A Department of Ecology Report

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Restover Truck Stop Groundwater Monitoring, Results of January 2000 Sampling

Abstract

This progress report is one in a series describing results of groundwater sampling at the Restover Truck Stop. This report describes results of samples collected in January 2000 from four upper aquifer wells for benzene, toluene, ethylbenzene, and total xylenes (BTEX), as well as total petroleum hydrocarbons as gasoline (TPH-G). All four BTEX compounds were detected in well WDOE-6A with an average total concentration of 233 µg/L. Low concentrations of benzene and ethylbenzene were detected in MW-30. TPH-G concentrations in wells MW-8A, MW-30 and WDOE-6A were 490 µg/L, 660 µg/L and 7,600 µg/L, respectively. Model Toxic Control Act (MTCA) cleanup standards were exceeded in WDOE-6A for benzene, ethylbenzene and total xylene, as well as for TPH. Benzene slightly exceeded the cleanup standard in well MW-30. Well WDOE-6A is the only well in which BTEX concentrations continue to be elevated.

Waterbody Numbers:

WA-1232184468211GW
WA-13-0030GW (Segment No. 06-13-03GW)

Background

The Department of Ecology has conducted groundwater sampling at the Restover Truck Stop in Thurston County, Washington, from 1987 to the present. To remediate soil and groundwater contamination, an Interim Action consisting of an air sparge/vapor extraction system (VES) was initiated in the summer of 1993. Operation of the VES was terminated in the fall of 1997, since BTEX concentrations had substantially decreased and continued operation of the system was no longer cost efficient. In late 1998 and early 1999, the VES and most of the remaining monitoring wells were decommissioned.

Methods

Groundwater Sampling

In January, groundwater samples were collected from four upper aquifer monitoring wells; MW-8A, MW-30, MW-31, and WDOE-6A (Figure 1). The upper aquifer consists of recessional

By Pamela B. Marti

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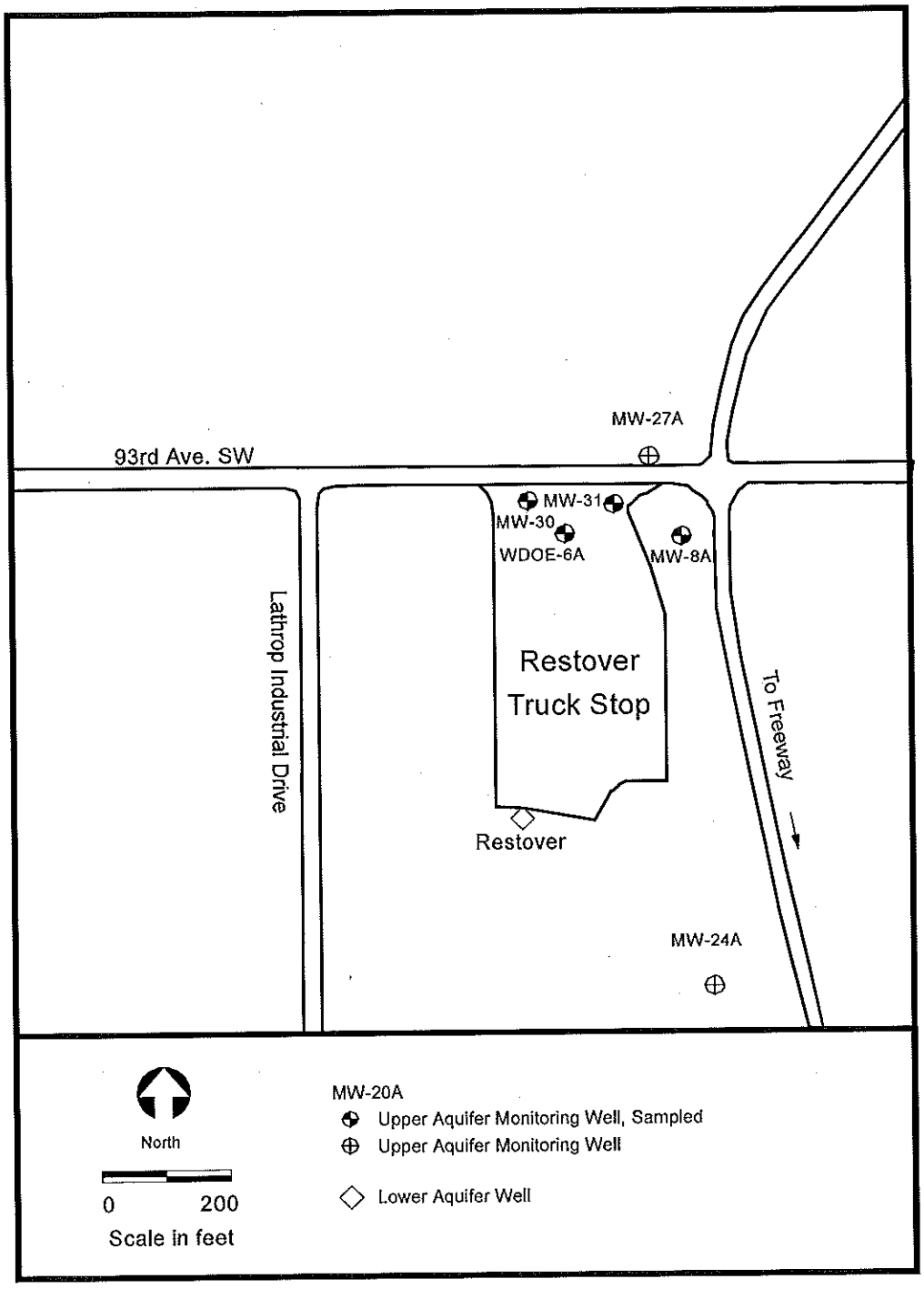

Figure 1: Well Locations, Restover Truck Stop

outwash. The Vashon Till, which is a regional aquitard, and advance outwash deposits that form a lower aquifer underlie this unit.

Sampling methods were consistent with those previously used on this project. Static water levels were recorded prior to well purging. Wells were purged with either a teflon bailer or submersible pump until pH, specific conductance, and temperature readings stabilized, and a minimum of three well volumes had been removed. All the monitoring well samples were collected using decontaminated, bottom-emptying teflon bailers. Sampling procedures are discussed in greater detail in Appendix A.

Analysis

Analytes, analytical method and detection limits are listed in Table 1 for both field and laboratory parameters. Monitoring well samples were analyzed for benzene, toluene, ethylbenzene, and xylene (BTEX) as well as total petroleum hydrocarbons as gasoline (TPH-G). BTEX samples from wells MW-8A, MW-30 and MW-31 were analyzed using EPA SW-846 Method 8020 (U.S. EPA, 1986). Due to the extreme weathering of the BTEX fraction and the difficulty of distinguishing these compounds from other hydrocarbons present by a Photoionization Detector (PID), samples collected from WDOE-6A were analyzed using EPA method 8260 (GC/MS) (U.S. EPA, 1986).

Table 1: Analytical Methods for January 25, 2000 Samples

Analytes	Method	Reference	Detection Limit
Field			
Water Level	Solinst Well Probe	NA	0.01 feet
PH	Orion 25A Field Meter	NA	0.1 Std. Units
Temperature	Orion 25A Field Meter	NA	0.1 C
Specific Conductance	Beckman Conductivity Bridge	NA	10 umhos/cm
Laboratory			
BTEX	SW-846 Methods 8020/8260	U.S. EPA 1986	1-5 µg/L
TPH-G	NWTPH-GX	Ecology 1994	0.025 mg/L

In general, the quality of the data is acceptable. Quality control samples collected in the field consisted of blind field duplicates for BTEX and TPH-G, which were obtained from well WDOE-6A. The numeric comparison of duplicate results is expressed as the relative percent difference (RPD). The RPD for the January duplicate samples were within 6% for BTEX and 8% for TPH-G. In addition to field quality control samples, a matrix spike, matrix spike duplicate, and surrogate compound recoveries were performed in the laboratory. Most of the surrogate spike recoveries were within the control limits of 50-150%. Matrix spikes for BTEX and TPH-G were within acceptable limits. Further discussion of quality assurance, as well as laboratory reporting sheets, are presented in Appendix B.

Results

Field Observations

Depth-to-water measurements and purge volume, as well as pH, specific conductance, and temperature readings at the time of sampling, are listed in Table 2.

Table 2: Summary of Field Parameters Results for January 25, 2000

Monitoring Well	Total Depth (feet)[1]	Depth to Water (feet)[2]	pH (standard units)	Specific Conductance (umhos/cm)	Temperature (°C)	Purge Volume (gallons)
MW-8A	21.01	7.45	5.9	60	10.5	8.5
MW-30	16.78	6.38	5.8	154	11.9	22
MW-31	13.47	7.25	5.8	83	11.3	3.5
WDOE-6A	21.68	7.96	6.1	99	11.7	10

[1] Below ground surface.

[2] Measured from top of casing.

Analytical Results

Analytical results for BTEX and TPH-G, as well as MTCA groundwater cleanup standards are shown in Table 3.

Table 3: Analytical Results (µg/L) for January 25, 2000

Monitoring Well	Benzene	Toluene	Ethylbenzene	Total Xylene	Total BTEX	TPH-G
MTCA Cleanup Std.	5.0	40.0	30.0	20.0		(Total TPH) 1000.0
MW-8A	1 U	1 U	1 U	3 U	3 U	490
MW-30	9.2	1 U		3 U	11.2	660
MW-31	1 U	1 U	1 U	3 U	3 U	60 U
WDOE-6A	17	7.8	53	160	238	7300
MW-6A (dup)*	18	7.9	50	152	228	7900

U : The analyte was not detected at or above the reported value.

J : The analyte was positively identified. The associated numerical result is an estimate.

* : MW-6A is a duplicate sample of WDOE-6A.

In January, all four BTEX compounds were detected in WDOE-6A with an average total concentration of 233 µg/L. Low concentrations of benzene and ethylbenzene were detected in MW-30. TPH-G concentrations in wells MW-8, MW-30 and WDOE-6A were 490 µg/L, 660 µg/L and 7,600 µg/L, respectively.

Table 4 shows BTEX concentrations for select monitoring wells over the entire monitoring period (1987 to 2000). Of the wells sampled, WDOE-6A is the only well that continues to have volatile organic concentrations that consistently exceed MTCA cleanup standards.

Figure 2 shows BTEX concentrations for well WDOE-6A for the same time period. Historically, concentrations in well WDOE-6A were relatively stable from August 1991 to February 1995. Since February 1995, BTEX concentrations in well WDOE-6A have been gradually decreasing. In April 1996, high BTEX concentrations were detected in this well. There is no apparent explanation for this increase. The decrease in BTEX concentrations in 1995 coincides with operation of the VES which was initiated in the summer of 1993. Operation of the VES was terminated in the fall of 1997, since BTEX concentrations had substantially decreased. The VES and most of the remaining monitoring wells were decommissioned in the fall of 1998 and early 1999. Beginning in 2001 the monitoring program will either be reduced to annual sampling of well WDOE-6A or will be concluded.

Conclusions/Recommendations

1. WDOE-6A is the only well that continues to have elevated BTEX concentrations. Since 1995, BTEX concentrations in this well have been gradually decreasing. WDOE-6A should continue to be sampled periodically for BTEX and TPH-G.

2. In January Model Toxic Control Act (MTCA) cleanup standards were exceeded in WDOE-6A for benzene, ethylbenzene, total xylene, and TPH. Benzene slightly exceeded the cleanup standard in well MW-30.

Table 4: Historical Restover Truck Stop BTEX Concentrations (ug/L) from May 1987 to January 2000

Well Number	May 1987	September 1987	October 1988	January 1989	July 1989	January 1990	August 1990	February 1991	August 1991	February 1992	July 1992
Upper Aquifer											
WDOE-6A	6950	1180	5300	28000	7490	9870	5190	3460	2840	3830	2990
MW-8A	230[1]	388[1]	479[1]	334[1]	64[2]	20[2]	178[2]	19[2]	20[2]	9[2]	53[2]
MW-15A	1433	--	--	ND	218	--	285	122	--	--	--
MW-17	ND	ND	ND	ND	ND	--	--	ND	ND	--	2.7
MW-20A	126	--	--	--	--	20	1400	5	293	11	452
MW-30	-	-	-	-	-	-	-	-	-	-	-
MW-9A	727	--	--	--	--	--	--	--	--	--	--
Lower Aquifer											
Restover	--	--	ND	ND	ND	ND	ND	ND	ND	ND	ND
Spencer	ND	ND	--	ND	ND	ND	ND	ND	ND	ND	ND
MW-12	53	5	8	ND	4	ND	6	ND	--	--	--

Well Number	January 1993	July 1993	November 1993	January 1994	April 1994	August 1994	November 1994	February 1995	April 1995	August 1995	October 1995
Upper Aquifer											
WDOE-6A	4784	2620	3070	6360	5242	3214	4624	2120	1829	638	646
MW-8A	47[2]	30[2]	41[2]	36[2]	4[2]	8[1]	32[2]	ND	ND	ND	ND
MW-15A	--	--	--	--	--	--	--	ND	--	2	--
MW-17	ND	--	--	--	--	--	--	--	--	--	--
MW-20A	--(Dry)	162	--(Dry)	ND	59	--(Dry)	ND	ND	ND	18	--(Dry)
MW-30	-	--	--(Dry)	--(Dry)	2400	--(Dry)	--(Dry)	8	8	7	ND
MW-31	-	-	-	-	-	-	-	-	-	--(Dry)	--(Dry)
MW-9A	--	--	--	--(Dry)	366	--	--	ND	--	1	--
Lower Aquifer											
Restover	ND	0.4	--	ND	--	--	--	--	--	ND	--
Spencer	ND	ND	--	--	--	--	--	--	--	--	--
MW-12	--	1.7	--	--	--	--	--	1.1	--	Well Decommissioned	
MW-12A	-	-	-	-	-	-	-	-	-	0.5	--

ND: Compound not detected
-- : Compound not tested

[1] : Value is based on one sample
[2] : Value represents the mean of duplicate samples

Table 4 (cont'd): Historical Restover Truck Stop BTEX Concentrations (ug/L) from May 1987 to January 2000

Well Number	February 1996	April 1996	August 1996	November 1996	February 1997	August 1997	February 1998	July 1998	January 1999	July 1999	January 2000
Upper Aquifer											
WDOE-6A	61	5900	488[2]	664[2]	310[2]	212[2]	214[2]	158[2]	412[2]	92[2]	233[2]
MW-8A	ND	ND	ND	5	ND	ND	ND	ND	ND	ND	ND
MW-15A	ND	--	--	--	ND	--	--	--	Well Decommissioned		
MW-17	--	--	--	--	--	--	--	--	Well Decommissioned		
MW-20A	ND	ND	1	6	ND	ND	ND	ND	Well Decommissioned		
MW-30	5	19	ND	1	ND	ND	2.5	ND	6.4	ND	11
MW-31	7.1	ND	--(Dry)	--(Dry)	ND	3.6	--	--(Dry)	1.1	1.5	ND
MW-9A	ND	--	--	--	ND	--	--	--	Well Decommissioned		
Lower Aquifer											
Restover	--	--	--	--	--	--	--	--	--	--	--
Spencer	--	--	--	--	--	--	--	--	--	--	--
MW-12											
MW-12A	ND	--	--	--	ND	--	--	--	Well Decommissioned		

ND: Compound not detected

-- : Compound not tested

[1] : Value is based on one sample

[2] : Value represents the mean of duplicate samples

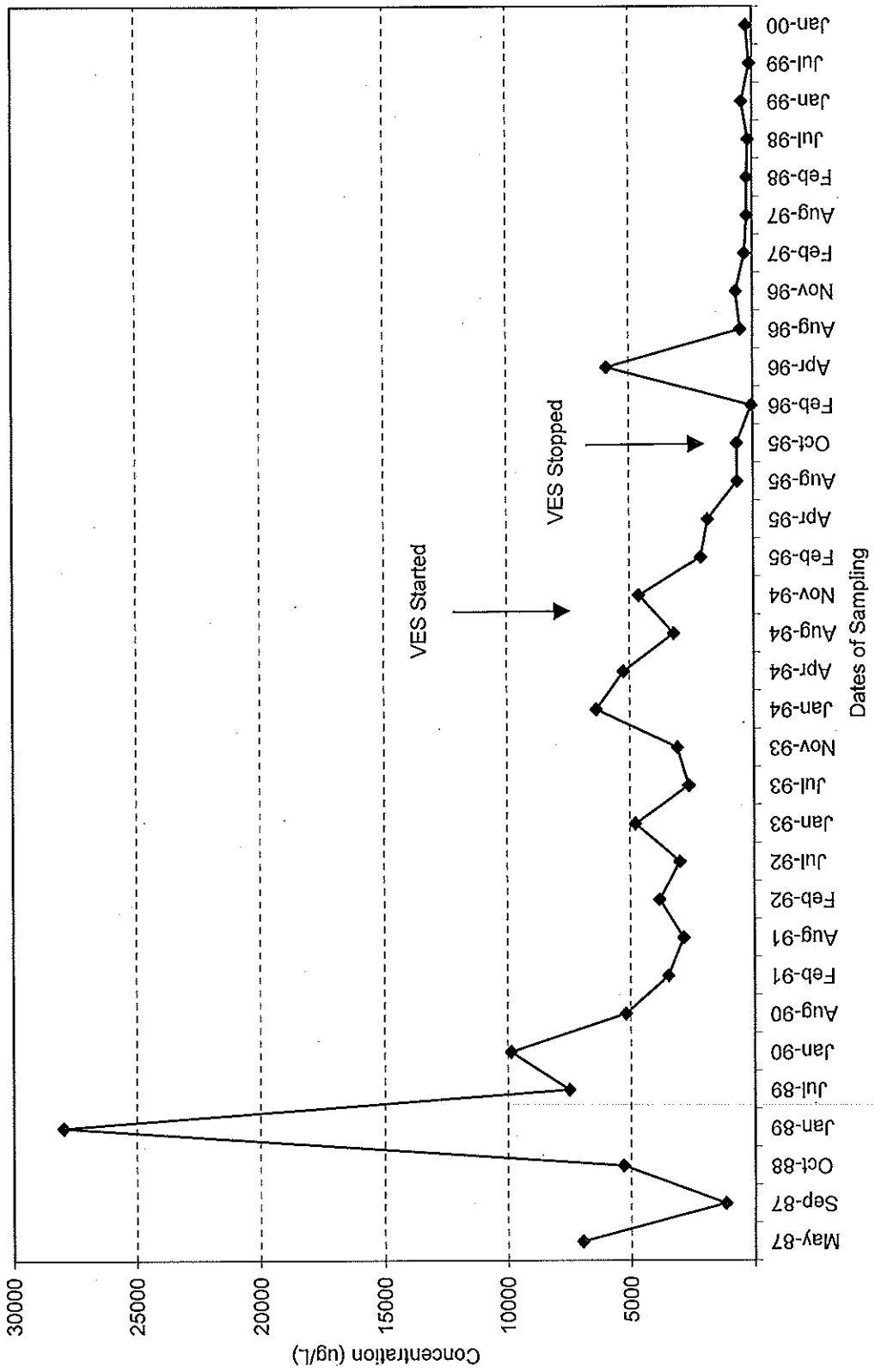

Figure 2: BTEX Concentrations in WDOE-6A from May 1987 to January 2000

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Contacts

Pamela B. Marti Washington State Department of Ecology
Environmental Assessment Program
Watershed Ecology Section
(360) 407-6768

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Appendix A

Groundwater Sampling

In January, samples for benzene, toluene, ethylbenzene, and xylene (BTEX), as well as total petroleum hydrocarbons as gasoline (TPH-G), were collected from four upper aquifer-monitoring wells.

Prior to sampling, static water level measurements were obtained from monitoring wells using an electronic water level probe. The probe was rinsed with deionized water and wiped clean between measurements. Based on the purge volume, wells were purged with either a teflon bailer or submersible pump. Wells were purged until pH, specific conductance, and temperature readings stabilized, and a minimum of three well volumes had been removed. Purge water was discharged onto the ground near each well, except for well WDOE-6A. Purge water from this well was collected in a 55-gallon barrel and stored with other vapor extraction system waste in the enclosed tank area. This waste will be transported and disposed of in accordance with State of Washington regulations (Chapter 173-340-400 WAC).

Monitoring well samples were collected using decontaminated, bottom-emptying teflon bailers. Bailers were pre-cleaned with sequential washes of Liquinox®, hot tap water, 10% nitric acid, distilled-deionized water and pesticide-grade acetone. After cleaning, bailers were air-dried and wrapped in aluminum foil. Samples for BTEX and TPH-G analysis were collected free of headspace and preserved with 1:1 hydrochloric acid.

Chain-of-custody procedures were followed in accordance with Manchester Laboratory protocol (Ecology, 1994). The Ecology/EPA Laboratory in Manchester analyzed all samples.

Appendix B

Quality Assurance

In general the quality of the data is acceptable. In January, BTEX samples from wells MW-8A, MW-30 and MW-31 were analyzed using EPA SW-846 Method 8020 (U.S. EPA, 1986). Due to extreme weathering of the BTEX fraction and difficulty distinguishing these compounds from other hydrocarbons present by a PID, samples collected from WDOE-6A were analyzed using EPA method 8260 (GC/MS) (U.S. EPA, 1986). TPH-G samples were analyzed using Washington State Method NWTPH-GX (Ecology, 1994).

Quality control samples collected in the field consisted of a blind field duplicate. Duplicate samples for BTEX and TPH-G were obtained from monitoring well WDOE-6A. Duplicate samples collected at WDOE-6A provide an estimate of combined sampling and laboratory precision. The numeric comparison of duplicate results is expressed as the relative percent difference (RPD). RPDs are the ratio of the difference and the mean of duplicate results expressed as a percentage. The RPD for the January duplicate samples were within 6% for BTEX and 8% for TPH-G.

In addition to field quality control samples, a matrix spike, matrix spike duplicate and surrogate compound recoveries were performed in the laboratory. Most of the surrogate spike recoveries were within the control limits of 50-150%. Recoveries were not calculated in some cases where there was positive interference with 1,4-difluorobenzene. Matrix spikes for BTEX and TPH-G were within acceptable limits. Karin Feddersen and Bob Carrell of the Manchester Laboratory conducted the quality assurance review.