

T-1276-01

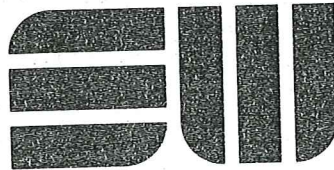
Release # 1583

WEYERHAEUSER  
SNOQUALMIE  
LIST # 3915

**Technical Memorandum 14  
Groundwater Quality Data  
Fourth Biannual Sampling Event  
The Weyerhaeuser Company  
Snoqualmie, Washington**

*June 1993*

**The Weyerhaeuser Company  
Attn: Mr. Max Healea, Jr.  
31002 Chinook Pass Highway  
Enumclaw, Washington 98022**



**SHANNON & WILSON, INC.**  
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

400 N. 34th St. ■ Suite 100  
P.O. Box 300303  
Seattle, Washington 98103  
206 ■ 632 ■ 8020

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DEPT OF ECOLOGY

June 2, 1993

The Weyerhaeuser Company  
31002 Chinook Pass Highway  
Enumclaw, Washington 98022

Attn: Mr. Max Healea, Jr.  
Environmental Project Manager

**RE: TECHNICAL MEMORANDUM 14, GROUNDWATER QUALITY DATA;  
FOURTH BIANNUAL SAMPLING EVENT OF MONITORING WELLS IN  
AREAS NO. 1 AND 2**

### INTRODUCTION

The purpose of this Memorandum is to provide you with the results of the fourth biannual sampling event of the 11 groundwater monitoring wells located in Areas No. 1 and 2 within the Weyerhaeuser Cascade Division's, Snoqualmie, Washington Facility. This sampling event represents the final action to be taken at this site under the current scope of work. The data from the previous three biannual sampling events are also presented in order to facilitate the evaluation of trends in the data.

The analytical methods chosen for this site are the appropriate, Washington Department of Ecology (Ecology), accepted methods for the time the groundwater monitoring at the site began in 1991. These prescribed Ecology methods for hydrocarbons have changed since that time (to the WTPH series); however, in a effort to maintain consistency, the original methods have been carried through all sampling events. Petroleum hydrocarbon products at the site were analyzed using Method 8015 -- Total Extractable Petroleum Hydrocarbons. Volatile compounds, including Benzene, Toluene, Ethylbenzene, and Xylenes, were analyzed using Method 8240 -- Volatile Organics. Lead was analyzed using Method 7421 (total lead).

The data is presented in both tabular and graphical formats for total extractable petroleum hydrocarbons (TEPH), benzene, toluene, ethylbenzene, xylenes (collectively referred to as BTEX), and lead in Figures 1 through 7. Groundwater elevations are also included on these figures. The seven figures are useful for quickly determining trends in individual contaminants compared to groundwater elevation. The data from each sampling event is also presented in Tables 1 through 4 for the July 1991, March 1992, September 1992, and April 1993 events, respectively, in a format similar to the previous reporting periods. These tables are useful for viewing the data for all the wells and analyses for a single sampling event.

### AUTHORIZATION

Services are provided in accordance with our contract dated June 19, 1991 (WEYCO PO No. 11-42540).

### RESULTS

Benzene, Toluene, Ethylbenzene, and Xylene (BTEX) concentrations exceed Model Toxics Control Act (MTCA) Method A cleanup levels in only Monitoring Well 3 (MW3) within Area No. 1 (former fuel storage facility).

Total Extractable Petroleum Hydrocarbons (TEPH) concentrations exceed MTCA cleanup levels in MW3, MW5 and MW6 within Area No. 1, and also MW3 within Area No. 2. This information is represented by shaded values on Table 4. A graphical summary of the gas chromatograph information reported by Alden Analytical Laboratories (see Enclosure) indicates that these TEPH results are similar to oil for all samples except monitoring well number 3 in Area 1 (A1-3), which contains gasoline range compounds in addition to the oil range compounds.

Total lead concentrations are exceeded in the seven monitoring wells in Area No. 1, MW-1, -2, -3, -4, -5, -6, and -7. Area No. 2 monitoring wells MW-1, -2, -3, and -4 also exceed the MTCA total lead cleanup level of 5 parts per billion.

### DISCUSSION

As indicated in the Third Biannual Sampling Report (November 1992), evaluation of trends among the sampling events indicates a direct relationship between increased water levels and increased TEPH and BTEX concentrations. For example, the water level in well number three, Area 2 (A2-3), is the highest of the four sampling events, and the corresponding TEPH value is also the highest of the four events, as shown in Figure 1. This phenomena is most likely due to the increased "wetted area" of soil exposed to groundwater. Contrary to this trend, however, is well A1-3, which indicates a reduction in TEPH independent of water level, which may be a positive sign that natural degradation is occurring, as discussed below.

The presence of higher concentrations of lead in the upgradient wells suggests that the levels are background and are not the direct result of spilled petroleum products which contain lead. There are no apparent trends in the lead data which would suggest continued source contamination of the aquifer.

As previously reported, the extent of the contamination does not appear to be spreading, primarily being limited to monitoring well number three in Area 1 (A1-3), and to a much lesser

extent, in monitoring wells 5 and 6, also in Area 1 (A1-5 and A1-6). As noted above, the total petroleum hydrocarbons present are similar to oil, except for well A1-3, which would tend to suggest that the movement in the subsurface and transfer to groundwater will be limited by physical adsorption (tendency of the oil to remain affixed to the soil, rather than become dissolved in the water). This process will be slow for oil, thereby closely limiting the impacted area.

The localized nature of the contamination is a positive sign when combined with information from the June 1990 treatability study performed by ReTeC, Inc. For soils generated from Areas No. 1 and 2, this study says, "Initial enumeration of total microorganisms and HC degraders in Area 1 and 2 site samples resulted in healthy concentrations of cells. The number of total microorganisms were typical of active landfarming operations which range from 106-108 cells/g soil" (page 26). This indicates an active ability to decrease the hydrocarbon concentrations in-situ under naturally occurring processes within these areas.

#### RECOMMENDATIONS

Given the limited extent of the source contamination, the static nature of the petroleum movement, and the availability of natural hydrocarbon degrading microorganisms, continued monitoring of the site seems unnecessary. Shannon & Wilson recommends that sampling activities be suspended until such time that further characterization may be required, i.e., a land-use change.

#### CLOSURE

The data presented in this Memorandum are based on limited research at the facility and should be considered representative at the time of our observations. Shannon & Wilson, Inc. performed this work within our best judgment to adequately describe site conditions at the facility. Changes in the conditions of the property can occur with time from both natural processes and human activities. In addition, changes in governmental codes, regulations, or law may occur. Due to such changes, our observations and recommendations applicable to this facility may need to be revised wholly or in part, due to changes beyond our control.

This Memorandum was prepared for the exclusive use of the Weyerhaeuser Company and in no way guarantees that an agency or its staff will reach the same conclusions as Shannon & Wilson, Inc. Shannon & Wilson has prepared the attached "Important Information About Your Subsurface Waste Management (Remediation) Report" to assist you and others in understanding the use and limitations of our reports.

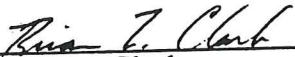
The Weyerhaeuser Company  
Attn: Mr. Max Healea, Jr.  
June 2, 1993  
Page 4


SHANNON & WILSON, INC.

A copy of this Memorandum should be forwarded to the Washington Department of Ecology for their reference. If you have any questions or comments regarding this material, please contact us at (206) 632-8020.

Sincerely,

SHANNON & WILSON, INC.

  
\_\_\_\_\_  
Brian L. Clark  
Environmental Engineer

  
\_\_\_\_\_  
Robert Colombo  
Associate



Frank W. Pita, P.E., P.G.  
Vice-President

- Enclosures:
- Table 1. July 1991 Groundwater Sample Results
  - Table 2. March 1992 Groundwater Sample Results
  - Table 3. September 1992 Groundwater Sample Results
  - Table 4. April 1993 Groundwater Sample Results /
  - Figure 1. TEPH Concentrations in Groundwater
  - Figure 2. Benzene Concentrations in Groundwater
  - Figure 3. Toluene Concentrations in Groundwater
  - Figure 4. Ethylbenzene Concentrations in Groundwater
  - Figure 5. O-Xylene Concentrations in Groundwater
  - Figure 6. M,P-Xylene Concentrations in Groundwater
  - Figure 7. Total Lead Concentrations in Groundwater
  - Copy of Alden Analytical Laboratory Report
  - Important Information About Your Subsurface Waste Management Report

Table 1. First Biannual Sampling Event (July 1991) ✓  
 Former Underground Fuel Storage Site (Area 1) and Above Ground Road Oil Storage Facilities (Area 2)  
 Groundwater Sample Results (1)

Well Location (2)	TEPH (8015 Mod.) (ppm)	Volatile Organic Analyses (EPA 624)				Total Lead (7421) (ppb)
		Benzene (ppb)	Toluene (ppb)	Ethylbenzene (ppb)	o-Xylene (ppb)	
A1-1	0.12	< 1.0	< 1.0	< 1.0	< 1.0	24
A1-2	0.49	< 1.0	< 1.0	< 1.0	< 1.0	21
A1-3	1.5	640	200	1700	350	58
A1-3 duplicate	1.7	700	< 10	670	430	64
A1-4	0.59	< 1.0	< 1.0	< 1.0	< 1.0	11
A1-5	1.1	14	< 1.0	2.3	1.6	18
A1-6	0.75	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0
A1-7	0.18	< 1.0	< 1.0	< 1.0	< 1.0	7
A2-1	0.37	< 1.0	< 1.0	< 1.0	< 1.0	22
A2-2	0.08	< 1.0	< 1.0	< 1.0	< 1.0	< 5.0
A2-3	0.42	< 1.0	< 1.0	< 1.0	< 1.0	53
A2-4	0.27	< 1.0	< 1.0	< 1.0	< 1.0	7
Ecology Cleanup Levels (3)	1.0	5.0	30.0	40.0	20.0	20.0

1) As reported by Alden Analytical Laboratory, Seattle, Washington  
 2) Legend: A1-1 = Area 1, Monitoring Well Number 1, etc.  
 3) Washington Model Toxics Control Act (MTCA) Method A  
 < Indicates value was less than the reporting limit, reporting limit indicated  
 Shaded cells indicate values exceeding MTCA Cleanup levels

Table 2. Second Biannual Sampling Event (March 1992)  
 Former Underground Fuel Storage Site (Area 1) and Above Ground Road Oil Storage Facilities (Area 2)  
 Groundwater Sample Results (1)

Well Location (2)	TEPH (8015 Mod.) (ppm)	Volatile Organic Analyses (EPA 624)						Total Lead (7421) (ppb)
		Benzene (ppb)	Toluene (ppb)	Ethylbenzene (ppb)	o-Xylene (ppb)	m,p-Xylene (ppb)		
A1-1	0.26	<1.0	<1.0	<1.0	<1.0	<1.0	6	
A1-2	0.61	<1.0	<1.0	<1.0	<1.0	<1.0	<2	
A1-3	4.6	1200	1400	370	260	1300	6	
A1-3 duplicate	4.0	1400	1600	460	290	1500	7	
A1-4	0.69	<1.0	<1.0	<1.0	<1.0	<1.0	18	
A1-5	0.98	<1.0	<1.0	<1.0	<1.0	<1.0	7	
A1-6	0.67	<1.0	<1.0	<1.0	<1.0	<1.0	6	
A1-7	<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	<2	
A2-1	0.47	<1.0	<1.0	<1.0	<1.0	<1.0	<2	
A2-2	<0.25	<1.0	<1.0	<1.0	<1.0	<1.0	3	
A2-3	0.78	<1.0	<1.0	<1.0	<1.0	<1.0	6	
A2-4	0.42	<1.0	<1.0	<1.0	<1.0	<1.0	<2	
Ecology Cleanup Levels (3)	1.0	5.0	30.0	40.0	20.0	20.0	5.0	

1) As reported by Alden Analytical Laboratory, Seattle, Washington  
 2) Legend: A1-1 = Area 1, Monitoring Well Number 1, etc.  
 3) Washington Model Toxics Control Act (MTCA) Method A  
 < Indicates value was less than the reporting limit, reporting limit indicated  
 Shaded cells indicate values exceeding MTCA Cleanup levels

Table 3. Third Biannual Sampling Event (September 1992) ✓  
 Former Underground Fuel Storage Site (Area 1) and Above Ground Road Oil Storage Facilities (Area 2)  
 Groundwater Sample Results (1)

Well Location (2)	TEPH (8015 Mod.) (ppm)	Volatile Organic Analyses (EPA 624)				Total Lead (7421) (ppm)
		Benzene (ppb)	Toluene (ppb)	Ethylbenzene (ppb)	o-Xylene (ppb)	
A1-1	0.19	< 1.0	< 1.0	< 1.0	< 1.0	0.025
A1-2	0.49	< 1.0	< 1.0	< 1.0	< 1.0	0.012
A1-3	2.8	1200	1100	360	240	0.036
A1-3 duplicate	NP	NP	NP	NP	NP	NP
A1-4	0.61	< 1.0	< 1.0	< 1.0	< 1.0	0.050
A1-5	1.2	14	21	1.1	1.6	0.022
A1-6	1.2	2.1	2.5	< 1.0	< 1.0	0.034
A1-7	0.19	< 1.0	< 1.0	< 1.0	< 1.0	0.016
A2-1	0.26	< 1.0	< 1.0	< 1.0	< 1.0	0.030
A2-2	0.15	< 1.0	< 1.0	< 1.0	< 1.0	0.007
A2-3	0.57	< 1.0	< 1.0	< 1.0	< 1.0	0.16
A2-4	0.41	< 1.0	< 1.0	< 1.0	< 1.0	0.047
Ecology Cleanup Levels (3)	1.0	5.0	40.0	30.0	20.0	20.0
						0.005

1) As reported by Alden Analytical Laboratory, Seattle, Washington

2) Legend: A1-1 = Area 1, Monitoring Well Number 1, etc.

3) Washington Model Toxics Control Act (MTCA) Method A

< Indicates value was less than the reporting limit, reporting limit indicated

Shaded cells indicate values exceeding MTCA Cleanup levels

NP indicates the test was Not Performed



Table 4. Fourth Biannual Sampling Event (April 1993) ✓  
 Former Underground Fuel Storage Site (Area 1) and Above Ground Road Oil Storage Facilities (Area 2)  
 Groundwater Sample Results (1)

Well Location (2)	TEPH (8015 Mod.) (ppm)	Volatile Organic Analyses (EPA 8240)						Total Lead (7421) (ppm)
		Benzene (ppb)	Toluene (ppb)	Ethylbenzene (ppb)	o-Xylene (ppb)	m,p-Xylene (ppb)		
A1-1	0.60	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	0.033	
A1-2	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	0.004	
A1-3	2.0	160	62	110	83	320	0.021	
A1-3 duplicate	2.3	150	78	90	68	300	0.011	
A1-4	0.97	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	0.006	
A1-5	1.5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	0.007	
A1-6	1.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	0.013	
A1-7	0.67	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	0.033	
A2-1	0.59	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	0.013	
A2-2	0.57	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	0.008	
A2-3	1.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	0.062	
A2-4	0.66	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	0.035	
Ecology Cleanup Levels (3)	1.0	5.0	40.0	30.0	20.0	20.0	0.005	

1) As reported by Alden Analytical Laboratory, Seattle, Washington

2) Legend: A1-1 = Area 1, Monitoring Well Number 1, etc.

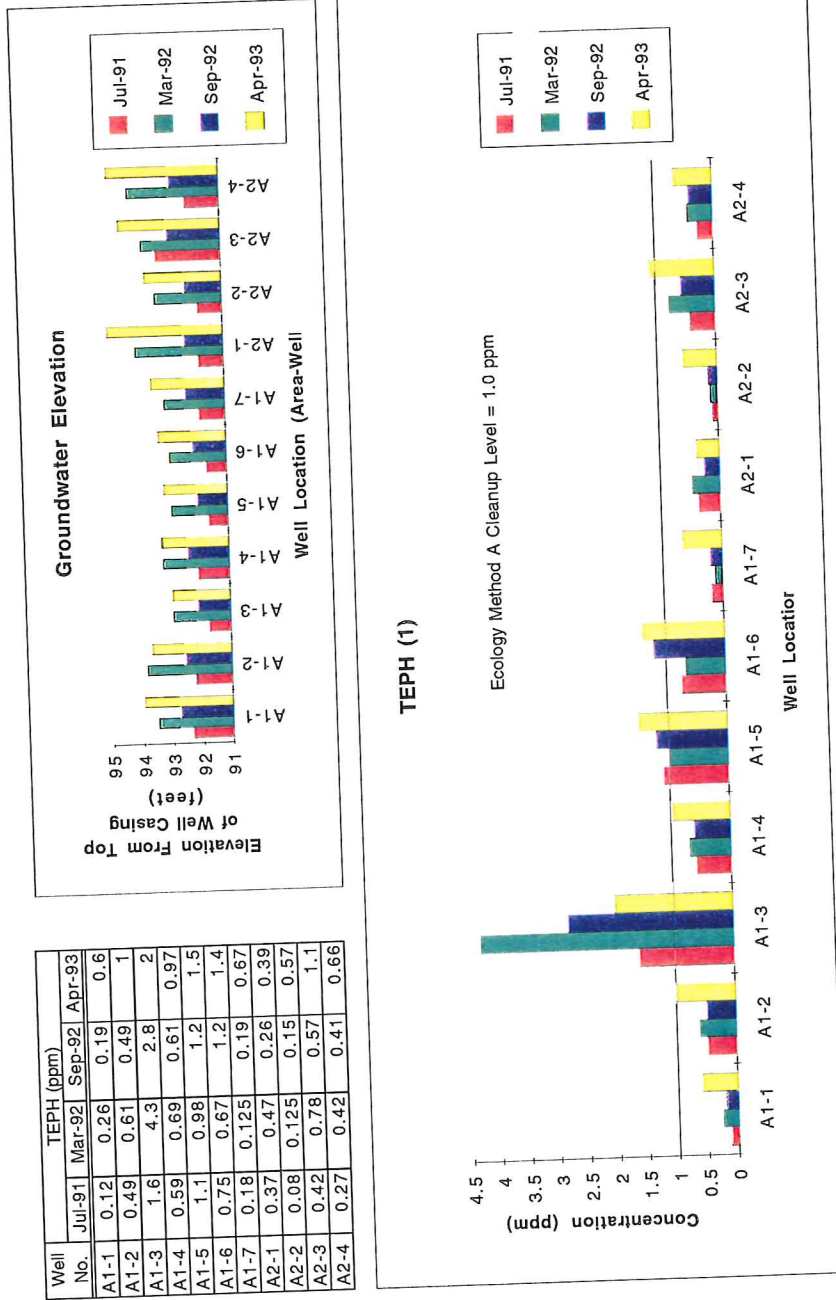
3) Washington Model Toxics Control Act (MTCA) Method A

< Indicates value was less than the reporting limit, reporting limit indicated

Shaded cells indicate values exceeding MTCA Cleanup levels

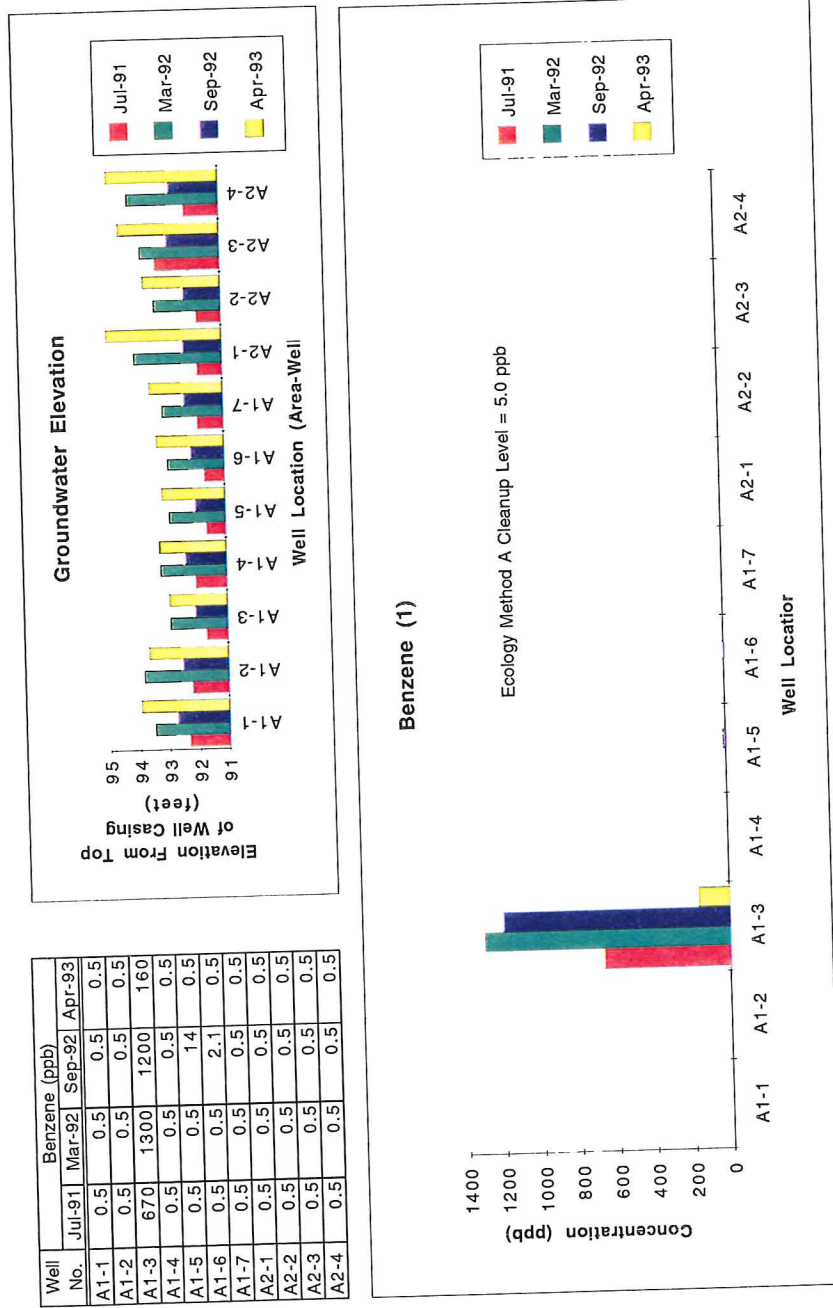
5/20/93  
 R2/1/93

Figure 1



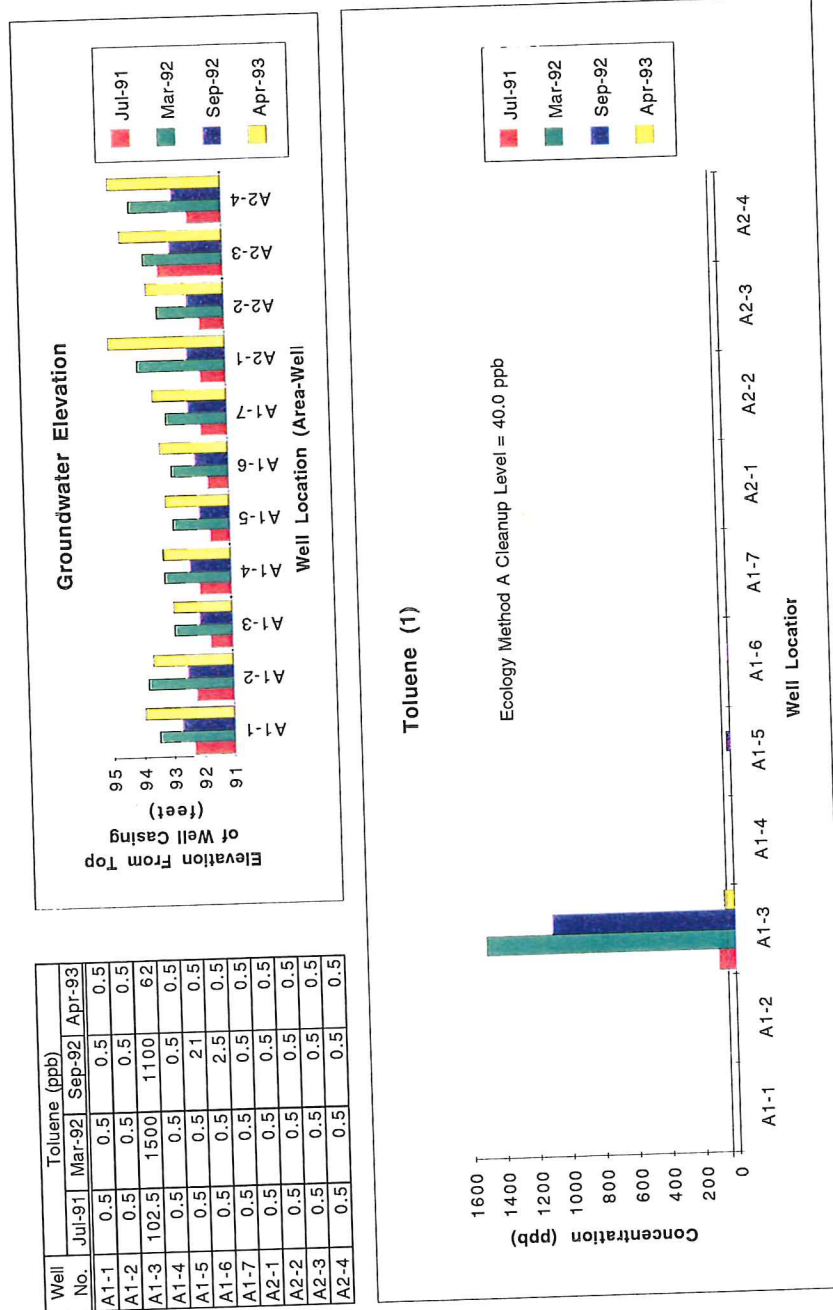
1) A value equal to one-half the reporting limit is represented for all values less than the reporting limit; laboratory reported non-detect (ND)

Figure 2



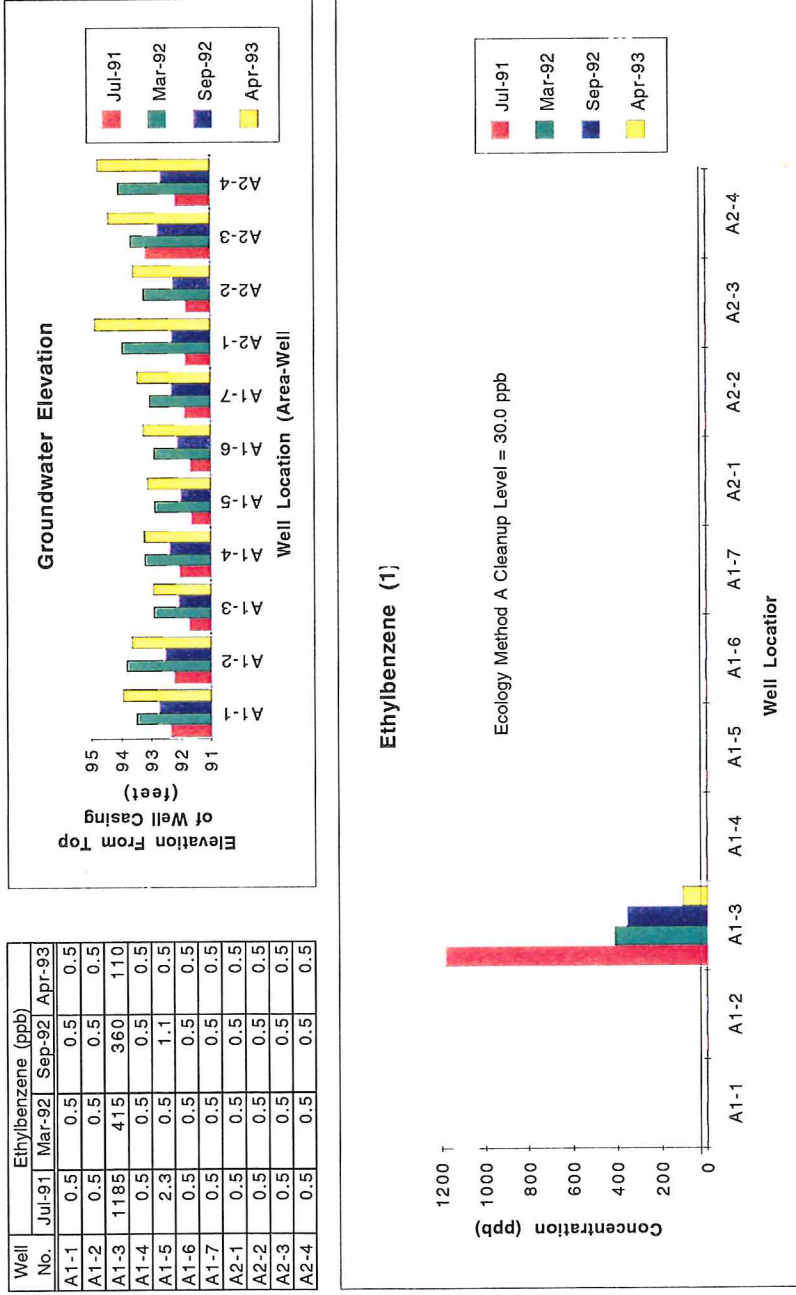
1) A value equal to one-half the reporting limit is represented for all values less than the reporting limit

Figure 3



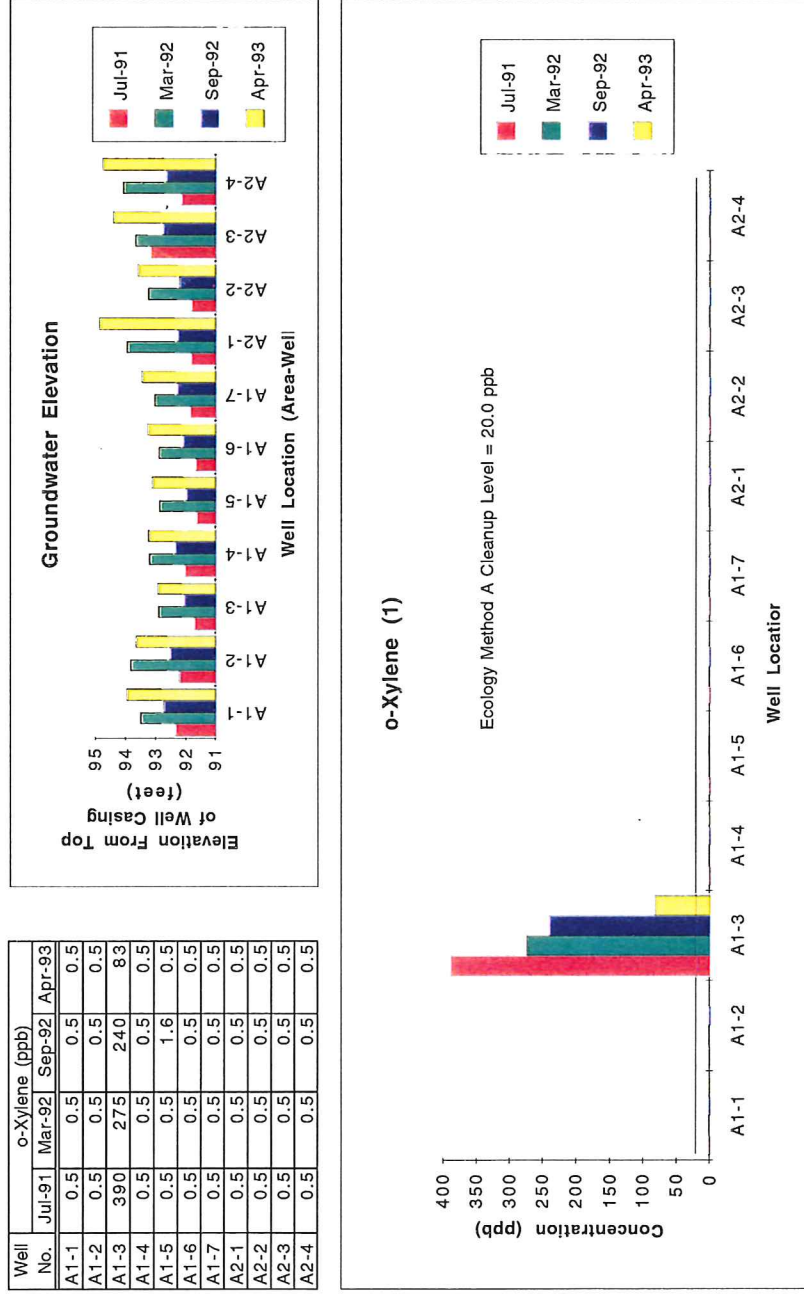
1) A value equal to one-half the reporting limit is represented for all values less than the reporting limit

Figure 4



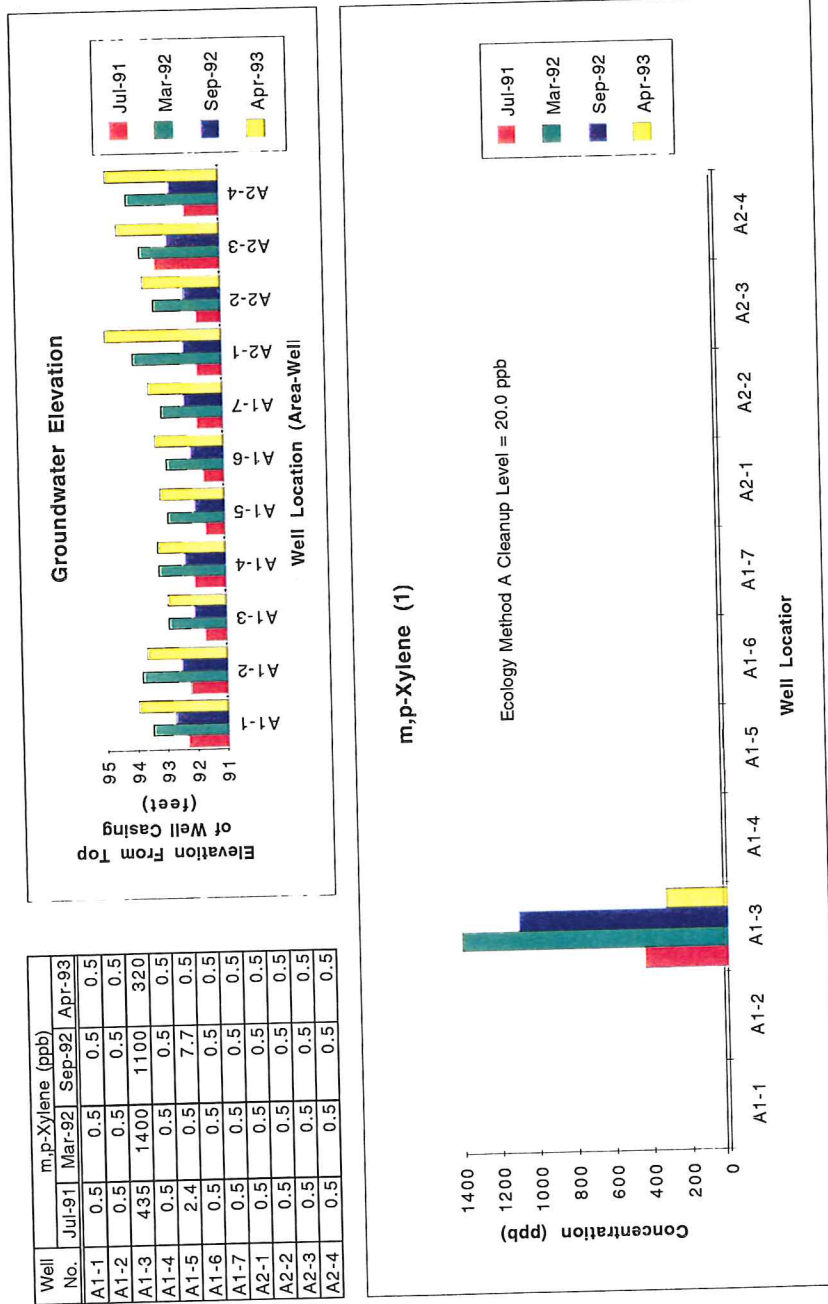
1) A value equal to one-half the reporting limit is represented for all values less than the reporting limit

Figure 5



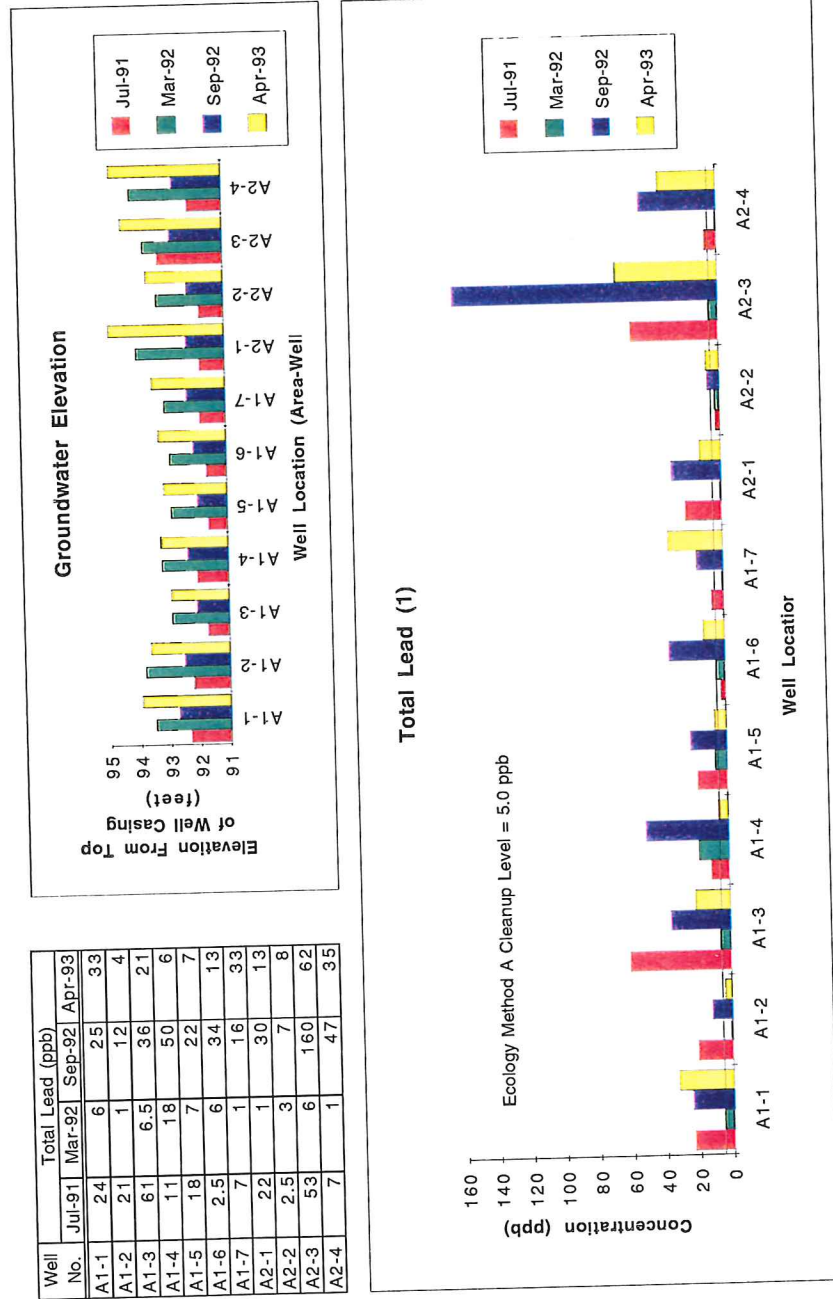
1) A value equal to one-half the reporting limit is represented for all values less than the reporting limit

Figure 6



1) A value equal to one-half the reporting limit is represented for all values less than the reporting limit

Figure 7



1) A value equal to one-half the reporting limit is represented for all values less than the reporting limit





Alden Analytical  
Laboratories, Inc.

May 11, 1993

Shannon & Wilson  
Attn: Brian Clark  
P.O. Box 300303  
Seattle, WA 98103

RE: ALDEN PROJECT NUMBER 9304055/1  
(SHANNON & WILSON PROJECT NUMBER T-1276-01)

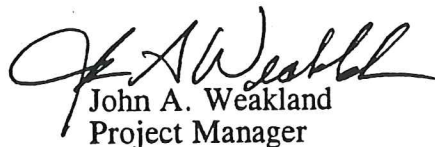
Dear Brian:

Enclosed are the analytical results for the water samples submitted to Alden Labs April 23, 1993. The samples were analyzed for Total Extractable Petroleum Hydrocarbons using Method 8015-Modified, BTEX using Method 8240, and Total Lead using Method 7421.

All samples met Alden's internal QA/QC criteria.

It is Alden's policy to dispose of all samples and extracts after the expiration of their hold time unless notified otherwise. If you have any questions, please do not hesitate to call me at the number below.

Sincerely,

  
John A. Weakland  
Project Manager

Enclosures



Alden Analytical  
Laboratories, Inc.

## REPORT OF ANALYTICAL RESULTS

*Client: Shannon & Wilson*  
*Client Sample Number: See Below*  
*Date of Sample Receipt: 04/23/93*  
*Matrix: Water*

*Alden Project Number: 9304055/1*  
*Alden Sample Number: See Below*  
*Analysis Method: EPA 8015-Modified*  
*Reporting Units: mg/L*

<i>Client Sample ID</i>	<i>Alden Sample Number</i>	<i>Extraction Date</i>	<i>Analysis Date</i>	<i>TPH</i>
N/A	Blank	04/26/93	04/30/93	< 0.25
1276477	3226	04/26/93	05/01/93	0.60
1276478	3227	04/26/93	05/01/93	0.97
1276479	3228	04/26/93	05/01/93	0.67
1276480	3229	04/26/93	05/01/93	1.4
1276481	3230	04/26/93	05/01/93	1.5
1276482	3231	04/26/93	05/01/93	1.0
1276483	3232	04/26/93	05/01/93	0.59
1276484	3233	04/26/93	05/01/93	1.1
1276485	3234	04/26/93	05/01/93	0.66
1276486	3235	04/26/93	05/01/93	0.57
1276487	3236	04/26/93	05/01/93	2.0
1276488	3237	04/26/93	05/01/93	2.3

Note: Results are reported to two significant figures.



Alden Analytical  
Laboratories, Inc.

### TPH (8015-Mod) GRAPHICAL SUMMARY\*

003

Run Time (Min.)

5

10

15

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25

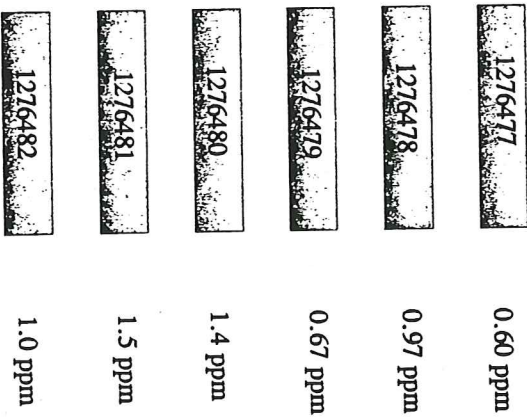
30

35

40

45

Client: Shannon & Wilson  
Alden Project: 9304055/1  
Matrix: Water  
Page 1 of 2



Sample ID

Gas

Diesel 2

Oil (30 Weight)

Diesel 1

Elution Ranges: Gasoline 5-10 minutes

Diesel 1 5-17 minutes

Diesel 2 10-22 minutes

Oil (30W) 22-50 minutes

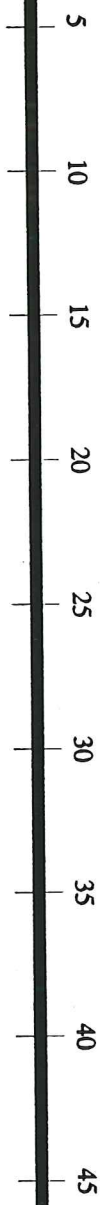
\*Note: This graphical representation is intended to provide a qualitative measurement of the elution range of hydrocarbons present in the sample versus known petroleum standards.



Alden Analytical  
Laboratories, Inc.

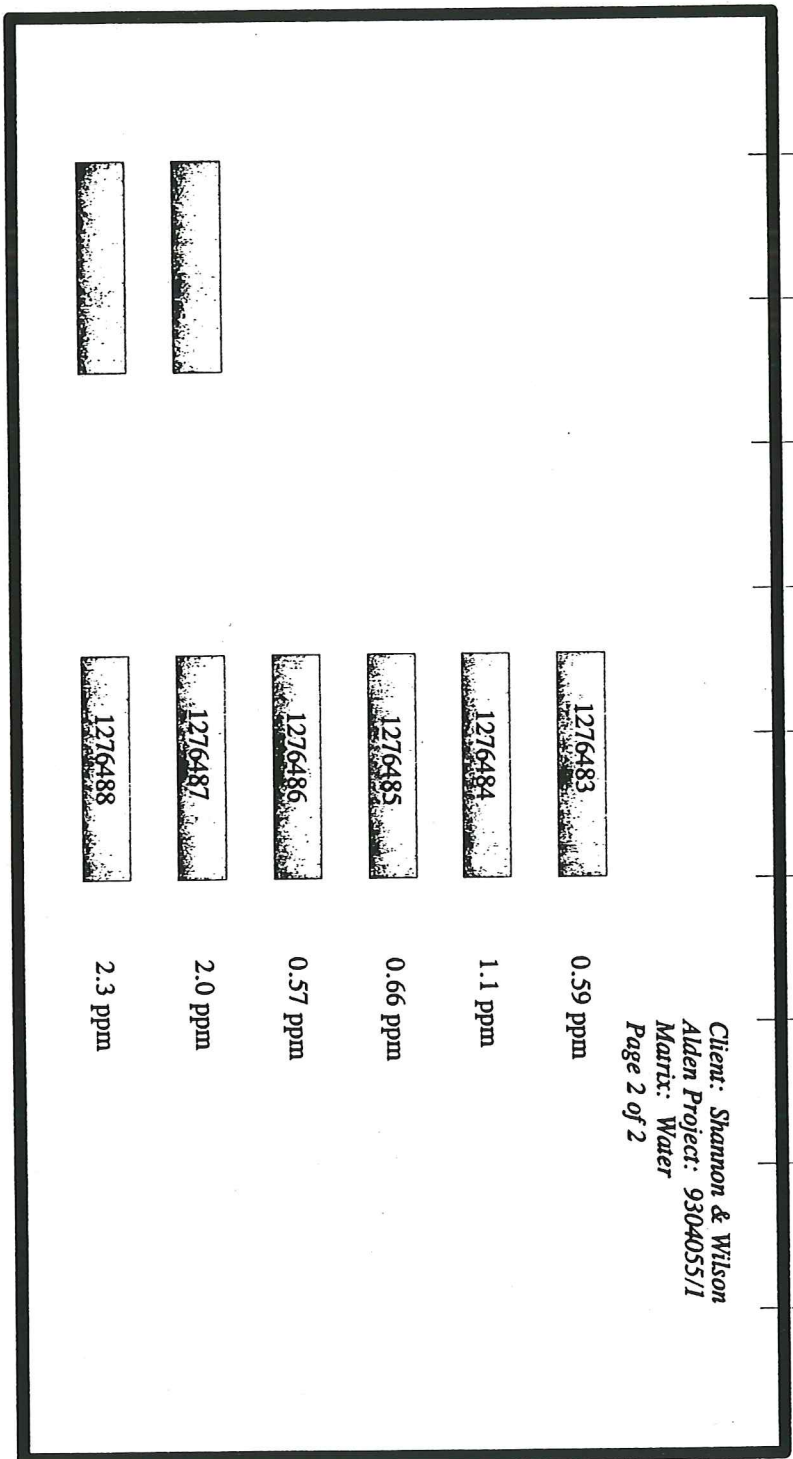
### TPH (8015-Mod) GRAPHICAL SUMMARY\*

Run Time (Min.)



Client: Shannon & Wilson  
Alden Project: 9304055/1  
Matrix: Water  
Page 2 of 2

Sample ID



1276483  
0.59 ppm

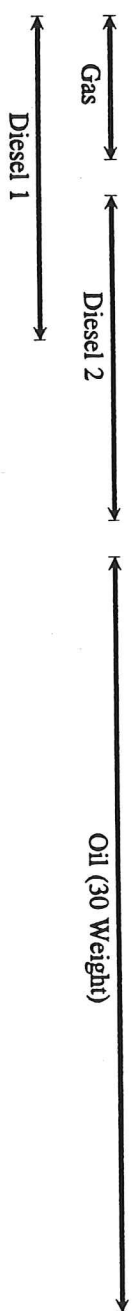
1276484  
1.1 ppm

1276485  
0.66 ppm

1276486  
0.57 ppm

1276487  
2.0 ppm

1276488  
2.3 ppm



Elution Ranges: Gasoline 5-10 minutes

Diesel 1 5-17 minutes

Diesel 2 10-22 minutes

Oil (30W) 22-50 minutes

\*Note: This graphical representation is intended to provide a qualitative measurement of the elution range of hydrocarbons present in the sample versus known petroleum standards.



Alden Analytical  
Laboratories, Inc.

## REPORT OF ANALYTICAL RESULTS

### 8015-Modified Blank Spike Recovery

*Client: Shannon & Wilson*  
*Client Sample Number: Blank*  
*Date of Sample Receipt: N/A*  
*Date of Sample Extraction: 04/26/93*  
*Date of Sample Analysis: 05/01/93*

*Alden Project Number: 9304055/1*  
*Alden Sample Number: Blank*  
*Analysis Method: EPA 8015-Mod.*  
*Matrix: Water*  
*Reporting Units: mg/L*

<i>Compound</i>	<i>Spike Added (mg/L)</i>	<i>Sample Concentration (mg/L)</i>	<i>MS Concentration (mg/L)</i>	<i>MS % Rec.</i>	<i>QC Limits Rec.</i>
Diesel Spike	2.0	0.00	2.3	115	39 - 150



Alden Analytical  
Laboratories, Inc.

## REPORT OF ANALYTICAL RESULTS

### 8015-Modified Matrix Spike/Matrix Spike Duplicate Recoveries

Client: Shannon & Wilson  
Client Sample Number: 1276486  
Date of Sample Receipt: 04/23/93  
Date of Sample Extraction: 04/26/93  
Date of Sample Analysis: 05/01/93

Alden Project Number: 9304055/1  
Alden Sample Number: 3235  
Analysis Method: EPA 8015-Mod.  
Matrix: Water  
Reporting Units: mg/L

Compound	Spike Added (mg/L)	Sample Concentration (mg/L)	MS Concentration (mg/L)	MS % Rec.	QC Limits Rec.
Diesel Spike	4.2	0.57	4.9	103	39 - 150

Compound	Spike Added (mg/L)	MSD Concentration (mg/L)	MSD % Rec.	% RPD	QC Limits	
					RPD	REC.
Diesel Spike	4.2	5.4	115	11	20	39 - 150

006



Alden Analytical  
Laboratories, Inc.

## REPORT OF ANALYTICAL RESULTS

*Client: Shannon & Wilson*

*Client Sample Number: N/A*

*Date of Sample Receipt: N/A*

*Date of Sample Extraction: N/A*

*Date of Sample Analysis: 04/27/93*

*Alden Project Number: 9304055/1*

*Alden Sample Number: BLANK1*

*Analysis Method: EPA 624*

*Matrix: Water*

*Reporting Units: ug/L*

<i>Compound Name</i>	<i>CAS No.</i>	<i>Reporting Limits(RL)</i>	<i>Reporting Results</i>
Benzene	71-43-2	1	< RL
Toluene	108-88-3	1	< RL
Ethylbenzene	100-41-4	1	< RL
m,p-Xylene*	1330-20-7	1	< RL
o-Xylene	1330-20-7	1	< RL

<i>Surrogates</i>	<i>Amount Added</i>	<i>Percent Recovery</i>	<i>Recovery Limits</i>
d4-1,2-Dichloroethane	250 ng	97	76-114
d8-Toluene	250 ng	99	88-110
Bromofluorobenzene	250 ng	105	86-115

\* m-Xylene and p-Xylene cannot be separated and are reported here as a total of the two isomers.



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Laboratories, Inc.

## REPORT OF ANALYTICAL RESULTS

*Client: Shannon & Wilson*  
*Client Sample Number: N/A*  
*Date of Sample Receipt: N/A*  
*Date of Sample Extraction: N/A*  
*Date of Sample Analysis: 04/28/93*

*Alden Project Number: 9304055/1*  
*Alden Sample Number: BLANK2*  
*Analysis Method: EPA 624*  
*Matrix: Water*  
*Reporting Units: ug/L*

<i>Compound Name</i>	<i>CAS No.</i>	<i>Reporting Limits(RL)</i>	<i>Reporting Results</i>
Benzene	71-43-2	1	<RL
Toluene	108-88-3	1	<RL
Ethylbenzene	100-41-4	1	<RL
m,p-Xylene*	1330-20-7	1	<RL
o-Xylene	1330-20-7	1	<RL

<i>Surrogates</i>	<i>Amount Added</i>	<i>Percent Recovery</i>	<i>Recovery Limits</i>
d4-1,2-Dichloroethane	250 ng	106	76-114
d8-Toluene	250 ng	96	88-110
Bromofluorobenzene	250 ng	95	86-115

\* m-Xylene and p-Xylene cannot be separated and are reported here as a total of the two isomers.





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## REPORT OF ANALYTICAL RESULTS

<i>Client: Shannon &amp; Wilson</i>	<i>Alden Project Number: 9304055/1</i>
<i>Client Sample Number: N/A</i>	<i>Alden Sample Number: BLANK3</i>
<i>Date of Sample Receipt: N/A</i>	<i>Analysis Method: EPA 624</i>
<i>Date of Sample Extraction: N/A</i>	<i>Matrix: Water</i>
<i>Date of Sample Analysis: 04/29/93</i>	<i>Reporting Units: ug/L</i>

<i>Compound Name</i>	<i>CAS No.</i>	<i>Reporting Limits(RL)</i>	<i>Reporting Results</i>
Benzene	71-43-2	1	<RL
Toluene	108-88-3	1	<RL
Ethylbenzene	100-41-4	1	<RL
m,p-Xylene*	1330-20-7	1	<RL
o-Xylene	1330-20-7	1	<RL

<i>Surrogates</i>	<i>Amount Added</i>	<i>Percent Recovery</i>	<i>Recovery Limits</i>
d4-1,2-Dichloroethane	250 ng	95	76-114
d8-Toluene	250 ng	98	88-110
Bromofluorobenzene	250 ng	95	86-115

\* m-Xylene and p-Xylene cannot be separated and are reported here as a total of the two isomers.



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## REPORT OF ANALYTICAL RESULTS

<i>Client: Shannon &amp; Wilson</i>	<i>Alden Project Number: 9304055/1</i>
<i>Client Sample Number: 1276477</i>	<i>Alden Sample Number: 3226</i>
<i>Date of Sample Receipt: 04/23/93</i>	<i>Analysis Method: EPA 624</i>
<i>Date of Sample Extraction: N/A</i>	<i>Matrix: Water</i>
<i>Date of Sample Analysis: 04/27/93</i>	<i>Reporting Units: ug/L</i>

<i>Compound Name</i>	<i>CAS No.</i>	<i>Reporting Limits(RL)</i>	<i>Reporting Results</i>
Benzene	71-43-2	1	<RL
Toluene	108-88-3	1	<RL
Ethylbenzene	100-41-4	1	<RL
m,p-Xylene*	1330-20-7	1	<RL
o-Xylene	1330-20-7	1	<RL

<i>Surrogates</i>	<i>Amount Added</i>	<i>Percent Recovery</i>	<i>Recovery Limits</i>
d4-1,2-Dichloroethane	250 ng	99	76-114
d8-Toluene	250 ng	101	88-110
Bromofluorobenzene	250 ng	106	86-115

\* m-Xylene and p-Xylene cannot be separated and are reported here as a total of the two isomers.



Alden Analytical  
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## REPORT OF ANALYTICAL RESULTS

<i>Client: Shannon &amp; Wilson</i>	<i>Alden Project Number: 9304055/1</i>
<i>Client Sample Number: 1276478</i>	<i>Alden Sample Number: 3227</i>
<i>Date of Sample Receipt: 04/23/93</i>	<i>Analysis Method: EPA 624</i>
<i>Date of Sample Extraction: N/A</i>	<i>Matrix: Water</i>
<i>Date of Sample Analysis: 04/27/93</i>	<i>Reporting Units: ug/L</i>

<i>Compound Name</i>	<i>CAS No.</i>	<i>Reporting Limits(RL)</i>	<i>Reporting Results</i>
Benzene	71-43-2	1	<RL
Toluene	108-88-3	1	<RL
Ethylbenzene	100-41-4	1	<RL
m,p-Xylene*	1330-20-7	1	<RL
o-Xylene	1330-20-7	1	<RL

<i>Surrogates</i>	<i>Amount Added</i>	<i>Percent Recovery</i>	<i>Recovery Limits</i>
d4-1,2-Dichloroethane	250 ng	106	76-114
d8-Toluene	250 ng	98	88-110
Bromofluorobenzene	250 ng	106	86-115

\* m-Xylene and p-Xylene cannot be separated and are reported here as a total of the two isomers.



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## REPORT OF ANALYTICAL RESULTS

*Client: Shannon & Wilson*  
*Client Sample Number: 1276479*  
*Date of Sample Receipt: 04/23/93*  
*Date of Sample Extraction: N/A*  
*Date of Sample Analysis: 04/27/93*

*Alden Project Number: 9304055/1*  
*Alden Sample Number: 3228*  
*Analysis Method: EPA 624*  
*Matrix: Water*  
*Reporting Units: ug/L*

<i>Compound Name</i>	<i>CAS No.</i>	<i>Reporting Limits(RL)</i>	<i>Reporting Results</i>
Benzene	71-43-2	1	<RL
Toluene	108-88-3	1	<RL
Ethylbenzene	100-41-4	1	<RL
m,p-Xylene*	1330-20-7	1	<RL
o-Xylene	1330-20-7	1	<RL

<i>Surrogates</i>	<i>Amount Added</i>	<i>Percent Recovery</i>	<i>Recovery Limits</i>
d4-1,2-Dichloroethane	250 ng	103	76-114
d8-Toluene	250 ng	98	88-110
Bromofluorobenzene	250 ng	106	86-115

\* m-Xylene and p-Xylene cannot be separated and are reported here as a total of the two isomers.



Alden Analytical  
Laboratories, Inc.

## REPORT OF ANALYTICAL RESULTS

<i>Client: Shannon &amp; Wilson</i>	<i>Alden Project Number: 9304055/1</i>
<i>Client Sample Number: 1276481</i>	<i>Alden Sample Number: 3230</i>
<i>Date of Sample Receipt: 04/23/93</i>	<i>Analysis Method: EPA 624</i>
<i>Date of Sample Extraction: N/A</i>	<i>Matrix: Water</i>
<i>Date of Sample Analysis: 04/27/93</i>	<i>Reporting Units: ug/L</i>

<i>Compound Name</i>	<i>CAS No.</i>	<i>Reporting Limits(RL)</i>	<i>Reporting Results</i>
Benzene	71-43-2	1	<RL
Toluene	108-88-3	1	<RL
Ethylbenzene	100-41-4	1	<RL
m,p-Xylene*	1330-20-7	1	<RL
o-Xylene	1330-20-7	1	<RL

<i>Surrogates</i>	<i>Amount Added</i>	<i>Percent Recovery</i>	<i>Recovery Limits</i>
d4-1,2-Dichloroethane	250 ng	105	76-114
d8-Toluene	250 ng	105	88-110
Bromofluorobenzene	250 ng	97	86-115

\* m-Xylene and p-Xylene cannot be separated and are reported here as a total of the two isomers.



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## REPORT OF ANALYTICAL RESULTS

*Client: Shannon & Wilson*  
*Client Sample Number: 1276482*  
*Date of Sample Receipt: 04/23/93*  
*Date of Sample Extraction: N/A*  
*Date of Sample Analysis: 04/28/93*

*Alden Project Number: 9304055/1*  
*Alden Sample Number: 3231*  
*Analysis Method: EPA 624*  
*Matrix: Water*  
*Reporting Units: ug/L*

<i>Compound Name</i>	<i>CAS No.</i>	<i>Reporting Limits(RL)</i>	<i>Reporting Results</i>
Benzene	71-43-2	1	<RL
Toluene	108-88-3	1	<RL
Ethylbenzene	100-41-4	1	<RL
m,p-Xylene*	1330-20-7	1	<RL
o-Xylene	1330-20-7	1	<RL

<i>Surrogates</i>	<i>Amount Added</i>	<i>Percent Recovery</i>	<i>Recovery Limits</i>
d4-1,2-Dichloroethane	250 ng	108	76-114
d8-Toluene	250 ng	105	88-110
Bromofluorobenzene	250 ng	107	86-115

\* m-Xylene and p-Xylene cannot be separated and are reported here as a total of the two isomers.



Alden Analytical  
Laboratories, Inc.

## REPORT OF ANALYTICAL RESULTS

### Volatiles Matrix Spike/Matrix Spike Duplicate Recoveries

Client: Shannon & Wilson  
Client Sample Number: 1276482  
Date of Sample Receipt: 04/23/93  
Date of Sample Extraction: N/A  
Date of Sample Analysis: 04/28/93

Alden Project Number: 9304055/1  
Alden Sample Number: 3231  
Analysis Method: EPA 624  
Matrix: Water  
Reporting Units: ug/L

Compound	Spike Added (ug/L)	Sample Concentration (ug/L)	MS Concentration (ug/L)	MS % Rec.	QC Limits Rec.
1,1-Dichloroethene	50	0	44.86	90	61 - 145
Trichloroethene	50	0	48.84	98	71 - 120
Benzene	50	0	48.78	98	76 - 127
Toluene	50	0	50.19	100	76 - 125
Chlorobenzene	50	0	52.36	105	75 - 130

Compound	Spike Added (ug/L)	MSD Concentration (ug/L)	MSD % Rec.	% RPD	QC Limits	
					RPD	REC.
1,1-Dichloroethene	50	47.15	94	5.0	14	61 - 145
Trichloroethene	50	49.46	99	1.3	14	71 - 120
Benzene	50	50.14	100	2.7	11	76 - 127
Toluene	50	54.00	108	7.3	13	76 - 125
Chlorobenzene	50	50.99	102	2.7	13	75 - 130



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## REPORT OF ANALYTICAL RESULTS

*Client: Shannon & Wilson*  
*Client Sample Number: 1276483*  
*Date of Sample Receipt: 04/23/93*  
*Date of Sample Extraction: N/A*  
*Date of Sample Analysis: 04/28/93*

*Alden Project Number: 9304055/1*  
*Alden Sample Number: 3232*  
*Analysis Method: EPA 624*  
*Matrix: Water*  
*Reporting Units: ug/L*

<i>Compound Name</i>	<i>CAS No.</i>	<i>Reporting Limits(RL)</i>	<i>Reporting Results</i>
Benzene	71-43-2	1	<RL
Toluene	108-88-3	1	<RL
Ethylbenzene	100-41-4	1	<RL
m,p-Xylene*	1330-20-7	1	<RL
o-Xylene	1330-20-7	1	<RL

<i>Surrogates</i>	<i>Amount Added</i>	<i>Percent Recovery</i>	<i>Recovery Limits</i>
d4-1,2-Dichloroethane	250 ng	103	76-114
d8-Toluene	250 ng	101	88-110
Bromofluorobenzene	250 ng	96	86-115

\* m-Xylene and p-Xylene cannot be separated and are reported here as a total of the two isomers.





Alden Analytical  
Laboratories, Inc.

## REPORT OF ANALYTICAL RESULTS

<i>Client: Shannon &amp; Wilson</i>	<i>Alden Project Number: 9304055/1</i>
<i>Client Sample Number: 1276486</i>	<i>Alden Sample Number: 3235</i>
<i>Date of Sample Receipt: 04/23/93</i>	<i>Analysis Method: EPA 624</i>
<i>Date of Sample Extraction: N/A</i>	<i>Matrix: Water</i>
<i>Date of Sample Analysis: 04/28/93</i>	<i>Reporting Units: ug/L</i>

<i>Compound Name</i>	<i>CAS No.</i>	<i>Reporting Limits(RL)</i>	<i>Reporting Results</i>
Benzene	71-43-2	1	<RL
Toluene	108-88-3	1	<RL
Ethylbenzene	100-41-4	1	<RL
m,p-Xylene*	1330-20-7	1	<RL
o-Xylene	1330-20-7	1	<RL

<i>Surrogates</i>	<i>Amount Added</i>	<i>Percent Recovery</i>	<i>Recovery Limits</i>
d4-1,2-Dichloroethane	250 ng	107	76-114
d8-Toluene	250 ng	97	88-110
Bromofluorobenzene	250 ng	94	86-115

\* m-Xylene and p-Xylene cannot be separated and are reported here as a total of the two isomers.



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## REPORT OF ANALYTICAL RESULTS

*Client: Shannon & Wilson*  
*Client Sample Number: 1276487*  
*Date of Sample Receipt: 04/23/93*  
*Date of Sample Extraction: N/A*  
*Date of Sample Analysis: 04/29/93*

*Alden Project Number: 9304055/1*  
*Alden Sample Number: 3236*  
*Analysis Method: EPA 624*  
*Matrix: Water*  
*Reporting Units: ug/L*

<i>Compound Name</i>	<i>CAS No.</i>	<i>Reporting Limits(RL)</i>	<i>Reporting Results</i>
Benzene	71-43-2	10	160
Toluene	108-88-3	10	62
Ethylbenzene	100-41-4	10	110
m,p-Xylene*	1330-20-7	10	320
o-Xylene	1330-20-7	10	83

<i>Surrogates</i>	<i>Amount Added</i>	<i>Percent Recovery</i>	<i>Recovery Limits</i>
d4-1,2-Dichloroethane	250 ng	102	76-114
d8-Toluene	250 ng	105	88-110
Bromofluorobenzene	250 ng	104	86-115

\* m-Xylene and p-Xylene cannot be separated and are reported here as a total of the two isomers.



Alden Analytical  
Laboratories, Inc.

## REPORT OF ANALYTICAL RESULTS

<i>Client: Shannon &amp; Wilson</i>	<i>Alden Project Number: 9304055/1</i>
<i>Client Sample Number: 1276488</i>	<i>Alden Sample Number: 3237</i>
<i>Date of Sample Receipt: 04/23/93</i>	<i>Analysis Method: EPA 624</i>
<i>Date of Sample Extraction: N/A</i>	<i>Matrix: Water</i>
<i>Date of Sample Analysis: 04/29/93</i>	<i>Reporting Units: ug/L</i>

<i>Compound Name</i>	<i>CAS No.</i>	<i>Reporting Limits(RL)</i>	<i>Reporting Results</i>
Benzene	71-43-2	10	150
Toluene	108-88-3	10	78
Ethylbenzene	100-41-4	10	90
m,p-Xylene*	1330-20-7	10	300
o-Xylene	1330-20-7	10	68

<i>Surrogates</i>	<i>Amount Added</i>	<i>Percent Recovery</i>	<i>Recovery Limits</i>
d4-1,2-Dichloroethane	250 ng	105	76-114
d8-Toluene	250 ng	97	88-110
Bromofluorobenzene	250 ng	102	86-115

\* m-Xylene and p-Xylene cannot be separated and are reported here as a total of the two isomers.



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## REPORT OF ANALYTICAL RESULTS

Client: Shannon & Wilson

Client Sample Number: 1276489

Date of Sample Receipt: 04/23/93

Date of Sample Extraction: N/A

Date of Sample Analysis: 04/29/93

Alden Project Number: 9304055/1

Alden Sample Number: 3238

Analysis Method: EPA 624

Matrix: Water

Reporting Units: ug/L

Compound Name	CAS No.	Reporting Limits(RL)	Reporting Results
Benzene	71-43-2	1	<RL
Toluene	108-88-3	1	<RL
Ethylbenzene	100-41-4	1	<RL
m,p-Xylene*	1330-20-7	1	<RL
o-Xylene	1330-20-7	1	<RL

Surrogates	Amount Added	Percent Recovery	Recovery Limits
d4-1,2-Dichloroethane	250 ng	108	76-114
d8-Toluene	250 ng	107	88-110
Bromofluorobenzene	250 ng	99	86-115

\* m-Xylene and p-Xylene cannot be separated and are reported here as a total of the two isomers.



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## REPORT OF ANALYTICAL RESULTS

*Client: Shannon & Wilson*  
*Client Sample Number: See Below*  
*Date of Sample Receipt: 04/23/93*  
*Matrix: Water*

*Alden Project Number: 9304055/1*  
*Alden Sample Number: See Below*  
*Analysis Method: EPA 7421*  
*Reporting Units: mg/L*

<i>Client Sample ID</i>	<i>Alden Sample Number</i>	<i>Digestion Date</i>	<i>Analysis Date</i>	<i>Reporting Limit</i>	<i>Total Lead</i>
N/A	Blank	4/26/93	4/26/93	0.002	< RL
1276477	3226	4/26/93	4/26/93	0.002	0.033
1276478	3227	4/26/93	4/26/93	0.002	0.006
1276479	3228	4/26/93	4/26/93	0.002	0.033
1276480	3229	4/26/93	4/26/93	0.002	0.013
1276481	3230	4/26/93	4/26/93	0.002	0.007
1276482	3231	4/26/93	4/26/93	0.002	0.004
1276483	3232	4/26/93	4/26/93	0.002	0.013
1276484	3233	4/26/93	4/26/93	0.002	0.062
1276485	3234	4/26/93	4/26/93	0.002	0.035
1276486	3235	4/26/93	4/26/93	0.002	0.008
1276487	3236	4/26/93	4/26/93	0.002	0.021
1276488	3237	4/26/93	4/26/93	0.002	0.011

Note: Results are reported to two significant figures.



Alden Analytical  
Laboratories, Inc.

## REPORT OF ANALYTICAL RESULTS

### Metals Blank Spike/Matrix Spike Recoveries

<i>Client: Shannon &amp; Wilson</i>	<i>Alden Project Number: 9304055/1</i>
<i>Client Sample Number: 1276481</i>	<i>Alden Sample Number: 3230</i>
<i>Date of Sample Receipt: 04/23/93</i>	<i>Analysis Method: EPA 7421</i>
<i>Date of Sample Digestion: 04/26/93</i>	<i>Matrix: Water</i>
<i>Date of Sample Analysis: 04/26/93</i>	<i>Reporting Units: mg/L</i>

<i>Compound</i>	<i>Spike Added (mg/L)</i>	<i>Blank Spike Concentration (mg/L)</i>	<i>Blank Spike % Rec.</i>	<i>QC Limits Rec.</i>
Lead	1.00	1.09	109	50 - 135

<i>Compound</i>	<i>Duplicate Concentration (mg/L)</i>	<i>% RPD</i>	<i>Spike Added (mg/L)</i>	<i>Matrix Spike Concentration (mg/L)</i>	<i>Matrix Spike % Recovery</i>	<i>QC Limits</i>	
						<i>RPD</i>	<i>REC.</i>
Lead	0.010	35*	1.00	0.78	77	20	50 - 135

\* Sample Result < 10x detection limit. RPD okay.









Project/PO Number T-1276-01  
 Contact: BRIAN CLARK  
 Company/Address SIU

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 Samplers: \_\_\_\_\_

**Analyses Requested**

SOIS MOD.	BTEX 8240	TOTAL Pb TUR
X	X	X
X	X	X
X	X	X

629

Alden Project Number: 9304055(1)

Sample Date/Time	Sample ID #	Matrix	# Containers	TAT	Lab ID #	Remarks
4/23/93	1276487	WATER	6	A	3236A-F	
	1276488		1	J	3237A-F	
	1276489		1	J	3238	

Special Instructions/Comments:

Received By:

Signature

Date Time

Received By:

Signature

Date Time

TAT Codes  
 A Standard  
 C 48 hr  
 E 1 Week  
 B 24hr  
 D 72hr  
 F Other:

Please note that samples received after 3PM are considered received 8AM the following business day.

Dated: June 2, 1993To: The Weyerhaeuser CompanyAttn: Mr. Max Healea, Jr.

## **Important Information About Your Geotechnical Engineering/ Subsurface Waste Management (Remediation) Report**

### **GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND PERSONS.**

Consulting geotechnical engineers 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 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 geotechnical engineer/geoscientist.

### **AN ENGINEERING REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.**

A geotechnical engineering/subsurface waste management (remediation) 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, have the consulting engineer(s)/scientist(s) evaluate how any factors which change subsequent to the date of the report, may affect the recommendations. Unless your consulting geotechnical/civil engineer and/or scientist 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. Geotechnical/civil engineers and/or scientists cannot accept responsibility for problems which 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 changes or human influence. Because a geotechnical/waste management engineering report is based on conditions which existed at the time of subsurface exploration, construction decisions should not be based on an engineering report whose adequacy may have been affected by time. Ask the geotechnical/waste management 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/waste management report. The geotechnical/civil engineer and/or scientist should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

### **MOST GEOTECHNICAL 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 minimize their impact. 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 geotechnical engineer'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. Because actual