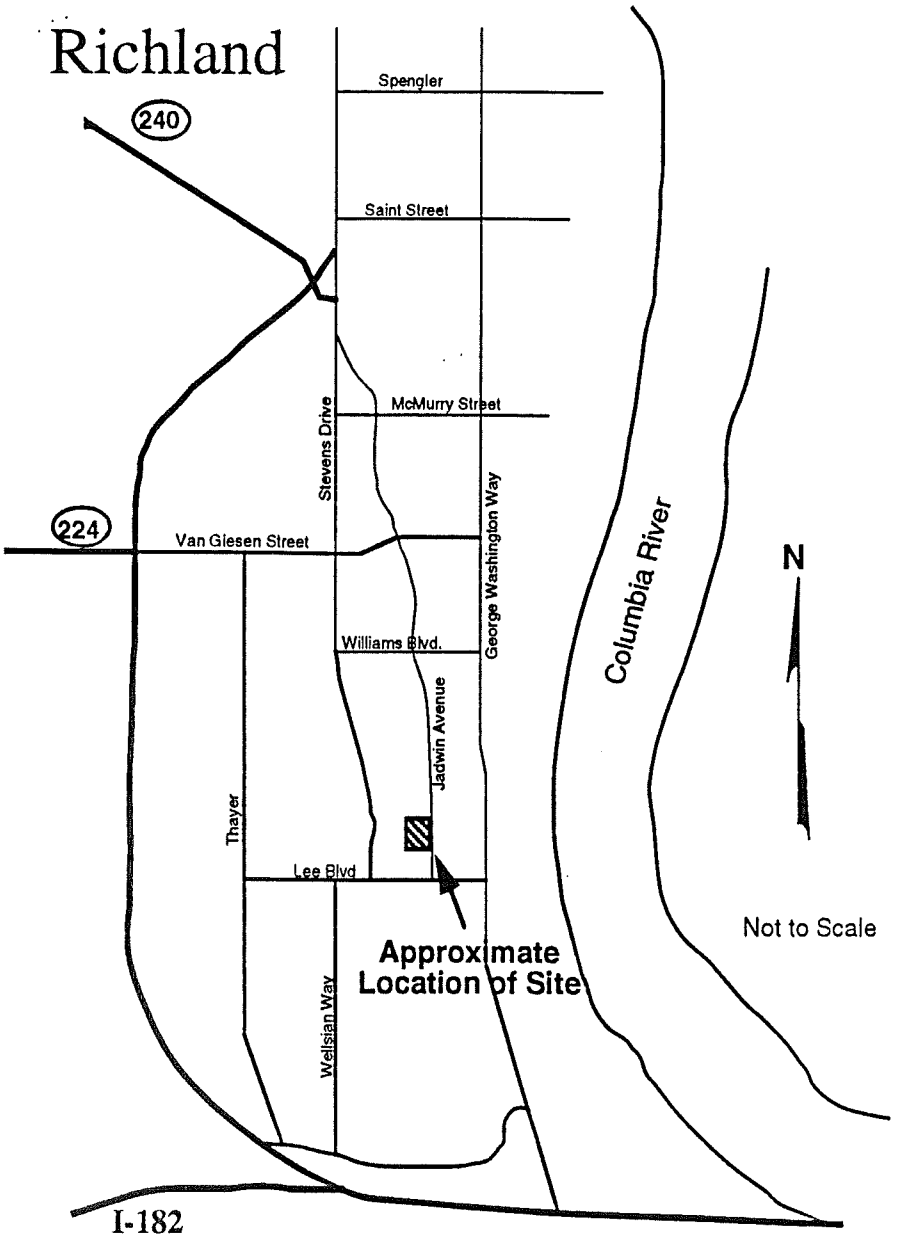
Parameter	Soil, mg/kg (Sample Depth, feet bgs)				Groundwater, µg/L
	9/9/98			7/13/98	9/10/98
	RFB-01 (8-9.5)	RFB-02 (10-11.5)	RFB-03 (12.5-14)	TP2 (8.5)	RFB-06
PAH					
Naphthalene	<0.072	<0.036	<0.035	<0.036	0.19
2-Methylnaphthalene	1.0	0.15	0.062	0.79	1.4
Acenaphthylene	<0.072	<0.036	<0.035	<0.036	0.11
Acenaphthene	<0.072	<0.036	<0.035	<0.036	0.41
Fluorene	<0.072	<0.036	<0.035	<0.036	1
Phenanthrene	<0.072	<0.036	<0.035	<0.036	3.4
Anthracene	1.9	1.6	0.18	1.1	<0.050
Fluoranthene	0.1	0.064	<0.035	<0.036	<0.050
Pyrene	0.4	0.24	0.056	0.19	0.13
Benzo(a)anthracene*	<0.072	<0.036	<0.035	<0.036	<0.050
Chrysene*	<0.072	<0.036	<0.035	<0.036	0.092
Benzo(b)fluoranthene*	<0.072	<0.036	<0.035	<0.036	<0.050
Benzo(k)fluoranthene*	<0.072	<0.036	<0.035	<0.036	<0.050
Benzo(a)pyrene*	<0.072	<0.036	<0.035	<0.036	<0.050
Indeno(1,2,3-cd)pyrene*	<0.072	<0.036	<0.035	<0.036	<0.050
Dibenzo(a,h)anthracene*	<0.072	<0.036	<0.035	<0.036	<0.050
Benzo(g,h,i)perylene	<0.072	<0.036	<0.035	<0.036	<0.050
EPH					
Aliphatic Fractions					
C10-C12	230	230	7.3	99	310
C12-C16	700	660	85	420	1,200
C16-C18	290	270	47	200	520
C18-C21	250	200	35	140	400
C21-C28	98	90	17	56	220
C28-C36	<10	<10	<10	<5.4	<200
Total Aliphatic	1,600	1,400	190	910	2,900
Aromatic Fractions					
C10-C12	92	140	<5.2	26	140
C12-C16	460	650	44	110	640
C16-C18	330	430	41	140	430
C18-C21	320	410	40	74	360
C21-C28	75	96	16	84	90
C28-C36	<5.4	7.8	8.5	<5.4	<150
Total Aromatic	1,300	1,700	150	440	1,700
VPH		NT	NT	NT	
Aliphatic Fractions					
C5-C6	<5.0				<50
C6-C8	<5.0				<50
C8-C10	<5.0				<50
C10-C12	250				88
Total Aliphatic	250				88
Aromatic Fractions					
C8-C10	36				<50
C10-C12	190				81
C12-C13	210				130
Total Aromatic	440				210
Target Analytes:					

TABLE 3
RESULTS OF ANALYTICAL TESTING (Con't)

Parameter	Soil, mg/kg (Sample Depth, feet bgs)				Groundwater, µg/L
	9/9/98			7/13/98	9/10/98
	RFB-01 (8-9.5)	RFB-02 (10-11.5)	RFB-03 (12.5-14)	TP2 (8.5)	RFB-06
VPH (Cont.)					
Methyl t-butylether	<0.50				<5.0
Benzene	<0.50				<5.0
Toluene	<0.50				<5.0
Ethylbenzene	<0.50				<5.0
Xylenes	<0.50				<5.0
TPH	NT	NT			NT
Diesel Range			300	2,600	
Heavy Oil Range			<52	92	

* Carcinogenic PAHs include benzo(a)pyrene, chrysene, dibenzo(a,h)-anthracene, indeno)1,2,3-cd)pyrene, benzo(k)fluoranthene, benzo(a)anthracene, and benzo(b)fluoranthene.

mg/kg = Milligrams per kilogram
µg/L = Micrograms per liter
MTCA = Model Toxics Control Act
PAH = Polycyclic aromatic hydrocarbons
EPH = Extractable petroleum hydrocarbons
VPH = Volatile petroleum hydrocarbons
TPH = Total petroleum hydrocarbons
NT = Not tested



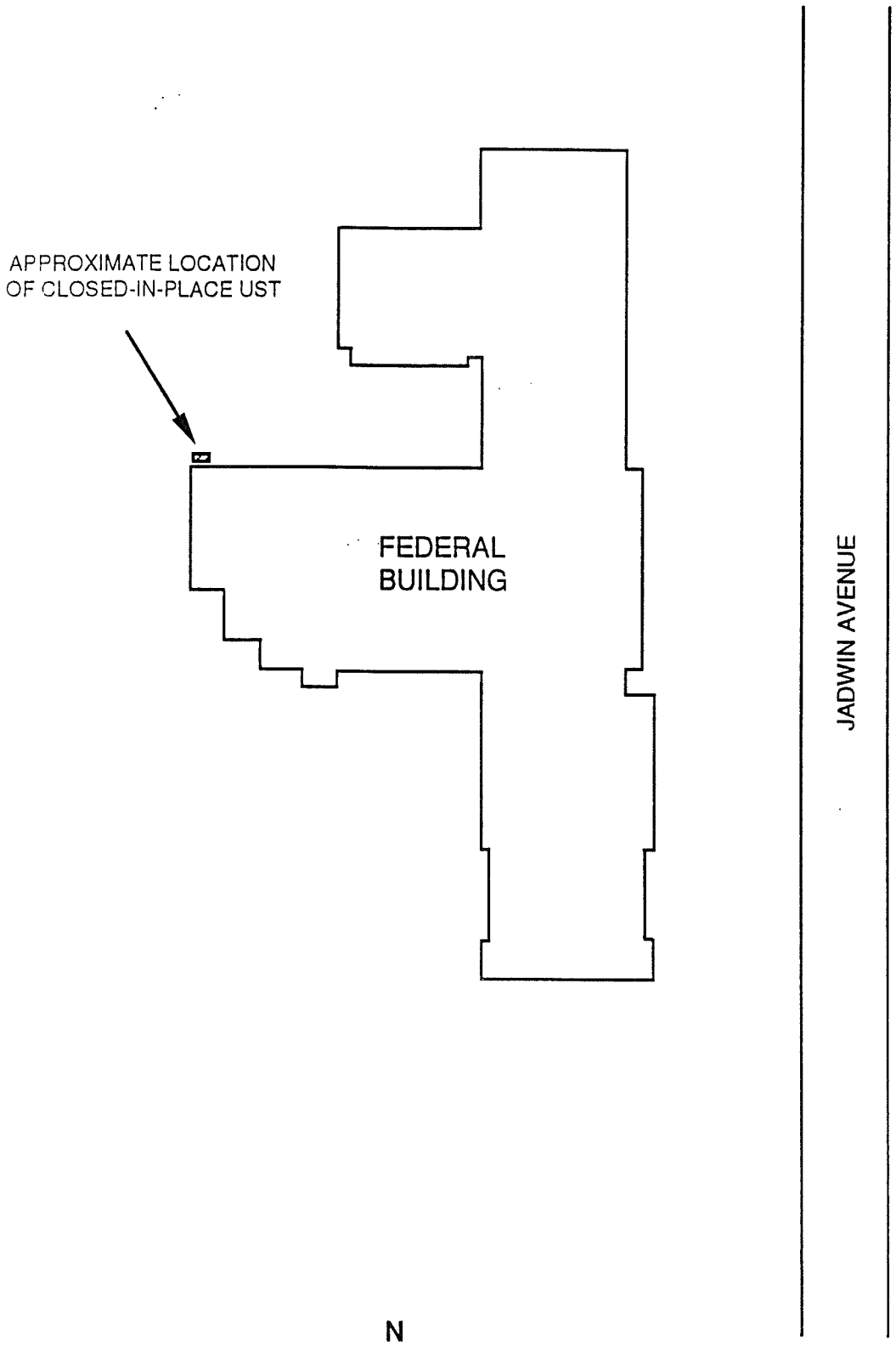
Federal Building Diesel Fuel UST Site
Richland, Washington

SITE VICINITY MAP

October 1998 V-1075-02

SHANNON & WILSON, INC.
Geotechnical & Environmental Consultants

FIG. 1



Federal Building Diesel Fuel UST Site
Richland, Washington

UST LOCATION MAP

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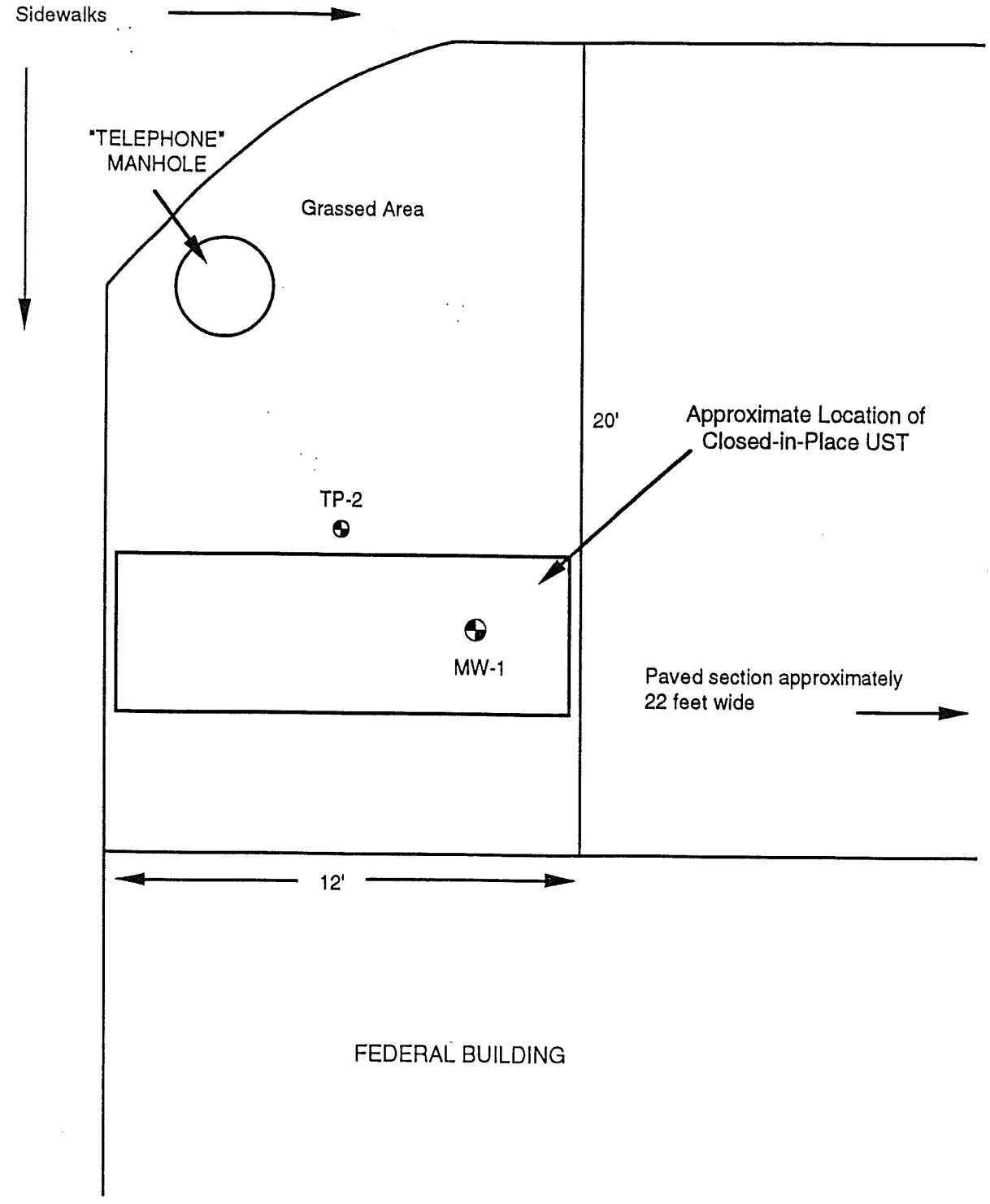
FIG. 2



LEGEND

MW-1 Exploration designation and approximate location

0 4 8

Approximate Scale in Feet

N

Federal Building Diesel Fuel UST Site
Richland, Washington

SITE PLAN AND SAMPLING LOCATIONS

October 1998 V-1075-02

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FIG. 3

APPENDIX A

SAMPLING AND ANALYSIS PLAN AND SITE HEALTH AND SAFETY PLAN

SAMPLING AND ANALYSIS PLAN
AND SITE HEALTH AND SAFETY PLAN
RICHLAND FEDERAL BUILDING UST SITE

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August 24, 1998

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TABLE OF CONTENTS

TABLE

Table No.

FIGURE

Figure No.

APPENDIX

1.0 SAMPLING AND ANALYSIS PLAN

1.1 Background Information

An underground storage tank (UST) located at the Richland Federal Building formerly contained diesel fuel for an emergency generator. The UST was decommissioned in 1998 by being closed in place. The closure involved cleaning of the interior of the UST and filling it with an engineered, inert fill material. During a site assessment performed following UST closure, a soil sample collected from approximately 8.5 feet below the ground surface (bgs) had a diesel range total petroleum hydrocarbon (TPH) concentration of 2,600 milligrams per kilogram (mg/kg). Potential regulatory criteria for diesel range TPH in the soil is 200 mg/kg. Therefore, the current investigation is being undertaken to further assess the soil and groundwater conditions below the bottom elevation of the closed UST. Data objectives include analyses of samples for potentially toxic constituents of diesel fuel for use in performing a site-specific risk assessment.

1.2 Sample Locations

The sampling plan involves drilling one boring through or adjacent to the UST. The location was selected in order to collect samples of soil where there is the greatest potential for diesel contamination to be present, and to evaluate the potential impact to groundwater at the same location.

1.3 Sample Types

Typically, samples are obtained from an air, soil, or water media. Field test sample containers vary in size and material and are usually adapted to best fit the particular test or analytical process being performed. The following sample types are commonly used for field and laboratory analyses:

1.3.1 Field Sample Types

- Air samples are commonly measured with direct reading instruments. Some cases involve the use of Draeger colorimetric indicator tubes for a particular gas analysis.

- Soil samples in the field are commonly screened for total organic vapors (TOV) using a photoionization detector (PID) or a flame ionization detector (FID). For the Federal Building site where the suspected contaminant is diesel fuel, Hanby™ tests will be used. This field screening method is more appropriate where low concentrations of volatile compounds are expected.

- Water samples are often obtained using a glass vile or clear plastic bailer and visually inspected for free product floating on the water surface.

1.3.2 Laboratory Sample Types

- Soil samples are submitted to the analytical laboratory for specific analyses per laboratory/EPA specified procedures. The most common containers are 4- or 8-ounce borosilicate wide-mouth glass jars, with Teflon lined lids.

- Water samples are submitted to the analytical laboratory for specific analyses per laboratory/EPA specified procedures. The most common containers are 1 liter amber glass bottles with Teflon lined caps, and 40 ml glass VOA vials with Teflon lined caps.

1.4 Field Screening

The following test procedure for field screening of soil samples shall be used for this project.

- Hanby™ Kit. This is an semi-quantitative analytical process that uses a colorimetric method to estimate the concentration of petroleum hydrocarbons in a sample. The process involves the extraction of petroleum contaminants from the sample using a solvent, and then adding a coloring compound and comparing the results with prepared photographs.

Field screening results will be used to select the soil samples to be submitted for laboratory analysis.

1.5 Analyses of Interest

Table 1 presents the recommended analytical methods, containers, preservatives, and allowable holding times for analyses anticipated for this project.

TABLE 1

SAMPLE ANALYSIS REQUIREMENTS

Sample Media	Est. No. of Samples	Parameter	Analytical Method	Container	Preservation Method	Holding Time, days
Soil	3	Polycyclic aromatic hydrocarbons (PAH)	Method 8270C (GC/MS)	Two 4-oz glass jars per sample	Cool to 4° C	14
	3	Extractable petroleum hydrocarbons (EPH)	GC		Cool to 4° C	14
	1*	Volatile petroleum hydrocarbons (VPH)**	GC		Cool to 4° C	14
Water	1	PAH	Method 625 (SIM)	1 L glass bottle	Cool to 4° C	7
	1	EPH	GC	1 L glass bottle	HCl and Cool to 4° C	14
	1	VPH**	GC	40 ml VOA	Cool to 4° C	14

* VPH analysis is proposed for one of the three soil samples submitted to the laboratory. (Select the sample with the highest potential concentration of TPH, based on field screening.)

** This method also measures the individual concentrations of benzene, toluene, ethylbenzene, xylenes, and methyl tert butylether (MTBE).

GC Gas chromatograph
GC/MS Gas chromatograph/Mass spectrometer
SIM Selective ion monitoring

2.0 SAMPLE COLLECTION, METHODS, HANDLING, AND CUSTODY

2.1 Preparation and Cleaning

The most common containers for most environmental sampling are made of borosilicate glass with Teflon-lined caps. Containers are either purchased from a supplier of certified clean containers, or pre-cleaned containers may be acquired from a selected laboratory. After collection, samples must be properly preserved until analyzed. Samples should be delivered to the laboratory performing the analyses within 48 hours of collection. Prior arrangements shall be made with the laboratory to ensure that the required analyses are completed and the results made available within the specified holding time.

Typically, disposable equipment will be used to transfer samples to the clean sample containers. If non-disposable equipment is used, it will be decontaminated by the following procedure:

Step 1) Alconox detergent wash
Step 2) Triple tap water rinse
Step 3) Distilled water rinse
Step 4) Air dried away from potential sources of contamination (e.g. splashes)

2.2 General Procedures

2.2.1 Documentation

Sampling activities, measurements, and other observations will be recorded by the field representative in a field log book using permanent black ink. Entries in the log book will include:

- Date
- Start and finish times of work
- Summary of work performed (including samples collected)
- Names of personnel present
- Names of visitors
- Observations and remarks
- Signature of person making entry

Samples prepared for shipment will be recorded on chain-of-custody forms (Figure 1), which will indicate the required analyses, the number of containers for each analysis, the date and time of collection, the sample matrix, and other relevant sample and sample custody information. Chain-of-custody forms will remain with the samples until delivery to the laboratory. A separate chain-of-custody form will be used for each cooler. The chain-of-custody form will serve as the

sample analysis request sheet. During all three phases of sample custody (field, shipment, and laboratory), Shannon & Wilson will ensure that the following custody objectives are met:

- All samples are uniquely identified,
- the correct samples are tested and are traceable to their source,
- important sample characteristics are preserved,
- samples are protected from loss or damage,
- any alteration of samples from preservation or filtration is documented, and
- a record of sample integrity is established and maintained through the entire custody process.

2.2.2 Field Custody Procedures

These procedures provide a method of completing and transferring chain-of-custody records. Use of these chain-of-custody guidelines creates an accurate written record that can be used to trace the possession and handling of the sample from the moment of its collection through analysis and its introduction as evidence. These guidelines are applicable to chain-of-custody control for samples collected during project activities.

Chain-of-custody records begin in the field at the time of sampling. A person is in custody of a sample if the sample is:

- in that person's physical possession,
- in view after being in that person's physical possession,
- placed in a locked repository by that person, or
- placed in a secure, restricted area by that person.

Samples collected from a site will be identified with a sample label. Indelible ink will be used to complete sample labels with the following information:

- Site Name
- Job Number
- Sample Number
- Sample Description
- Company Name
- Parameters to be Analyzed
- Date
- Time

NOTE: Do NOT indicate if a sample is a duplicate on the sample label. Do this only in the field log book key. Assign project-unique numbers to all samples.

Sample numbers indicate the year, site location, sample number, and matrix. An example of the sample numbering scheme is as follows:

YYLOC###XX where:

YY	=	the year of the sampling event; 1998
LOC	=	site location
###	=	sequence number for site samples
XX	=	matrix (GW = groundwater, SL = soil, SD = sediment, DR = drum, TK = tank, WP = wipe, MI = miscellaneous)

2.2.3 Sample Shipment

Immediately upon collection, all samples will be placed in coolers maintained at 4° C ± 2° C with ice. Custody of samples will be maintained through the shipment of samples to the selected laboratory. Samples will be packaged and shipped, using the following procedures:

- Use waterproof high-strength ice chests or coolers only.
- After filling out the pertinent information on the sample label and tag, put the sample in the bottle or vial and screw on the lid.
- Place inert cushioning material such as "bubble-wrap" in the bottom of the cooler.
- Enclose the bottles in clear plastic bags through which the sample labels are visible, and seal the bag. Place bottles upright in the cooler in such a way that they do not touch and shall not touch during shipment.
- Place additional inert packing material to partially cover sample bottles. Place bags of ice around, among, and on top of the sample bottles, and fill cooler with cushioning material.
- Put paperwork (chain-of-custody record) in a waterproof plastic bag and tape it to the inside lid of the cooler. Custody forms for samples will be signed by the field team member who is relinquishing custody. The custody form will include the method of shipment, and time and date of transfer of custody.
- Tape the drain shut. Secure lid by taping with strapping tape at a minimum of two locations. Do not cover any labels.
- Attach shipping label to top of the cooler.
- Ship the cooler by overnight express to the laboratory.

2.2.4 Laboratory Custody

Once the samples arrive at the laboratory, custody of the samples will be maintained by laboratory personnel. The laboratory will, at a minimum, document the chain-of-custody through the following stages of analysis:

- Sample Receipt
- Sample Extraction/Preparation
- Sample Analysis
- Data Reduction
- Data Reporting

2.3 Specific Sampling Procedures

Shannon & Wilson will provide experienced and qualified personnel to perform and supervise field soil and water sampling. Our company has established the following sampling protocol for soil and water media.

2.3.1 Laboratory Soil Sampling Protocol

- Obtain laboratory certified clean sampling containers required for each analytical method.
- Personnel obtaining the samples shall wear applicable personal protective equipment (PPE) as specified in the site specific health and safety plan (Appendix).
- Gloves and sampling tools shall be cleaned and/or changed between sampling locations.
- The split spoon sampler shall be pressure washed between uses within the boring.
- Soils shall be packed tightly in the sample container, typically a 4- or 8-ounce wide-mouth glass jar, to minimize head space, and capped with a Teflon-lined cap.
- Samples shall be chilled in wet ice on site until final packaging in strong tight coolers with ice. Samples shall be kept at 4° C ± 2° C for shipment to the analytical laboratory.
- A sample chain-of-custody form shall be completed and accompany each sealed cooler shipped to the laboratory (Figure 1).
- Field sampling logs shall contain a complete record of samples and shipments to the laboratory. Copies of the actual chain-of-custody shall be kept with the field logbook.

2.3.2 Laboratory Water Sampling Protocol

- Obtain laboratory certified clean sampling containers required for each analytical method.

- Personnel obtaining the samples shall wear applicable PPE as specified within the site specific health and safety plan.

- Gloves and sampling tools shall be cleaned and/or changed between sampling locations.

- Collect groundwater samples following the purging of at least three well volumes using a new, disposable Teflon bailer. The initial water removed from the well shall be examined for evidence of free product. If free product is apparent, the purged water shall be containerized and held for appropriate disposal following receipt of laboratory results.

- VOA sample containers shall be completely filled and tightly capped with zero headspace (no visible bubbles when inverting sample container).

- Samples shall be chilled in wet ice on site until final packaging in strong tight coolers with ice. Samples shall be kept at 4° C $\pm$ 2° C for shipment to the analytical laboratory.

- A sample chain-of-custody form shall be completed and accompany each sealed cooler shipped to the laboratory (Figure 1).

- Field sampling logs shall contain a complete record of samples and shipments to the laboratory. Copies of the actual chain-of-custody shall be kept with the field logbook.

3.0 REFERENCES

Procedures incorporate guidance and regulations from the following documents.

1. API 1628, Second Edition, American Petroleum Institute, "A Guide to the Assessment and Remediation of Underground Petroleum Releases," August 1989.

2. EPA/600/4-84/075, "Characterization of Hazardous Waste Sites- A Methods Manual, Volume 1- Site Investigations," April 1985.

3. State of California, State Water Resources Control Board, Leaking Underground Fuel Tank Field Manual, "Guidelines for Site Assessment, Cleanup, and Underground Storage Tank Closure," October 1990.

4. Washington State Department of Ecology Toxics Cleanup Program, "Interim Interpretive and Policy Statement, Cleanup of Total Petroleum Hydrocarbons (TPH)," Publication No. ECY97-600, January 1997.

5. Washington State Department of Ecology Toxics Cleanup Program, "The Model Toxics Control Act Cleanup Regulations Chapter 173-340 WAC," Publication No. 94-06, Amended January 1996.

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

CHAIN OF CUSTODY RECORD

Page _____ of _____
Laboratory_____
Attn:_____

400 N 34th Street, Suite 100
Seattle, WA 98103
(206) 632 8020

11500 Olive Blvd., Suite 276
St Louis, MO 63141
(314) 872-8170

1354 N. Grandridge Blvd
Kennewick, WA 99336
(509) 735-1280

2055 Hill Road
Fairbanks, AK 99709
(907) 479-0600

5430 Fairbanks Street, Suite 3
Anchorage, AK 99518
(907) 561-2120

2412 N 30th St., Suite 201
Tacoma, WA 98407
(206) 759-0156

Analysis Parameters/Sample Container Description
(include preservative if used)

Sample Identity	Lab No.	Time	Date Sampled	Comp.	Grab							Total Number of Containers	Remarks/Matrix

Project Information	Sample Receipt	
Project Number:	Total Number of Containers	
Project Name:	COC Seals/Intact? Y/N/NA	
Contact:	Received Good Cond./Cold	
Ongoing Project? Yes ☐ No ☐	Delivery Method:	
Sampler:	(attach shipping bill, if any)	

Instructions

Requested Turn Around Time:

Special Instructions:

Relinquished By: 1.	Relinquished By: 2.	Relinquished By: 3.
Signature: Time:	Signature: Time:	Signature: Time:
Printed Name: Date:	Printed Name: Date:	Printed Name: Date:
Company:	Company:	Company:
Received By: 1.	**Received By: 2.**	**Received By: 3.**
Signature: Time:	Signature: Time:	Signature: Time:
Printed Name: Date:	Printed Name: Date:	Printed Name: Date:
Company:	Company:	Company:

Distribution: White - w/shipment - returned to Shannon & Wilson w/ Laboratory report
Yellow - w/shipment - for consignee files
Pink - Shannon & Wilson - Job File

F-19-91/UR

No._____

Site Health and Safety Plan
Federal Building Diesel Fuel UST Site
Richland, Washington

CHAIN OF CUSTODY RECORD/ ANALYTICAL REQUEST FORM

August 1998 V-1075-02

SHANNON & WILSON, INC.
Geotechnical & Environmental Consultants

FIG. 1

APPENDIX

SITE HEALTH AND SAFETY PLAN

SITE HEALTH AND SAFETY PLAN

THIS HEALTH AND SAFETY PLAN IS TO BE USED IN CONJUNCTION WITH
SHANNON & WILSON'S EMPLOYEE SAFETY GUIDELINES AND
CORPORATE HEALTH AND SAFETY PROGRAM
FOR ACTIVITIES INVOLVING HAZARDOUS SUBSTANCE/WASTE PROJECTS

DATE: August 24, 1998 PROJECT NUMBER: V-1075-02

SITE NAME: Richland Federal Building Closed UST

SITE ADDRESS: 825 Jadwin Avenue, Richland, Washington 99352

SITE ACCESS: Coordinate with Mr. Craig Frantz (509) 946-4586

EMERGENCY CONTACTS/PHONE NUMBERS: **(Map to nearest hospital is attached.)**

Fire: 911 Ambulance: 911 Hospital: 911

Site Safety Officer: Donna R. Parkes Phone: On-site cell (509) 539-2534

S&W Project Manager: Dee J. Burrie Phone: (509) 946-6309

Client Contact: Craig Frantz Phone: (509) 946-4586

GSA Contact: Ron Smith Phone: (253) 931-7696

Location of Health and Safety Equipment: (Health and Safety Certificates, Fire Extinguisher, First Aid Kit, Eyewash Station): Shannon & Wilson vehicle on site. Environmental West Exploration, Inc., (driller) will provide health and safety equipment for their employees.

PROJECT OBJECTIVES:

Activities:	☐ UST Removal	☒ Drilling	☐ Test Pits	☐ Other: _____
Sampling:	☒ Soil	☒ Water	☐ Waste	☐ Other: _____
Equipment:	☒ Drill Rig	☐ Backhoe	☐ Excavator	☐ Other: _____

Topography, site control, site boundaries. **(Site plan is attached.)**

Railing on north side and building on south side limit access to the site.

CHEMICAL HAZARD EVALUATION:

Exposure Route and Evaluation (For PPE Purposes)

Substance	Concentration	Skin L[1] M[2] H[3] E[4]	Inhalation L M H E	Ingestion L M H E
Diesel fuel		☒ ☐ ☐ ☐	☒ ☐ ☐ ☐	☒ ☐ ☐ ☐
Carbon tetrachloride	Field test kit reagent	☐ ☐ ☒ ☐	☐ ☐ ☒ ☐	☐ ☐ ☒ ☐
		☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐

[1]Low
Materials which on exposure would cause irritation but only minor residual injury even if no treatment is given.

[2]Moderate
Materials which on intense or continued exposure could cause temporary incapacitation or possible residual injury unless prompt medical treatment is given.

[3]High
Materials which on short exposure could cause serious temporary or residual injury even though prompt medical treatment was given.

[4]Extreme
Materials which on very short exposure could cause death or major residual injury even though prompt medical treatment was given.

PHYSICAL HAZARDS: Heavy machinery (drill rig); noise; slips, trips, falls; heat stress.

FIRE / EXPLOSION HAZARDS: ☐ Fire ☐ Explosion (See Emergency Procedures)
Special Considerations: _____

CONFINED SPACE ENTRY REQUIRED: ☐ Yes ☒ No; If yes, permit required? ☐ Yes ☐ No
Special Considerations: _____

AIR MONITORING: ☐ Yes ☒ No Personnel Performing Air Monitoring: _____
(A) On entry before job begins: ☐ Yes ☐ No
(B) During time project tasks are performed: ☐ Yes ☐ No
If "YES," Time Interval: _____
(C) Air Monitoring Instrument Calibrated on: _____

Instrument	Action Level*	Level of Protection
☐ PID ☐ FID ☐ CGI	_____	☐ D ☐ C
☐ PID ☐ FID ☐ CGI	_____	☐ D ☐ C
☐ PID ☐ FID ☐ CGI	_____	☐ D ☐ C

*Based on a sustained reading of one minute.

PPE / RESPIRATORY PROTECTION:

Personnel protection will be modified level D. A first aid kit, fire extinguisher, and eyewash facilities will also be present at the site during work.

Modified Level D
Hard hat
Cotton jeans, nomex or tyvek coveralls
Outer neoprene gloves
Eye protection; shatter proof lenses
Steel-toed boots
Ear plugs

DECONTAMINATION / PPE DISPOSAL: ☒ Not Applicable

EMERGENCY PROCEDURES

In an **EMERGENCY**, do the following:

Call for help as soon as possible. Give the following information:

- WHERE the emergency is - use addresses, cross streets, or landmarks.
- PHONE NUMBER you are calling from.
- WHAT HAPPENED - type of emergency.
- HOW MANY/MUCH persons need help, spilled.
- WHAT is being done.
- YOU HANG UP LAST - let the person you called hang up first.

In the event of a **MEDICAL EMERGENCY**, do the following:

1. Call for help as soon as possible.

2. Administer CPR and emergency first aid if necessary.

3. If the victim can be moved, transport to the hospital while one person calls the hospital to notify them. If the injury or exposure is not life threatening, decontaminate the individual first. If decontamination is not feasible, wrap the individual in a blanket or sheet of plastic prior to transport; transport to hospital via rescue squad vehicle.

4. Notify the Site Safety Officer and Office Health and Safety Manager (OHSM) (who will notify the Corporate Health and Safety Officer (CHSO) within 24 hours) and Project Manager (PM).

5. Complete appropriate form(s); see Appendix A of the Corporate Health and Safety Program.

In the event of a **FIRE OR EXPLOSION**, do the following:

1. Evacuate all personnel from the vicinity.

2. Call the fire department (911) as soon as possible. Provide all requested information regarding the location and nature of the emergency.

3. Notify the Site Safety Officer, OHSM, PM and the Client Contact.

In the event of an **ACCIDENTAL RELEASE OF CONTAMINANTS**, do the following:

1. Take immediate measures to control and/or contain the spill.

2. Report as soon as possible to the National Response Center (800-424-8802) and the State Emergency Services. Be prepared to advise the center and emergency services as to the type and amount of contaminant(s) released; and the types of environments contaminated and/or endangered.

3. Notify the Site Safety Officer, OHSM, PM, and the Client Contact.

4. Keep people away.

REFERENCES for Hazard Evaluation

Chemical Hazard Response Information System (C.H.R.I.S.), U.S. Department of Transportation and U.S. Coast Guard.

Dangerous Properties of Industrial Materials, Sax and Lewis.

NIOSH Pocket Guide to Chemical Hazards, U.S. Department of Health and Human Services.

Handbook of Toxic & Hazardous Chemicals and Carcinogens, Sittig.

SIGNATURE PAGE

I am familiar with this Health and Safety Plan for activities at the Richland Federal Building UST site. I understand the contents of this plan and any questions I had regarding the Plan have been satisfactorily answered.

NAME DATE

_____

_____

_____

_____

_____

_____

_____

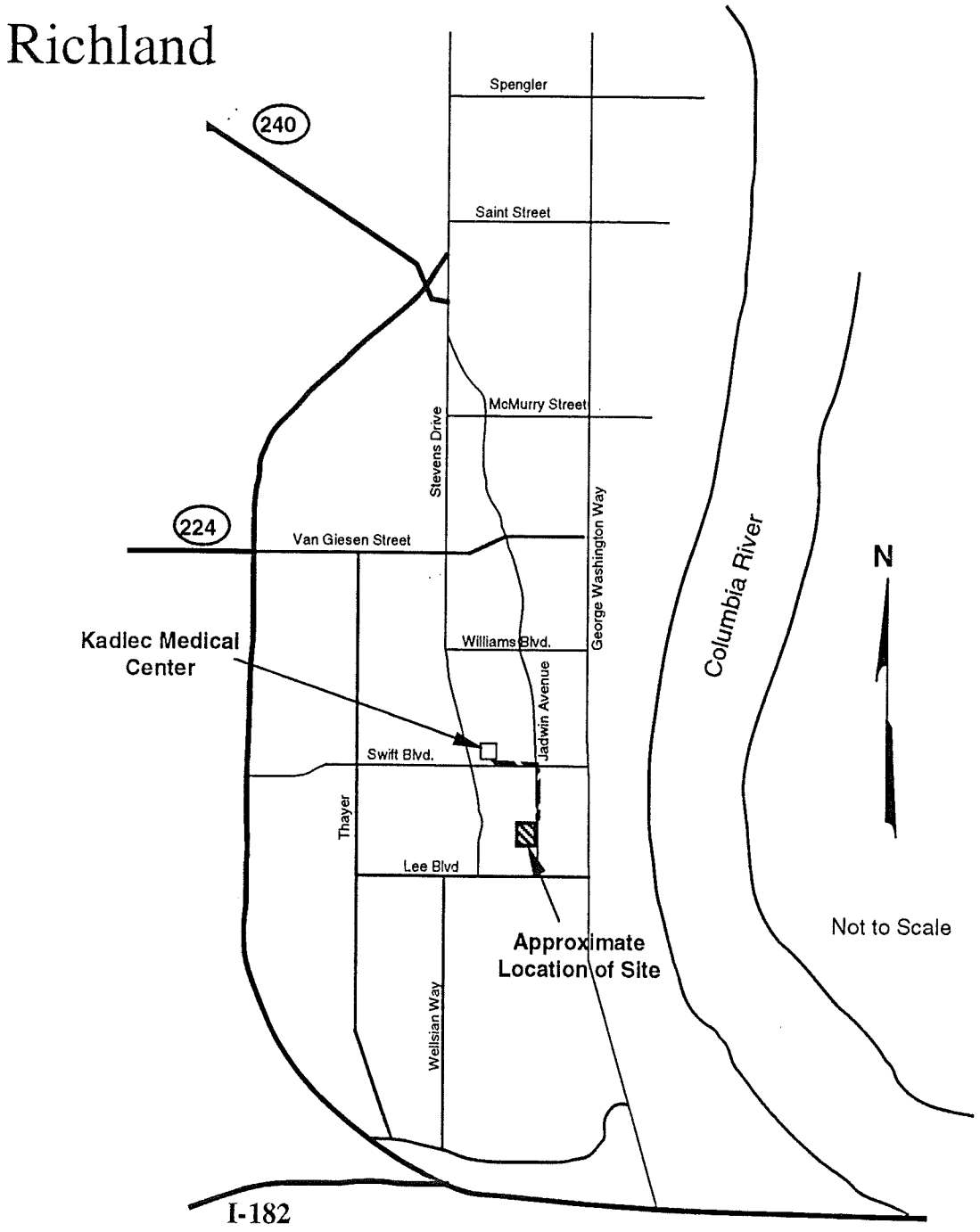
_____

As the Shannon & Wilson Site Safety Officer for this project, I have reviewed this plan together with all personnel authorized to perform work - and am satisfied with their understanding of its contents. I understand that this plan must be routinely reviewed with all involved personnel prior to each daily work effort.

_____

Site Safety Officer Date

8-18-98/h&s1075.pln/v-1075-01/drp



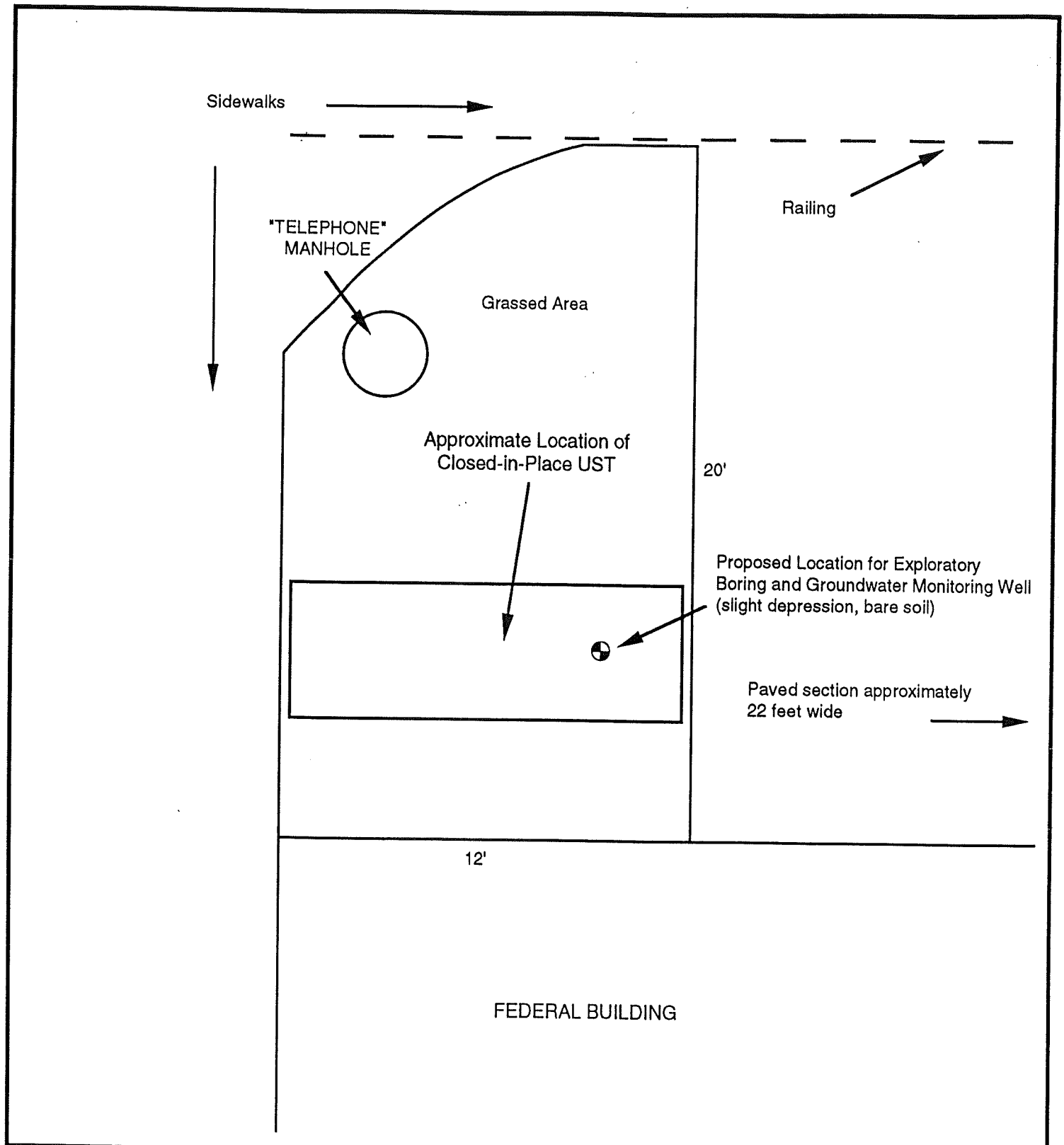
Site Health and Safety Plan
Federal Building UST Site
Richland, Washington

SITE LOCATION AND ROUTE TO NEAREST HOSPITAL

August 1998 V-1075-02

SHANNON & WILSON, INC.
Geotechnical & Environmental Consultants

ATTACHMENT 1



0 4 8

Approximate Scale in Feet

N

Site Health and Safety Plan
Federal Building Diesel Fuel UST Site
Richland, Washington

SITE PLAN

August 1998 V-1075-01

SHANNON & WILSON, INC.
Geotechnical & Environmental Consultants

ATTACHMENT 2

APPENDIX B

MONITORING WELL LOG

LOG & AS-BUILT DIAGRAM

GEOLOGIC LOG

Driller: Environmental West Exploration
Completion Date: 9/9/98

Ground Surface

Brown, silty SAND with gravel.

Grey, coarse SAND (no noticeable petroleum odor). Drilled through top and bottom of tank at 4.0 and 8.0 feet.

Sandy GRAVEL, moist (noticeable petroleum odor).

Sandy, cobbly GRAVEL, wet (slight petroleum odor).

Sandy, cobbly GRAVEL, wet (no noticeable petroleum odor).

Bottom of Boring at 20.0'

* Groundwater encountered at 14 feet below the ground surface during drilling.

** Samples S4 and S5 of drill cuttings; materials too coarse for split spoon sampler.

Hydrologic Unit

Samples

Unsaturated Zone

Saturated Zone

S1 (N > 95)

S2 (N > 95)

S3 (N > 50)

S4

S5

Depth in Feet

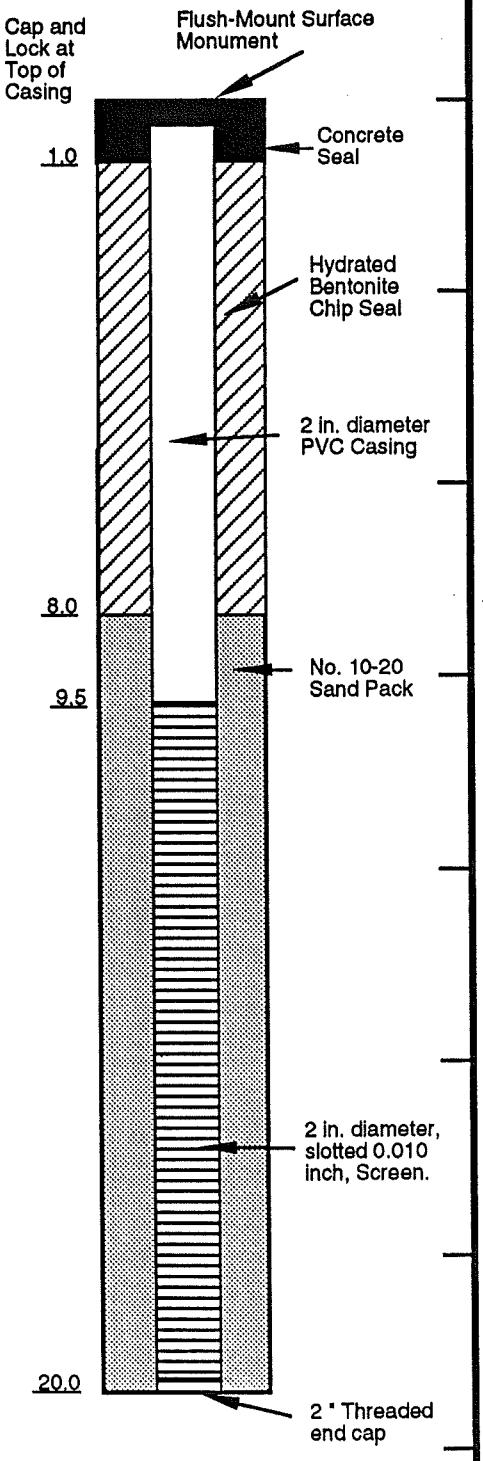
0, 3, 6, 9, 12, 15, 18, 21

Water Level

Depth to Groundwater 12.6 feet* 9/9/98

AS-BUILT

Top of Monument Elevation = _____



Note: SPT done in accordance with ASTM D- 1586-84 using 140 lb. hammer, 30" free fall, and 3" OD split-spoon sampler. N = number of blows to drive sampler last 12 inches.

Drilling Method: Air Rotary
Sampling Method: SPT

Note: Soil classification based on description of cuttings and samples; actual transitions may be gradual.

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

September 1998 V-1075-02

Closed Diesel Fuel UST, Federal Building
Richland, Washington

MONITORING WELL MW-01
(Ecology Tag No. AEA 917)

APPENDIX C
LABORATORY REPORT AND CHAIN-OF-CUSTODY FORM

OnSite Environmental Inc.
Analytical Testing and Mobile Laboratory Services

September 22, 1998

Donna Parkes
Shannon & Wilson, Inc.
400 N 34th Street, Suite 100
Seattle, WA 98103

Re: Analytical Data for Project V-1075-02
Laboratory Reference No. 9809-056

Dear Donna:

Enclosed are the analytical results and associated quality control data for samples submitted on September 11, 1998.

The standard policy of OnSite Environmental Inc., is to store your samples for 30 days from the date of receipt. If you require longer storage, please contact the laboratory.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning the data, or need additional information, please feel free to call me.

Sincerely,

David Baumeister for
Project Chemist

Enclosures

14924 NE 31st Circle • Redmond, WA 98052 • (425) 883-3881 • Fax (425) 885-4603

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

PAH's by EPA 8270C

Date Extracted:	9-11-98
Date Analyzed:	9-14-98
Matrix:	Soil
Units:	mg/kg (ppm)
Lab ID:	09-056-01
Client ID:	RFB-01-SL

Compound:	Results	Flags	PQL
Naphthalene	ND		0.072
2-Methylnaphthalene	1.0		0.072
Acenaphthylene	ND		0.072
Acenaphthene	ND		0.072
Fluorene	ND		0.072
Phenanthrene	ND		0.072
Anthracene	1.9		0.072
Fluoranthene	0.1		0.072
Pyrene	0.4		0.072
Benzo[a]anthracene	ND		0.072
Chrysene	ND		0.072
Benzo[b]fluoranthene	ND		0.072
Benzo[k]fluoranthene	ND		0.072
Benzo[a]pyrene	ND		0.072
Indeno[1,2,3-cd]pyrene	ND		0.072
Dibenz[a,h]anthracene	ND		0.072
Benzo[g,h,i]perylene	ND		0.072

Surrogate :	Percent Recovery	Flags	Control Limits
Nitrobenzene-d5	98		23 - 120
2-Fluorobiphenyl	138	*	30 - 115
Terphenyl-d14	99		18 - 137

* Outside control limit

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

PAH's by EPA 8270C

Date Extracted:	9-11-98
Date Analyzed:	9-14-98
Matrix:	Soil
Units:	mg/kg (ppm)
Lab ID:	09-056-02
Client ID:	RFB-02-SL

Compound:	Results	Flags	PQL
Naphthalene	ND		0.036
2-Methylnaphthalene	0.15		0.036
Acenaphthylene	ND		0.036
Acenaphthene	ND		0.036
Fluorene	ND		0.036
Phenanthrene	ND		0.036
Anthracene	1.6		0.036
Fluoranthene	0.064		0.036
Pyrene	0.24		0.036
Benzo[a]anthracene	ND		0.036
Chrysene	ND		0.036
Benzo[b]fluoranthene	ND		0.036
Benzo[k]fluoranthene	ND		0.036
Benzo[a]pyrene	ND		0.036
Indeno[1,2,3-cd]pyrene	ND		0.036
Dibenz[a,h]anthracene	ND		0.036
Benzo[g,h,i]perylene	ND		0.036

Surrogate :	Percent Recovery	Flags	Control Limits
Nitrobenzene-d5	92		23 - 120
2-Fluorobiphenyl	145	*	30 - 115
Terphenyl-d14	91		18 - 137

* Outside control limit

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

PAH's by EPA 8270C

Date Extracted:	9-11-98
Date Analyzed:	9-14-98
Matrix:	Soil
Units:	mg/kg (ppm)
Lab ID:	09-056-03
Client ID:	RFB-03-SL

Compound:	Results	Flags	PQL
Naphthalene	ND		0.035
2-Methylnaphthalene	0.062		0.035
Acenaphthylene	ND		0.035
Acenaphthene	ND		0.035
Fluorene	ND		0.035
Phenanthrene	ND		0.035
Anthracene	0.18		0.035
Fluoranthene	ND		0.035
Pyrene	0.056		0.035
Benzo[a]anthracene	ND		0.035
Chrysene	ND		0.035
Benzo[b]fluoranthene	ND		0.035
Benzo[k]fluoranthene	ND		0.035
Benzo[a]pyrene	ND		0.035
Indeno[1,2,3-cd]pyrene	ND		0.035
Dibenz[a,h]anthracene	ND		0.035
Benzo[g,h,i]perylene	ND		0.035

Surrogate :	Percent Recovery	Flags	Control Limits
Nitrobenzene-d5	61		23 - 120
2-Fluorobiphenyl	81		30 - 115
Terphenyl-d14	98		18 - 137

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

PAH's by EPA 8270C
METHOD BLANK QUALITY CONTROL

Date Extracted:	9-11-98
Date Analyzed:	9-14-98
Matrix:	Soil
Units:	mg/kg (ppm)
Lab ID:	MB0911S1

Compound:	Results	Flags	PQL
Naphthalene	ND		0.033
2-Methylnaphthalene	ND		0.033
Acenaphthylene	ND		0.033
Acenaphthene	ND		0.033
Fluorene	ND		0.033
Phenanthrene	ND		0.033
Anthracene	ND		0.033
Fluoranthene	ND		0.033
Pyrene	ND		0.033
Benzo[a]anthracene	ND		0.033
Chrysene	ND		0.033
Benzo[b]fluoranthene	ND		0.033
Benzo[k]fluoranthene	ND		0.033
Benzo[a]pyrene	ND		0.033
Indeno[1,2,3-cd]pyrene	ND		0.033
Dibenz[a,h]anthracene	ND		0.033
Benzo[g,h,i]perylene	ND		0.033

Surrogate :	Percent Recovery	Flags	Control Limits
Nitrobenzene-d5	56		23 - 120
2-Fluorobiphenyl	70		30 - 115
Terphenyl-d14	97		18 - 137

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

PAH's by EPA 8270C
MS/MSD QUALITY CONTROL

Date Extracted: 9-04-98
Date Analyzed: 9-09-98

Matrix: Soil
Units: mg/Kg (ppm)

Lab ID: 02101SMSD

Compound:	Spike Amount	MS	Percent Recovery	MSD	Percent Recovery	RPD
Phenol	3.30	2.74	83	3.19	97	15
2-Chlorophenol	3.30	2.64	80	3.03	92	14
1,4-Dichlorobenzene	1.65	1.22	74	1.41	85	14
N-Nitroso-di-n-propylamine	1.65	1.53	93	1.70	103	10
1,2,4-Trichlorobenzene	1.65	1.53	93	1.65	100	7.4
4-Chloro-3-methylphenol	3.30	3.58	108	3.79	115	5.8
Acenaphthene	1.65	2.00	102	2.17	113	9.6
2,4-Dinitrotoluene	1.65	1.48	89	1.63	99	10
4-Nitrophenol	3.30	3.04	92	3.38	102	10
Pentachlorophenol	3.30	2.84	86	3.31	100	15
Pyrene	1.65	3.43	92	3.81	115	22

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

PAH's by SIM

Date Extracted:	9-17-98
Date Analyzed:	9-21-98
Matrix:	Water
Units:	ug/L (ppb)
Lab ID:	09-056-04
Client ID:	**RFB-06-GW**

Compound:	Results	Flags	PQL
Naphthalene	0.19		0.050
2-Methylnaphthalene	1.4		0.050
Acenaphthylene	0.11		0.050
Acenathphene	0.41		0.050
Fluorene	1		0.050
Phenanthrene	3.4		0.050
Anthracene	ND		0.050
Fluoranthene	ND		0.050
Pyrene	0.13		0.050
Benzo[a]anthracene	ND		0.050
Chrysene	0.092		0.050
Benzo[b]fluoranthene	ND		0.050
Benzo[k]fluoranthene	ND		0.050
Benzo[a]pyrene	ND		0.050
Indeno[1,2,3-cd]pyrene	ND		0.050
Dibenz[a,h]anthracene	ND		0.050
Benzo[g,h,i]perylene	ND		0.050

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

PAH's by SIM
METHOD BLANK QUALITY CONTROL

Date Extracted:	9-17-98
Date Analyzed:	9-21-98
Matrix:	Water
Units:	ug/L (ppb)
Lab ID:	MB0917W1

Compound:	Results	Flags	PQL
Naphthalene	ND		0.050
2-Methylnaphthalene	ND		0.050
Acenaphthylene	ND		0.050
Acenathphene	ND		0.050
Fluorene	ND		0.050
Pentachloropehenol	ND		0.050
Phenanthrene	ND		0.050
Anthracene	ND		0.050
Fluoranthene	ND		0.050
Benzo[a]anthracene	ND		0.050
Chrysene	ND		0.050
Benzo[b]fluoranthene	ND		0.050
Benzo[k]fluoranthene	ND		0.050
Benzo[a]pyrene	ND		0.050
Indeno[1,2,3-cd]pyrene	ND		0.050
Dibenz[a,h]anthracene	ND		0.050
Benzo[g,h,i]perylene	ND		0.050

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

PAH's by EPA 8270

Date Extracted:	9-17-98
Date Analyzed:	9-18-98
Matrix:	Water
Units:	ug/L (ppb)
Lab ID:	09-056-04
Client ID:	**RFB-06-GW**

Compound:	Results	Flags	PQL
Naphthalene	ND		1.0
2-Methylnaphthalene	1.6		1.0
Acenaphthylene	ND		1.0
Acenaphthene	ND		1.0
Fluorene	ND		1.0
Phenanthrene	2.5		1.0
Anthracene	ND		1.0
Fluoranthene	ND		1.0
Pyrene	ND		1.0
Benzo[a]anthracene	ND		1.0
Chrysene	ND		1.0
Benzo[b]fluoranthene	ND		1.0
Benzo[k]fluoranthene	ND		1.0
Benzo[a]pyrene	ND		1.0
Indeno[1,2,3-cd]pyrene	ND		1.0
Dibenz[a,h]anthracene	ND		1.0
Benzo[g,h,i]perylene	ND		1.0

Surrogate	Percent Recovery	Control Limits
Nitrobenzene-d5	66	35 - 114
2-Fluorobiphenyl	74	43 - 116
Terphenyl-d14	78	33 - 144

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

PAH's by EPA 8270
METHOD BLANK QUALITY CONTROL

Date Extracted:	9-17-98
Date Analyzed:	9-18-98
Matrix:	Water
Units:	ug/L (ppb)
Lab ID:	MB0917W1

Compound:	Results	Flags	PQL
Naphthalene	ND		1.0
2-Methylnaphthalene	ND		1.0
Acenaphthylene	ND		1.0
Acenaphthene	ND		1.0
Fluorene	ND		1.0
Phenanthrene	ND		1.0
Anthracene	ND		1.0
Fluoranthene	ND		1.0
Pyrene	ND		1.0
Benzo[a]anthracene	ND		1.0
Chrysene	ND		1.0
Benzo[b]fluoranthene	ND		1.0
Benzo[k]fluoranthene	ND		1.0
Benzo[a]pyrene	ND		1.0
Indeno[1,2,3-cd]pyrene	ND		1.0
Dibenz[a,h]anthracene	ND		1.0
Benzo[g,h,i]perylene	ND		1.0

Surrogate	Percent Recovery	Control Limits
Nitrobenzene-d5	74	35 - 114
2-Fluorobiphenyl	86	43 - 116
Terphenyl-d14	84	33 - 144

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

PAH's by EPA 8270
SB/SBD QUALITY CONTROL

Date Extracted: 9-17-98
Date Analyzed: 9-17-98

Matrix: Water
Units: ug/L (ppb)

Lab ID: SB0915W1

Compound:	Spike Amount	SB	Percent Recovery	SBD	Percent Recovery		RPD
Phenol	100	25.0	25	28.1	28		12
2-Chlorophenol	100	71.9	72	78.4	78		8.6
1,4-Dichlorobenzene	50	35.7	71	41.3	83		15
N-Nitroso-di-n-propylamine	50	37.2	74	41.8	84		12
1,2,4-Trichlorobenzene	50	37.0	74	43.9	88		17
4-Chloro-3-methylphenol	100	83.9	84	101	101		18
Acenaphthene	50	43.5	87	50.2	100		14
2,4-Dinitrotoluene	50	49.2	98	57.7	115	**	16
4-Nitrophenol	100	32.0	32	38.6	39		19
Pentachlorophenol	100	89.6	90	102	102		13
Pyrene	50	53.6	107	61.0	122		13

** Compound recovery outside control limits.

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

EXTRACTABLE PETROLEUM HYDROCARBONS

Date Extracted: 9-15-98
Date Analyzed: 9-17&18-98

Matrix: Soil
Units: mg/Kg (ppm)

Lab ID: 09-056-01
Client ID: RFB-01-SL

		PQL
Aliphatic C10-C12:	230	5.4
Aliphatic C12-C16:	700	5.4
Aliphatic C16-C18:	290	5.4
Aliphatic C18-C21:	250	5.4
Aliphatic C21-C28:	98	5.4
Aliphatic C28-C36:	ND	10
Total Aliphatic:	1600	
Aromatic C10-C12:	92	5.4
Aromatic C12-C16:	460	5.4
Aromatic C16-C18:	330	5.4
Aromatic C18-C21:	320	5.4
Aromatic C21-C28:	75	5.4
Aromatic C28-C36:	ND	5.4
Total Aromatic:	1300	
Surrogate Recovery:		Control Limits
o-Terphenyl	118%	50%-150%

Flags:

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

EXTRACTABLE PETROLEUM HYDROCARBONS

Date Extracted: 9-15-98
Date Analyzed: 9-17&18-98

Matrix: Soil
Units: mg/Kg (ppm)

Lab ID: 09-056-02
Client ID: RFB-02-SL

		PQL
Aliphatic C10-C12:	230	5.2
Aliphatic C12-C16:	660	5.2
Aliphatic C16-C18:	270	5.2
Aliphatic C18-C21:	200	5.2
Aliphatic C21-C28:	90	5.2
Aliphatic C28-C36:	ND	10
Total Aliphatic:	1400	
Aromatic C10-C12:	140	5.2
Aromatic C12-C16:	650	5.2
Aromatic C16-C18:	430	5.2
Aromatic C18-C21:	410	5.2
Aromatic C21-C28:	96	5.2
Aromatic C28-C36:	7.8	5.2
Total Aromatic:	1700	

Surrogate Recovery:		Control Limits
o-Terphenyl	168%	50%-150%

Flags: F

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

EXTRACTABLE PETROLEUM HYDROCARBONS

Date Extracted: 9-15-98
Date Analyzed: 9-23-98

Matrix: Soil
Units: mg/Kg (ppm)

Lab ID: 09-056-03
Client ID: RFB-03-SL

		PQL
Aliphatic C10-C12:	7.3	5.2
Aliphatic C12-C16:	85	5.2
Aliphatic C16-C18:	47	5.2
Aliphatic C18-C21:	35	5.2
Aliphatic C21-C28:	17	5.2
Aliphatic C28-C36:	ND	10
Total Aliphatic:	190	
Aromatic C10-C12:	ND	5.2
Aromatic C12-C16:	44	5.2
Aromatic C16-C18:	41	5.2
Aromatic C18-C21:	40	5.2
Aromatic C21-C28:	16	5.2
Aromatic C28-C36:	8.5	5.2
Total Aromatic:	150	
Surrogate Recovery:		Control Limits
o-Terphenyl	113%	50%-150%

Flags:

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

EXTRACTABLE PETROLEUM HYDROCARBONS
METHOD BLANK QUALITY CONTROL

Date Extracted: 9-15-98
Date Analyzed: 9-18-98

Matrix: Soil
Units: mg/Kg (ppm)

Lab ID: MB0915S1

		PQL
Aliphatic C10-C12:	ND	5.0
Aliphatic C12-C16:	ND	5.0
Aliphatic C16-C18:	ND	5.0
Aliphatic C18-C21:	ND	5.0
Aliphatic C21-C28:	ND	5.0
Aliphatic C28-C36:	ND	10
Total Aliphatic:	NA	
Aromatic C10-C12:	ND	5.0
Aromatic C12-C16:	ND	5.0
Aromatic C16-C18:	ND	5.0
Aromatic C18-C21:	ND	5.0
Aromatic C21-C28:	ND	5.0
Aromatic C28-C36:	ND	5.0
Total Aromatic:	NA	
Surrogate Recovery:		Control Limits
o-Terphenyl	107%	50%-150%

Flags:

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

EXTRACTABLE PETROLEUM HYDROCARBONS
DUPLICATE QUALITY CONTROL

Date Extracted: 9-15-98
Date Analyzed: 9-22&23-98

Matrix: Soil
Units: mg/Kg (ppm)

Lab ID:	09-056-03	09-056-03 DUP		
			PQL	RPD
Aliphatic C10-C12:	7.3	7.4	5.0	1.4
Aliphatic C12-C16:	85	90	5.0	5.7
Aliphatic C16-C18:	47	51	5.0	8.2
Aliphatic C18-C21:	35	44	5.0	23
Aliphatic C21-C28:	17	20	5.0	16
Aliphatic C28-C36:	ND	8.7	5.0	N/A
Aromatic C10-C12:	ND	ND	5.0	N/A
Aromatic C12-C16:	44	42	5.0	4.7
Aromatic C16-C18:	41	39	5.0	5.0
Aromatic C18-C21:	40	37	5.0	7.8
Aromatic C21-C28:	16	14	5.0	13
Aromatic C28-C36:	8.5	11	5.0	26

Surrogate Recovery:		Control Limits
o-Terphenyl	113%	113%

Flags:

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

EXTRACTABLE PETROLEUM HYDROCARBONS
SB/SBD QUALITY CONTROL

Date Extracted: 9-15-98
Date Analyzed: 9-22-98

Matrix: Soil
Units: mg/Kg (ppm)

Spike level: 100 ppm

Lab ID:	SB0915S1		SB0915S1 DUP			
		Percent Recovery		Percent Recovery	PQL	RPD
Aliphatic C10-C12:	ND	N/A	ND	N/A	5.0	N/A
Aliphatic C12-C16:	17.8	18	17.9	18	5.0	0.56
Aliphatic C16-C18:	11.9	12	11.8	12	5.0	0.84
Aliphatic C18-C21:	11.5	12	11.4	11	5.0	0.87
Aliphatic C21-C28:	5.88	6	5.56	6	5.0	5.5
Aliphatic C28-C36:	6.96	7	6.47	6	5.0	7.2
Total Aliphatic:	54.0		53.1			
Aromatic C10-C12:	ND	N/A	ND	N/A	5.0	N/A
Aromatic C12-C16:	10.0	10	9.92	10	5.0	0.80
Aromatic C16-C18:	8.96	9	8.72	9	5.0	2.7
Aromatic C18-C21:	9.73	10	9.50	10	5.0	2.4
Aromatic C21-C28:	ND	N/A	ND	N/A	5.0	N/A
Aromatic C28-C36:	9.59	10	7.50	8	5.0	24
Total Aromatic:	38.3		35.6			
Surrogate Recovery:				Control Limits		
o-Terphenyl	74%		74%	50%-150%		

Flags:

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

EXTRACTABLE PETROLEUM HYDROCARBONS

Date Extracted: 9-17-98
Date Analyzed: 9-18-98

Matrix: Water
Units: mg/L (ppm)

Lab ID: 09-056-04
Client ID: RFB-06-GW

		PQL
Aliphatic C10-C12:	0.31	0.05
Aliphatic C12-C16:	1.2	0.05
Aliphatic C16-C18:	0.52	0.05
Aliphatic C18-C21:	0.40	0.05
Aliphatic C21-C28:	0.22	0.05
Aliphatic C28-C36:	ND	0.20
Total Aliphatic:	2.9	
Aromatic C10-C12:	0.14	0.05
Aromatic C12-C16:	0.64	0.05
Aromatic C16-C18:	0.43	0.05
Aromatic C18-C21:	0.36	0.05
Aromatic C21-C28:	0.09	0.05
Aromatic C28-C36:	ND	0.15
Total Aromatic:	1.7	

Surrogate Recovery:		Control Limits
o-Terphenyl	72%	50%-150%

Flags:

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

EXTRACTABLE PETROLEUM HYDROCARBONS
METHOD BLANK QUALITY CONTROL

Date Extracted: 9-17-98
Date Analyzed: 9-18-98

Matrix: Water
Units: mg/L (ppm)

Lab ID: MB0917W2

		PQL
Aliphatic C10-C12:	ND	0.05
Aliphatic C12-C16:	ND	0.05
Aliphatic C16-C18:	ND	0.05
Aliphatic C18-C21:	ND	0.05
Aliphatic C21-C28:	ND	0.05
Aliphatic C28-C36:	ND	0.05
Total Aliphatic:	NA	0.20
Aromatic C10-C12:	ND	0.05
Aromatic C12-C16:	ND	0.05
Aromatic C16-C18:	ND	0.05
Aromatic C18-C21:	ND	0.05
Aromatic C21-C28:	ND	0.05
Aromatic C28-C36:	ND	0.05
Total Aromatic:	NA	0.15
Surrogate Recovery:		Control Limits
o-Terphenyl	86%	50%-150%
Flags:	G	

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

EXTRACTABLE PETROLEUM HYDROCARBONS
SB/SBD QUALITY CONTROL

Date Extracted: 9-17-98
Date Analyzed: 9-18-98

Matrix: Water
Units: mg/L (ppm)

Spike Level: 1.00 ppm

Lab ID: SB0917W1 SB0917W2 DUP

	SB	Percent Recovery	SBD	Percent Recovery	PQL	RPD
Aliphatic C10-C12:	ND	N/A	ND	N/A	0.05	N/A
Aliphatic C12-C16:	0.169	17	0.156	16	0.05	7.9
Aliphatic C16-C18:	0.120	12	0.105	10	0.05	13
Aliphatic C18-C21:	0.114	11	0.104	10	0.05	9.0
Aliphatic C21-C28:	0.0782	8	0.0829	8.0	0.05	9.0
Aliphatic C28-C36:	0.177	18	0.175	18	0.05	1.1
Total Aliphatic:	0.658		0.623			
Aromatic C10-C12:	ND	N/A	ND	N/A	0.05	N/A
Aromatic C12-C16:	0.121	12	0.120	12	0.05	0.83
Aromatic C16-C18:	0.113	11	0.109	11	0.05	3.6
	0.108	11	0.105	10	0.05	2.8
Aromatic C21-C28:	ND	N/A	ND	5.0	0.05	N/A
Aromatic C28-C36:	0.0538	5	ND	N/A	0.05	N/A
Total Aromatic:	0.396		0.334			
Surrogate Recovery:						
o-Terphenyl	87%		70%			

Flags:

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

VOLATILE PETROLEUM HYDROCARBONS

Date Extracted:	9-16-98
Date Analyzed:	9-16-98
Matrix:	Soil
Units:	mg/Kg (ppm)
Lab ID:	09-056-1
Client ID:	RFB-01-SL

VPH:	Results	PQL
Aliphatic C5-C6	ND	5.0
Aliphatic C6-C8	ND	5.0
Aliphatic C8-C10	ND	5.0
Aliphatic C10-C12	250	5.0
Total Aliphatic:	250	
Aromatic C8-C10	36	5.0
Aromatic C10-C12	190	5.0
Aromatic C12-C13	210	5.0
Total Aromatic:	440	
Target Analytes:		
Methyl t-butylether	ND	0.50
Benzene	ND	0.50
Toluene	ND	0.50
Ethylbenzene	ND	0.50
m , p - Xylene	ND	0.50
o -Xylene	ND	0.50

Surrogate:	Percent Recovery	Control Limits
Fluorobenzene	---	70%-130%

Flags: S

	Result
VPH	690

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

VOLATILE PETROLEUM HYDROCARBONS
METHOD BLANK QUALITY CONTROL

Date Extracted:	9-16-98
Date Analyzed:	9-16-98
Matrix:	Soil
Units:	mg/Kg (ppm)
Lab ID:	MB0916S1

VPH:	Results	PQL
Aliphatic C5-C6	ND	5.0
Aliphatic C6-C8	ND	5.0
Aliphatic C8-C10	ND	5.0
Aliphatic C10-C12	ND	5.0
Total Aliphatic:	NA	
Aromatic C8-C10	ND	5.0
Aromatic C10-C12	ND	5.0
Aromatic C12-C13	ND	5.0
Total Aromatic:	NA	
Target Analytes:		
Methyl t-butylether	ND	0.50
Benzene	ND	0.50
Toluene	ND	0.50
Ethylbenzene	ND	0.50
m , p - Xylene	ND	0.50
o -Xylene	ND	0.50

Surrogate:	Percent Recovery	Control Limits
Fluorobenzene	120	70%-130%

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

VOLATILE PETROLEUM HYDROCARBONS
DUPLICATE QUALITY CONTROL

Date Extracted: 9-16-98
Date Analyzed: 9-17-98

Matrix: Soil
Units: mg/Kg (ppm)

Lab ID:	09-080-03	Duplicate		
VPH:	Results	Results	PQL	RPD
Aliphatic C5-C6	ND	ND	5.0	NA
Aliphatic C6-C8	ND	ND	5.0	NA
Aliphatic C8-C10	ND	ND	5.0	NA
Aliphatic C10-C12	ND	ND	5.0	NA
Aromatic C8-C10	ND	ND	5.0	NA
Aromatic C10-C12	ND	ND	5.0	NA
Aromatic C12-C13	ND	ND	5.0	NA
Target Analytes:				
Methyl t-butylether	ND	ND	0.50	NA
Benzene	ND	ND	0.50	NA
Toluene	ND	ND	0.50	NA
Ethylbenzene	ND	ND	0.50	NA
m , p - Xylene	ND	ND	0.50	NA
o -Xylene	ND	ND	0.50	NA
Surrogate:	Percent Recovery	Percent Recovery	Control Limits	
Fluorobenzene	110	110	70%-130%	

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

VOLATILE PETROLEUM HYDROCARBONS
MS/MSD QUALITY CONTROL

Date Extracted: 9-16-98
Date Analyzed: 9-16-98

Matrix: Soil
Units: mg/Kg (ppm)
Spike Level: 1.00 ppm

Lab ID: SB0916S1

	SB	Percent Recovery	SBD	Percent Recovery	PQL	RPD
Benzene:	0.933	93	0.935	94	0.50	0.22
Toluene:	0.977	98	0.998	100	0.50	2.2
Ethylbenzene:	1.01	101	1.02	102	0.50	1.0
m , p - Xylene:	1.01	101	1.03	103	0.50	2.0
o -Xylene:	0.979	98	0.986	99	0.50	0.80
Surrogate:					Control Limits	
Fluorobenzene		96		96	70%-130%	

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

VOLATILE PETROLEUM HYDROCARBONS

Date Extracted:	9-16-98
Date Analyzed:	9-16-98
Matrix:	Water
Units:	ug/L (ppb)
Lab ID:	09-056-04
Client ID:	RFB-06-GW

VPH:	Results	PQL
Aliphatic C5-C6	ND	50
Aliphatic C6-C8	ND	50
Aliphatic C8-C10	ND	50
Aliphatic C10-C12	88	50
Total Aliphatic:	88	
Aromatic C8-C10	ND	50
Aromatic C10-C12	81	50
Aromatic C12-C13	130	50
Total Aromatic:	210	
Target Analytes:		
Methyl t-butylether	ND	5.0
Benzene	ND	5.0
Toluene	ND	5.0
Ethylbenzene	ND	5.0
m , p - Xylene	ND	5.0
o -Xylene	ND	5.0

Surrogate:	Percent Recovery	Control Limits
Fluorobenzene	79	70%-130%

Flags:

	Result
VPH	298

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

VOLATILE PETROLEUM HYDROCARBONS
METHOD BLANK QUALITY CONTROL

Date Extracted:	9-16-98
Date Analyzed:	9-16-98
Matrix:	Water
Units:	ug/L (ppb)
Lab ID:	MB0916W1

VPH:	Results	PQL
Aliphatic C5-C6	ND	50
Aliphatic C6-C8	ND	50
Aliphatic C8-C10	ND	50
Aliphatic C10-C12	ND	50
Total Aliphatic:	NA	
Aromatic C8-C10	ND	50
Aromatic C10-C12	ND	50
Aromatic C12-C13	ND	50
Total Aromatic:	NA	
Target Analytes:		
Methyl t-butylether	ND	5.0
Benzene	ND	5.0
Toluene	ND	5.0
Ethylbenzene	ND	5.0
m , p - Xylene	ND	5.0
o -Xylene	ND	5.0

Surrogate:	Percent Recovery	Control Limits
Fluorobenzene	79	70%-130%

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

VOLATILE PETROLEUM HYDROCARBONS
DUPLICATE QUALITY CONTROL

Date Extracted: 9-16-98
Date Analyzed: 9-16-98

Matrix: Water
Units: ug/L (ppb)

Lab ID:	09-056-04	Duplicate		
VPH:	Results	Results	PQL	RPD
Aliphatic C5-C6	ND	ND	50	NA
Aliphatic C6-C8	ND	ND	50	NA
Aliphatic C8-C10	ND	ND	50	NA
Aliphatic C10-C12	ND	ND	50	NA
Aromatic C8-C10	ND	ND	50	NA
Aromatic C10-C12	80.8	75.8	50	6.4
Aromatic C12-C13	130	128	50	1.6
Target Analytes:				
Methyl t-butylether	ND	ND	5.0	NA
Benzene	ND	ND	5.0	NA
Toluene	ND	ND	5.0	NA
Ethylbenzene	ND	ND	5.0	NA
m , p - Xylene	ND	ND	5.0	NA
o -Xylene	ND	ND	5.0	NA
Surrogate:	Percent Recovery	Percent Recovery	Control Limits	
Fluorobenzene	79	83	70%-130%	

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

VOLATILE PETROLEUM HYDROCARBONS
SB/SBD QUALITY CONTROL

Date Extracted: 9-16-98
Date Analyzed: 9-16-98

Matrix: Water
Units: ug/L (ppb)
Spiking Level: 50.0 ppb

Lab ID: SB0916W1

	SB	Percent Recovery	SBD	Percent Recovery	PQL	RPD
Benzene:	49.8	100	51.0	102	5.0	2.4
Toluene:	51.6	103	52.9	106	5.0	2.4
Ethylbenzene:	53.3	107	54.8	110	5.0	2.8
m,p 0- Xylene:	52.7	105	54.2	108	5.0	2.8
o -Xylene:	51.1	102	52.5	105	5.0	2.8
Surrogate:					Control Limits	
Fluorobenzene		80		83	70%-130%	

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

NWTPH-Dx

Date Extracted:	9-15-98
Date Analyzed:	9-15-98
Matrix:	Soil
Units:	mg/Kg (ppm)
Client ID:	RFB-03-SL
Lab ID:	09-056-03
Diesel Fuel:	300
PQL:	26
Heavy Oil:	ND
PQL:	52
Surrogate Recovery:	
o-Terphenyl	113%

Flags:

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

NWTPH-Dx
METHOD BLANK QUALITY CONTROL

Date Extracted:	9-15-98
Date Analyzed:	9-15-98
Matrix:	Soil
Units:	mg/Kg (ppm)
Lab ID:	MB0915S1
Diesel Fuel:	ND
PQL:	25
Heavy Oil:	ND
PQL:	50
Surrogate Recovery:	
o-Terphenyl	90%

Flags:

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

NWTPH-Dx
DUPLICATE QUALITY CONTROL

Date Extracted:	9-15-98
Date Analyzed:	9-15-98
Matrix:	Soil
Units:	mg/Kg (ppm)

Lab ID:	09-056-03	09-056-03 DUP
Diesel Fuel:	287	254
PQL:	25	25
RPD:	12	
Surrogate Recovery:		
o-Terphenyl	113%	108%

Flags:

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

NWTPH-Dx
SB/SBD QUALITY CONTROL

Date Extracted:	9-15-98	
Date Analyzed:	9-15&16-98	
Matrix:	Soil	
Units:	mg/Kg (ppm)	
Spike Level:	100 ppm	
Lab ID:	SB0915S1	SB0915S1 DUP
Diesel Fuel:	108	112
PQL:	25	25
Percent Recovery:	108	112
RPD:	3.6	
Surrogate Recovery:		
o-Terphenyl	106%	112%

Flags:

Date of Report: September 22, 1998
Samples Submitted: September 11, 1998
Lab Traveler: 09-056
Project: V-1075-02

Date Analyzed: 9-11-98

% MOISTURE

Client ID	Lab ID	% Moisture
RFB-01-SL	09-056-01	8.0
RFB-02-SL	09-056-02	4.0
RFB-03-SL	09-056-03	4.0

OnSite Environmental Inc.

DATA QUALIFIERS AND ABBREVIATIONS

A - Due to high sample concentration, the amount spiked is insufficient for meaningful MS/MSD recovery data.

B - The analyte indicated was also found in the blank sample.

C - The duplicate RPD is outside control limits due to high result variability when analyte concentrations are within five times the quantitation limit.

D - Data from 1:____ dilution.

E - The value reported exceeds the quantitation range, and is an estimate.

F - Surrogate recovery data is not available due to the high concentration of coeluting target compounds.

G - Insufficient sample quantity for duplicate analysis.

J - The value reported was below the practical quantitation limit. The value is an estimate.

K - Sample duplicate RPD is outside control limits due to sample inhomogeniety. The sample was re-extracted and re-analyzed with similar results.

M - Predominantly _____ range hydrocarbons present in the sample.

N - Hydrocarbons in the gasoline range (C7-toluene) are present in the sample which are elevating the diesel result.

O - Hydrocarbons in the heavy oil range (>C24) are present in the sample which are elevating the diesel result.

P - Hydrocarbons in the diesel range (C12-C24) are present in the sample which are elevating the oil result.

Q - The RPD of the results between the two columns is greater than 25.

R - Hydrocarbons outside the defined gasoline range are present in the sample; NWTPH-Dx recommended.

S - Surrogate recovery data is not available due to the necessary dilution of the sample.

T - The sample chromatogram is not similar to a typical _____.

U - Matrix Spike/Matrix Spike Duplicate RPD are outside control limits due to matrix effects.

V - Matrix Spike/Matrix Spike Duplicate recoveries are outside control limits due to matrix effects.

X - Sample underwent silica gel cleanup procedures.

Y - Sample underwent acid cleanup procedures.

Z - Interferences were present which prevented the quantitation of the analyte below the detection limit reported.

ND - Not Detected
MRL - Method Reporting Limit
PQL - Practical Quantitation

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

CHAIN OF CUSTODY RECORD

Page 1 of 1
Laboratory Onsite
Attn:

400 N. 34th Street, Suite 100
Seattle, WA 98103
(206) 632-8020

11500 Olive Blvd., Suite 276
St. Louis, MO 63141
(314) 872-8170

1354 N. Grandridge Blvd. 303 Wellsian Way
Kennewick, WA 99336 Richland WA
(509) 735-1280 (509) 946-6309

2055 Hill Road
Fairbanks, AK 99709
(907) 479-0600

5430 Fairbanks Street, Suite 3
Anchorage, AK 99518
(907) 561-2120

2412 N. 30th St., Suite 201
Tacoma, WA 98407
(206) 759-0156

Analysis Parameters/Sample Container Description
(include preservative if used)

Sample Identity	Lab No.	Time	Date Sampled	Comp.	Grab	PAH 8270D	PAH 625 (SIM)	EPH	TPH	NWTPH-Dx		Total Number of Containers	Remarks/Matrix
RFB-01-SL	1	5:00P	9-9			X		X	X			2	Soil
RFB-02-SL	2	5:15	9-9-98			X		X				2	Soil
RFB-03-SL	3	5:30	9-9			X		X		X		2	Soil
RFB-06-GW	4	7:30A	9-10				X	X	X			5	Water - 3 amber + VOA preserved w/ HCl

Project Information		Sample Receipt	
Project Number:	V-1075-02	Total Number of Containers	
Project Name:	Federal Bldg UST	COC Seals/Intact? Y/N/NA	
Contact:	Donna Parkes	Received Good Cond./Cold	
Ongoing Project?	Yes ☐ No ☐	Delivery Method:	UPS Overnight
Sampler:		(attach shipping bill, if any)	

Instructions

Requested Turn Around Time:

Special Instructions:

(509) 946-6309

Relinquished By: 1.	Relinquished By: 2.	Relinquished By: 3.
Signature: Donna Parkes Time: 4:15	Signature: Time:	Signature: Time:
Printed Name: Donna Parkes Date: 9-10-98	Printed Name: Date:	Printed Name: Date:
Company:	Company:	Company:

Received By: 1.	Received By: 2.	Received By: 3.
Signature: Time:	Signature: Time:	Signature: Time:
Printed Name: Date:	Printed Name: Date:	Printed Name: Date:
Company:	Company:	Company:

Distribution: White - w/shipment - returned to Shannon & Wilson w/ Laboratory report
Yellow - w/shipment - for consignee files
Pink - Shannon & Wilson - Job File

F-19-91/UR

APPENDIX D
IMPORTANT INFORMATION ABOUT YOUR ENVIRONMENTAL REPORT

Dated: October 13, 1998

To: Abide International, Inc.

Re: Richland Federal Building UST Site

Important Information About Your Geotechnical/Environmental Report

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include: the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used: (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors which were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the
ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland