

March 2007 Monitoring Results for Centralia, Kansas

Environmental Science Division



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March 2007 Monitoring Results for Centralia, Kansas

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Contents

Notation.....	iv
1 Introduction and Background	1-1
2 Sampling and Analysis Activities.....	2-1
2.1 Measurement of Groundwater Levels.....	2-1
2.2 Monitoring Well and Piezometer Sampling and Analyses	2-1
2.3 Handling and Disposal of Investigation-Derived Waste	2-2
2.4 Quality Control for Sample Collection, Handling, and Analysis	2-2
3 Results and Discussion	3-1
3.1 Groundwater Level Data.....	3-1
3.2 Groundwater Analysis Results.....	3-2
3.2.1 Results of the Groundwater Analyses for VOCs	3-2
3.2.2 Results of the Groundwater Analyses for Indicators of Possible Contaminant Degradation	3-2
4 Conclusions and Recommendations	4-1
4.1 Conclusions.....	4-1
4.2 Recommendations.....	4-1
5 References.....	5-1
Appendix A: Sequence of Sampling Activities at Centralia, Kansas, in March 2007.....	A-1
Appendix B: Data Summary for Verification VOCs analyses by EnviroSystems, Inc.....	B-1

Tables

3.1 Groundwater levels measured by hand at Centralia on January 8 and March 26-29, 2007.....	3-4
3.2 Analytical results from the AGEM Laboratory for volatile organic compounds in groundwater samples collected at Centralia, October 2003 to March 2007	3-5
3.3 Field measurements for groundwater samples collected at Centralia, October 2003 to March 2007	3-8

3.4	Results of attenuation parameter analyses for groundwater samples collected at Centralia, October 2003–March 2007.....	3-11
A.1	Sequence of sampling activities at Centralia in March 2007.....	A-2

Figures

1.1	Monitoring network at Centralia, as of March 2007.....	1-2
3.1	Potentiometric surface at Centralia, based on water levels measured manually on January 8, 2007	3-17
3.2	Hydrographs summarizing results of long-term water level monitoring in wells MW01-MW06 at Centralia from June 16, 2006, to January 8, 2007	3-18
3.3	Carbon tetrachloride levels in groundwater at Centralia in March 2007, with the interpreted lateral extent of the contaminant at intervals during the period August 2004 to March 2007	3-19

Notation

AGEM	Applied Geosciences and Environmental Management
AMSL	above mean sea level
BGL	below ground level
°C	degree(s) Celsius
CCC	Commodity Credit Corporation
EPA	U.S. Environmental Protection Agency
ft	foot (feet)
gal	gallon(s)
gpm	gallon(s) per minute
hr	hour
KDHE	Kansas Department of Health and Environment
µg/kg	microgram(s) per kilogram
µg/L	microgram(s) per liter
µS/cm	microsiemen(s) per centimeter
mg/L	milligram(s) per liter
min	minute
mV	millivolt(s)
nM	nanomolar
ORP	oxidation-reduction potential
TOC	top of casing
TU	tritium unit(s)
USDA	U.S. Department of Agriculture
VOC	volatile organic compound

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1 Introduction and Background

In September 2005, periodic sampling of groundwater was initiated by the Commodity Credit Corporation of the U.S. Department of Agriculture (CCC/USDA) in the vicinity of a grain storage facility formerly operated by the CCC/USDA at Centralia, Kansas. The sampling at Centralia is being performed on behalf of the CCC/USDA by Argonne National Laboratory, in accord with a monitoring program approved by the Kansas Department of Health and Environment (KDHE). The objective is to monitor levels of carbon tetrachloride contamination identified in the groundwater at Centralia (Argonne 2003, 2004, 2005a). Under the KDHE-approved *Monitoring Plan* (Argonne 2005b), the groundwater is being sampled twice yearly (for a recommended period of two years) for analyses for volatile organic compounds (VOCs), as well as measurement of selected geochemical parameters to aid in the evaluation of possible natural contaminant degradation (reductive dechlorination) processes in the subsurface environment. The sampling is presently conducted in a network of 11 monitoring wells and 5 piezometers (Figure 1.1), at locations approved by the KDHE (Argonne 2006a).

The results of groundwater sampling and VOCs analyses in September-October 2005, March 2006, and September 2006 were documented previously (Argonne 2006a,b). The results have demonstrated the presence of carbon tetrachloride contamination, at levels exceeding the KDHE Tier 2 Risk-Based Screening Level of 5 µg/L for this compound, in a broad groundwater plume that has shown little movement.

This report presents the results of the groundwater sampling at Centralia in March 2007, performed in accord with the KDHE-approved *Monitoring Plan* (Argonne 2005b). The March 2007 sampling represents the fourth monitoring event performed under the recommended two-year monitoring program approved by the KDHE. A final sampling event under this program is scheduled for September 2007.

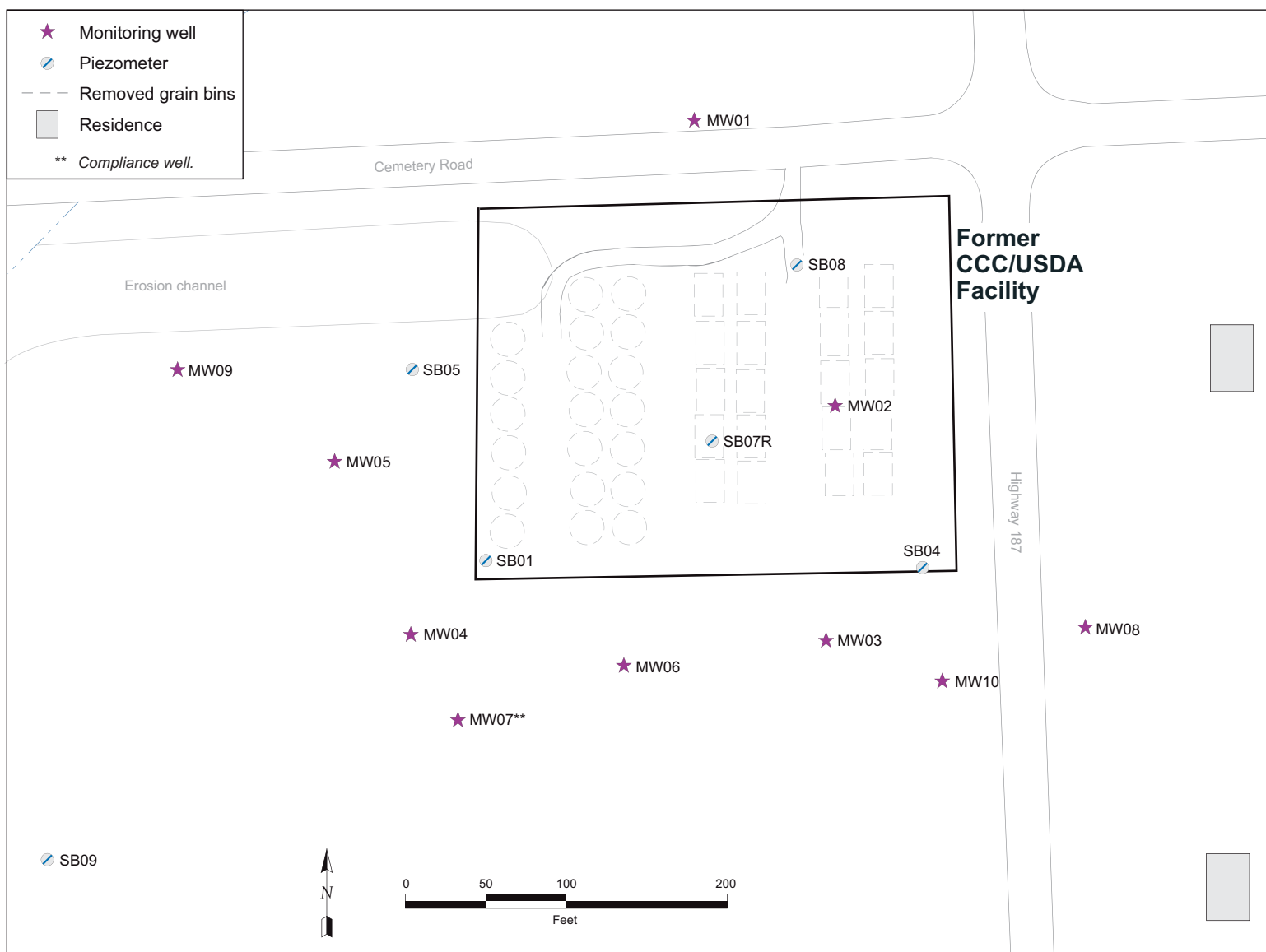


FIGURE 1.1 Monitoring network at Centralia, as of March 2007.

2 Sampling and Analysis Activities

2.1 Measurement of Groundwater Levels

Monitoring wells MW01-MW09 and piezometers SB01, SB04, SB05, SB07R, SB08, and SB09 (Figure 1.1) were sampled on March 26-29, 2007. Before the wells were purged, a water level indicator was used to measure the depth to groundwater and the total depth of each well, to within 0.01 ft, from the top of the well casing.

Data recorders currently installed in MW01-MW06 are gathering long-term data on the groundwater elevation and gradient at Centralia. The data recorders in these wells were downloaded, and water levels were measured manually at all monitoring points, on January 8, 2007.

The groundwater level data are discussed in Section 3.1.

2.2 Monitoring Well and Piezometer Sampling and Analyses

After measurement of water levels and dissolved oxygen levels, the monitoring points were purged of a minimum three well volumes. Field measurements of temperature, pH, and conductivity were taken during purging until the measurements stabilized. Field measurements of carbon dioxide, iron(II), and oxidation reduction potential (ORP) were made for the evaluation of possible biodegradation processes, as outlined in the *Monitoring Plan* (Argonne 2005b). All sampling and field analyses were performed in accord with procedures in the *Master Work Plan* (Argonne 2002). The sequence of activities during the March well sampling event is summarized in Appendix A.

Groundwater samples designated for VOCs and selected geochemical analyses identified in the *Monitoring Plan* (Argonne 2005b) were collected in appropriate laboratory containers, labeled, packaged, and chilled to 4°C by placement in ice-filled coolers. The samples were shipped by an overnight delivery service to the Applied Geosciences and Environmental Management (AGEM) Laboratory at Argonne for VOCs analyses with U.S. Environmental Protection Agency (EPA) Method 524.2 (EPA 1995). Aliquots of selected samples (chosen in

the field) were also shipped to EnviroSystems, Inc., Columbia, Maryland, for verification VOCs analyses.

Samples designated for laboratory analyses of degradation parameters were collected and shipped to Severn-Trent Laboratories, South Burlington, Vermont. The analyses included dissolved chloride, sulfate, nitrate, and phosphate concentrations by EPA Method 300; total alkalinity by EPA Method 310.1; nitrate-nitrite nitrogen by EPA Method 353.2; nitrite nitrogen by EPA Method 354.1; sulfide by EPA Method 376.2; total organic carbon by EPA Method 415.1; and dissolved metals (aluminum, calcium, iron, magnesium, manganese, phosphorus, potassium, silicon, sodium, and zinc) by EPA Method 6010 (EPA 1998a). Analyses for the natural attenuation indicators methane, ethane, and ethene were conducted with Method RSK-175 (Kampbell and Vandegrift 1998).

The analytical results are presented and discussed in Section 3.2.

2.3 Handling and Disposal of Investigation-Derived Waste

Purge water generated as potentially contaminated investigation-derived waste was containerized on-site in 55-gal drums. The accumulated purge water was sampled and analyzed for VOCs and found to contain carbon tetrachloride at 188 µg/L and chloroform at 6.9 µg/L. With the approval of the KDHE (2007), the water was disposed of at the Sabetha, Kansas, publicly owned treatment works on May 9, 2007 (Sabetha 2007).

2.4 Quality Control for Sample Collection, Handling, and Analysis

Quality assurance/quality control procedures followed during the March 2007 monitoring event are described in detail in the *Master Work Plan* (Argonne 2002). The results are summarized as follows:

- Sample collection and handling activities were monitored by the documentation of samples as they were collected and the use of chain-of-custody forms and custody seals to ensure sample integrity during handling and shipment.

- Samples designated for VOCs analyses were received with custody seals intact and at the appropriate preservation temperature. All samples were analyzed within the required holding times.
- Quality control samples collected to monitor sample collection and handling activities (a field blank, an equipment rinsate, and trip blanks) and method blanks analyzed with the samples to monitor analytical methodologies were all free of carbon tetrachloride and chloroform contamination.
- Groundwater samples were analyzed for VOCs at the AGEM Laboratory with the purge-and-trap method on a gas chromatograph-mass spectrometer system. Calibration checks with each sample delivery group were required to be within $\pm 20\%$ of the standard. Surrogate standard determinations performed on samples and blanks were within the specified range of 80-120% for all samples, in either the initial analysis or a successful reanalysis.
- In accordance with the procedures defined in the *Master Work Plan* (Argonne 2002), the analyses of water samples at the AGEM Laboratory were verified at a second laboratory. Two groundwater samples were analyzed according to the EPA's Contract Laboratory Program methodology by EnviroSystems, Inc., Columbia, Maryland. The sample from monitoring well MW08 analyzed at the AGEM Laboratory with no carbon tetrachloride or chloroform detected was analyzed by EnviroSystems with similar results. The analytical results from the AGEM Laboratory and EnviroSystems for the sample from piezometer SB01 were 222 $\mu\text{g/L}$ and 300 $\mu\text{g/L}$, respectively, for carbon tetrachloride and 4.9 $\mu\text{g/L}$ and 5.3 $\mu\text{g/L}$, respectively, for chloroform. The resulting relative percent differences are 29.9% for carbon tetrachloride and 7.8% for chloroform. Recoveries of surrogate compounds were marginally outside the target quality control range in the analyses of these samples and the associated trip blank by EnviroSystems. Summary pages for the verification organic analyses are in Appendix B.
- Samples shipped to Severn-Trent Laboratories for attenuation parameter analyses were received with custody seals intact and at the appropriate preservation conditions. All samples were analyzed within the required

holding times. (Although the analyses of some samples for nitrate with EPA Method 300 did occur beyond the 48-hr holding time limit, the primary analyses of preserved sample volumes for total nitrogen with EPA Method 353.2 and were within the holding time limit.) Results were within the acceptable limits for laboratory quality control samples prepared and analyzed with the samples to evaluate accuracy and precision.

3 Results and Discussion

3.1 Groundwater Level Data

Depths to groundwater were measured manually in all available monitoring wells on January 8, 2007, and March 26-29, 2007 (during sampling). The hand-measured water level data are in Table 3.1. The tables for Section 3 are grouped at the end of the section's text, before the figures.

The potentiometric surface at Centralia, interpreted from manual measurements on January 8, 2007, is depicted in Figure 3.1. The recent results are consistent with previous measurements (Figures 4.1-4.3 in Argonne 2006a), indicating an apparent groundwater flow direction toward the southwest across much of the former CCC/USDA facility. Figure 3.1 (and Figure 4.3 in Argonne 2006a) indicates that groundwater flow is focused toward a localized low in the potentiometric surface, defined by the water level measurements at SB01, MW04, MW06, and MW07. Argonne's earlier investigations (Argonne 2003, 2004) suggested that the increased hydraulic gradients observed near these wells are a reflection of relatively low-permeability silts and clays that comprise the aquifer unit in this portion of the study area, in comparison to the more coarse-grained deposits identified in the northern and eastern portions of the site. The results of groundwater analyses at Centralia (discussed in Section 3.2) support an interpretation of slow groundwater flow (and carbon tetrachloride migration) to the south-southwest, in keeping with the observed water level patterns.

The hydrographs in Figure 3.2 summarize data for the period June 16, 2006, through January 8, 2007, from the recording transducers installed for long-term water level monitoring in wells MW01-MW06. The water level recorders at both wells MW02 and MW03 experienced electrical malfunctions on September 29, 2006, and no data were recorded at these locations beyond that time.

Groundwater levels at the site were relatively stable (Figure 3.2), showing a maximum net decline of approximately 2 ft during the monitoring period. Responses to individual recharge events were most prominent in well MW05, near the western edge of the former CCC/USDA facility (Figure 3.1). In contrast, the traces for monitoring wells MW04 and MW06, located in the finer-grained portion of the aquifer unit noted above, showed virtually no response to these events (Figure 3.2). (The sharp downward spike observed in the hydrograph for MW06 is an

artifact corresponding to the September 2006 sampling event, when the water level recorder at this location was removed for sampling and then replaced.)

3.2 Groundwater Analysis Results

3.2.1 Results of the Groundwater Analyses for VOCs

The analytical data for VOCs in the groundwater samples collected in March 2007 are in Table 3.2, together with data for the previous sampling events conducted at Centralia since sampling of the monitoring well network began in 2004. The March 2007 data for carbon tetrachloride are illustrated in Figure 3.3, along with the lateral margins of the plume, as interpreted by Argonne on the basis of each of the groundwater sampling events summarized in Table 3.2.

Carbon tetrachloride was detected in March 2007 at 10 of the 16 monitoring locations (Figure 3.3), at concentrations ranging from $< 1 \mu\text{g/L}$ (at MW05) to a maximum of $829 \mu\text{g/L}$ (at MW02). Chloroform concentrations ranging from $< 1 \mu\text{g/L}$ to $14 \mu\text{g/L}$ were detected at 6 of the 16 sampled locations (Table 3.2), in association with the more elevated carbon tetrachloride levels identified beneath of the former CCC/USDA facility (at MW02, SB01, SB04, SB07R, and SB08) and immediately to the west (at SB05).

The present results indicate that measured carbon tetrachloride levels declined slightly (MW02, SB01, SB04), were unchanged (SB07R), or rose slightly (SB08) at sampling locations in the central body of the groundwater plume, in comparison to the September 2006 sampling event. Table 3.2 and Figure 3.3 indicate, however, that relatively consistent longer-term trends of increasing carbon tetrachloride levels have been detected at monitoring points SB05, MW03, MW04, and MW07, along the western and southern margins of the groundwater plume and in the apparent direction of groundwater flow.

3.2.2 Results of the Groundwater Analyses for Indicators of Possible Contaminant Degradation

The results of field measurements and selected laboratory geochemical analyses on the groundwater samples are summarized in Tables 3.3 and 3.4. The reported parameters can be used

to estimate whether the *in situ* conditions at Centralia are suitable for possible degradation of carbon tetrachloride by natural anaerobic (reductive dechlorination) processes, as outlined in regulatory guidance for the evaluation of these conditions (KDHE 2001; EPA 1998b).

The monitoring results to date give limited evidence for possible anaerobic biodegradation of carbon tetrachloride at Centralia. The persistent occurrence of the carbon tetrachloride breakdown product chloroform at relatively elevated concentrations at monitoring points SB01, SB05, and (particularly) MW02 during the March 2005 sampling event and each of the subsequent sampling events (Table 3.2 in the present report; see also Argonne 2005a, 2006a,b) suggests that carbon tetrachloride is being degraded at these locations.

TABLE 3.1 Groundwater levels measured by hand at Centralia on January 8 and March 26-29, 2007.

Well	Horizontal Location ^a (ft)		Top of Casing Elevation ^b (ft AMSL) ^c	Groundwater Level on January 8, 2007		Groundwater Level on March 26-29, 2007	
				Depth (ft TOC) ^d	Elevation (ft AMSL)	Depth (ft TOC)	Elevation (ft AMSL)
MW01	515257.2	1839058.4	1329.30	16.48	1312.82	16.12	1313.18
MW02	515079.9	1839143.0	1334.82	25.98	1308.84	25.08	1309.74
MW03	514935.9	1839135.8	1334.70	25.88	1308.82	25.32	1309.38
MW04	514942.5	1838880.5	1322.71	28.35	1294.36	28.05	1294.66
MW05	515049.6	1838835.0	1318.11	10.69	1307.42	9.95	1308.16
MW06	514922.3	1839011.2	1329.82	39.96	1289.86	40.00	1289.82
MW07	514889.0	1838906.8	1324.83	31.47	1293.36	31.31	1293.52
MW08	514939.6	1839294.4	1332.41	23.61	1308.80	23.10	1309.31
MW09	515104.0	1838737.4	1310.49	3.12	1307.37	2.52	1307.97
MW10	514909.9	1839205.5	1334.56	25.51	1309.05	25.22	1309.34
SB01	514987.3	1838927.1	1325.16	22.87	1302.29	21.98	1303.18
SB04	514979.9	1839195.6	1335.73	26.92	1308.81	26.39	1309.34
SB07R	515059.3	1839067.0	1331.71	22.67	1309.04	22.51	1309.20
SB08	515167.1	1839120.5	1332.56	23.76	1308.80	23.19	1309.37
SB09	514805.7	1838653.4	1311.04	6.51	1304.53	5.68	1305.36

^a Horizontal coordinates are target location centers. Northings and eastings are Kansas State Plane Coordinates. Horizontal datum is North American Datum (NAD) 83.

^b Vertical datum is National GEodetic Vertical Datum (NGVD) 88.

^c AMSL, above mean sea level.

^d TOC, below top of casing.

Source of data: Schwab-Eaton, Manhattan, Kansas.

TABLE 3.2 Analytical results from the AGEM Laboratory for volatile organic compounds in groundwater samples collected at Centralia, October 2003 to March 2007.

Well	Screen Interval (ft BGL)	Sample Date	Concentration (µg/L)		
			Carbon Tetrachloride	Chloroform	Methylene Chloride
MW01	54.5–64.5	8/24/04	ND ^a	ND	ND
		9/10/05	ND	ND	ND
		10/11/05	ND	ND	ND
		3/15/06	ND	ND	ND
		9/25/06	ND	ND	ND
		3/29/07	ND	ND	ND
MW02	49.5–59.5	8/26/04	215	6.2	ND
		9/11/05	776	33	ND
		10/12/05	528	21	ND
		3/16/06	847	21	ND
		9/26/06	1233	25	ND
		3/26/07	829	14	ND
MW03	50.5–60.5	8/24/04	1.2	ND	ND
		9/10/05	1.6	ND	ND
		10/11/05	1.8	ND	ND
		3/17/06	2.6	0.2 J ^b	ND
		9/26/06	2.7	ND	ND
		3/27/07	2.5	ND	ND
MW04	37.5–47.5	8/24/04	ND	ND	ND
		9/11/05	0.9 J	ND	ND
		10/11/05	0.8 J	ND	ND
		3/15/06	1.3	ND	ND
		9/25/06	1.4	0.1 J	ND
		3/28/07	2.1	ND	ND
MW05	34.5–44.5	8/25/04	ND	ND	ND
		9/10/05	1.9	ND	ND
		10/11/05	1.5	ND	ND
		3/15/06	1.3	ND	ND
		9/25/06	1.3	ND	ND
		3/28/07	0.5 J	ND	ND

TABLE 3.2 (Cont.)

Well	Screen Interval (ft BGL)	Sample Date	Concentration (µg/L)		
			Carbon Tetrachloride	Chloroform	Methylene Chloride
MW06	46.5–56.5	8/25/04	ND	ND	ND
		9/10/05	ND	ND	ND
		10/11/05	0.3 J	ND	ND
		3/15/06	0.2 J	ND	ND
		9/27/06	ND	ND	ND
		3/27/07	ND	ND	ND
MW07	45–55	3/14/06	0.4 J	0.6 J	ND
		9/26/06	1.1	ND	ND
		3/26/07	1.8	ND	ND
MW08	38–53	3/14/06	ND	ND	ND
		9/26/06	ND	ND	ND
		3/27/07	ND	ND	ND
MW09	25–35	3/15/06	ND	ND	ND
		9/25/06	ND	ND	ND
		3/27/07	ND	ND	ND
MW10	30–45	3/14/06	ND	ND	ND
		9/26/06	ND	ND	ND
		3/28/07	ND	ND	ND
SB01	40–50	8/26/04	186	6.5	ND
		9/9/05	269	6.8	ND
		10/12/05	288	6.6	ND
		3/17/06	320	5.7	ND
		9/27/06	267	6.3	ND
		3/27/07	222	4.9	ND
SB04	51–61	8/26/04	30	ND	ND
		9/9/05	47	0.6 J	ND
		10/12/05	44	0.5 J	ND
		3/16/06	51	0.5 J	0.4 J B ^c
		9/25/06	54	0.7 J	ND
		3/28/07	44	0.5 J	ND

TABLE 3.2 (Cont.)

Well	Screen Interval (ft BGL)	Sample Date	Concentration (µg/L)		
			Carbon Tetrachloride	Chloroform	Methylene Chloride
SB05	32–42	8/26/04	59	5.5	ND
		9/9/05	77	7.2	ND
		10/12/05	54	5.5	ND
		3/17/06	104	7.2	ND
		9/27/06	139	12	ND
		3/28/07	138	12	ND
SB07R	45–60	3/15/06	41	2.7	ND
		9/26/06	30	1.7	ND
		3/26/07	30	1.7	ND
SB08	52–62	8/26/04	79	3.1	ND
		9/8/05	80	2.6	ND
		10/12/05	77	2.8	ND
		3/17/06	91	2.7	ND
		9/21/06	53	1.6	ND
		3/28/07	64	2.0	ND
SB09	32–42	8/26/04	ND	ND	ND
		9/11/05	ND	ND	ND
		10/11/05	ND	ND	ND
		3/17/06	ND	ND	ND
		9/25/06	ND	ND	ND
		3/28/07	ND	ND	ND

^a ND, not detected at an instrument detection limit of 0.1 µg/L.

^b Qualifier J indicates an estimated concentration below the method quantitation limit of 1.0 µg/L.

^c Qualifier B indicates that the contaminant was present in the associated method blank.

TABLE 3.3 Field measurements for groundwater samples collected at Centralia, October 2003 to March 2007.

Well	Screen Interval (ft BGL)	Sample Date	Temperature (°C)	pH	Conductivity (μS/cm)	Concentration (mg/L)			ORP (mV)
						Dissolved Oxygen	Carbon Dioxide	Iron(II)	
MW01	54.5–64.5	8/24/04	16.3	7.39	652	0.06	25	0.00	230
		9/10/05	16.3	7.26	599	6.31	–	0.00	104
		10/11/05	16.4	6.45	634	– ^a	–	–	–
		3/15/06	14.3	7.56	621	9.33	30	0.04	297
		9/25/06	13.3	7.01	782	6.82	50	0.31	92
		3/29/07	16.5	6.54	629	4.39	–	0.00	174
MW02	49.5–59.5	8/26/04	14.4	7.31	729	0.16	20	0.12	235
		9/11/05	15.3	7.02	739	1.28	–	–	–
		10/12/05	14.8	6.60	766	–	–	–	–
		3/16/06	14.2	6.78	759	1.24	–	0.00	295
		9/26/06	13.2	6.98	957	3.05	40	0.06	67
		3/26/07	15.7	6.39	739	2.29	50	–	67
MW03	50.5–60.5	8/24/04	13.1	7.28	783	0.10	55	0.21	230
		9/10/05	15.1	7.05	715	10.42	65	0.00	142
		10/11/05	16.3	6.46	765	–	–	–	–
		3/17/06	13.8	6.75	753	9.39	77	0.00	290
		9/26/06	13.2	6.92	960	11.57	45	0.08	251
		3/27/07	15.3	6.40	774	7.73	25	–	268
MW04	37.5–47.5	8/24/04	16.2	7.39	717	0.11	40	0.04	210
		9/11/05	15.4	7.18	665	8.43	60	0.00	226
		10/11/05	14.4	7.14	811	–	–	–	–
		3/15/06	13.5	7.78	675	6.82	55	0.06	283
		9/25/06	–	7.02	613	9.13	40	0.19	46
		3/28/07	15.4	6.47	678	5.46	–	0.00	197
MW05	34.5–44.5	8/25/04	14.3	7.14	613	0.08	25	0.06	215
		9/10/05	14.2	6.80	620	1.40	110	0.00	160
		10/11/05	14.8	6.35	610	–	–	–	–
		3/15/06	14.3	6.90	701	0.90	30	0.06	156
		9/25/06	13.6	6.95	768	0.09	50	0.02	55
		3/28/07	14.4	6.44	573	4.53	35	0.00	295
MW06	46.5–56.5	8/25/04	15.9	7.50	637	0.05	15	0.00	215
		9/10/05	14.6	7.23	659	0.04	60	0.00	41
		10/11/05	15.8	6.99	638	–	–	–	–
		3/15/06	14.1	7.38	630	9.87	35	0.02	263
		9/27/06	13.1	6.16	652	0.05	45	1.12	63
		3/27/07	19.0	6.42	466	0.11	20	0.00	13

TABLE 3.3 (Cont.)

Well	Screen Interval (ft BGL)	Sample Date	Temperature (°C)	pH	Conductivity (μS/cm)	Concentration (mg/L)			ORP (mV)
						Dissolved Oxygen	Carbon Dioxide	Iron(II)	
MW07	45–55	3/14/06	14.7	6.61	709	0.34	–	0.03	143
		9/26/06	13.1	7.23	642	2.91	50	0.00	–
		3/26/07	15.8	6.50	642	1.87	30	0.00	261
MW08	38–53	3/14/06	13.5	6.35	854	5.32	–	0.00	145
		9/26/06	13.3	6.75	1095	0.16	50	0.18	37
		3/27/07	15.8	6.31	874	1.49	30	0.21	237
MW09	25–35	3/15/06	17.7	7.33	664	0.95	55	0.09	214
		9/25/06	12.8	6.87	859	1.59	45	0.18	90
		3/27/07	14.9	6.35	689	4.10	30	0.69	152
MW10	30–45	3/14/06	14.8	6.60	834	6.42	65	0.00	166
		9/26/06	13.6	6.87	1058	6.94	50	0.50	51
		3/28/07	17.0	6.36	834	5.09	35	0.00	270
SB01	40–50	8/26/04	26.0	7.46	699	5.21	30	0.00	210
		9/9/05	25.0	7.11	674	6.25	95	0.00	140
		10/12/05	13.8	7.23	686	–	–	–	–
		3/17/06	12.4	7.30	692	5.98	55	0.00	185
		9/27/06	14.4	7.03	832	6.54	40	0.52	198
		3/27/07	18.0	6.37	659	3.81	25	0.23	173
SB04	51–61	8/26/04	17.9	7.14	765	3.78	55	0.37	230
		9/9/05	16.0	7.09	708	8.67	100	–	206
		10/12/05	13.9	7.17	813	–	–	–	–
		3/16/06	13.0	7.57	799	5.96	30	–	276
		9/25/06	14.9	7.16	791	9.32	70	1.18	64
		3/28/07	16.2	6.45	850	6.18	–	0.23	266
SB05	32–42	8/26/04	15.7	7.25	761	–	25	0.06	220
		9/9/05	16.9	6.98	687	7.58	100	–	–
		10/12/05	14.0	7.00	728	–	–	–	–
		3/17/06	13.3	7.67	718	4.80	40	0.18	253
		9/27/06	13.7	6.58	763	4.70	50	0.25	78
		3/28/07	16.7	4.03	0.11	2.58	35	0.07	296
SB07R	45–60	3/15/06	16.8	7.24	685	7.41	60	0.08	83
		9/26/06	13.2	6.89	842	6.17	55	0.26	67
		3/26/07	19.0	6.38	668	5.08	40	0.07	237

TABLE 3.3 (Cont.)

Well	Screen Interval (ft BGL)	Sample Date	Temperature (°C)	pH	Conductivity (μS/cm)	Concentration (mg/L)			ORP (mV)
						Dissolved Oxygen	Carbon Dioxide	Iron(II)	
SB08	52–62	8/26/04	19.5	7.31	635	0.16	20	0.53	235
		9/8/05	21.2	7.27	598	3.21	75	0.00	111
		10/12/05	13.9	7.15	630	–	–	–	–
		3/17/06	12.9	7.14	645	3.40	40	0.00	246
		9/21/06	14.1	6.96	809	4.53	40	0.00	37
		3/28/07	15.8	6.53	645	3.57	35	0.24	208
SB09	32–42	8/26/04	30.9	7.09	910	0.26	75	0.00	185
		9/11/05	14.6	6.71	877	0.13	225	0.00	–
		10/11/05	13.9	6.85	910	–	–	–	–
		3/17/06	11.7	7.03	969	1.53	99	0.00	206
		9/25/06	14.2	7.00	976	0.29	70	0.38	86
		3/28/07	14.3	6.32	957	0.89	40	0.09	236

^a Measurement not recorded.

TABLE 3.4 Results of attenuation parameter analyses for groundwater samples collected at Centralia, October 2003–March 2007.

Well	Screen Interval (ft BGL)	Sample Date	Concentration (mg/L)											
			Total Alkalinity	Chloride	Sulfate	Sulfide	Nitrate	Nitrite	Nitrate-Nitrite Nitrogen	Phosphate	Aluminum	Calcium	Iron	Magnesium
MW01	54.5–64.5	8/24/04	324	12.3	5.83	–	0.459	U < 0.005	0.299	U < 0.2	U < 0.2	66.2	U < 0.1	27.2
		9/10/05	303	U ^a < 0.2	U < 0.2	0.054	0.434	U < 0.005	0.299	0.328	U < 0.2	71.7	U < 0.1	30.2
		3/15/06	325	14.9	6.30	U < 0.02	0.82	U < 0.005	0.315	U < 0.2	U < 0.2	72.2	U < 0.1	30.1
		9/25/06	325	11.6	5.08	U < 0.02	0.561	–	0.294	U < 0.2	U < 0.2	67.2	U < 0.1	27.6
		3/29/07	310	11.0	5.00	U < 0.02	0.33 H ^b	–	0.230	U < 0.2	U < 0.2	66.6	0.14 B ^c	28.5
MW02	49.5–59.5	8/26/04	354	7.95	5.45	–	7.92	0.018	8.30	U < 0.2	U < 0.2	71.7	U < 0.1	27.5
		9/11/05	352	7.03	14.7	0.0563	9.31	0.028	9.79	U < 0.2	U < 0.2	71.8	U < 0.1	27.2
		3/16/06	364	8.45	12.2	0.0381	9.92	0.007	9.27	0.25	U < 0.2	73.6	U < 0.1	28.0
		9/26/06	362	8.01	13.9	U < 0.02	9.73	–	9.25	U < 0.2	U < 0.2	69.0	U < 0.1	25.0
		3/26/07	360	8.20	15.0	U < 0.02	8.8 H	–	9.00	U < 0.2	U < 0.2	70.6	U < 0.1	26.0
MW03	50.5–60.5	8/24/04	353	20.6	8.63	–	6.43	0.0053	6.79	U < 0.2	U < 0.2	77.2	U < 0.1	27.6
		9/10/05	338	19.6	7.82	U < 0.02	7.06	0.019	8.36	0.351	U < 0.2	78.9	U < 0.1	28.8
		3/17/06	353	24.0	9.15	U < 0.02	9.17	U < 0.005	8.59	U < 0.2	U < 0.2	83.2	U < 0.1	29.7
		9/26/06	356	25.5	7.82	U < 0.02	8.41	–	8.80	U < 0.2	U < 0.2	79.8	U < 0.1	28.1
		3/27/07	370	22.0	7.60	U < 0.02	7.3 H	–	9.70	U < 0.2	U < 0.2	79.1	U < 0.1	28.6
MW04	37.5–47.5	8/24/04	337	10.1	10.7	–	4.28	0.0254	4.42	0.276	U < 0.2	61.1	U < 0.1	23.3
		9/11/05	336	10.2	7.90	U < 0.02	4.45	0.015	5.05	0.435	U < 0.2	74.5	U < 0.1	29.4
		3/15/06	337	11.9	6.38	0.0794	4.97	U < 0.005	4.84	U < 0.2	U < 0.2	69.8	U < 0.1	27.2
		9/25/06	338	12.5	5.89	U < 0.02	4.51	–	4.31	U < 0.2	U < 0.2	65.0	U < 0.1	24.8
		3/28/07	360	11.0	5.10	0.027	3.4 H	–	2.60	U < 0.2	U < 0.2	65.7	U < 0.1	26.0
MW05	34.5–44.5	8/25/04	315	4.58	4.56	–	2.46	0.0158	2.55	U < 0.2	U < 0.2	77.2	U < 0.1	27.2
		9/10/05	303	9.42	5.35	U < 0.02	3.07	0.022	3.22	0.312	U < 0.2	85.4	U < 0.1	30.2
		3/15/06	304	9.66	5.17	U < 0.02	3.36	0.0073	3.20	U < 0.2	U < 0.2	79.8	U < 0.1	27.7
		9/25/06	319	7.11	3.90	U < 0.02	2.98	–	2.77	U < 0.2	U < 0.2	74.0	U < 0.1	25.4
		3/28/07	320	5.20	3.00	U < 0.02	2.6 H	–	2.00	U < 0.2	U < 0.2	76.8	U < 0.1	27.6
MW06	46.5–56.5	8/25/04	334	9.25	5.72	–	0.379	U < 0.005	0.267	U < 0.2	U < 0.2	73.4	U < 0.1	23.9
		9/10/05	317	6.88	4.61	0.0228	0.58	0.0094	0.345	0.283	U < 0.2	77.2	U < 0.1	29.8
		3/15/06	343	8.98	5.00	U < 0.02	0.524	0.0055	0.218	U < 0.2	U < 0.2	73.2	U < 0.1	28.9

TABLE 3.4 (Cont.)

Well	Screen Interval (ft BGL)	Sample Date	Concentration (mg/L)											
			Total Alkalinity	Chloride	Sulfate	Sulfide	Nitrate	Nitrite	Nitrate-Nitrite Nitrogen	Phosphate	Aluminum	Calcium	Iron	Magnesium
MW07	45–55	9/27/06	345	7.83	4.69	U < 0.02	0.472	–	0.117	0.681	U < 0.2	69.7	U < 0.1	26.7
		3/27/07	330	8.40	5.20	U < 0.02	0.15 H	–	0.044	U < 0.2	U < 0.2	66.2	U < 0.1	25.1
		3/14/06	299	8.72	28.5	U < 0.02	1.18	0.0175	0.978	U < 0.2	U < 0.2	59.6	U < 0.1	23.1
		9/26/06	351	6.03	23.3	U < 0.02	1.49	–	1.12	0.653	U < 0.2	66.1	U < 0.1	25.7
		3/26/07	350	5.90	20.0	U < 0.02	1.1 H	–	0.71	U < 0.2	U < 0.2	64.9	U < 0.1	26.3
MW08	38–53	3/14/06	342	47.4	14.4	U < 0.02	2.47	0.0124	2.14	U < 0.2	U < 0.2	86.5	U < 0.1	33.1
		9/26/06	249	21.9	9.64	U < 0.02	1.44	–	3.10	U < 0.2	U < 0.2	83.1	U < 0.1	30.6
		3/27/07	390	34.0	11.0	U < 0.02	3 H	–	3.20	U < 0.2	U < 0.2	85.0	U < 0.1	32.1
MW09	25–35	3/15/06	329	6.39	6.23	U < 0.02	3.25	0.0203	2.93	U < 0.2	U < 0.2	83.2	U < 0.1	28.8
		9/25/06	360	7.04	5.41	U < 0.02	3.86	–	3.54	U < 0.2	U < 0.2	85.5	U < 0.1	29.5
		3/27/07	360	6.90	6.40	U < 0.02	4.1 H	–	3.80	U < 0.2	U < 0.2	87.4	U < 0.1	31.3
MW10	30–45	3/14/06	298	74.3	10.8	U < 0.02	1.23	0.0175	0.814	U < 0.2	U < 0.2	91.6	U < 0.1	32.0
		9/26/06	319	97.9	8.80	U < 0.02	1.22	–	1.34	0.606	U < 0.2	88.4	U < 0.1	29.7
		3/28/07	330	100.0	9.10	U < 0.02	1.2 H	–	1.10	U < 0.2	U < 0.2	89.4	U < 0.1	31.1
SB01	40–50	8/26/04	292	61.8	10.6	–	2.32	U < 0.005	1.94	U < 0.2	U < 0.2	75.0	U < 0.1	30.6
		9/9/05	339	18.9	4.31	U < 0.02	1.05	0.0082	1.86	U < 0.2	U < 0.2	75.2	U < 0.1	30.3
		3/17/06	338	22.5	4.87	U < 0.02	1.14	–	2.50	U < 0.2	U < 0.2	66.1	U < 0.1	26.5
		9/27/06	336	60.6	46.2	U < 0.02	3.34	–	3.46	0.233	U < 0.2	74.6	U < 0.1	28.5
		3/27/07	340	30.0	7.40	U < 0.02	1.1 H	–	0.80	U < 0.2	U < 0.2	67.9	U < 0.1	27.3
SB04	51–61	8/26/04	375	40.3	5.89	–	1.84	U < 0.005	1.93	U < 0.2	U < 0.2	78.8	U < 0.1	30.2
		9/9/05	369	45.5	5.05	U < 0.02	1.73	0.0077	2.64	U < 0.2	U < 0.2	79.0	U < 0.1	30.0
		3/16/06	371	40.0	5.98	U < 0.02	3.07	U < 0.005	2.85	U < 0.2	U < 0.2	82.6	U < 0.1	31.4
		9/25/06	374	45.1	6.67	U < 0.02	2.44	–	2.56	U < 0.2	U < 0.2	76.0	U < 0.1	27.7
		3/28/07	370	48.0	15.0	U < 0.02	1.7 H	–	4.60	U < 0.2	U < 0.2	79.1	U < 0.1	28.6
SB05	32–42	8/26/04	326	51.9	6.07	–	2.42	U < 0.005	2.28	U < 0.2	U < 0.2	98.5	U < 0.1	37.0
		9/9/05	318	57.4	4.27	U < 0.02	2.57	0.01	2.41	U < 0.2	U < 0.2	88.1	U < 0.1	33.0

TABLE 3.4 (Cont.)

Well	Screen Interval (ft BGL)	Sample Date	Concentration (mg/L)											
			Total Alkalinity	Chloride	Sulfate	Sulfide	Nitrate	Nitrite	Nitrate-Nitrite Nitrogen	Phosphate	Aluminum	Calcium	Iron	Magnesium
		3/17/06	324	57.1	2.96	U < 0.02	2.56	U < 0.005	2.73	U < 0.2	U < 0.2	92.6	U < 0.1	35.0
		9/27/06	320	67.1	4.11	U < 0.02	2.33	–	2.47	0.521	U < 0.2	86.6	U < 0.1	31.1
		3/28/07	320	66.0	4.90	U < 0.02	2.4 H	–	2.10	U < 0.2	U < 0.2	67.7	U < 0.1	23.4
SB07R	45–60	3/15/06	318	30.4	16.8	U < 0.02	1.27	0.0084	1.04	U < 0.2	U < 0.2	72.4	U < 0.1	26.0
		9/26/06	333	25.2	17.2	U < 0.02	1.47	–	1.62	0.612	U < 0.2	71.0	U < 0.1	25.1
		3/26/07	310	23.0	11.0	U < 0.02	1 H	–	1.10	U < 0.2	U < 0.2	70.2	U < 0.1	25.4
SB08	52–62	8/26/04	322	17.9	8.51	–	1.12	U < 0.005	0.892	U < 0.2	U < 0.2	74.9	U < 0.1	30.1
		9/8/05	319	16.2	7.83	U < 0.02	1.37	0.012	1.28	U < 0.2	U < 0.2	73.0	U < 0.1	29.2
		3/17/06	327	19.3	9.25	U < 0.02	1.69	U < 0.005	1.41	U < 0.2	U < 0.2	72.7	U < 0.1	29.1
		9/21/06	323	16.9	7.08	U < 0.02	1.34	–	1.15	U < 0.2	U < 0.2	69.5	U < 0.1	27.4
		3/28/07	330	17.0	7.40	U < 0.02	1.2 H	–	0.68	U < 0.2	U < 0.2	71.9	U < 0.1	29.0
SB09	32–42	8/26/04	449	14.8	32.0	–	4.92	0.009	5.08	U < 0.2	U < 0.2	108	U < 0.1	39.1
		9/11/05	446	13.4	30.1	U < 0.02	4.37	0.021	4.91	U < 0.2	U < 0.2	119	U < 0.1	42.2
		3/17/06	495	15.6	38.8	U < 0.02	4.67	U < 0.005	4.76	U < 0.2	U < 0.2	115	U < 0.1	40.4
		9/25/06	504	15.5	34.5	U < 0.02	4.17	–	4.13	U < 0.2	U < 0.2	108	U < 0.1	36.5
		3/28/07	530	16.0	32.0	U < 0.02	4.4 H	–	1.20	U < 0.2	U < 0.2	112	U < 0.1	39.5

TABLE 3.4 (Cont.)

Well	Screen Interval (ft BGL)	Sample Date	Manganese	Concentration (mg/L)			Concentration (µg/L)			Total Organic Carbon (mg/L)	Dissolved Hydrogen (nM)	Tritium (TU)
				Silicon	Sodium	Zinc	Ethane	Ethene	Methane			
MW01	54.5–64.5	8/24/04	U < 0.015	14.9	23.4	U < 0.02	< 4	< 3	< 2	< 1	–	0.11 ± 0.09
		9/10/05	0.0153	31.6 E ^d	24.6	U < 0.02	< 4	< 3	< 2	< 1	–	–
		3/15/06	0.217	15.2	24.8	U < 0.02	< 4	< 3	< 2	6.19	–	–
		9/25/06	U < 0.015	15.8	22.8	U < 0.02	< 4	< 3	< 2	< 1	–	–
		3/29/07	U < 0.015	16.1	24.0	U < 0.02	< 4	< 3	< 2	< 1	–	–
MW02	49.5–59.5	8/26/04	U < 0.015	15.1	49.8	U < 0.02	< 4	< 3	< 2	1.84	–	0.78 ± 0.09
		9/11/05	0.0167	15.9	56.4	U < 0.02	< 4	< 3	59	< 1	3.1	–
		3/16/06	U < 0.015	16.4	56.1	U < 0.02	< 4	< 3	34	3.57	–	–
		9/26/06	U < 0.015	15.4	53.0	U < 0.02	< 4	< 3	43	1.29	–	–
		3/26/07	U < 0.015	15.8	55.1	U < 0.02	< 4	< 3	21	1.10	–	–
MW03	50.5–60.5	8/24/04	U < 0.015	15.1	44.7	U < 0.02	< 4	< 3	< 2	1.14	–	0.09 ± 0.09
		9/10/05	U < 0.015	30.9 E	44.4	U < 0.02	< 4	< 3	< 2	< 1	–	–
		3/17/06	U < 0.015	15.0	46.8	U < 0.02	< 4	< 3	< 2	1.23	–	–
		9/26/06	U < 0.015	15.9	44.0	U < 0.02	< 4	< 3	< 2	1.02	–	–
		3/27/07	U < 0.015	15.8	44.5	U < 0.02	< 4	< 3	< 2	< 1	–	–
MW04	37.5–47.5	8/24/04	U < 0.015	15.4	59.3	U < 0.02	< 4	< 3	< 2	< 1	–	0.15 ± 0.09
		9/11/05	0.0373	15.5	48.0	U < 0.02	< 4	< 3	4.5	< 1	–	–
		3/15/06	0.0626	15.1	43.8	U < 0.02	< 4	< 3	51	5.07	–	–
		9/25/06	0.0485	14.9	38.3	U < 0.02	< 4	< 3	140	< 1	–	–
		3/28/07	0.0296	15.3	40.5	U < 0.02	< 4	< 3	6.2	< 1	–	–
MW05	34.5–44.5	8/25/04	U < 0.015	15.1	13.5	U < 0.02	< 4	< 3	< 2	< 1	–	0.16 ± 0.09
		9/10/05	U < 0.015	15.6	12.5	U < 0.02	< 4	< 3	< 2	< 1	–	–
		3/15/06	U < 0.015	14.2	11.6	U < 0.02	< 4	< 3	< 2	5.54	–	–
		9/25/06	U < 0.015	14.6	9.43	U < 0.02	< 4	< 3	< 2	< 1	–	–
		3/28/07	U < 0.015	15.5	10.6	U < 0.02	< 4	< 3	< 2	< 1	–	–
MW06	46.5–56.5	8/25/04	U < 0.015	13.6	26.7	U < 0.02	< 4	< 3	< 2	1.62	–	0.10 ± 0.09
		9/10/05	0.305	15.6	27.1	U < 0.02	< 4	< 3	< 2	< 1	–	–
		3/15/06	0.124	15.5	25.8	U < 0.02	< 4	< 3	2.3	4.12	–	–
		9/27/06	1.3	14.1	22.8	U < 0.02	< 4	< 3	65	< 1	–	–
		3/27/07	0.156	14.2	23.0	U < 0.02	< 4	< 3	6.5	4	–	–

TABLE 3.4 (Cont.)

Well	Screen Interval (ft BGL)	Sample Date	Concentration (mg/L)				Concentration (µg/L)			Total Organic Carbon (mg/L)	Dissolved Hydrogen (nM)	Tritium (TU)
			Manganese	Silicon	Sodium	Zinc	Ethane	Ethene	Methane			
MW07	45–55	3/14/06	0.077	10.5	33.3	U < 0.02	< 4	< 3	< 2	35.4	–	0.31 ± 0.09
		9/26/06	U < 0.015	12.7	34.9	U < 0.02	< 4	< 3	< 2	2.24	–	–
		3/26/07	0.0152	13.6	35.6	0.197	< 4	< 3	< 2	1.00	–	–
MW08	38–53	3/14/06	0.194	15.8	57.5	U < 0.02	< 4	< 3	< 2	9.00	–	4.63 ± 0.15
		9/26/06	0.0306	14.4	51.9	0.0239	< 4	< 3	< 2	1.96	–	–
		3/27/07	U < 0.015	14.7	53.8	U < 0.02	< 4	< 3	< 2	1.90	–	–
MW09	25–35	3/15/06	0.133	13.6	11.6	U < 0.02	< 4	< 3	< 2	10.7	–	1.87 ± 0.09
		9/25/06	U < 0.015	14.6	11.5	U < 0.02	< 4	< 3	< 2	< 1	–	–
		3/27/07	U < 0.015	15.0	13.2	U < 0.02	< 4	< 3	< 2	< 1	–	–
MW10	30–45	3/14/06	0.129	14.5	38.7	U < 0.02	< 4	< 3	< 2	7.96	–	1.39 ± 0.09
		9/26/06	U < 0.015	13.4	41.9	U < 0.02	< 4	< 3	< 2	1.69	–	–
		3/28/07	U < 0.015	14.0	45.0	U < 0.02	< 4	< 3	< 2	1.20	–	–
SB01	40–50	8/26/04	0.106	14.2	44.0	U < 0.02	< 4	< 3	< 2	4.04	–	–
		9/9/05	U < 0.015	31.7 E	44.1	U < 0.02	< 4	< 3	< 2	1.86	71	–
		3/17/06	U < 0.015	16.1	35.8	U < 0.02	< 4	< 3	< 2	8.97	–	–
		9/27/06	U < 0.015	14.6	47.7	0.0339	< 4	< 3	< 2	1.59	–	–
		3/27/07	U < 0.015	15.5	36.7	U < 0.02	< 4	< 3	< 2	< 1	–	–
SB04	51–61	8/26/04	U < 0.015	15.4	57.8	U < 0.02	< 4	< 3	< 2	3.00	–	–
		9/9/05	U < 0.015	15.0	54.9	U < 0.02	< 4	< 3	< 2	< 1	24	–
		3/16/06	U < 0.015	16.5	56.9	U < 0.02	< 4	< 3	< 2	3.78	–	–
		9/25/06	U < 0.015	15.6	51.2	U < 0.02	< 4	< 3	< 2	1.20	–	–
		3/28/07	U < 0.015	16.1	62.2	U < 0.02	< 4	< 3	< 2	2.00	–	–
SB05	32–42	8/26/04	U < 0.015	15.3	34.0	U < 0.02	< 4	< 3	< 2	2.26	–	–
		9/9/05	U < 0.015	33.4 E	20.3	U < 0.02	< 4	< 3	< 2	< 1	11	–
		3/17/06	U < 0.015	14.5	21.3	U < 0.02	< 4	< 3	< 2	4.97	–	–
		9/27/06	U < 0.015	15.0	21.9	U < 0.02	< 4	< 3	< 2	1.17	–	–
		3/28/07	U < 0.015	16.6	52.3	U < 0.02	< 4	< 3	< 2	1.20	–	–

TABLE 3.4 (Cont.)

Well	Screen Interval (ft BGL)	Sample Date	Manganese	Concentration (mg/L)			Concentration (µg/L)			Total Organic Carbon (mg/L)	Dissolved Hydrogen (nM)	Tritium (TU)
				Silicon	Sodium	Zinc	Ethane	Ethene	Methane			
SB07R	45–60	3/15/06	0.179	13.8	38.2	U < 0.02	< 4	< 3	< 2	11.2	–	0.32 ± 0.09
		9/26/06	U < 0.015	14.0	34.5	0.0371	< 4	< 3	< 2	1.35	–	–
		3/26/07	U < 0.015	14.1	32.5	U < 0.02	< 4	< 3	< 2	1.10	–	–
SB08	52–62	8/26/04	U < 0.015	15.9	27.1	U < 0.02	< 4	< 3	< 2	1.88	–	–
		9/8/05	U < 0.015	14.9	26.7	U < 0.02	< 4	< 3	< 2	< 1	6.1	–
		3/17/06	U < 0.015	14.6	26.1	U < 0.02	< 4	< 3	< 2	5.99	–	–
		9/21/06	U < 0.015	16.1	24.4	U < 0.02	< 4	< 3	< 2	< 1	–	–
		3/28/07	U < 0.015	16.2	26.6	U < 0.02	< 4	< 3	< 2	< 1	–	–
SB09	32–42	8/26/04	U < 0.015	14.7	52.5	U < 0.02	< 4	< 3	< 2	1.94	–	–
		9/11/05	U < 0.015	15.0	57.0	U < 0.02	< 4	< 3	< 2	1.57	–	–
		3/17/06	U < 0.015	14.2	54.9	U < 0.02	< 4	< 3	< 2	6.88	–	–
		9/25/06	U < 0.015	15.0	49.5	U < 0.02	< 4	< 3	< 2	1.86	–	–
		3/28/07	U < 0.015	16.0	53.2	U < 0.02	< 4	< 3	< 2	1.50	–	–

^a U, not detected at the indicated method reporting limit.

^b Qualifier H indicates that the holding time for the analysis was exceeded.

^c Qualifier B indicates that the analyte was present in the blank.

^d Qualifier E indicates that interference with the analysis was reported.

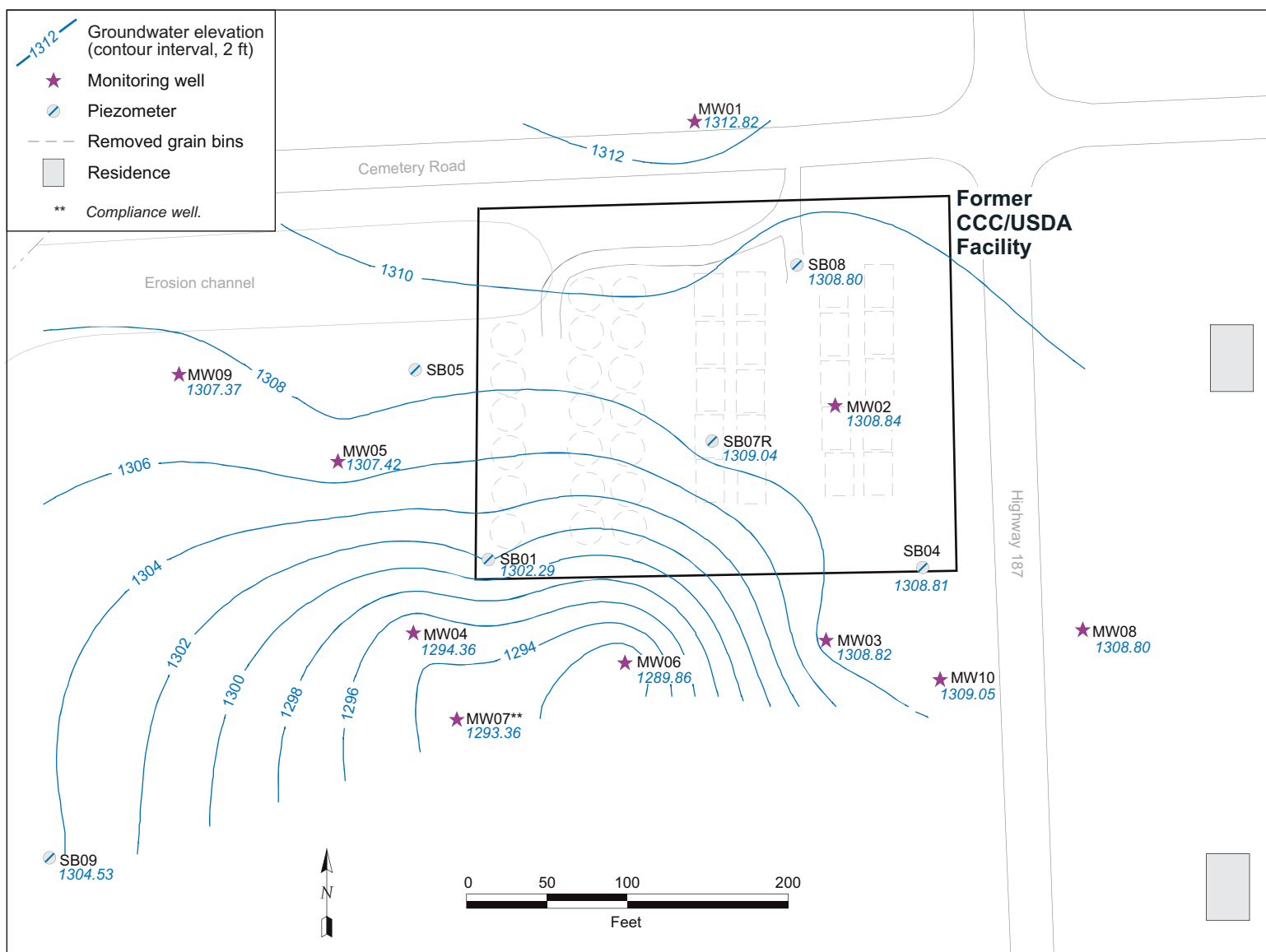


FIGURE 3.1 Potentiometric surface at Centralia, based on water levels measured manually on January 8, 2007.

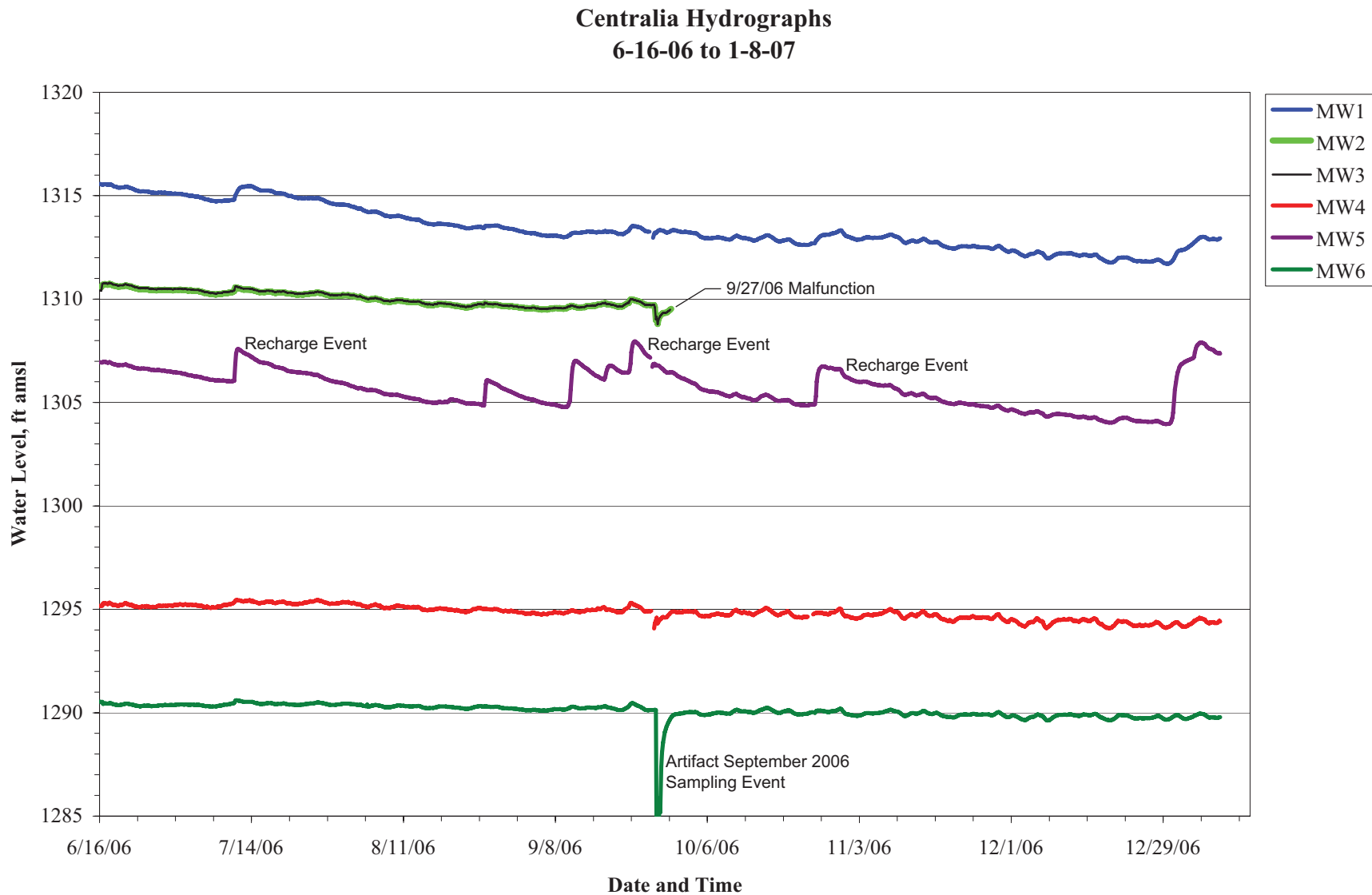


FIGURE 3.2 Hydrographs summarizing results of long-term water level monitoring in wells MW01-MW06 at Centralia from June 16, 2006, to January 8, 2007.

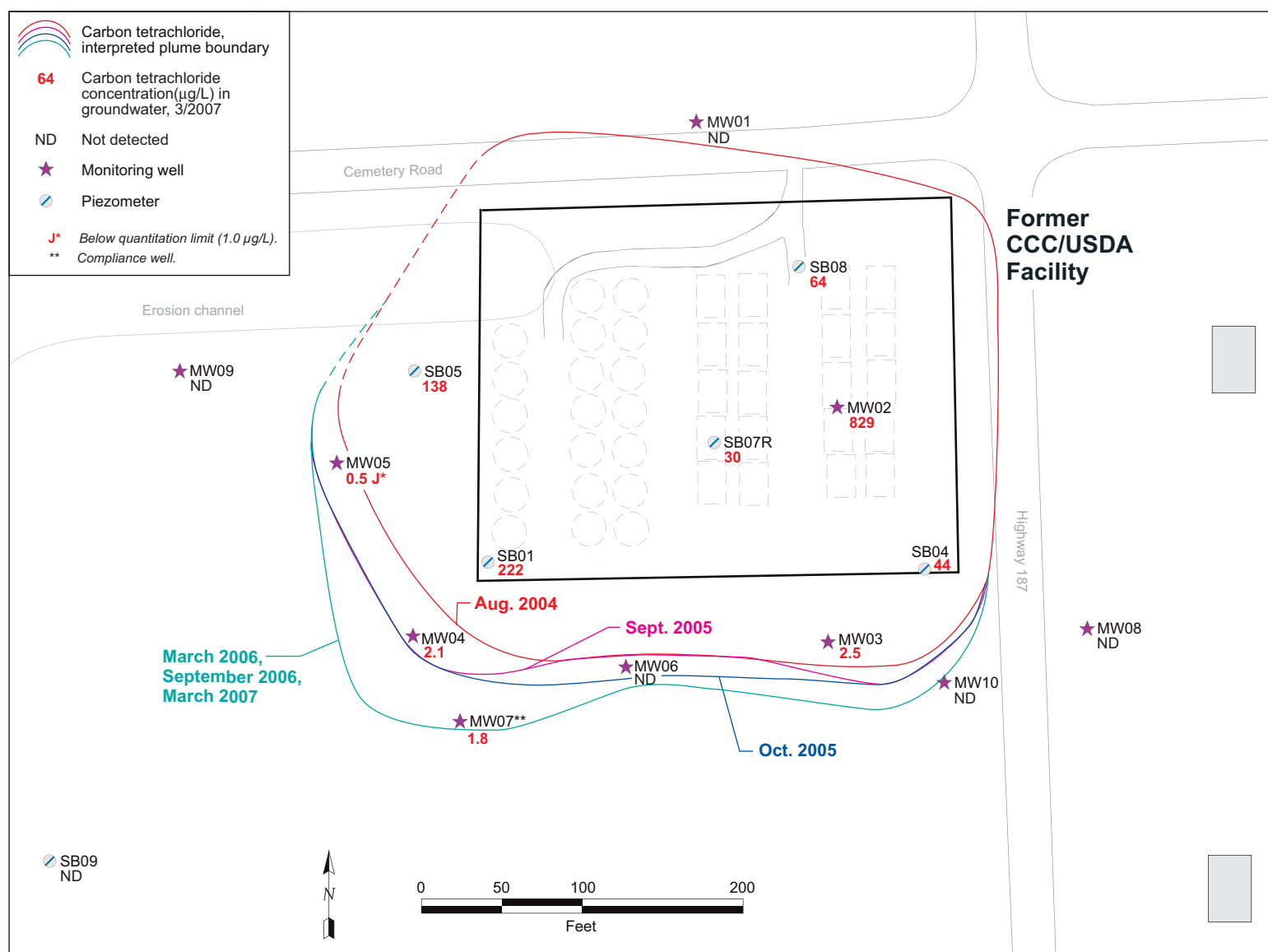


FIGURE 3.3 Carbon tetrachloride levels in groundwater at Centralia in March 2007, with the interpreted lateral extent of the contaminant at intervals during the period August 2004 to March 2007.

4 Conclusions and Recommendations

4.1 Conclusions

The findings of the March 2007 monitoring event at Centralia support the following conclusions:

- Measurements of groundwater levels obtained manually and through the use of automatic recorders have consistently indicated an apparent direction of groundwater flow to the south-southwest across the former CCC/USDA facility.
- The March 2007 well sampling data are generally consistent with previous results. The data show minor increases or decreases in contaminant levels at various locations relative to the September 2006 sampling event. Relatively consistent longer-term trends of increasing carbon tetrachloride levels have been detected, however, at monitoring points SB05, MW03, MW04, and MW07, along the western and southern margins of the groundwater plume. These trends suggest slow expansion of the plume at the downgradient locations.
- Sampling to date has yielded only limited evidence for the presence of subsurface conditions at Centralia conducive to anaerobic degradation of the carbon tetrachloride contamination in groundwater. Nevertheless, chloroform has consistently been detected at relatively elevated concentrations at monitoring points SB01, SB05, and (particularly) MW02, suggesting that carbon tetrachloride is being degraded at these locations.

4.2 Recommendations

The final event of the twice-yearly sampling program approved by the KDHE for Centralia under the existing *Monitoring Plan* (Argonne 2005b) is scheduled for September 2007. The CCC/USDA recommends that the sampling for natural degradation parameters be suspended, in light of impending remediation efforts at the site.

The CCC/USDA intends to submit an *Interim Measure Conceptual Design Plan* in the immediate future, proposing a pilot test of the Adventus EHC *in situ* chemical reduction (ISCR) technology. Further information about the Adventus ISCR product is available online (<http://www.adventusgroup.com/pdfs/Release-ISCR-ISCO.pdf>).

Groundwater sampling will be incorporated into the design of the pilot test and will also be implemented as part of the compliance monitoring program to evaluate the effectiveness of the proposed EHC remediation technology at the Centralia site. Upon the approval of the KDHE, implementation of the proposed interim measure is anticipated in the fall of 2007.

5 References

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Appendix A:

Sequence of Sampling Activities at Centralia, Kansas, in March 2007

TABLE A.1 Sequence of sampling activities at Centralia in March 2007.

Sample Date	Time	Location	Sample	Sample Medium	Type ^a	Depth (ft TOC)	Chain of Custody No.	Sample Description
03/26/07	12:35	MW02	CNMW02-W-15489	Water	MW	49.5–59.5	4581	Depth to water from top of casing (TOC) = 25.08 ft. Depth of well from TOC = 61.20 ft. Sample collected from 4-in. monitoring well at low flow after purging of 70 gal with Redi-Flo pump at approx 1 gpm. Purged to container.
03/26/07	16:40	MW07	CNMW07-W-15492	Water	MW	45–55	4581	Depth to water from TOC = 31.31 ft. Depth of well from TOC = 58.60 ft. Sample collected from 2-in. monitoring well by using valved tube after purging of 14 gal. Purged to ground.
03/26/07	18:00	SB07R	CNSB07R-W-15490	Water	CPT/P	45–60	4581	Depth to water from TOC = 22.51 ft. Depth of well from TOC = 58.53 ft. Sample collected from 2-in. monitoring well at low flow after purging of 18 gal with Redi-Flo pump at approx 0.5 gpm. Purged to container.
03/26/07	18:02	QC	CNQCRI-W-16328	Water	RI	—	4581	Rinsate of decontaminated Redi-Flo pump after sampling of monitoring well SB07R.
03/27/07	8:43	MW08	CNMW08-W-15493	Water	MW	38–53	4581	Depth to water from TOC = 23.10 ft. Depth of well from TOC = 57.21 ft. Sample collected from 2-in. monitoring well at low flow after purging of 19 gal with Redi-Flo pump at approx 0.5 gpm. Purged to ground.
03/27/07	8:43	MW08	CNMW08-W-16330	Water	MW	38–53	4585	Replicate of sample CNMW08-W-15493 for verification organic analysis by EnviroSystems, Inc.
03/27/07	11:15	MW03	CNMW03-W-15494	Water	MW	50.5–60.5	4581	Depth to water from TOC = 25.32 ft. Depth of well from TOC = 62.41 ft. Sample collected from 4-in. monitoring well at low flow after purging of 73 gal with Redi-Flo pump at 1 gpm. Purged to ground.
03/27/07	13:30	SB01	CNSB01-W-15491	Water	CPT/P	40–50	4581	Depth to water from TOC = 21.98 ft. Depth of well from TOC = 48.99 ft. Sample collected from 1-in. monitoring well by using valved tube on March 27. Well had been purged dry after purging of 1 gal on March 26. Purged to container.

TABLE A.1 (Cont.)

Sample Date	Time	Location	Sample	Sample Medium	Type ^a	Depth (ft TOC)	Chain of Custody No.	Sample Description
03/27/07	13:30	SB01	CNSB01-W-16329	Water	CPT/P	40–50	4585	Replicate of sample CNSB01-W-15491 for verification organic analysis by EnviroSystems, Inc.
03/27/07	13:37	MW06	CNMW06-W-16208	Water	MW	46.5–56.5	4581	Depth to water from TOC = 40.00 ft. Depth of well from TOC = 60.00 ft. Sample collected from 4-in. monitoring well at low flow after purging of 29 gal with Redi-Flo pump at approx 1 gpm. Purged to ground.
03/27/07	15:00	QC	CNQCTB-W-16331	Water	TB	—	4585	Trip blank sent to EnviroSystems, Inc., for verification organic analyses with samples listed on chain-of-custody form (COC) 4585.
03/27/07	15:30	QC	CNQCTB-W-16332	Water	TB	—	4584	Trip blank sent to Severn-Trent Laboratories for attenuation parameter analyses with samples listed on COC 4584.
03/27/07	15:35	QC	CNQCTB-W-16333	Water	TB	—	4582	Trip blank sent to Severn-Trent Laboratories for attenuation parameter analyses with samples listed on COC 4582.
03/27/07	15:40	QC	CNQCTB-W-16334	Water	TB	—	4581	Trip blank sent to the AGEM Laboratory for organic analyses with samples listed on COC 4581.
03/27/07	15:45	QC	CNQCFB-W-16335	Water	FB	—	4581	Field blank of water used for equipment decontamination during March 2007 monitoring event.
03/27/07	17:09	MW09	CNMW09-W-16209	Water	MW	25–35	4594	Depth to water from TOC = 2.52 ft. Depth of well from TOC = 39.15 ft. Sample collected from 2-in. monitoring well at low flow after purging of 19 gal with Redi-Flo pump at approx 1 gpm. Purged to ground.
03/28/07	9:15	SB09	CNSB09-W-16211	Water	CPT/P	32–42	4594	Depth to water from TOC = 5.68 ft. Depth of well from TOC = 36.15 ft. Sample collected from 1-in. monitoring well by using valved tube after purging of 4 gal. Purged to ground.
03/28/07	10:25	MW04	CNMW04-W-16210	Water	MW	37.5–47.5	4594	Depth to water from TOC = 28.05 ft. Depth of well from TOC = 49.23 ft. Sample collected from 4-in. monitoring well at low flow after purging of 23.5 gal with Redi-Flo pump at approx 1 gpm. Purged to ground.

TABLE A.1 (Cont.)

Sample Date	Time	Location	Sample	Sample Medium	Type ^a	Depth (ft TOC)	Chain of Custody No.	Sample Description
03/28/07	10:55	SB05	CNSB05-W-16212	Water	CPT/P	32–42	4594	Depth to water from TOC = 12.70 ft. Depth of well from TOC = 40.91 ft. Sample collected from 1-in. monitoring well by using valved tube after purging of 4 gal. Purged to container.
03/28/07	12:36	MW05	CNMW05-W-16213	Water	MW	34.5–44.5	4594	Depth to water from TOC = 9.95 ft. Depth of well from TOC = 47.66 ft. Sample collected from 1-in. monitoring well at low flow after purging of 74 gal with Redi-Flo pump at approx 1 gpm. Purged to ground.
03/28/07	13:30	SB08	CNSB08-W-16214	Water	CPT/P	52–62	4594	Depth to water from TOC = 23.19 ft. Depth of well from TOC = 59.76 ft. Sample collected from 1-in. monitoring well by using valved tube after purging of 4.5 gal. Purged to container.
03/28/07	15:50	MW10	CNMW10-W-16215	Water	MW	30–45	4594	Depth to water from TOC = 25.22 ft. Depth of well from TOC = 47.67 ft. Sample collected from 2-in. monitoring well at low flow after purging of 12.5 gal with Redi-Flo pump at 1 gpm. Purged to ground.
03/28/07	15:55	SB04	CNSB04-W-16216	Water	CPT/P	51–61	4594	Depth to water from TOC = 26.39 ft. Depth of well from TOC = 59.35 ft. Sample collected from 1-in. monitoring well by using valved tube after purging of 4 gal. Purged to container.
03/28/07	17:30	QC	CNPURGEWATER-W-16217	Water	BT	—	4594	Composite from four drums of waste purge water.
03/29/07	12:10	QC	CNQCTB-W-16186	Water	TB	—	4594	Trip blank sent to the AGEM Laboratory for organic analyses with samples listed on COC 4594.
03/29/07	12:15	QC	CNQCTB-W-16207	Water	TB	—	4591	Trip blank sent to Severn-Trent Laboratories for attenuation parameter analyses with samples listed on COC 4591.
03/29/07	12:20	MW01	CNMW01-W-16326	Water	MW	54.5–64.5	4594	Depth to water from TOC = 16.12 ft. Depth of well from TOC = 69.60 ft. Sample collected from 4-in. monitoring well at low flow after purging of 100 gal with Redi-Flo pump at 1 gpm. Purged to ground.

TABLE A.1 (Cont.)

Sample Date	Time	Location	Sample	Sample Medium	Type ^a	Depth (ft TOC)	Chain of Custody No.	Sample Description
03/29/07	12:20	QC	CNQCTB-W-15434	Water	TB	—	4590	Trip blank sent to Severn-Trent Laboratories for attenuation parameter analyses with samples listed on COC 4590.
03/29/07	12:20	MW01	CNQCDU-W-16327	Water	MW	54.5–64.5	4594	Replicate of sample CNMW01-W-16326.
03/29/07	12:55	QC	CNQCFB-W-16336	Water	FB	—	4594	Field blank of water used for equipment decontamination during March 2007 monitoring event.

^a Sample types: BT, wastewater composite; CPT/P, cone penetrometer piezometer; FB, field blank; RI, rinsate; MW, monitoring well; TB, trip blank.

Appendix B:

Data Summary for Verification VOCs analyses by Envirosystems, Inc.

ENVIROSYSTEMS, INC.

9200 Rumsey Road • Suite B102 • Columbia, Maryland 21045-1934
Phone (410) 964-0330 • Fax (410) 740-9306
Email: info@envsystems.com • Webpage: www.envsystems.com/envsys

April 11, 2007

Jorge S. Alvarado, Ph.D
Argonne National Laboratory
Environmental Sciences Division
Applied Geoscience and Environmental
Management Section
9700 South Cass Avenue, EV-203-A137
Argonne, Illinois 60439

RE: ENVSYS Report 070213

Dear Jorge:

Enclosed is the Analytical Data Package for the samples received on March 28, 2007 for volatile organics analysis by US EPA CLP SOW OLM04.3

Please do not hesitate to call me if you have any questions, comments, or require additional information.

Sincerely,



fr → Mohan Khare, Ph.D
President/CEO

MK/pl

**SDG NARRATIVE
VOLATILE ORGANICS (VOC)**

Envirosystems, Inc.

Contract: N/A
Client: Argonne National Laboratory
Case: N/A
SDG: N/A

1. SAMPLE RECEIPT

Date received: 03-28-2007
Cooler Temperature: 2

Sample Summary

Client ID	Laboratory ID	Matrix	pH
CNSB01-W-16329	0070310-01	WATER	7
CNMW08-W-16330	0070310-02	WATER	7
CNQCTB-W-16331	0070310-03	WATER	7

2. HOLDING TIMES

- A. **Sample Preparation:** All holding times were met.
- B. **Sample Analysis:** All holding times were met

3. METHODS

The samples were analyzed and reported by using method SW-846 8260B and USEPA CLP SOW OLM04.3 for target compound list.

4. INSTRUMENT AND CHROMATOGRAPHIC CONDITIONS

A Hewlett Packard 6890 gas chromatograph equipped with a Hewlett Packard 5973 MSD was used for sample analysis. The capillary column used was a Restek 20m by 0.18 mm ID by 1.0 μ m film thickness (Restek Cat. # RTX-624). The trap used with the sample concentrator is an OI Analytical Trap #10, 30cm packed with Tenax/silica gel/cms (PN#228122).

5. PREPARATION

The submitted samples were analyzed as received.

6. ANALYSIS

A. Calibration:

I. Initial calibration

All acceptance criteria as stipulated by SW-846 8260b were met for all SPCC's and CCC's. All target compounds met the required percent RSD except for acetone.

**SDG NARRATIVE
VOLATILE ORGANICS (VOC)**

II. Blanks:

All acceptance criteria were met.

II. Surrogates:

All acceptance criteria were met with the exception of: Sample CNQCTB-2-163 had 1 out of 3 surrogates outside QC limits. Sample CNSB01-W-163 had 2 out of 3 surrogates outside QC limits. CNSB01-W-163DL had 2 out of 3 surrogates outside QC limits. Sample CNSB01-W-163 DUP had 2 out of 3 surrogates outside QC limits. The most probable cause for the variances is matrix effect. Since the QC met acceptance criteria no further action was taken.

B. Spikes:

I. Laboratory Control Spikes (LCS)

All acceptance criteria were met.

II. Matrix Spike/Matrix Spike Duplicate (MS/MSD)

The client did not request a MS/MSD.

C. Internal Standards:

All acceptance criteria were met.

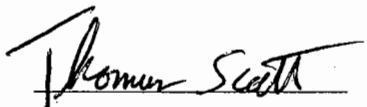
D. Samples

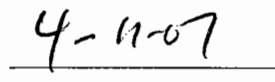
Sample analysis proceeded normally.

Note that samples CNSB01-W-163 and CNSB01-W-163DUP required a 1:5 dilution due to Carbon tetrachloride outside of linear range. Both the full and diluted runs are reported.

Manual Integration Summary

No manual integrations were required.


Laboratory Manager


Date

[illegible]

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

CNSB01-W-16329

Lab Name: ENVIROSYSTEMS, INC.

Contract: ARGONNE

Lab Code: ENVSYS

Case No.: ARGONNE SAS No.: N/A

SDG No.: NA

Matrix: (soil/water) WATER

Lab Sample ID: 0070310-01

Sample wt/vol: 5.000 (g/mL) ML

Lab File ID: AG75HE859

Level: (low/med) LOW

Date Received: 03/28/07

% Moisture: not dec. _____

Date Analyzed: 03/29/07

GC Column: RTX-624 ID: 0.18 (mm)

Dilution Factor: 1.0

Soil Extract Volume: _____ (uL)

Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
---------	----------	--	---

75-71-8-----	Dichlorodifluoromethane	5.0	U
74-87-3-----	Chloromethane	5.0	U
75-01-4-----	Vinyl Chloride	5.0	U
74-83-9-----	Bromomethane	5.0	U
75-00-3-----	Chloroethane	5.0	U
75-69-4-----	Trichlorofluoromethane	5.0	U
75-35-4-----	1,1-Dichloroethene	5.0	U
76-13-1-----	1,1,2-Trichloro-1,2,2-triflu	5.0	U
67-64-1-----	Acetone	5.0	U
75-15-0-----	Carbon Disulfide	5.0	U
79-20-9-----	Methyl Acetate	5.0	U
75-09-2-----	Methylene Chloride	5.0	U
156-60-5-----	trans-1,2-Dichloroethene	5.0	U
1634-04-4-----	Methyl tert-Butyl Ether	5.0	U
75-34-3-----	1,1-Dichloroethane	5.0	U
156-59-2-----	cis-1,2-Dichloroethene	5.0	U
78-93-3-----	2-Butanone	5.0	U
67-66-3-----	Chloroform	5.3	
71-55-6-----	1,1,1-Trichloroethane	5.0	U
110-82-7-----	Cyclohexane	5.0	U
56-23-5-----	Carbon Tetrachloride	310	E
71-43-2-----	Benzene	5.0	U
107-06-2-----	1,2-Dichloroethane	5.0	U
79-01-6-----	Trichloroethene	5.0	U
108-87-2-----	Methylcyclohexane	5.0	U
78-87-5-----	1,2-Dichloropropane	5.0	U
75-27-4-----	Bromodichloromethane	5.0	U
10061-01-5-----	cis-1,3-Dichloropropene	5.0	U
108-10-1-----	4-Methyl-2-Pentanone	5.0	U
108-88-3-----	Toluene	5.0	U
10061-02-6-----	trans-1,3-Dichloropropene	5.0	U
79-00-5-----	1,1,2-Trichloroethane	5.0	U
127-18-4-----	Tetrachloroethene	5.0	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

CNSB01-W-16329

Lab Name: ENVIROSYSTEMS, INC.

Contract: ARGONNE

Lab Code: ENVSYS

Case No.: ARGONNE SAS No.: N/A

SDG No.: NA

Matrix: (soil/water) WATER

Lab Sample ID: 0070310-01

Sample wt/vol: 5.000 (g/mL) ML

Lab File ID: AG75HE859

Level: (low/med) LOW

Date Received: 03/28/07

% Moisture: not dec. _____

Date Analyzed: 03/29/07

GC Column: RTX-624 ID: 0.18 (mm)

Dilution Factor: 1.0

Soil Extract Volume: _____ (uL)

Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
---------	----------	--	---

591-78-6-----2-Hexanone	5.0	U
124-48-1-----Dibromochloromethane	5.0	U
106-93-4-----1,2-Dibromoethane	5.0	U
108-90-7-----Chlorobenzene	5.0	U
100-41-4-----Ethylbenzene	5.0	U
1330-20-7-----Xylene (Total)	5.0	U
100-42-5-----Styrene	5.0	U
75-25-2-----Bromoform	5.0	U
98-82-8-----Isopropylbenzene	5.0	U
79-34-5-----1,1,2,2-Tetrachloroethane	5.0	U
541-73-1-----1,3-Dichlorobenzene	5.0	U
106-46-7-----1,4-Dichlorobenzene	5.0	U
95-50-1-----1,2-Dichlorobenzene	5.0	U
96-12-8-----1,2-Dibromo-3-chloropropane	5.0	U
120-82-1-----1,2,4-Trichlorobenzene	5.0	U
91-20-3-----Naphthalene	10	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

CNSB01-W-16329

Lab Name: ENVIROSYSTEMS, INC.

Contract: ARGONNE

Lab Code: ENVSYS

Case No.: ARGONNE SAS No.: N/A

SDG No.: NA

Matrix: (soil/water) WATER

Lab Sample ID: 0070310-01

Sample wt/vol: 5.000 (g/mL) ML

Lab File ID: AG75HE903

Level: (low/med) LOW

Date Received: 03/28/07

% Moisture: not dec. _____

Date Analyzed: 04/05/07

GC Column: RTX-624 ID: 0.18 (mm)

Dilution Factor: 5.0

Soil Extract Volume: _____ (uL)

Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
---------	----------	--	---

75-71-8-----	Dichlorodifluoromethane	25	U
74-87-3-----	Chloromethane	25	U
75-01-4-----	Vinyl Chloride	25	U
74-83-9-----	Bromomethane	25	U
75-00-3-----	Chloroethane	25	U
75-69-4-----	Trichlorofluoromethane	25	U
75-35-4-----	1,1-Dichloroethene	25	U
76-13-1-----	1,1,2-Trichloro-1,2,2-triflu	25	U
67-64-1-----	Acetone	25	U
75-15-0-----	Carbon Disulfide	25	U
79-20-9-----	Methyl Acetate	25	U
75-09-2-----	Methylene Chloride	25	U
156-60-5-----	trans-1,2-Dichloroethene	25	U
1634-04-4-----	Methyl tert-Butyl Ether	25	U
75-34-3-----	1,1-Dichloroethane	25	U
156-59-2-----	cis-1,2-Dichloroethene	25	U
78-93-3-----	2-Butanone	25	U
67-66-3-----	Chloroform	10	J
71-55-6-----	1,1,1-Trichloroethane	25	U
110-82-7-----	Cyclohexane	25	U
56-23-5-----	Carbon Tetrachloride	300	
71-43-2-----	Benzene	25	U
107-06-2-----	1,2-Dichloroethane	25	U
79-01-6-----	Trichloroethene	25	U
108-87-2-----	Methylcyclohexane	25	U
78-87-5-----	1,2-Dichloropropane	25	U
75-27-4-----	Bromodichloromethane	25	U
10061-01-5-----	cis-1,3-Dichloropropene	25	U
108-10-1-----	4-Methyl-2-Pentanone	25	U
108-88-3-----	Toluene	25	U
10061-02-6-----	trans-1,3-Dichloropropene	25	U
79-00-5-----	1,1,2-Trichloroethane	25	U
127-18-4-----	Tetrachloroethene	25	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

CNSB01-W-16329

Lab Name: ENVIROSYSTEMS, INC.

Contract: ARGONNE

Lab Code: ENVSYS

Case No.: ARGONNE SAS No.: N/A

SDG No.: NA

Matrix: (soil/water) WATER

Lab Sample ID: 0070310-01

Sample wt/vol: 5.000 (g/mL) ML

Lab File ID: AG75HE903

Level: (low/med) LOW

Date Received: 03/28/07

% Moisture: not dec. _____

Date Analyzed: 04/05/07

GC Column: RTX-624 ID: 0.18 (mm)

Dilution Factor: 5.0

Soil Extract Volume: _____ (uL)

Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
---------	----------	--	---

591-78-6-----	2-Hexanone	25	U
124-48-1-----	Dibromochloromethane	25	U
106-93-4-----	1,2-Dibromoethane	25	U
108-90-7-----	Chlorobenzene	25	U
100-41-4-----	Ethylbenzene	25	U
1330-20-7-----	Xylene (Total)	25	U
100-42-5-----	Styrene	25	U
75-25-2-----	Bromoform	25	U
98-82-8-----	Isopropylbenzene	25	U
79-34-5-----	1,1,2,2-Tetrachloroethane	25	U
541-73-1-----	1,3-Dichlorobenzene	25	U
106-46-7-----	1,4-Dichlorobenzene	25	U
95-50-1-----	1,2-Dichlorobenzene	25	U
96-12-8-----	1,2-Dibromo-3-chloropropane	25	U
120-82-1-----	1,2,4-Trichlorobenzene	25	U
91-20-3-----	Naphthalene	50	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

CNMW08-W-16330

Lab Name: ENVIROSYSTEMS, INC.

Contract: ARGONNE

Lab Code: ENVSYS

Case No.: ARGONNE SAS No.: N/A

SDG No.: NA

Matrix: (soil/water) WATER

Lab Sample ID: 0070310-02

Sample wt/vol: 5.000 (g/mL) ML

Lab File ID: AG75HE860

Level: (low/med) LOW

Date Received: 03/28/07

% Moisture: not dec. _____

Date Analyzed: 03/29/07

GC Column: RTX-624 ID: 0.18 (mm)

Dilution Factor: 1.0

Soil Extract Volume: _____ (uL)

Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
---------	----------	--	---

75-71-8-----	Dichlorodifluoromethane	5.0	U
74-87-3-----	Chloromethane	5.0	U
75-01-4-----	Vinyl Chloride	5.0	U
74-83-9-----	Bromomethane	5.0	U
75-00-3-----	Chloroethane	5.0	U
75-69-4-----	Trichlorofluoromethane	5.0	U
75-35-4-----	1,1-Dichloroethene	5.0	U
76-13-1-----	1,1,2-Trichloro-1,2,2-triflu	5.0	U
67-64-1-----	Acetone	5.0	U
75-15-0-----	Carbon Disulfide	5.0	U
79-20-9-----	Methyl Acetate	5.0	U
75-09-2-----	Methylene Chloride	5.0	U
156-60-5-----	trans-1,2-Dichloroethene	5.0	U
1634-04-4-----	Methyl tert-Butyl Ether	5.0	U
75-34-3-----	1,1-Dichloroethane	5.0	U
156-59-2-----	cis-1,2-Dichloroethene	5.0	U
78-93-3-----	2-Butanone	5.0	U
67-66-3-----	Chloroform	5.0	U
71-55-6-----	1,1,1-Trichloroethane	5.0	U
110-82-7-----	Cyclohexane	5.0	U
56-23-5-----	Carbon Tetrachloride	5.0	U
71-43-2-----	Benzene	5.0	U
107-06-2-----	1,2-Dichloroethane	5.0	U
79-01-6-----	Trichloroethene	5.0	U
108-87-2-----	Methylcyclohexane	5.0	U
78-87-5-----	1,2-Dichloropropane	5.0	U
75-27-4-----	Bromodichloromethane	5.0	U
10061-01-5-----	cis-1,3-Dichloropropene	5.0	U
108-10-1-----	4-Methyl-2-Pentanone	5.0	U
108-88-3-----	Toluene	5.0	U
10061-02-6-----	trans-1,3-Dichloropropene	5.0	U
79-00-5-----	1,1,2-Trichloroethane	5.0	U
127-18-4-----	Tetrachloroethene	5.0	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

CNMW08-W-16330

Lab Name: ENVIROSYSTEMS, INC.

Contract: ARGONNE

Lab Code: ENVSYS

Case No.: ARGONNE SAS No.: N/A

SDG No.: NA

Matrix: (soil/water) WATER

Lab Sample ID: 0070310-02

Sample wt/vol: 5.000 (g/mL) ML

Lab File ID: AG75HE860

Level: (low/med) LOW

Date Received: 03/28/07

% Moisture: not dec. _____

Date Analyzed: 03/29/07

GC Column: RTX-624 ID: 0.18 (mm)

Dilution Factor: 1.0

Soil Extract Volume: _____ (uL)

Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
---------	----------	--	---

591-78-6-----	2-Hexanone	5.0	U
124-48-1-----	Dibromochloromethane	5.0	U
106-93-4-----	1,2-Dibromoethane	5.0	U
108-90-7-----	Chlorobenzene	5.0	U
100-41-4-----	Ethylbenzene	5.0	U
1330-20-7-----	Xylene (Total)	5.0	U
100-42-5-----	Styrene	5.0	U
75-25-2-----	Bromoform	5.0	U
98-82-8-----	Isopropylbenzene	5.0	U
79-34-5-----	1,1,2,2-Tetrachloroethane	5.0	U
541-73-1-----	1,3-Dichlorobenzene	5.0	U
106-46-7-----	1,4-Dichlorobenzene	5.0	U
95-50-1-----	1,2-Dichlorobenzene	5.0	U
96-12-8-----	1,2-Dibromo-3-chloropropane	5.0	U
120-82-1-----	1,2,4-Trichlorobenzene	5.0	U
91-20-3-----	Naphthalene	10	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

CNQCTB-2-16331

Lab Name: ENVIROSYSTEMS, INC.

Contract: ARGONNE

Lab Code: ENVSYS

Case No.: ARGONNE SAS No.: N/A

SDG No.: NA

Matrix: (soil/water) WATER

Lab Sample ID: 0070310-03

Sample wt/vol: 5.000 (g/mL) ML

Lab File ID: AG75HE856

Level: (low/med) LOW

Date Received: 03/28/07

% Moisture: not dec. _____

Date Analyzed: 03/29/07

GC Column: RTX-624 ID: 0.18 (mm)

Dilution Factor: 1.0

Soil Extract Volume: _____ (uL)

Soil Aliquot Volume: _____ (uL)

CAS NO. COMPOUND CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L Q

75-71-8-----	Dichlorodifluoromethane	5.0	U
74-87-3-----	Chloromethane	5.0	U
75-01-4-----	Vinyl Chloride	5.0	U
74-83-9-----	Bromomethane	5.0	U
75-00-3-----	Chloroethane	5.0	U
75-69-4-----	Trichlorofluoromethane	5.0	U
75-35-4-----	1,1-Dichloroethene	5.0	U
76-13-1-----	1,1,2-Trichloro-1,2,2-triflu	5.0	U
67-64-1-----	Acetone	7.5	
75-15-0-----	Carbon Disulfide	5.0	U
79-20-9-----	Methyl Acetate	5.0	U
75-09-2-----	Methylene Chloride	5.0	U
156-60-5-----	trans-1,2-Dichloroethene	5.0	U
1634-04-4-----	Methyl tert-Butyl Ether	5.0	U
75-34-3-----	1,1-Dichloroethane	5.0	U
156-59-2-----	cis-1,2-Dichloroethene	5.0	U
78-93-3-----	2-Butanone	5.0	U
67-66-3-----	Chloroform	5.0	U
71-55-6-----	1,1,1-Trichloroethane	5.0	U
110-82-7-----	Cyclohexane	5.0	U
56-23-5-----	Carbon Tetrachloride	5.0	U
71-43-2-----	Benzene	5.0	U
107-06-2-----	1,2-Dichloroethane	5.0	U
79-01-6-----	Trichloroethene	5.0	U
108-87-2-----	Methylcyclohexane	5.0	U
78-87-5-----	1,2-Dichloropropane	5.0	U
75-27-4-----	Bromodichloromethane	5.0	U
10061-01-5-----	cis-1,3-Dichloropropene	5.0	U
108-10-1-----	4-Methyl-2-Pentanone	5.0	U
108-88-3-----	Toluene	5.0	U
10061-02-6-----	trans-1,3-Dichloropropene	5.0	U
79-00-5-----	1,1,2-Trichloroethane	5.0	U
127-18-4-----	Tetrachloroethene	5.0	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

CNQCTB-2-16331

Lab Name: ENVIROSYSTEMS, INC.

Contract: ARGONNE

Lab Code: ENVSYS

Case No.: ARGONNE SAS No.: N/A

SDG No.: NA

Matrix: (soil/water) WATER

Lab Sample ID: 0070310-03

Sample wt/vol: 5.000 (g/mL) ML

Lab File ID: AG75HE856

Level: (low/med) LOW

Date Received: 03/28/07

% Moisture: not dec. _____

Date Analyzed: 03/29/07

GC Column: RTX-624 ID: 0.18 (mm)

Dilution Factor: 1.0

Soil Extract Volume: _____ (uL)

Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
---------	----------	--	---

591-78-6-----	2-Hexanone	5.0	U
124-48-1-----	Dibromochloromethane	5.0	U
106-93-4-----	1,2-Dibromoethane	5.0	U
108-90-7-----	Chlorobenzene	5.0	U
100-41-4-----	Ethylbenzene	5.0	U
1330-20-7-----	Xylene (Total)	5.0	U
100-42-5-----	Styrene	5.0	U
75-25-2-----	Bromoform	5.0	U
98-82-8-----	Isopropylbenzene	5.0	U
79-34-5-----	1,1,2,2-Tetrachloroethane	5.0	U
541-73-1-----	1,3-Dichlorobenzene	5.0	U
106-46-7-----	1,4-Dichlorobenzene	5.0	U
95-50-1-----	1,2-Dichlorobenzene	5.0	U
96-12-8-----	1,2-Dibromo-3-chloropropane	5.0	U
120-82-1-----	1,2,4-Trichlorobenzene	5.0	U
91-20-3-----	Naphthalene	10	U



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