



**TABLES**



**TABLE 1-1  
 DETAILED SUMMARY OF EVENTS RELATED TO  
 1990 HARRIS/VAN WEST and 1997 YOUNGS BAY TEXACO RELEASES**

Remedial Investigation/Feasibility Study  
 Astoria Area-Wide Petroleum Site  
 Astoria, Oregon

Date	Activity	Analytical Summary	Reference
12/2/1990	Fire Department responds to complaints of vapors in apartment building. Narrows down the length of combined storm sewer (CSS) line in which product could be seen. Impacted area is between Niemi Oil Cardlock (NCL) and Harris/Van West (HVW).		Rittenhouse-Zeman 1990 (Appendix A)
12/3/1990	Riedel Environmental Services (RES) arrives on site at request of City of Astoria. Manhole A is impacted (free product) Manhole B is up-gradient manhole. Recover water and free product from CSS line (now blocked off). RES obtains a sample of product from Manhole A and gives it to DEQ (Loren Garner) for analysis. (See Figure 1-8 for manhole locations)		
12/3/1990	RES completes three soil probes (P1 to P3) on NCL site to determine source of free product. Impacted soil is encountered (P3) but characteristics are not considered consistent with those that would generate free product.		
12/3/1990	RES monitors the excavation of six exploratory test pits on the NCL site. Sample from T1 (near P3) is submitted to DEQ laboratory for analysis to see if hydrocarbons are consistent with free product identification in Manhole A (it is not). Explorations identify the CSS line has been perforated by concrete-form stakes associated with building the retaining wall. Exploration T6 identifies free product "product begins to seep freely into the trench at the height of the sewer line and below". A sample of product and soil from T6 is collected and held on ice to give to DEQ for analysis and comparison to free product found in the sewer line. RES states that free product "originated somewhere behind the retaining wall".		

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Date	Activity	Analytical Summary	Reference
12/4/1990	DEQ Laboratory results from emergency response activities.	Manhole A free product analysis identifies fresh gasoline. T1 soil sample based on DEQ chromatogram identifies "weathered gas degraded diesel."	Rittenhouse-Zeman 1990 (Appendix A)
12/4/1990	Rittenhouse-Zeman Associates (RZA) arrives on site at the request of Harris Oil Company.		
12/5/1990	RES couriers the T6 free product sample and soil sample to DEQ.	Copy of DEQ chromatogram for both soil and free product states "gasoline – looks new not much indication of weathering or biodegradation...very much like 901075" (id number for Manhole A free product sample).	
12/5/1990	RW-1 a culvert/recovery well is installed on NCL site by RZA. RW-1 was installed using a backhoe to depth of 12 feet. Visible contamination was present to total depth and approx 1-inch of free product observed on water table. Installed recovery system. 20-Day Report states "product sample collected from RW-1, . . . , yielded evidence of gasoline and diesel". No RW-1 product test results attached. Attached test results are for a 12/14/90 RW-1 water sample. Please see 12/14/90 entry.	Analytical testing of sample HA 12590 from base of RW-1 did not detect hydrocarbons by EPA 418.1 or by Hydrocarbon I.D. by GC/FID. RW-1 water sample dated 12/14/90 has 540 ppm C <sub>6</sub> - C <sub>13</sub> (similar to gas) and 23 ppm C <sub>-13</sub> - C <sub>22</sub> (in range of #2 diesel)	RZA 1990
12/1990 - 2/1991	Four wells (MW1, 2, 3 and recovery well RW-2) and two soil borings (B6 and B7) installed on HVW site using a drill rig. Strong petroleum odors in RW-2, MW2, MW3, B6, and B7. Visible contamination in RW-2 from 12 feet below ground surface (bgs) to total depth of boring (30 feet bgs).	Hydrocarbon ID from RW-2 15 feet bgs soil sample (HA12890-4) indicated 4,900 ppm gasoline range and 3,300 ppm diesel range (no comment on overlap, weathering, or degradation). Soil samples from borings in vicinity of tank cavity detected gasoline range hydrocarbons. A heavy fuel hydrocarbon was detected in one sample from B6.	RZA 1991

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12/7/1990	New CSS line installed at NCL. Old CSS line between manhole A and B is abandoned. CSS line from manhole B now flows to sewer line in Industry Street (See Figure 1-8)		
12/9/1990	Two samples of groundwater/product from RW-1 were collected and submitted for fuel fingerprint by GC.	Both samples were identified by Friedman & Bruya Laboratory as water soluble portion of gasoline.	RZA 1991 (Appendix E)
12/14/1990	Samples of water from MW1, MW2, RW-1, RW-2. (This laboratory report is presented in RZA 1990 Appendix B but not discussed in text. Is discussed in RZA 1991 text and included as part of Appendix E). Results discussed correctly in RZA 1991 report. Previous comment in RZA 1990 about product sample from RW-1 yielding evidence of gasoline and diesel, is omitted.	Pacific Environmental Laboratory (PEL) Water Analytical Results. MW1 and MW2 – ND; RW-2 water sample results are 94 ppm similar to gasoline (C <sub>6</sub> - C <sub>13</sub> ); RW-1 water sample results are 540 ppm similar to gasoline (C <sub>6</sub> - C <sub>13</sub> ), and 23 ppm in range of #2 diesel (no comment on overlap, etc...).	RZA 1990 (Appendix A), RZA 1991a (Appendix E)
1/1/1991 - 1/7/1991	Total fluids recovery system installed in RW-2.		RZA 1991a
1/25/1991	2.5 feet of product measured in RW-2 prior to startup of recovery system.	Free product also in MW-3 (unknown thickness).	RZA 1991a
2/1/1991	New recovery system installed in RW-2, dual pump system.		RZA 1991a
2/11/1991	USTs removed at HVW site.		RZA 1991a
May 1991	Subsurface Investigation at Young's Bay Texaco. Five soil borings completed as monitoring wells (MW-1 to MW-5).	Analytical results were not detected or very low. MW-5/SB-5 had a TPH-G detection of 350 ppm.	Sheet-Edwards/EMCON 1991
7/16/1991	RW-2 recovery system influent sample analysis (sample date 4/6/91)	RZA chemist review states chromatogram is indicative of degraded gasoline.	RZA 1991b

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Date	Activity	Analytical Summary	Reference
9/10/1991	Remediation system shut down due to water level decline. Based on RZA information, no product in RW-1 since August 1991.		Seacor 1992a
10/1991 - 11/1991	Seacor performs characterization at HVW site. Five soil borings (B8 to B12, B8 completed as MW-4), 3 hand auger borings (HA1 to HA3) and 7 (TP1 to TP7) test pits. Hand auger borings are on NCL site.	HA1 gasoline and low diesel (report suggests overlap.) B8, B10, B11, B12 had some diesel/bunker.	Seacor 1992a
	Sampled monitoring wells in October (MW1, MW2, MW3) and December 1991 (MW1, MW2, MW3, MW-4, RW-1).	No Product in MW3. Water sampling did not include evaluation of hydrocarbon ID. December 1991 results note RW-1 and M-3 hydrocarbons are "gasoline type".	
1/1992 - 3/1993	January 1992 to March 1993: Young's Bay Texaco UST removal activities.	Confirmation samples within guidelines.	AGI 1992
10/2/1992	Seacor CAP report for HVW site. Summarizes work to date.	Report summary states "low concentrations of diesel range hydrocarbons were detected in several samples containing relatively high concentrations of gasoline. It is possible that the detected hydrocarbons labeled "Diesel" actually represent higher range gasoline which overlaps diesel normally detected by the method." Higher levels of diesel or bunker-type hydrocarbons were detected in other areas isolated from the primary area of gasoline and have no obvious pattern or correlation to gasoline (UST) release	Seacor 1992b
March 1993	Install MW-6 at Young's Bay Texaco. MW-6 is downgradient well near north property line	Analytical results ND	Pacific Environmental Group 1993

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<b>Date</b>	<b>Activity</b>	<b>Analytical Summary</b>	<b>Reference</b>
7/1993 - 8/1993	Fuel UST remedial excavation completed at HVW site. RW-2 removed.	Laboratory analysis indicated excavation was completed within guidelines.	PNE 1996
August 1993	Exploration activities (B-1, B-2, B-3, B-4) along Industry Street in vicinity of NCL in association with McCall diesel release. Borings intended to be "upgradient" from 1993 McCall diesel release. (See Figure 1-5 for locations)	TPH-G detected at concentrations up to 6,200 ppm in B-1, 2,200 ppm in B-3, and 3,100 ppm in B-2.	Hahn and Associates, 1993
October 1993	Sump/Pipe recovery well replaces RW-2 to continue ground water remediation. Sump/Pipe was installed in remedial excavation – not drilled well.		
March 1994	PNE report – Quarterly GW report (samples dates 3/9 and 3/21)	Analysis detected 54 ppb diesel and 276 ppb other (oil) in RW-1 (VH-CULWS-3/9), Sump/Pipe (VH-WEXS-3/21) sample 7040 ppb gasoline (CAS hydrocarbon scan)	PNE 1994a
July/August 1994	Waste Oil UST remedial excavation at HVW site.	Laboratory analysis indicated excavation was completed within guidelines.	PNE 1994b
July 11, 1994	Groundwater sampling of Sump/Pipe, MW1 and MW2 and analyzed for TPH-G/BTEX. A sample from RW-1 (or VHCULWS is not discussed)	Analysis detected 5260 ppb TPH-G in Pipe/Sump. In appendix sample ID VHCULWS-7/11/94 is on chain of custody for hydrocarbon scan and analytical results detected 572ppb gasoline.	PNE 1994b
2/29/1996	Wayne Coppel letter asks for closure at HVW.		Coppel, 1996
8/12/1996	DEQ borings at AAW site. DEQ boring 5 is on NCL site (near intersection of north/south trending CSS line and Industry Street). Sample analyzed from 6.5 feet bgs.	TPH-G at 3,200 ppm	DEQ 1997

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Date	Activity	Analytical Summary	Reference
1/16/1997	PNG Environmental (PNG) investigation consisting of six soil borings (1 to 6) on NCL site. Boring 6 is located between HVW and NCL facilities, 5 located downgradient of north/south trending CSS line and RW-1 (exact location is somewhat unclear).	Soil analytical results detected gas and diesel. 5 had highest detects (sample depth 4 - 8 feet bgs) detected TPH-G at 2500 ppm and TPH-D at 2000 ppm. Boring 6 (sample depth 0 - 4 feet bgs) detects TPH-G at 550 ppm, TPH-D at 3100 ppm and TPH-Oil at 269 ppm.  Well point water samples detect very elevated gas and relative lower diesel hydrocarbons (note on diesel analysis that gas component eluted in the diesel range). In general concentrations for gas component is in 10,000's and diesel was in 1,000s range.	PNG 1997
5/5/1997	1,700 gallon gasoline release into UST vault at Youngs Bay site. Release stopped 6/5/97. Known to be gasoline. Approximately 1460 gallons reported recovered from vault.		DEQ 1997b
June 1997	Free product and soil samples from recovery trench at Youngs Bay site submitted to DEQ Laboratory. Recovery trench located between retaining wall/UST vault and CSS line (no exact location noted).	DEQ Laboratory identifies product as gas. Soil analyzed for TPH-Gx had detections.	DEQ 1997a
8/1/1997	Qwest Investigation to evaluate May 1997 Youngs Bay release and Qwest UST/pump island area before excavating. Boring B completed inside Qwest building and boring 1 to 7 completed near Qwest UST, piping, or dispenser.	Soil from boring B essentially ND. Water from boring B detected elevated BTEX; up to 2,200 ppb benzene.  Pre-decommissioning analytical results detected minor hydrocarbons except in one location. Specifically elevated TPH-G (12,000 ppm) in soil in the vicinity of the dispenser (boring 7) prior to removal/ excavation activities.	First Strike Environmental 1997a

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10/1/1997	Qwest investigation to evaluate contamination (boring 37 to 48). Borings 38, 44, 45 south of Qwest building. Borings 39, 40, 43 between Qwest utility yard and former apartment building. Boring 37 and 47 near Manhole B. Boring 41 and 48 near CSS line to Industry Street.	Soil samples from borings between Qwest site and Young's Bay site/former apartment building essentially ND. Near Manhole B maximum TPH-G at 2,100 ppm (Boring 47). Along north/south CSS reroute from Manhole B to Industry Street TPH-G near Manhole B at 1,500 ppm (Boring 37); mid line 690 ppm (Boring 41); near Industry 8,200 ppm (Boring 48)	First Strike Environmental 1997b
August 1997	Neil Shaw report for Young's Bay summarizes that examination of soil samples from test pits (no location or number) and 2 hand auger borings (MW-1 and MW-2) indicate release was limited to a small area near release point.	Water analytical results from MW-1 and MW-2 were ND.	Neil Shaw 1997
November 1997	Neil Shaw, Inc. conducts subsurface investigation (Hole 1(Q) to Hole 9(Q)) at Qwest site for Young's Bay gasoline release. All borings inside Qwest building or on Qwest side of CCS line. No visual evidence of impacted soils.	One soil sample from each borehole analyzed for TPH-G. All ND except Hole-8(Q) had TPH-G at 13 mg/kg.	Neil Shaw, 1998
1/28/1998	Water samples from RW-1 submitted for analysis. Columbia Analytical Services (CAL) performs Qualitative Evaluation for Niemi Oil Company TPH Chromatograms. Includes samples from 1993, 1997, and 1998.	See 9/25/1998 entry	PNG 1998 (Appendix A)
9/25/1998	PNG Focused Environmental Site Assessment report for NCL site presents CAS review of chromatograms from Hahn August 30, 1993 work (Industry Street borings), PNG January 6, 1997 work (NCL explorations), and January 28, 1998 work (RW-1 water sample).	Review indicates primary contaminant gasoline. Although TPH-D reported, most of reported TPH-D was carry over from gasoline. Diesel fingerprint identified in soil sample SB-3-8 and SB-1 water sample (both of NCL). Diesel finger print from RW-1 was not identified	PNG 1998 (Appendix A)

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June 1999	Neil Shaw conducts subsurface investigation at Qwest for Youngs Bay 1997 gasoline release. Three borings advanced to 1 foot below water table to collect one-time groundwater samples (10, 11, and 12).	Laboratory BTEX analysis of water samples detected only benzene at 2 mg/L in 10. All other analyses were ND.	Neil Shaw, 1999
2002 and 2003	AAW investigations	Laboratory results indicated soil along CSS between Qwest/Young's Bay Texaco is not significantly impacted by petroleum hydrocarbons; Elevated TPH-G along CSS line from Manhole B to Industry Street and on NCL is detected. TPH-D along this CSS line essentially ND; TPH-D on Niemi Carlock detected but almost always less than TPH-G except at SB-604(N); TPH-D not detected along combined sewer between HVW and NCL; TPH-G ground water plume appears centered along the former lateral; TPH-D follows similar pattern but smaller and of less magnitude.	Envirologic Resources Inc. 2007

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FIELD PARAMETERS**

Remedial Investigation/Feasibility Study  
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Locator ID	Sample ID	Sample Date	DO		Temp deg C	ORP mV	Conductivity µS	pH
			mg/L	%				
R-1(M)	R-1(M)	10/22/2003		5.3	17.2	162	104	7.39
MW-1(F)	MW-1(F)	10/22/2003		15.1	14.3	100	182	7.06
MW-1(F)	MW-1(F)	1/15/2004	0.60	5.9	12.9	122	112	6.88
MW-1(F)	MW-1(F)	4/15/2004	2.56	23.6	12.2	164	640	6.75
MW-1(F)	MW-1(F)	7/20/2004	0.69	6.7	16.2	82	589	6.54
MW-2(M)	MW-2(M)	10/15/2003		7.3	15.7	-21	253	6.91
MW-2(M)	MW-2(M)	1/12/2004	0.71	6.8	14.4	67	93.2	6.97
MW-2(M)	MW-2(M)	4/14/2004	0.08	0.1	12.4	126	366	6.68
MW-2(M)	MW-2(M)	7/22/2004		negative error	17.2	-37	318	6.55
MW-6(M)	MW-6(M)	10/22/2003		10.4	15.7	9	120	7.28
MW-6(M)	MW-6(M)	1/12/2004	1.05	10.1	8.8	68	172	6.61
MW-6(M)	MW-6(M)	4/13/2004	0.59	5.0	12.6	na	509	6.60
MW-6(M)	MW-6(M)	7/19/2004	2.09	24.2	16.2	-1	446	6.64
MW-7(M)	MW-7(M)	10/13/2003		7.6	16.8	0.43	414	6.73
MW-7(M)	MW-7(M)	1/12/2004	0.90	9.1	14.3	69	135	6.94
MW-7(M)	MW-7(M)	4/12/2004	0.70	6.9	13.2	91	357	6.93
MW-7(M)	MW-7(M)	7/19/2004	0.21	2.1	15.6	55	286	6.93
MW-10(M)	MW-10(M)	10/15/2003		12.8	15.2	-34	330	6.72
MW-10(M)	MW-10(M)	1/13/2004	7.20	67.4	13.5	-10	111	6.93
MW-10(M)	MW-10(M)	4/13/2004	negative error	0.0	12.6	14	751	6.85
MW-10(M)	MW-10(M)	7/19/2004		negative error	15.2	-6	556	6.82

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Locator ID	Sample ID	Sample Date	DO		Temp deg C	ORP mV	Conductivity µS	pH
			mg/L	%				
MW-11(M)	MW-11(M)	10/15/2003		n/a	13.9	-37	161	6.86
MW-11(M)	MW-11(M)	1/13/2004	1.80	16.0	15.2	-24	94.1	6.93
MW-11(M)	MW-11(M)	4/13/2004	0.68	6.2	13.2	17	371	6.89
MW-11(M)	MW-11(M)	7/21/2004		negative error	15.0	15	311	6.80
MW-12(A)	MW-12(M)	1/15/2004	1.34	12.6	12.9	151	129	6.95
MW-12(A)	MW-12(M)	4/16/2004	1.62	15.3	12.3	199	881	6.64
MW-12(A)	MW-12(M)	7/22/2004	negative error	1.9	14.9	169	789	6.63
MW-13(A)	MW-13(A)	10/22/2003		4.5	15.5	-10	340	7.9
MW-13(A)	MW-13(A)	1/15/2004	0.52	4.9	15.5	43	132	7.05
MW-13(A)	MW-13(A)	4/16/2004	2.95	27.6	13.6	194	728	7.46
MW-13(A)	MW-13(A)	7/22/2004		negative error	15.9	2	743	7.12
MW-14(A)	MW-14(A)	10/21/2003		17.3	16.1	203	170	6.73
MW-14(A)	MW-14(A)	1/15/2004	5.65	53.0	12.7	135	100	6.95
MW-14(A)	MW-14(A)	4/16/2004	3.07	28.0	12.1	232	722	6.61
MW-14(A)	MW-14(A)	7/23/2004	2.71	27.3	15.8	134	646	6.45
MW-15(A)	MW-15(A)	10/20/2003		6.7	15.8	-52	424	7.24
MW-16(A)	MW-16(A)	10/20/2003		8.4	16.8	22	193	7.04
MW-16(A)	MW-16(A)	1/19/2004	1.17	10.9	15.4	128	701	6.77
MW-16(A)	MW-16(A)	4/15/2004	1.12	102.0	12.2	154	729	6.86
MW-16(A)	MW-16(A)	7/22/2004	3.13	31.9	17.8	90	557	6.70
MW-17(A)	MW-17(A)	10/17/2003		6.4	15.9	-21	430	6.90
MW-17(A)	MW-17(A);	1/19/2004	0.34	3.2	14.6	101	577	6.67

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			mg/L	%				
MW-17(A)	MW-17(A)	4/15/2004	0.36	3.5	12.3	96	545	6.95
MW-17(A)	MW-17(A)	7/22/2004		negative error	15.5	-4	545	6.97
MW-18(A)	MW-18(A)	10/21/2003		4.1	18.1	-76	342	7.18
MW-18(A)	MW-18(A)	1/19/2004	1.11	10.5	15.3	-11	640	6.90
MW-18(A)	MW-18(A)	4/15/2004	0.38	4.1	12.6	49	657	6.88
MW-18(A)	MW-18(A)	7/21/2004	0.12	1.3	16.0	-56	652	6.90
MW-19(A)	MW-19(A)	10/20/2003		8.2	16.5	n/a	364	6.88
MW-19(A)	MW-19(A)	1/13/2004	5.16	47.7	14.6	137	94.2	6.99
MW-19(A)	MW-19(A)	4/15/2004	1.48	13.6	11.9	159	256	6.95
MW-19(A)	MW-19(A)	7/20/2004	4.50	45.4	15.7	147	461	6.68
MW-20(A)	MW-20(A)	10/20/2003		7.6	16.7	-25	166	6.86
MW-20(A)	MW-20(A)	1/13/2004	0.93	9.0	14.9	59	100	6.94
MW-20(A)	MW-20(A)	4/15/2004	0.65	5.9	13.1	57	324	6.88
MW-20(A)	MW-20(A)	7/20/2004	0.87	10.0	16.0	47	378	6.76
MW-21(A)	MW-21(A)	10/20/2003		7.5	17.3	-1	158	6.35
MW-21(A)	MW-21(A);	1/13/2004	1.83	17.9	15.5	125	89.3	6.93
MW-21(A)	MW-21(A)	4/16/2004	1.17	1.0	12.7	149	344	6.64
MW-21(A)	MW-21(A)	7/20/2004	3.89	38.0	15.7	80	278	6.55
MW-22(A)	MW-22(A)	10/16/2003		11.0	14.7	183	193	6.94
MW-22(A)	MW-22(A)	1/19/2004	5.32	49.7	14.5	122	289	6.66
MW-22(A)	MW-22(A)	4/15/2004	3.57	32.9	11.9	173	319	6.93
MW-22(A)	MW-22(A)	7/20/2004	4.73	45.0	14.7	106	395	6.65

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			mg/L	%				
MW-23(A)	MW-23(A)	10/20/2003		6.0	15.1	105	153	6.73
MW-23(A)	MW-23(A)	1/15/2004	0.31	3.0	9.2	135	90.2	7.04
MW-23(A)	MW-23(A)	4/15/2004	2.12	19.7	12.5	166	438	6.45
MW-23(A)	MW-23(A)	7/20/2004	0.87	8.3	14.8	155	365	6.40
MW-24(A)	MW-24(A)	10/21/2003		10.8	16.5	67	327	7.34
MW-24(A)	MW-24(A)	1/15/2004	0.94	8.6	9.6	na	41	7.00
MW-24(A)	MW-24(A)	4/14/2004	3.70	33.4	11.1	117	489	6.62
MW-24(A)	MW-24(A)	7/22/2004	1.83	17.4	15.5	106	411	6.76
MW-26(A)	MW-26(A)	10/17/2003		24.6	15.0	46	361	6.74
MW-26(A)	MW-26(A)	1/15/2004	0.59	5.5	10.7	27	81	6.96
MW-26(A)	MW-26(A)	4/14/2004	3.45	31.5	11.4	122	315	6.48
MW-26(A)	MW-26(A)	7/22/2004	0.45	4.6	15.9	89	278	6.42
MW-27(A)	MW-27(A)	1/14/2004	0.63	6.2	12.5	192	89.4	7.08
MW-27(A)	MW-27(A)	4/14/2004	2.70	24.5	11.6	216	212	6.45
MW-27(A)	MW-27(A)	7/22/2004	0.88	8.8	17.0	176	206	6.16
MW-28(A)	MW-28(A)	10/17/2003		5.7	17.6	28	320	6.46
MW-28(A)	MW-28(A)	1/19/2004	0.37	3.6	16.6	64	501	6.38
MW-28(A)	MW-28(A)	4/14/2004	0.76	6.8	12.3	63	490	6.62
MW-28(A)	MW-28(A)	7/23/2004		negative error	18.5	7	398	6.60
MW-29(A)	MW-29(A)	10/21/2003		5.4	17.1	-14	118	6.80
MW-29(A)	MW-29(A)	1/19/2004	0.17	1.6	14.2	94	347	6.57
MW-29(A)	MW-29(A)	4/16/2004	1.10	10.2	12.1	96	315	6.67
MW-29(A)	MW-29(A)	7/22/2004		negative error	17.5	18	267	6.56

**TABLE 4-1  
FIELD PARAMETERS**

Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon

Locator ID	Sample ID	Sample Date	DO		Temp deg C	ORP mV	Conductivity µS	pH
			mg/L	%				
MW-30(A)	MW-30(A)	10/16/2003		6.6	14.4	-12	258	6.76
MW-30(A)	MW-30(A)	1/16/2004	0.82	7.5	14.7	45	119	7.06
MW-30(A)	MW-30(A)	4/13/2004	0.78	7.3	11.8	145	432	6.75
MW-30(A)	MW-30(A)	7/20/2004		negative error	13.8	136	347	6.68
MW-31(A)	MW-31(A);	10/20/2003		5.9	15.3	-32	297	6.99
MW-31(A)	MW-31(A)	1/12/2004	0.92	8.8	13.1	37	97.4	7.29
MW-31(A)	MW-31(A)	4/13/2004	0.17	1.2	12.5	28	417	6.97
MW-31(A)	MW-31(A)	7/20/2004	0.66	6.4	15.5	-20	400	6.86
MW-32(A)	MW-32(A)	10/14/2003		6.0	16.3	52	373	7.07
MW-32(A)	MW-32(A)	1/12/2004	0.53	5.5	14.3	141	102	7.16
MW-32(A)	MW-32(A)	4/13/2004	0.10	0.2	13.0	142	438	6.81
MW-32(A)	MW-32(A)	7/19/2004	1.25	12.5	15.8	106	424	6.82
MW-33(A)	MW-33(A)	10/14/2003		13.5	15.4	30	330	6.75
MW-33(A)	MW-33(A)	1/12/2004	1.10	11.3	14.4	100	110	7.14
MW-33(A)	MW-33(A)	4/13/2004	0.93	9.0	12.5	58	555	6.92
MW-33(A)	MW-33(A)	7/19/2004	3.26	35.5	16.4	-7	434	6.77
MW-34(A)	MW-34(A)	1/13/2004	0.11	0.1	14.7	150	95.7	6.30
MW-34(A)	MW-34(A)	4/14/2004	0.57	5.3	11.9	191	514	6.20
MW-34(A)	MW-34(A)	7/20/2004		negative error	15.9	418	514	6.59
MW-35(A)	MW-35(A)	10/16/2003		6.2	15.1	235	134	6.90
MW-35(A)	MW-35(A)	1/16/2004	1.31	12.2	12.8	145	104	7.08
MW-35(A)	MW-35(A)	4/13/2004	1.11	10.1	11.4	139	249	6.93
MW-35(A)	MW-35(A)	7/20/2004		n/a	14.2	160	186	6.79

**TABLE 4-1  
FIELD PARAMETERS**

Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon

Locator ID	Sample ID	Sample Date	DO		Temp deg C	ORP mV	Conductivity µS	pH
			mg/L	%				
MW-36(A)	MW-36(A)	10/21/2003		5.1	16.5	168	579	7.13
MW-36(A)	MW-36(A)	1/14/2004	2.98	27.6	11.5	185	96.1	7.12
MW-36(A)	MW-36(A)	4/14/2004	3.86	36.0	12.4	201	335	6.46
MW-36(A)	MW-36(A)	7/22/2004	5.25	57.5	16.1	150	519	6.81
MW-37(A)	MW-37(A)	10/17/2003		6.7	15.1	-2	298	6.96
MW-38(A)	MW-38(A)	10/21/2003		19.7	17.7	131	174	6.76
MW-38(A)	MW-38(A)	1/14/2004	3.71	33.3	12.3	170	85.6	6.93
MW-38(A)	MW-38(A)	4/14/2004	1.30	11.2	11.4	189	287	6.72
MW-38(A)	MW-38(A)	7/22/2004	1.53	15.5	17.1	138	273	6.70
MW-39(A)	MW-39(A)	10/16/2003		15.4	15.4	218	143	6.93
MW-39(A)	MW-39(A)	1/16/2004	0.62	5.8	12.9	127	82.2	7.09
MW-39(A)	MW-39(A)	4/14/2004	1.60	14.5	11.0	193	115	6.88
MW-39(A)	MW-39(A)	7/21/2004	0.09	1.0	15.0	156	90.5	6.48
MW-40(A)	MW-40(A)	10/17/2003		5.8	15.6	-4	193	6.77
MW-40(A)	MW-40(A)	1/20/2004	0.26	2.4	13.7	67	512	6.43
MW-40(A)	MW-40(A)	4/16/2004	0.30	2.7	12.1	90	409	6.61
MW-41(A)	MW-41(A);	10/14/2003		4.8	15.7	-12	190.5	6.87
MW-42(A)	MW-42(A)	10/15/2003		5.1	15.3	-8	194	6.80
MW-43(A)	MW-43(A)	1/12/2004	2.05	19.7	13.7	105	95.7	6.77
MW-43(A)	MW-43(A)	4/13/2004	1.48	13.8	12.1	120	346	6.56
MW-43(A)	MW-43(A)	7/21/2004	2.47	23.7	15.0	135	294	6.50

**TABLE 4-1  
FIELD PARAMETERS**

Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon

Locator ID	Sample ID	Sample Date	DO		Temp deg C	ORP mV	Conductivity µS	pH
			mg/L	%				
MW-44(A)	MW-44(A)	10/17/2003		6.1	16.0	-3	165	6.47
MW-45(A)	MW-45(A)	10/16/2003		5.6	15.4	217	155	6.89
MW-45(A)	MW-45(A)	1/16/2004	4.75	42.7	11.3	137	93.6	7.02
MW-45(A)	MW-45(A)	4/14/2004	2.14	19.2	10.9	201	198	6.68
MW-45(A)	MW-45(A)	7/21/2004	2.80	27.2	16.4	177	125	6.44
MW-46(A)	MW-46(A)	10/14/2003		6.3	14.7	142	130	6.86
MW-46(A)	MW-46(A)	1/14/2004	6.57	58.2	10.3	169	93.1	7.06
MW-46(A)	MW-46(A)	4/12/2004	1.59	14.7	11.6	166	468	6.39
MW-46(A)	MW-46(A)	7/21/2004	1.6	11.6	15.9	133	153	6.43
MW-47(A)	MW-47(A)	10/13/2003		20.1	14.9	165	151	6.45
MW-47(A)	MW-47(A)	1/14/2004	1.10	8.9	10.6	175	118	7.13
MW-47(A)	MW-47(A)	4/12/2004	1.85	16.1	10.8	100	199	6.57
MW-47(A)	MW-47(A)	7/21/2004	1.69	16.4	14.7	183	155	6.42
MW-48(A)	MW-48(A)	10/20/2003		7.3	14.6	28	260	6.84
MW-48(A)	MW-48(A)	1/14/2004	0.54	5.1	11.8	152	93.8	7.1
MW-48(A)	MW-48(A)	4/12/2004	1.43	13.6	11.6	55	388	6.64
MW-48(A)	MW-48(A)	7/21/2004	0.18	1.8	15.5	49	347	6.54

**TABLE 4-2  
ANIONS and CATIONS IN GROUND WATER**

Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon

Locator ID	Sample ID	Sample Date	Alkalinity, Total (as CaCO3)	Calcium	Calcium	Chloride	Chloride	Iron	Magnesium	Magnesium	Manganese	Nitrogen, Nitrate- Nitrite
			mg/L	mg/L	mEq	mg/L	mEq	mg/L	mg/L	mEq	mg/L	mg/L
MW-19(A)	BM-19(A)	10/20/2003						12.8				
MW-19(A)	MW-19(A)	10/20/2003						12.7				
MW-19(A)	MW-19 (A)	1/13/2004	92.7	19.7	0.985	12.6	0.355	3.01	10.4	0.852	0.162	0.512
MW-22(A)	MW-22 (A)	10/16/2003						18.6				
MW-22(A)	MW-22(A)	1/19/2004	85	26.6	1.33	10.2	0.287	14.3	10	0.82	0.337	0.415 J+,B
MW-32(A)	MW-32(A)	10/14/2003	153	12.4	0.62	26.7	0.752	3.24	24.4	2	0.11	0.052 J
MW-35(A)	MW-35 (A)	10/16/2003	45.7	9.06	0.453	16.6	0.468	5.93	6.62	0.543	0.206	2 U
MW-38(A)	MW-38(A)	10/21/2003	150	32.4	1.62	17.2	0.485	1.48	13	1.07	0.209	1 U
MW-43(A)	MW-43(A)	10/13/2003	91	25.9	1.295	9.31	0.262	6.25	5.58	0.457	0.598	0.07 J

**TABLE 4-2**  
**ANIONS and CATIONS IN GROUND WATER**

Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon

Locator ID	Sample ID	Sample Date	Potassium		Sodium		Sulfate	
			mg/L	mEq	mg/L	mEq	mg/L	mEq
MW-19(A)	BM-19(A)	10/20/2003						
MW-19(A)	MW-19(A)	10/20/2003						
MW-19(A)	MW-19 (A)	1/13/2004	5.05	0.129	24.5	0.628	25	0.521
MW-22(A)	MW-22 (A)	10/16/2003						
MW-22(A)	MW-22(A)	1/19/2004	5.28	0.135	12	0.308	38.1	0.794
MW-32(A)	MW-32(A)	10/14/2003	12	0.308	48.2	1.24	64.5	1.34
MW-35(A)	MW-35 (A)	10/16/2003	4.94	0.127	8.04	0.206	8.64	0.18
MW-38(A)	MW-38(A)	10/21/2003	6.6	0.169	29.4	0.754	38.9	0.810
MW-43(A)	MW-43(A)	10/13/2003	4.32	0.111	6.42	0.165	7.61	0.159

**TABLE 4-3  
TRANSMISSIVITY VALUES**

Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon

Well	Aquifer Test Date *	Tidal Peak	Average Lag Time (days)	Input Storage Coefficient (S)	Resulting Hydraulic Conductivity (K) (feet/day)	Resulting Transmissivity (T) (feet <sup>2</sup> /day)
MW-9	Dec-04	First	0.12	0.01	10	450
	Dec-04	Second	0.10	0.01	14	650
	Dec-04	First	0.12	0.03	30	1300
	Dec-04	Second	0.10	0.03	43	1900
MW-11	Oct-04	First	0.05	0.01	26	1200
	Oct-04	Second	0.05	0.01	20	910
	Oct-04	First	0.05	0.03	79	3600
	Oct-04	Second	0.05	0.03	61	2700
	Oct-04	First	0.05	0.05	130	5900
	Oct-04	Second	0.05	0.05	100	4500
	Oct-04	First	0.05	0.10	260	12000
	Oct-04	Second	0.05	0.10	200	9100
MW-34	Dec-04	First	0.11	0.03	180	8200
	Dec-04	Second	0.18	0.03	65	2900
MW-35	Oct-04	First	0.23	0.01	31	1400
	Oct-04	Second	0.23	0.01	30	1400
	Oct-04	First	0.23	0.03	92	4100
	Oct-04	Second	0.23	0.03	90	4100
	Oct-04	First	0.23	0.05	150	6900
	Oct-04	Second	0.23	0.05	150	6800
	Oct-04	First	0.23	0.10	310	14000
	Oct-04	Second	0.23	0.10	300	14000

**Notes:**

\* Well response peaks - Ferris (1963) tidal lag response (aquifer test) solution  
Input aquifer thickness (b) = 45 feet

**TABLE 5-1  
POTENTIAL SOURCES**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

<b>Facility</b>	<b>Name of Potential Source</b>	<b>Type of Potential Source</b>	<b>Pre-RI Remedial Actions?</b>	<b>Confirmed Source? Type of Source</b>	<b>Off-site Migration Suspected?</b>	<b>Additional Characterization Anticipated?</b>
<b>Youngs Bay Texaco</b>						
	USTs and dispensers	Gasoline	Yes	No	No	No
	1997 AST overfill	Gasoline	Yes	Yes Gasoline	Yes but appears to be limited	No. Data from Qwest site indicates off-site migration of gasoline has not significantly impacted soil or water along the 8" sewer line adjoining the ChevronTexaco property line.
<b>Former Delphia Bulk Plant</b>						
	West tank farm and loading rack (removed between 2002 and 2006)	Diesel and gasoline	No	Likely source of gasoline- and diesel-range organics	Yes	No.
	East tank farm and associated piping (not currently in use)	Lubricating Oils	No	Possible source of oil-range organics	No	No.
	Gasoline leaks to ground and to storm drain during gasoline delivery in 1973 (volume unknown)	Gasoline	No	No (not distinguishable from other sources).	No	No
	Historical drum storage	Petroleum products	No	No (not distinguishable from other sources)	No	No
	Former warehouse, loading rack, and product lines on north side of site (removed by 1993)	Petroleum products	No	No (not distinguishable from other potential sources)	No	No

**TABLE 5-1  
POTENTIAL SOURCES**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

<b>Facility</b>	<b>Name of Potential Source</b>	<b>Type of Potential Source</b>	<b>Pre-RI Remedial Actions?</b>	<b>Confirmed Source? Type of Source</b>	<b>Off-site Migration Suspected?</b>	<b>Additional Characterization Anticipated?</b>
<b>Former Val's Texaco</b>						
	Former diesel UST and associated piping (removed in 2006)	Diesel		Yes, diesel-range organics	Yes, onto Delphia Bulk Plant	No.
	Heating Oil AST (not currently used)	Heating Oil	No.	No (can not distinguish from other potential sources)	No.	No
	Former gasoline and waste oil USTs and associated piping on west side of site (removed in 1996)	Gasoline and waste oil	Yes, Tank removal in 1996 – No TPH detected	Possible source of gasoline-range organics and VOCs, but can't distinguish from other potential sources.	Unknown, possibly onto Delphia Bulk Plant	No
	Spill of 5 gallons of gasoline near pump island in 1991.	Gasoline	No	No (not distinguishable from other sources).	Unknown, No indication that spill reached storm sewer.	No
	Former Service island dispensers (removed 2006)	Gasoline and Diesel	No	Yes, gasoline-range organics and VOCs	Unknown, possible onto Delphia Bulk Plant	No

**TABLE 5-1  
POTENTIAL SOURCES**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

Facility	Name of Potential Source	Type of Potential Source	Pre-RI Remedial Actions?	Confirmed Source? Type of Source	Off-site Migration Suspected?	Additional Characterization Anticipated?
<b>Former Chevron/McCall Bulk Plant</b>						
	Tank Bottom Wastes	Bunker C Heating Oil	Yes, 1984	Historical Yes. Remedial action removed source	No	No
	AST releases	Bunker C Heating Oil	No (2002 remedial action)	Historical Yes. Remedial action removed source	Not likely, possible impact to ground water in the vicinity of MW-48(A)	No
	Releases from Pumps	Bunker C Heating Oil	No, (2002 remedial action)	Historical Yes. Remedial action removed source	Not suspected	No
	Heating oil UST	Bunker C Heating Oil	No, (2002 remedial action)	Historical Yes. Remedial action removed source	Not suspected	No
	Train Activities	Chrome 6	No	Unknown	Unknown	No
<i>McCall Oil Pipeline</i>						
	Petroleum pipeline	Diesel	Yes	Yes Diesel	Confirmed	None planned.

**TABLE 5-1  
POTENTIAL SOURCES**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

<b>Facility</b>	<b>Name of Potential Source</b>	<b>Type of Potential Source</b>	<b>Pre-RI Remedial Actions?</b>	<b>Confirmed Source? Type of Source</b>	<b>Off-site Migration Suspected?</b>	<b>Additional Characterization Anticipated?</b>
<b>Niemi Oil Cardlock</b>						
	Two 10,000 gal USTs	Diesel	Yes (PNG – 1997)	Yes Diesel	Yes	No. Would be necessary to identify specific sources.
	One 20,000-gal UST	Gasoline	Yes (PNG – 1997)	Yes Gasoline	Yes	
	Two 550-gallon USTs (former)	Gasoline	Yes (removed 1999)	Unknown	Unknown	
	Up to three ASTs ranging between 1,000 and 6,000 gallons in size.	Petroleum	?	Unknown	Unknown	See Above
	Overhead loading rack.	Petroleum	Yes (PNG – 1997)	Unknown	Unknown	See Above
	Single diesel (former) dispenser island.	Diesel	Yes (removed by PNG – 1997)	Unknown	Unknown	See Above
	Gasoline and diesel dispenser island.	Gasoline and diesel	?	Suspected Diesel and Gasoline	Yes	See Above
	<i>Former Associated Oil</i>					
	AST, pump house, two fueling racks and garage	Petroleum	No	Yes Diesel and Gasoline	Yes	None planned

**TABLE 5-1  
POTENTIAL SOURCES**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

<b>Facility</b>	<b>Name of Potential Source</b>	<b>Type of Potential Source</b>	<b>Pre-RI Remedial Actions?</b>	<b>Confirmed Source? Type of Source</b>	<b>Off-site Migration Suspected?</b>	<b>Additional Characterization Anticipated?</b>
<b>Former Exxon/Mobil/Niemi Oil Bulk Plant</b>						
	Up to 10 gasoline ASTs ranging between 7,000 and 420,000 gallons. Two overhead truck loading racks, product pumps and below ground conveyance piping.	Petroleum (gasoline)	No	Specific source not known, cannot distinguish from subsequent site use.	Yes.	None Planned (all facilities removed)
	Vehicle garage and lube oil storage.	Petroleum	No	Yes Diesel/Gasoline	Yes	No
	Steam boiler, cesspool, heating oil UST and 550-gallon drywell.	Unknown	No	Yes Diesel/Gasoline	Yes	None planned (all facilities removed as part of redevelopment)
	Five gasoline ASTs ranging between 750 to 35,000 gallons in size. Ancillary equipment included one overhead truck loading rack, product pumps and below ground conveyance piping.	Gasoline, Diesel	No	Yes Free product identified in MW-40(A) and MW-44(A). Gasoline, diesel, heavy oil	Yes	None planned. (Site redevelopment is planned)
	Off-site conveyance piping to Slip 2	Petroleum fuel products.	No known	No	Unknown	None planned.
	Off-site conveyance piping to Pier 2	Petroleum fuel products.	No known	No	Unknown	None planned.
	Vehicle garage and petroleum storage.	Petroleum	No	No	No	No

**TABLE 5-1  
POTENTIAL SOURCES**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

Facility	Name of Potential Source	Type of Potential Source	Pre-RI Remedial Actions?	Confirmed Source? Type of Source	Off-site Migration Suspected?	Additional Characterization Anticipated?
<b>Port of Astoria</b>						
	<i>Former Furniture Manufacturing</i>					
	Furniture Finishing	Unknown	No	No	Not Applicable	No
	Paint Shed	Unknown	No	No	Not Applicable	No
	Glue Room	Unknown	No	No	No	No
	Fuel Storage/Boiler Room	Petroleum hydrocarbons	No	No Source is suspected to be from another site.	Not from this site.	None planned
	Saw Mill	Unknown	No	No Source is suspected to be from another site	Not from this site	None planned
	Boiler House	Unknown	No	No	Not Applicable	No
	<i>Former Steel Works</i>					
	Black Smith	Unknown	No	No	Not Applicable	No
	Boiler	Unknown	No	No	Not Applicable	No
	Machine Shop	Unknown	No	No	Not Applicable	No
	Transformer Bank	Unknown	No	No	Not Applicable	No
	Fumigating Plant	Unknown	No	No	Not Applicable	No
	Former Transformer Vault	Transformer Oil	No	No	Not Applicable	No
	<i>Port Facilities</i>					
	UST near Port Maintenance Shop	1,000-Gallon UST	Yes	No	Not Applicable	No
	Paint Shop & Wash Rack	Unknown	No	No	Not Applicable	No
	Gas & Oil Chemical Cart	Unknown	No	No	Not Applicable	No
	Welding & Machine Shop	Unknown	No	No	Not Applicable	No
	Welding	Unknown	No	No	Not Applicable	No

**TABLE 5-1  
POTENTIAL SOURCES**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

Facility	Name of Potential Source	Type of Potential Source	Pre-RI Remedial Actions?	Confirmed Source? Type of Source	Off-site Migration Suspected?	Additional Characterization Anticipated?
<b>Port of Astoria Cont.</b>						
	<i>Astoria Oil Services</i>					
	Paint Waste in drums	VOCs, metals	Yes	No	Not Applicable	No
	Solvent waste in drums	VOCs	Yes	No	Not Applicable	No
	Bolt Washing Area	VOCs	Yes	No	Not Applicable	No
<i>Upland Slip 1</i>						
	Unknown. Associated with buried catch basin	Heavy Oil/Bunker C	Yes	Unknown Heavy oil/Bunker C	Unknown	No
<b>Qwest Vehicle Service Center</b>						
	10,000-gallon UST & piping	Petroleum	Yes	No	No	No
	Fuel Dispenser	Petroleum	Yes	No	No	No
<b>Former Shell Bulk Plant</b>						
	Former ASTs, filling dock, pump house, and ancillary on-site piping.	Gasoline, diesel, heavy oil	No	Yes Gasoline, diesel, heavy oil	Yes	None planned
	6-inch bulk petroleum delivery pipeline (Pier 2 and onshore).	Gasoline, diesel, heavy oil.	No	Suspected gasoline and diesel, Unknown Heavy Oil	Yes, pipes extend off site	None planned
	Two, 3-inch petroleum pipelines (product delivery to former Shell marine filling station (south end of Slip 2).	Petroleum fuel products.	No	Unknown	Unknown	None planned

**TABLE 5-1  
POTENTIAL SOURCES**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

<b>Facility</b>	<b>Name of Potential Source</b>	<b>Type of Potential Source</b>	<b>Pre-RI Remedial Actions?</b>	<b>Confirmed Source? Type of Source</b>	<b>Off-site Migration Suspected?</b>	<b>Additional Characterization Anticipated?</b>
<b>Former Harris/Van West Service Station</b>						
	4,000-gallon Regular Leaded UST (T-1)	Gasoline	Yes. Soil remedied & ground water treated.	Yes. Gasoline. On-site removed	Yes	None planned
	4,000-gallon Regular Leaded UST (T-2)	Gasoline	Yes. No release detected.	No	No	None planned
	6,000-gallon Super Unleaded UST (T-3)	Gasoline	Yes. Soil remedied & ground water treated.	Yes. Gasoline	Yes	None planned
	8,000-gallon Regular Unleaded UST (T-4)	Gasoline	Yes. No release detected.	Yes. Gasoline. On-site removed	Yes	None planned
	550-gallon Waste Oil UST (T-5)	Waste Oil	Yes. Soil remedied & ground water treated.	Yes. Gasoline. On-site removed	Yes	None planned

**TABLE 5-2  
ENVIRONMENTAL HISTORY**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

<b>FACILITY</b>	<b>DATE</b>	<b>INVESTIGATION</b>
<b>Youngs Bay Texaco</b>		
	Prior to June 1990	Service station since 1960s; Petroleum hydrocarbon
	Jun-90	Station decommissioned (5 USTs, product dispensers, product & vent lines, hoists, and buildings);
	Aug-91	Subsurface Environmental Site Assessment;
	1991	DEQ LUST File 04-91-0250
	Jan-92	All decommissioned facilities removed
	Apr-92	UST Closure Assessment
	Nov-92	Soil Excavation & Ground-Water Sampling,
	June-November 1992	On-Site Soil Aeration
	1993	Environmental Site Assessment
	July 1993 - March 1994	Four Quarterly Monitoring Events (7/93, 10/93, 12/93,
	Mar-94	No Further Action Issued by DEQ; 11 soil borings and
	Mar-94	Well Abandonment
	1995	Young's Bay Texaco constructed
	May-97	Gasoline overfill of AST
	June-November 1997	Investigation and air sparging system installed; 2 monitoring wells installed with soil and ground water
	Jan-03	Phase 1 Source/ Soil Characterization, Remedial Investigation/Feasibility StudyPhase 1 Source/ Soil
	Feb-03	Beneficial Land and Water Use Surveys, Remedial
	October 2003 – July 2004	Four Quarterly Monitoring Events (10/03, 01/04,
	Nov-03	Geophysical Investigation, Remedial Investigation/Feasibility StudyGeophysical
	January 2004 – December 2004	Storm Water Sampling: Four Quarterly Monitoring Events (01/04, 03/04, 05/04, and 12/04)
	Apr-04	Phase 1, Monitoring Well Installation, Remedial Investigation/Feasibility Study
	Nov-04	Phase 2, Soil Characterization, Remedial Investigation
<b>Former Delphia Oil Bulk Plant</b>		
	1960s	Facility identified bulk plant losses from one AST in west tank farm; referred to as “worm holes” at bottom
	Prior to 1979	Texaco lined inside of 4 ASTs
	2002 to 2006	Four ASTs in West Tank Farm removed
	Jan-03	Phase 1 Source/ Soil Characterization
	Feb-03	Beneficial Land and Water Use Surveys
	October 2003 – July 2004	Four Quarterly Monitoring Events (10/03, 01/04, 04/04, and 07/04 fieldwork)

**TABLE 5-2  
ENVIRONMENTAL HISTORY**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

<b>FACILITY</b>	<b>DATE</b>	<b>INVESTIGATION</b>
<b>Former Delphia Oil Bulk Plant Cont.</b>		
	Apr-04	Phase 1, Monitoring Well Installation Report
	Jun-04	Forensic Analysis of Samples of Separate-Phase Hydrocarbon from the Astoria Area-Wide Petroleum
	Nov-04	Phase 2, Soil Characterization
	August 2004 to present	Free product removal from MW-15(A)
	Feb-06	Groundwater and free product sampling and forensic
<b>Former Val's Texaco</b>		
	Mar-91	25-gal gasoline spill near pump island; Spill response
	Oct-96	5 gasoline USTs & 1 used oil UST decommissioned
	Jan-03	Phase 1 Source/ Soil Characterization
	Feb-03	Beneficial Land and Water Use Surveys
	October 2003 – July 2004	Four Quarterly Ground-Water Monitoring Events
	Nov-03	Geophysical Investigation
	Apr-04	Phase 1, Monitoring Well Installation Report
	Nov-04	Phase 2, Soil Characterization
	Feb-06	Ground-water sampling, service station closes.
	May/June 2006	Diesel UST, diesel product piping, gasoline product
<b>Former Chevron/McCall Oil Bulk Plant (and pipelines)</b>		
	1981	Employee identified hazardous waste in oil pits
	1984	52,000-gals of tank bottom waste removed
	1985	Tank bottom waste recycled and/or consolidated into
	Sep-87	Preliminary Assessment pursuant to US EPA contract
	May-93	Line tightness test; pipeline failed test
	Oct-93	Subsurface Investigations
	July 1994.	Storm Sewer Line Investigation; release from pipeline
	May-95	NPDES issued for discharge of treated water to
	Jul-95	Ground-water treatment system installed
	Jul-96	Site Assessment (15 soil borings with 20 soil and 6
	Feb-97	Ground-Water Treatment System Operation Analysis
	2002	ASTs and structures decommissioned
	2002	Heating oil UST discovered
	Jan-03	Phase 1 Source/ Soil Characterization, Remedial
	Feb-03	Beneficial Land and Water Use Surveys, Remedial
	October 2003 – July 2004	Four Quarterly Monitoring Events (10/03, 01/04,
	Nov-03	Geophysical Investigation, Remedial
	January 2004 – December 2004	Storm Water Sampling: Four Quarterly Monitoring Events (01/04, 03/04, 05/04, and 12/04)

**TABLE 5-2  
ENVIRONMENTAL HISTORY**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

<b>FACILITY</b>	<b>DATE</b>	<b>INVESTIGATION</b>
<b>Former Chevron/McCall Oil Bulk Plant (and pipelines) Cont.</b>		
	Apr-04	Phase 1, Monitoring Well Installation, Remedial
	Jun-04	Forensic Analysis of Samples of Separate-Phase Hydrocarbon from the Astoria Area-Wide Petroleum
	Aug-04	Level I Ecological Risk Assessment, Remedial Investigation/Feasibility Study, Astoria Area-Wide Site
	Nov-04	Phase 2, Soil Characterization, Remedial Investigation
	Apr-05	Vapor Intrusion Pathway Assessment, Port of Astoria
	Jun-05	Slip 2 Hydrocarbon Seep Interim Removal Action Measures, Upland Data Collection, Astoria Area-Wide
<b>Niemi Oil Cardlock</b>		
	1927	Former Associated Oil Services facility occupies
	1939	Former Associated Oil Services facility vacant
	1973	Burns-Johanson built bulk plant/cardlock facility. No
	1978	Sold to Niemi Oil
	Dec-90	Off-site investigation and product recovery by Harris/Van West from release at 460 West Marine
	Dec-90	3 Soil borings / 6 test pits in response to Harris/Van West release (no quantitative analyses)
	1996	DEQ installed one boring near Site
	Jan-97	Subsurface Investigation with 6 soil borings and collected soil and ground water samples
	Nov-97	Technical Memorandum: Current and Historic Petroleum Storage Sites Near the Former Shell Service
	1997	Confirmed Release List
	1998	Focused Site Assessment (1 ground water sample)
	1999	UST Decommissioning (two 550-gallon gasoline
	Jan-03	Phase 1 Source/ Soil Characterization, Remedial
	Feb-03	Beneficial Land and Water Use Surveys, Remedial
	October 2003 – July 2004	Four Quarterly Monitoring Events (10/03, 01/04,
	Nov-03	Geophysical Investigation, Remedial
	January 2004 – December 2004	Storm Water Sampling: Four Quarterly Monitoring Events (01/04, 03/04, 05/04, and 12/04 fieldwork)
	Apr-04	Phase 1, Monitoring Well Installation, Remedial
	Nov-04	Phase 2, Soil Characterization, Remedial Investigation

**TABLE 5-2  
ENVIRONMENTAL HISTORY**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

<b>FACILITY</b>	<b>DATE</b>	<b>INVESTIGATION</b>
<b>Former ExxonMobil/Niemi Oil Bulk Plant</b>		
	1925	Mobil Oil or predecessors built bulk plant on property
		Service Oil and Niemi Oil obtained oil products under
	1976	Niemi bought storage tanks and equipment from Mobil and commenced leasing site from Port of Astoria
	Late 1990s	Niemi operations cease
	1996	DEQ completed 1 soil boring on northeast portion of site with collected soil sample and 2 borings northeast
	1970s – 1990s	ASTs and aboveground ancillary equipment removed
	2002	Former bulk plant features observed by environmental
	Jan-03	Phase 1 Source/ Soil Characterization, Remedial
	Feb-03	Beneficial Land and Water Use Surveys, Remedial
	Aug-03	Remedial Investigation/Interim Removal Action
	October 2003 – July 2004	Four Quarterly Monitoring Events (10/03, 01/04,
	Nov-03	Geophysical Investigation, Remedial
	January 2004 – December 2004	Storm Water Sampling: Four Quarterly Monitoring Events (01/04, 03/04, 05/04, and 12/04)
	Apr-04	Phase 1, Monitoring Well Installation, Remedial
	Jun-04	Forensic Analysis of Samples of Separate-Phase Hydrocarbon from the Astoria Area-Wide Petroleum
	Jul-04	Historical Shell/Niemi/Mobil Petroleum Pipeline Investigation and Decommissioning Report
	Aug-04	Level I Ecological Risk Assessment, Remedial Investigation/Feasibility Study, Astoria Area-Wide Site
	Nov-04	Phase 2, Soil Characterization, Remedial Investigation
	Apr-05	Vapor Intrusion Pathway Assessment, Port of Astoria
	Jun-05	Slip 2 Hydrocarbon Seep Interim Removal Action Measures, Upland Data Collection, Astoria Area-Wide
	2005 to present	Free product removal from MW-44(A)
<b>Port of Astoria</b>		
	Aug-83	Astoria Oil Services moved operations to end of Pier 3
	Jan-86	Oregon DEQ inspected Astoria Oil Services site;
	1986	Astoria Oil Services soil investigations; soil samples
	Sep-86	Astoria Oil Services impacted soil excavated and
	Dec-86	DEQ Interoffice Memo indicating Astoria Oil Services closure completed in accordance with closure plan

**TABLE 5-2  
ENVIRONMENTAL HISTORY**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

<b>FACILITY</b>	<b>DATE</b>	<b>INVESTIGATION</b>
<b>Port of Astoria Cont.</b>		
	Mar-93	1,000-gal UST used for diesel and gas decommissioned on N. side of maintenance shop; soil
	Mar-93	Two 10,000-gal diesel USTs decommissioned near
	Jul-93	Investigation & Cleanup of UST Related Diesel
	Sep-93	PCS treated by bioremediation on site
	Sep-93	Request closure of soil aeration site
	Dec-93	No Further Action issued by DEQ
	Through 2002	Storm-water sampling under the 1200Z NPDES
	Jan-03	Phase 1 Source/ Soil Characterization, Remedial
	Feb-03	Beneficial Land and Water Use Surveys, Remedial
	October 2003 – July 2004	Four Quarterly Monitoring Events (10/03, 01/04,
	Nov-03	Geophysical Investigation, Remedial
	January 2004 – December 2004	Storm Water Sampling: Four Quarterly Monitoring Events (01/04, 03/04, 05/04, and 12/04)
	Apr-04	Phase 1, Monitoring Well Installation, Remedial
	Jun-04	Forensic Analysis of Samples of Separate-Phase Hydrocarbon from the Astoria Area-Wide Petroleum
	Aug-04	Level I Ecological Risk Assessment, Remedial Investigation/Feasibility Study, Astoria Area-Wide Site
	Nov-04	Phase 2, Soil Characterization, Remedial Investigation
	Apr-05	Vapor Intrusion Pathway Assessment, Port of Astoria
	Jun-05	Slip 2 Hydrocarbon Seep Interim Removal Action Measures, Upland Data Collection, Astoria Area-Wide
	2005 to present	Free product removal from MW-3(M), MW-9(M), MW-4(M), MW-8(M), MW-41(A), MW-42(A), MW-
<b>Qwest Vehicle Service Center</b>		
	~1960s	Qwest leased property
	1962	Installed 10,000 gallon UST
	1973	UST moved to different location (previous location
	1987	Tank was glass armor-lined
	1997	UST Decommissioning
	Dec-97	Site Contamination Investigation
	Apr-98	NFA issued by DEQ

**TABLE 5-2  
ENVIRONMENTAL HISTORY**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

<b>FACILITY</b>	<b>DATE</b>	<b>INVESTIGATION</b>
<b>Qwest Vehicle Service Center Cont.</b>		
	Jan-03	Phase 1 Source/ Soil Characterization, Remedial
	Feb-03	Beneficial Land and Water Use Surveys, Remedial
	October 2003 – July 2004	Four Quarterly Monitoring Events (10/03, 01/04,
	Nov-03	Geophysical Investigation, Remedial
	January 2004 – December 2004	Storm Water Sampling: Four Quarterly Monitoring Events (01/04, 03/04, 05/04, and 12/04)
	Apr-04	Phase 1, Monitoring Well Installation, Remedial
	Nov-04	Phase 2, Soil Characterization, Remedial Investigation
<b>Former Shell Bulk Plant</b>		
	1925 - 1972	The facility ceased operations in 1972 and all ASTs and associated above-ground piping were reportedly removed by 1974. No historical environmental
	Jan-03	Phase 1 Source/ Soil Characterization, Remedial
	Feb-03	Beneficial Land and Water Use Surveys, Remedial
	October 2003 – July 2004	Four Quarterly Monitoring Events (10/03, 01/04,
	Aug-03	Remedial Investigation/Interim Removal Action
	Nov-03	Geophysical Investigation, Remedial
	January 2004 – December 2004	Storm Water Sampling: Four Quarterly Monitoring Events (01/04, 03/04, 05/04, and 12/04)
	Apr-04	Phase 1, Monitoring Well Installation, Remedial
	Jul-04	Historical Shell/Niemi/Mobil Petroleum Pipeline Investigation and Decommissioning Report
	Nov-04	Phase 2, Soil Characterization, Remedial Investigation
<b>Former Harris/VanWest Service Station</b>		
	Nov-89	Site Investigation indicated gasoline release in soils in immediate vicinity of UST nest and pump island; 10
	Dec-89	Tank and line pressure testing and repair
	August/September 1990	Inventory control records indicated losses
	Oct-90	Tank and line testing (2 soil samples)
	Dec-90	Liquid phase petroleum hydrocarbons discovered in sewer line near site; samples of free product collected
	Dec-90	Site Characterization; 6 soil borings and 3 monitoring wells and 1 recovery well installed (total of 26 soil

**TABLE 5-2  
ENVIRONMENTAL HISTORY**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

<b>FACILITY</b>	<b>DATE</b>	<b>INVESTIGATION</b>
<b>Former Harris/VanWest Service Station Cont.</b>		
	Dec-90	Pressure line tests
	Dec-90	Ground water treatment
	Dec-90	20-Day Release Report
	Jan-91	NPDES Permit 1500J
	1991	Liquid phase petroleum recovery system installed that
	Feb-91	4 gasoline USTs and product piping removed (no
	Mar-91	45-Day Release Report
	Jul-91	Second Quarter, Groundwater Monitoring
	Dec-91	Subsurface Assessment with 48 soil and 8 ground
	Oct-92	Corrective Action Plan with excavation, transport, and off-site treatment of soil (12 confirmation samples)
	Nov-93	Waste oil UST Decommissioning with 9 soil
	Mar-94	Quarterly Groundwater Monitoring
	Oct-94	Quarterly Ground-Water Monitoring & Soil Matrix
	December 1990 – September 1995	Ten ground water sampling events from on-site monitoring and recovery wells
	Feb-96	Request for Closure
	Dec-97	One monitoring well installed
	Jan-03	Phase 1 Source/ Soil Characterization, Remedial
	Feb-03	Beneficial Land and Water Use Surveys, Remedial
	October 2003 – July 2004	Four Quarterly Monitoring Events (10/03, 01/04,
	Nov-03	Geophysical Investigation, Remedial
	January 2004 – December 2004	Storm Water Sampling: Four Quarterly Monitoring Events (01/04, 03/04, 05/04, and 12/04)
	Apr-04	Phase 1, Monitoring Well Installation, Remedial
	Nov-04	Phase 2, Soil Characterization, Remedial Investigation

**TABLE 6-1**  
**Guide To Analytical and COPC Flags and Notes**

**Astoria Area-Wide Petroleum Site**  
**Astoria, Oregon**

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% = percent.

\*\* = Chemical risk score > 1/Total Number of Chemicals.

bgs = below ground surface.

BSL = below baseline.

COPC = chemical of potential concern.

COPC(MC) = chemical of potential concern because of additive effect of multiple chemicals.

COPC(NTD) = chemical of potential concern because of no toxicity data.

DEQ = Oregon Department of Environmental Quality.

DRO = diesel-range organics.

Ecology = Washington State Department of Ecology.

GRO = gasoline-range organics.

ID = identification.

IFD = infrequently detected.

LOF = locality of the facility.

mg/kg = milligrams per kilogram.

mg/L = milligrams per liter.

MSL = mean sea level.

NA = not applicable.

np = no product.

NV = no value.

PRG = preliminary remediation goal.

Pt = point.

RBC = risk-based concentration.

ug/L = micrograms per liter.

USEPA = U.S. Environmental Protection Agency.

<sup>1</sup>Background concentration is 90th percentile values from Clark County (Ecology, 1994).

<sup>2</sup>Industrial Soil PRG (USEPA, 2004a) with the exception of hydrocarbons. GRO and DRO screening values are RBCs for soil ingestion, dermal contact, and inhalation for occupational workers (DEQ, 2003) and the lube oil screening value is the level 2 DEQ soil matrix value (DEQ, 2000).

<sup>3</sup>Chemical Risk Score = maximum detected concentration/screening level.

<sup>4</sup>Tap Water Preliminary Remediation Goal (USEPA, 2004) with the exception of hydrocarbons and lead. Hydrocarbon and lead screening values are RBCs for ingestion and inhalation from tap water (DEQ, 2003).

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Guide to Notes on Figures:

mg/kg = milligrams per kilogram

mg/L = milligrams per liter

ug/L = micrograms per liter

NP = not present

PNT = Present

U= Not Detected

J = estimated value

B= analyte also detected in laboratory blank

R = analytical data rejected

**TABLE 6-2**  
**CONSTITUENTS OF INTEREST IN SOIL**

Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon

Chemicals of Interest	Sample Size	Detection Frequency (%)	Background Concentration <sup>1</sup> (mg/kg)	Maximum Detected Concentration (mg/kg)
<b>Volatile Organic Compounds</b>				
1,2,4-Trimethylbenzene	232	46.1	NA	6.89E+02
1,2-Dichloroethane	234	0.9	NA	3.15E-04
1,3,5-Trimethylbenzene	234	41.9	NA	1.89E+02
1,4-Dichlorobenzene	99	1.0	NA	2.22E-04
2-Butanone	99	4.0	NA	1.45E-01
4-Isopropyltoluene	99	7.1	NA	4.34E+00
Acetone	97	23.7	NA	5.43E-01
Benzene	424	13.2	NA	1.72E+01
Bromomethane	95	3.2	NA	4.28E-04
Carbon Disulfide	99	7.1	NA	3.89E-03
Chloromethane	99	2.0	NA	1.67E-02
Ethylbenzene	423	27.2	NA	1.51E+02
Formaldehyde	5	20.0	NA	2.80E+00
Isopropylbenzene	234	27.8	NA	2.26E+01
Methyl iodide	97	1.0	NA	4.99E-03
Methylene Chloride	98	8.2	NA	1.77E-02
Naphthalene	250	45.2	NA	1.32E+02
n-Butylbenzene	99	15.2	NA	1.50E+01
n-Propylbenzene	234	33.8	NA	9.13E+01
sec-Butylbenzene	99	6.1	NA	4.88E+00
tert-Butylbenzene	99	1.0	NA	9.61E-03
Tetrachloroethene	99	14.1	NA	6.28E-03
Xylenes	424	28.8	NA	4.78E+02
<b>Semivolatile Organic Compounds</b>				
2-Methylnaphthalene	2	100.0	NA	8.05E+01
Acenaphthene	185	20.0	NA	7.40E+00
Acenaphthylene	185	3.8	NA	1.65E+00
Anthracene	185	18.9	NA	3.72E+00
Benzo(a)anthracene	185	11.9	NA	4.43E+00

**TABLE 6-2**  
**CONSTITUENTS OF INTEREST IN SOIL**

Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon

Chemicals of Interest	Sample Size	Detection Frequency (%)	Background Concentration <sup>1</sup> (mg/kg)	Maximum Detected Concentration (mg/kg)
Semivolatile Organic Compounds, cont.				
Benzo(a)pyrene	185	14.1	NA	5.84E+00
Benzo(b)fluoranthene	185	11.9	NA	3.48E+00
Benzo(g,h,i)perylene	185	17.3	NA	6.39E+00
Benzo(k)fluoranthene	185	9.7	NA	3.54E+00
Chrysene	185	23.2	NA	5.39E+00
Dibenzo(a,h)anthracene	185	7.0	NA	8.40E-01
Fluoranthene	185	21.6	NA	2.45E+01
Fluorene	185	22.2	NA	8.15E+00
Indeno(1,2,3-cd)pyrene	185	13.0	NA	4.23E+00
Naphthalene	185	27.6	NA	7.11E+01
Phenanthrene	185	35.7	NA	3.58E+01
Pyrene	185	35.7	NA	2.44E+01
Hydrocarbons				
GRO	332	43.4	NA	7.62E+03
DRO	327	37.3	NA	3.55E+04
Lube oil	327	28.7	NA	1.92E+04
Metals				
Arsenic	78	100.0	6	2.42E+01
Barium	78	100.0	NV	1.61E+02
Cadmium	101	1.0	1	6.68E-01
Chromium	104	100.0	27	9.22E+01
Lead	179	97.2	17	2.00E+02
Mercury	78	3.8	0.04	5.51E-01
Selenium	78	25.6	NV	2.45E+01

Notes:

mg/kg = milligrams per kilogram

Table adapted from MFA, 2005 (Human Health Risk Assessment Work Plan, RI/FS)

**TABLE 6-3**  
**CONSTITUENTS OF INTEREST IN GROUND WATER**

Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon

Chemicals of Interest	Sample Size	Detection Frequency (%)	Maximum Detected Concentration
<b>Volatile Organic Compounds (ug/L)</b>			
1,2,4-Trimethylbenzene	220	48.2	3.47E+03
1,2-Dichloroethane	220	0.9	6.80E+00
1,3,5-Trimethylbenzene	220	37.3	9.58E+02
4-Isopropyltoluene	24	16.7	1.51E+01
Benzene	261	51.0	3.02E+03
Ethylbenzene	261	60.9	2.89E+03
Isopropylbenzene	220	54.5	2.33E+02
Methylene chloride	24	4.2	5.08E+00
Methyl-t-butyl ether	220	3.6	9.80E-01
Naphthalene	220	51.8	1.50E+03
n-Butylbenzene	24	29.2	1.82E+01
n-Propylbenzene	220	61.4	6.76E+02
sec-Butylbenzene	24	16.7	6.25E+00
tert-Butylbenzene	24	4.2	6.50E-01
Tetrachloroethene	24	8.3	4.10E-01
Toluene	261	46.0	8.17E+03
Xylenes	261	52.9	1.49E+04
<b>Semivolatile Organic Compounds (ug/L)</b>			
Acenaphthene	225	35.1	7.37E+00
Acenaphthylene	225	0.9	9.98E-02
Anthracene	225	4.4	1.56E-01
Benzo(a)anthracene	225	4.0	4.75E-02
Benzo(a)pyrene	225	2.2	6.90E-02

**TABLE 6-3**  
**CONSTITUENTS OF INTEREST IN GROUND WATER**

Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon

Chemicals of Interest	Sample Size	Detection Frequency (%)	Maximum Detected Concentration
Semivolatile Organic Compounds (ug/L), cont.			
Benzo(b)fluoranthene	225	3.1	6.25E-02
Benzo(k)fluoranthene	225	2.2	5.48E-02
Chrysene	225	6.2	5.00E-01
Dibenzo(a,h)anthracene	225	0.9	1.11E-02
Fluoranthene	225	2.2	1.23E-01
Fluorene	225	30.7	1.72E+01
Indeno(1,2,3-cd)pyrene	225	1.3	1.40E-02
Naphthalene	225	58.7	1.64E+03
Phenanthrene	225	18.7	3.99E+01
Pyrene	225	2.7	2.00E-01
Hydrocarbons (mg/L)			
GRO	210	56.2	6.77E+01
DRO	220	42.3	9.38E+00
Lube oil	220	10.5	2.18E+00
Metals (mg/L)			
Arsenic	84	76.2	3.72E-02
Barium	84	100.0	2.54E-01
Cadmium	104	3.8	7.00E-04
Calcium	42	100.0	1.36E+02
Chromium	110	62.7	1.56E-01
Chromium, Hexavalent	4	50.0	1.48E-02
Iron	64	100.0	6.83E+01
Lead	176	85.2	1.48E-01
Magnesium	42	100.0	4.68E+01
Manganese	42	100.0	1.05E+01
Mercury	84	13.1	3.30E-04
Potassium	42	100.0	1.24E+01
Selenium	84	31.0	4.41E-03
Silver	84	4.8	1.80E-04
Sodium	42	100.0	9.63E+01

Notes:

mg/kg = milligrams per kilogram

Table adapted from MFA, 2005 (Human Health Risk Assessment Work Plan, RI/FS)

TABLE 7-1

## LNAPL RECOVERED

Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon

Locator ID	Date	Amount of Product Removed (cubic feet)	Amount of Product Removed (fluid ounces)	Amount of Product Removed (pounds)	Amount of Product Removed (gallons)	Total Gallons of Product Removed
MW-3(M)	8/13/2003	0.02			0.150	5.590
MW-3(M)	10/23/2003		9	0.56	0.070	
MW-3(M)	10/23/2003		3	0.19	0.023	
MW-3(M)	11/12/2003		4	0.25	0.030	
MW-3(M)	11/12/2003		2	0.125	0.016	
MW-3(M)	12/16/2003		33	2.06	0.264	
MW-3(M)	1/20/2004		90	5.63	0.720	
MW-3(M)	2/12/2004		80	5.00	0.640	
MW-3(M)	3/18/2004		36	2.25	0.288	
MW-3(M)	6/16/2004				0.333	
MW-3(M)	7/23/2004		16	1	0.128	
MW-3(M)	8/17/2004				0.330	
MW-3(M)	10/19/2004		1	0.06	0.008	
MW-3(M)	11/16/2004		3	0.19	0.024	
MW-3(M)	12/13/2004		4	0.25	0.032	
MW-3(M)	4/25/2005		17.6	1.1	0.141	
MW-3(M)	5/26/2005		12.8	0.8	0.102	
MW-3(M)	6/27/2005		17.6	1.1	0.141	
MW-3(M)	7/26/2005		12.8	0.8	0.102	
MW-3(M)	8/29/2005		14.4	0.9	0.115	
MW-3(M)	9/27/2005		6.4	0.4	0.051	
MW-3(M)	10/26/2005		4.8	0.3	0.038	
MW-3(M)	11/28/2005		14.4	0.9	0.115	
MW-3(M)	12/27/2005		20.8	1.3	0.166	
MW-3(M)	5/26/2006		12.8	0.8	0.102	
MW-3(M)	6/28/2006		6.4	0.4	0.051	
MW-3(M)	8/28/2006		1.6	0.1	0.013	
MW-3(M)	11/2/2006		3.2	0.2	0.026	
MW-3(M)	11/27/2006		6.4	0.4	0.051	
MW-3(M)	12/28/2006		22.4	1.4	0.179	
MW-3(M)	1/29/2007		24	1.5	0.192	

TABLE 7-1

## LNAPL RECOVERED

Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon

Locator ID	Date	Amount of Product Removed (cubic feet)	Amount of Product Removed (fluid ounces)	Amount of Product Removed (pounds)	Amount of Product Removed (gallons)	Total Gallons of Product Removed
MW-3(M)	2/28/2007		25.6	1.6	0.205	
MW-3(M)	3/30/2007		28.8	1.8	0.230	
MW-3(M)	4/30/2007		22.4	1.4	0.179	
MW-3(M)	5/29/2007		16	1	0.128	
MW-3(M)	6/28/2007		12.8	0.8	0.102	
MW-3(M)	7/30/2007		11.2	0.7	0.090	
MW-3(M)	8/28/2007		1.6	0.1	0.013	
MW-4(M)	7/14/2003	0.002			0.015	<b>4.808</b>
MW-4(M)	7/14/2003	0.0006			0.004	
MW-4(M)	8/13/2003	0.0004			0.004	
MW-4(M)	10/23/2003		4	0.25	0.032	
MW-4(M)	10/23/2003		0.2	0.01	0.002	
MW-4(M)	2/12/2004		55	3.44	0.440	
MW-4(M)	3/18/2004				1.000	
MW-4(M)	6/16/2004				0.333	
MW-4(M)	7/19/2004		1	0.06	0.008	
MW-4(M)	4/25/2005		1.6	0.1	0.013	
MW-4(M)	5/26/2005		20.8	1.3	0.166	
MW-4(M)	6/27/2005		14.4	0.9	0.115	
MW-4(M)	7/26/2005		12.8	0.8	0.102	
MW-4(M)	8/29/2005		11.2	0.7	0.090	
MW-4(M)	9/27/2005		8	0.5	0.064	
MW-4(M)	10/26/2005		1.6	0.1	0.013	
MW-4(M)	11/28/2005		20.8	1.3	0.166	
MW-4(M)	12/27/2005		22.4	1.4	0.179	
MW-4(M)	5/26/2006		16	1	0.128	
MW-4(M)	6/28/2006		16	1	0.128	
MW-4(M)	8/28/2006		11.2	0.7	0.090	
MW-4(M)	9/27/2006		9.6	0.6	0.077	
MW-4(M)	11/27/2006		17.6	1.1	0.141	

TABLE 7-1

## LNAPL RECOVERED

Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon

Locator ID	Date	Amount of Product Removed (cubic feet)	Amount of Product Removed (fluid ounces)	Amount of Product Removed (pounds)	Amount of Product Removed (gallons)	Total Gallons of Product Removed
MW-4(M)	12/28/2006		27.2	1.7	0.218	
MW-4(M)	1/29/2007		28.8	1.8	0.230	
MW-4(M)	2/28/2007		27.2	1.7	0.218	
MW-4(M)	3/30/2007		25.6	1.6	0.205	
MW-4(M)	4/30/2007		22.4	1.4	0.179	
MW-4(M)	5/29/2007		12.8	0.8	0.102	
MW-4(M)	6/28/2007		17.6	1.1	0.141	
MW-4(M)	7/30/2007		16	1	0.128	
MW-4(M)	8/28/2007		9.6	0.6	0.077	
MW-8(M)	7/14/2003	0.007			0.052	1.913
MW-8(M)	7/14/2003	0.0008			0.006	
MW-8(M)	8/13/2003	0.003			0.022	
MW-8(M)	10/23/2003		15	0.94	0.120	
MW-8(M)	10/23/2003		1	0.06	0.008	
MW-8(M)	11/12/2003		4	0.25	0.032	
MW-8(M)	3/18/2004		4	0.25	0.032	
MW-8(M)	8/17/2004		2	0.13	0.016	
MW-8(M)	12/13/2004		3	0.19	0.024	
MW-8(M)	4/25/2005		16	1	0.128	
MW-8(M)	5/26/2005		16	1	0.128	
MW-8(M)	6/27/2005		3.2	0.2	0.026	
MW-8(M)	7/26/2005		4.8	0.3	0.038	
MW-8(M)	8/29/2005		3.2	0.2	0.026	
MW-8(M)	9/27/2005		3.2	0.2	0.026	
MW-8(M)	10/26/2005		11.2	0.7	0.090	
MW-8(M)	11/28/2005		11.2	0.7	0.090	
MW-8(M)	12/27/2005		16	1	0.128	
MW-8(M)	5/26/2006		12.8	0.8	0.102	
MW-8(M)	6/28/2006		9.6	0.6	0.077	
MW-8(M)	8/28/2006		8	0.5	0.064	

TABLE 7-1

## LNAPL RECOVERED

Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon

Locator ID	Date	Amount of Product Removed (cubic feet)	Amount of Product Removed (fluid ounces)	Amount of Product Removed (pounds)	Amount of Product Removed (gallons)	Total Gallons of Product Removed
MW-8(M)	11/2/2006		11.2	0.7	0.090	
MW-8(M)	11/27/2006		17.6	1.1	0.141	
MW-8(M)	12/28/2006		8	0.5	0.064	
MW-8(M)	1/29/2007		9.6	0.6	0.077	
MW-8(M)	2/28/2007		9.6	0.6	0.077	
MW-8(M)	3/30/2007		6.4	0.4	0.051	
MW-8(M)	4/30/2007		8	0.5	0.064	
MW-8(M)	5/29/2007		4.8	0.3	0.038	
MW-8(M)	6/28/2007		4.8	0.3	0.038	
MW-8(M)	7/30/2007		4.8	0.3	0.038	
MW-8(M)	8/28/2007		0	0	0.000	
MW-9(M)	7/14/2003	0.02			0.150	5.106
MW-9(M)	7/14/2003	0.005			0.037	
MW-9(M)	8/13/2003	0.01			0.075	
MW-9(M)	10/23/2003		18	1.13	0.144	
MW-9(M)	10/23/2003		9	0.56	0.072	
MW-9(M)	11/12/2003		5	0.31	0.040	
MW-9(M)	12/16/2003		6	0.38	0.048	
MW-9(M)	1/20/2004		4	0.25	0.032	
MW-9(M)	2/12/2004		20	1.25	0.160	
MW-9(M)	3/18/2004		28	1.75	0.224	
MW-9(M)	7/19/2004		9	0.56	0.072	
MW-9(M)	8/17/2004				0.500	
MW-9(M)	10/19/2004		4	0.25	0.032	
MW-9(M)	11/16/2004		4	0.25	0.032	
MW-9(M)	12/13/2004		4	0.25	0.032	
MW-9(M)	4/25/2005		24	1.5	0.192	
MW-9(M)	5/26/2005		24	1.5	0.192	
MW-9(M)	6/27/2005		19.2	1.2	0.154	
MW-9(M)	7/26/2005		14.4	0.9	0.115	

TABLE 7-1

## LNAPL RECOVERED

Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon

Locator ID	Date	Amount of Product Removed (cubic feet)	Amount of Product Removed (fluid ounces)	Amount of Product Removed (pounds)	Amount of Product Removed (gallons)	Total Gallons of Product Removed
MW-9(M)	8/29/2005		19.2	1.2	0.154	
MW-9(M)	9/27/2005		14.4	0.9	0.115	
MW-9(M)	10/26/2005		8	0.5	0.064	
MW-9(M)	11/28/2005		16	1	0.128	
MW-9(M)	12/27/2005		16	1	0.128	
MW-9(M)	5/26/2006		16	1	0.128	
MW-9(M)	6/28/2006		22.4	1.4	0.179	
MW-9(M)	8/28/2006		17.6	1.1	0.141	
MW-9(M)	11/2/2006		28.8	1.8	0.230	
MW-9(M)	11/27/2006		16	1	0.128	
MW-9(M)	12/28/2006		12.8	0.8	0.102	
MW-9(M)	1/29/2007		24	1.5	0.192	
MW-9(M)	2/28/2007		25.6	1.6	0.205	
MW-9(M)	3/30/2007		32	2	0.256	
MW-9(M)	4/30/2007		14.4	0.9	0.115	
MW-9(M)	5/29/2007		12.8	0.8	0.102	
MW-9(M)	6/28/2007		16	1	0.128	
MW-9(M)	7/30/2007		12.8	0.8	0.102	
MW-9(M)	8/28/2007		25.6	1.6	0.205	
MW-15(A)	5/19/2004				sample only	<b>2.986</b>
MW-15(A)	8/17/2004				0.330	
MW-15(A)	10/19/2004				0.250	
MW-15(A)	4/25/2005		19.2	1.2	0.154	
MW-15(A)	5/26/2005		24	1.5	0.192	
MW-15(A)	6/27/2005		11.2	0.7	0.090	
MW-15(A)	7/26/2005		11.2	0.7	0.090	
MW-15(A)	8/29/2005		1.6	0.1	0.013	
MW-15(A)	9/27/2005		0	0	0.000	
MW-15(A)	10/26/2005		4.8	0.3	0.038	
MW-15(A)	5/26/2006		14.4	0.9	0.115	

TABLE 7-1

## LNAPL RECOVERED

Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon

Locator ID	Date	Amount of Product Removed (cubic feet)	Amount of Product Removed (fluid ounces)	Amount of Product Removed (pounds)	Amount of Product Removed (gallons)	Total Gallons of Product Removed
MW-15(A)	6/28/2006		12.8	0.8	0.102	
MW-15(A)	8/28/2006		12.8	0.8	0.102	
MW-15(A)	11/2/2006		4.8	0.3	0.038	
MW-15(A)	11/27/2006		16	1	0.128	
MW-15(A)	12/28/2006		20.8	1.3	0.166	
MW-15(A)	1/29/2007		24	1.5	0.192	
MW-15(A)	2/28/2007		24	1.5	0.192	
MW-15(A)	3/30/2007		24	1.5	0.192	
MW-15(A)	4/30/2007		17.6	1.1	0.141	
MW-15(A)	5/29/2007		22.4	1.4	0.179	
MW-15(A)	6/28/2007		17.6	1.1	0.141	
MW-15(A)	7/30/2007		6.4	0.4	0.051	
MW-15(A)	8/28/2007		11.2	0.7	0.090	
MW-37(A)	5/19/2004		1	0.06	0.008	<b>0.008</b>
MW-40(A)	11/12/2003		1	0.06	0.008	<b>1.557</b>
MW-40(A)	5/19/2004		5	0.31	0.040	
MW-40(A)	7/19/2004		2	0.13	0.016	
MW-40(A)	8/17/2004		1	0.06	0.008	
MW-40(A)	4/25/2005		12.8	0.8	0.102	
MW-40(A)	5/26/2005		4.8	0.3	0.038	
MW-40(A)	6/27/2005		1.6	0.1	0.013	
MW-40(A)	7/26/2005		1.6	0.1	0.013	
MW-40(A)	8/29/2005		0	0	0.000	
MW-40(A)	9/27/2005		3.2	0.2	0.026	
MW-40(A)	10/26/2005		3.2	0.2	0.026	
MW-40(A)	11/28/2005		6.4	0.4	0.051	
MW-40(A)	12/27/2005		24	1.5	0.192	
MW-40(A)	5/26/2006		14.4	0.9	0.115	
MW-40(A)	6/28/2006		9.6	0.6	0.077	

TABLE 7-1

## LNAPL RECOVERED

Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon

Locator ID	Date	Amount of Product Removed (cubic feet)	Amount of Product Removed (fluid ounces)	Amount of Product Removed (pounds)	Amount of Product Removed (gallons)	Total Gallons of Product Removed
MW-40(A)	8/28/2006		0	0	0.000	
MW-40(A)	11/2/2006		0	0	0.000	
MW-40(A)	11/27/2006		14.4	0.9	0.115	
MW-40(A)	12/28/2006		12.8	0.8	0.102	
MW-40(A)	1/29/2007		8	0.5	0.064	
MW-40(A)	2/28/2007		12.8	0.8	0.102	
MW-40(A)	3/30/2007		22.4	1.4	0.179	
MW-40(A)	4/30/2007		12.8	0.8	0.102	
MW-40(A)	5/29/2007		6.4	0.4	0.051	
MW-40(A)	6/28/2007		3.2	0.2	0.026	
MW-40(A)	7/30/2007		4.8	0.3	0.038	
MW-40(A)	8/28/2007		6.4	0.4	0.051	
MW-41(A)	5/19/2004		8	0.5	0.064	2.278
MW-41(A)	4/25/2005		19.2	1.2	0.154	
MW-41(A)	5/26/2005		25.6	1.6	0.205	
MW-41(A)	6/27/2005		20.8	1.3	0.166	
MW-41(A)	7/26/2005		4.8	0.3	0.038	
MW-41(A)	8/29/2005		1.6	0.1	0.013	
MW-41(A)	9/27/2005		4.8	0.3	0.038	
MW-41(A)	10/26/2005		4.8	0.3	0.038	
MW-41(A)	11/28/2005		1.6	0.1	0.013	
MW-41(A)	12/27/2005		19.2	1.2	0.154	
MW-41(A)	5/26/2006		22.4	1.4	0.179	
MW-41(A)	6/28/2006		20.8	1.3	0.166	
MW-41(A)	8/28/2006		0	0	0.000	
MW-41(A)	11/2/2006		4.8	0.3	0.038	
MW-41(A)	11/27/2006		17.6	1.1	0.141	
MW-41(A)	12/28/2006		17.6	1.1	0.141	
MW-41(A)	1/29/2007		14.4	0.9	0.115	
MW-41(A)	2/28/2007		17.6	1.1	0.141	

TABLE 7-1

## LNAPL RECOVERED

Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon

Locator ID	Date	Amount of Product Removed (cubic feet)	Amount of Product Removed (fluid ounces)	Amount of Product Removed (pounds)	Amount of Product Removed (gallons)	Total Gallons of Product Removed
MW-41(A)	3/30/2007		19.2	1.2	0.154	
MW-41(A)	4/30/2007		20.8	1.3	0.166	
MW-41(A)	5/29/2007		11.2	0.7	0.090	
MW-41(A)	6/28/2007		1.6	0.1	0.013	
MW-41(A)	7/30/2007		3.2	0.2	0.026	
MW-41(A)	8/28/2007		3.2	0.2	0.026	
MW-42(A)	5/19/2004				2.000	<b>5.606</b>
MW-42(A)	6/16/2004				0.500	
MW-42(A)	7/19/2004		5	0.31	0.040	
MW-42(A)	8/17/2004		2	0.13	0.016	
MW-42(A)	10/19/2004		1	0.06	0.008	
MW-42(A)	11/16/2004		2	0.13	0.016	
MW-42(A)	4/25/2005		20.8	1.3	0.166	
MW-42(A)	5/26/2005		25.6	1.6	0.205	
MW-42(A)	6/27/2005		12.8	0.8	0.102	
MW-42(A)	7/26/2005		17.6	1.1	0.141	
MW-42(A)	8/29/2005		17.6	1.1	0.141	
MW-42(A)	9/27/2005		14.4	0.9	0.115	
MW-42(A)	10/26/2005		12.8	0.8	0.102	
MW-42(A)	11/28/2005		22.4	1.4	0.179	
MW-42(A)	12/27/2005		28.8	1.8	0.230	
MW-42(A)	5/26/2006		24	1.5	0.192	
MW-42(A)	6/28/2006		22.4	1.4	0.179	
MW-42(A)	8/28/2006		8	0.5	0.064	
MW-42(A)	11/2/2006		9.6	0.6	0.077	
MW-42(A)	11/27/2006		11.2	0.7	0.090	
MW-42(A)	12/28/2006		9.6	0.6	0.077	
MW-42(A)	1/29/2007		14.4	0.9	0.115	
MW-42(A)	2/28/2007		27.2	1.7	0.218	
MW-42(A)	3/30/2007		12.8	0.8	0.102	

TABLE 7-1

## LNAPL RECOVERED

Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon

Locator ID	Date	Amount of Product Removed (cubic feet)	Amount of Product Removed (fluid ounces)	Amount of Product Removed (pounds)	Amount of Product Removed (gallons)	Total Gallons of Product Removed
MW-42(A)	4/30/2007		22.4	1.4	0.179	
MW-42(A)	5/29/2007		4.8	0.3	0.038	
MW-42(A)	6/28/2007		17.6	1.1	0.141	
MW-42(A)	7/30/2007		16	1	0.128	
MW-42(A)	8/28/2007		6.4	0.4	0.051	
MW-44(A)	5/19/2004				0.500	2.354
MW-44(A)	7/19/2004		6	0.38	0.048	
MW-44(A)	8/17/2004		2	0.13	0.016	
MW-44(A)	10/19/2004		3	0.19	0.024	
MW-44(A)	4/25/2005		17.6	1.1	0.141	
MW-44(A)	5/26/2005		19.2	1.2	0.154	
MW-44(A)	6/27/2005		9.6	0.6	0.077	
MW-44(A)	7/26/2005		14.4	0.9	0.115	
MW-44(A)	8/29/2005		1.6	0.1	0.013	
MW-44(A)	9/27/2005		4.8	0.3	0.038	
MW-44(A)	10/26/2005		3.2	0.2	0.026	
MW-44(A)	11/28/2005		9.6	0.6	0.077	
MW-44(A)	12/27/2005		12.8	0.8	0.102	
MW-44(A)	5/26/2006		9.6	0.6	0.077	
MW-44(A)	6/28/2006		9.6	0.6	0.077	
MW-44(A)	8/28/2006		0	0	0.000	
MW-44(A)	11/2/2006		3.2	0.2	0.026	
MW-44(A)	11/27/2006		19.2	1.2	0.154	
MW-44(A)	12/28/2006		14.4	0.9	0.115	
MW-44(A)	1/29/2007		14.4	0.9	0.115	
MW-44(A)	2/28/2007		12.8	0.8	0.102	
MW-44(A)	3/30/2007		12.8	0.8	0.102	
MW-44(A)	4/30/2007		11.2	0.7	0.090	
MW-44(A)	5/29/2007		8	0.5	0.064	
MW-44(A)	6/28/2007		6.4	0.4	0.051	

**TABLE 7-1****LNAPL RECOVERED****Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

<b>Locator ID</b>	<b>Date</b>	<b>Amount of Product Removed (cubic feet)</b>	<b>Amount of Product Removed (fluid ounces)</b>	<b>Amount of Product Removed (pounds)</b>	<b>Amount of Product Removed (gallons)</b>	<b>Total Gallons of Product Removed</b>
MW-44(A)	7/30/2007		4.8	0.3	0.038	
MW-44(A)	8/28/2007		1.6	0.1	0.013	
MW-50(A)	1/29/2007		28.8	1.8	0.230	<b>1.830</b>
MW-50(A)	2/28/2007		25.6	1.6	0.205	
MW-50(A)	3/30/2007		32	2	0.256	
MW-50(A)	4/30/2007		35.2	2.2	0.282	
MW-50(A)	5/29/2007		20.8	1.3	0.166	
MW-50(A)	6/28/2007		30.4	1.9	0.243	
MW-50(A)	7/30/2007		25.6	1.6	0.205	
MW-50(A)	8/28/2007		30.4	1.9	0.243	
<b>TOTAL GALLONS OF PRODUCT REMOVED</b>						<b>34.037</b>

**TABLE 8-1  
PHYSICAL AND CHEMICAL PROPERTIES OF CONSTITUENTS DETECTED**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

Constituents	Molecular Weight (g/mol)	Water Solubility (mg/L 25degC)	Specific Gravity	Vapor Pressure		Henry's Law Constant (atm-m <sup>3</sup> /mol)	Koc (ml/g)	LogKow	logPoct
				(ug/m <sup>3</sup> )	(mm Hg 25 deg C)				
Petroleum Hydrocarbons									
Diesel	142	32			4.50E-02	2.90E-04	4500	7200.00	
Gasoline									
Lube Oil									
Heavy Oil									
Volatile Organic Compounds									
1,2,4-Trimethylbenzene	120.19	2.60E-01		6.16E+04	341 (at 140 deg C)	5.70E-03	3.70E+03		3.8
1,2-Dibromoethane	187.88	3.40E+03		4.53E+07	11 (at 20 deg C)	3.20E-04	2.81E+01		
1,2-Dichloroethane	99	8.52E+03		3.45E+08	61 (at 20 deg C)	9.74E-04	1.74E+01		
1,3,5-Trimethylbenzene	120.19	5.00E+-1		1.60E+07	1.82 (at 20 deg C)	7.70E-03	8.20E+02		3.42
1,4-Dichlorobenzene	147.01	79 (at 25 deg C)			0.6 (at 20 deg C)				3.39 (at 20 deg C)
2-Butanone	72.1	352000 (at 10 deg C)			77.5 (at 20 deg C)				0.26
4-Isopropyltoluene	134.22								
Acetone	58.08				270 (at 30 deg C)				-0.24
Benzene	78.11	1.75E+03		4.04E+08	76 (at 20 deg C)	5.55E-03	5.89E+01		2.13 (at 20 deg C)
Bromomethane	94.95	900 (at 20 deg C)							
Carbondisulfide	76.14	2100 (at 20 deg C)			260 (at 20 deg C)				1.84 to 2.16
Chloroform	119.38	9300 (at 25 deg C)			160 (at 20 deg C)	0.15 (at 25 deg C)			1.97 (at 20 deg C)
Chloromethane	51	6500 (at 30 deg C)			5 atm (at 20 deg C)	0.36 (at 25 deg C)			0.91 (at 23 deg C)
Ethylbenzene	106.17	1.69E+02		5.54E+07	7 (at 20 deg C)	7.88E-03	3.63E+02		3.15
Isopropylbenzene	120	3.00E+01		1.62E+07		1.30E-02	2.20E+03		
Methylenechloride	84.93	16700 (at 25 deg C)			349 (at 20 deg C)	-1.04 (at 25 deg C)			
methyl tert-butyl ether	88	5.10E+04		1.25E+09		5.87E-04	1.12E+01		
n-Butylbenzene	134.21				1 (at 23 deg C)				
n-Propylbenzene	120.19	1.40E+01		7.57E+06	2.5 (at 20 deg C)	1.30E-02	2.80E+03		3.57 or 3.68
sec-Butylbenzene	134.21				1.1 (at 20 deg C)				
tert-Butylbenzene	134.21				1.5 (at 20 deg C)				4.11
Tetrachloroethene	165.83	150 (at 25 deg C)			14 (at 20 deg C)	0.7 (at 25 deg C)			2.53
Toluene	92.1	5.26E+02		1.45E+08	22 (at 20 deg C)	6.64E-03	1.82E+02		2.69 (at 20 deg C)
Trichloroethene	131.5	1100 (at 25 deg C)			60 (at 20 deg C)	0.4 (at 25 deg C)			2.42
o-Xylene	106.17	175 (at 20 deg C)			5 (at 20 deg C)				2.77

**TABLE 8-1  
PHYSICAL AND CHEMICAL PROPERTIES OF CONSTITUENTS DETECTED**

**Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon**

Constituents	Molecular Weight (g/mol)	Water Solubility (mg/L 25degC)	Specific Gravity	Vapor Pressure		Henry's Law Constant (atm-m <sup>3</sup> /mol)	Koc (ml/g)	LogKow	logPoct
				(ug/m <sup>3</sup> )	(mm Hg 25 deg C)				
m-Xylene	106.16				6 (at 20 deg C)				3.2
p-Xylene	106.17	198 (at 25 deg C)		4.90E+07	6.5 (at 20 deg C)	6.73E-03	3.86E+02		3.15
Xylenes	106	1.75E+02							
Semivolatile Organic Compounds									
2-Methylnaphthalene	142	2.50E+01	1.01		4.50E-02	2.90E-04	7400	3.86	
Acenaphthene	154	4.24E+00	1.02	2.73E+04	1.60E-03	1.55E-04	4.90E+03	4.00	
Acenaphthylene	152.2	3.93	0.899		9.12E-04				4.07
Anthracene	178	4.34E-02	1.24	1.17E+02	2.00E-04	6.50E-05	2.95E+04	4.45	
Benz(a)anthracene	228	9.40E-03	1.27	1.31E+00	2.20E-08	3.35E-06	3.98E+05	5.61	
Benzo(a)pyrene	252	1.62E-03		7.61E-02		1.13E-06	1.02E+06		
Benzo(b)fluoranthene	252	1.50E-03		6.93	5.00E-07	1.11E-04	1.23E+06	6.06	
Benzo(g,h,i)perylene	276	2.60E-04			1E-10 (at 20 deg C)				7.23
Benzo(k)fluoranthene	252	8.00E-04		2.76E-02	5.10E-07	3.90E-05	1.23E+06	6.08	
Chrysene	228	1.60E-03	1.27	6.30E+00	6.30E-09	9.46E-05	3.98E+05	5.61	
Dibenz(a,h)anthracene	278	2.49E-04		1.52E-04		1.47E-08	3.80E+06		
Fluoranthene	202	2.06E-01		1.38E+02	5.00E-06	1.61E-05	1.07E+05	4.90	
Fluorene	166	1.98E+00	1.20	5.23E+03	7.10E-04	6.35E-05	1.38E+04	4.20	
Indeno(1,2,3-cd)pyrene	276	2.20E-05		1.46E-03		1.60E-06	3.47E+06		
Naphthalene	128	3.10E+01	1.15	6.23E+05	4.5E+00(at 20 deg C)	4.83E-04	2.00E+03	3.41	
Phenanthrene	178.22	1.6 at 15 deg C			6.8E-04 (at 20 deg C)				4.46
Pyrene	202	1.35E-01	1.27	6.18E+01	2.50E-06	1.10E-05	1.05E+05	4.88	
Other / Metals									
Formaldehyde	30.0				25 hPa (at 20 deg C)				0.00; -0.78
Arsenic, Total									
Barium									
Chromium									
Lead	207								
Mercury									
Selenium									

**TABLE 8-2  
SUMMARY OF BULK DENSITY**

Remedial Investigation/Feasibility Study  
Astoria Area-Wide Petroleum Site  
Astoria, Oregon

<b>Locator ID</b>	<b>Sample ID</b>	<b>Dry Unit Weight (pcf) ASTM D2937</b>	<b>Moisture Content (%) ASTM D2216</b>	<b>Organic Content (%) ASTM D2974</b>
SB-404(F)	SB-404(F) (2'-3')	107.2	13	2.3
SB-404(F)	SB-404(F) (20'-21')	103.3	6.6	2
SB-509(M)	SB-509(M) (7'-8')	61.9	65.5	6.5
SB-618(N)	SB-618(N) (6'-7')	95.4	8	1.3
SB-707(P)	SB-707(P) (6'-7')	107.5	12	0.7
SB-710(P)	SB-710(P) (9'-10')	100	22.3	0.2
SB-807(Q)	SB-807(Q) (6'-7')	84.9	20.6	1.7
SB-829(Q)	SB-829(Q) (6'-7')	87.5	14.1	1.2
SB-911(S)	SB-911(S) (6'-7')	87.5	8.2	0.5