2009 ANNUAL MONITORING REPORT

for the

WHEATLEY SITE
BROOKFIELD, VERMONT

VT DEC Site #77-0087

February 2, 2010

Prepared for:

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1.0 INTRODUCTION

The following *2009 Annual Monitoring Report* for the Wheatley Site in Brookfield, Vermont (see attached Site Location Map in Appendix A) was prepared by Waite Environmental Management, LLC (WEM) for the Vermont Department of Environmental Conservation (VT DEC). This report has been completed in accordance WEM's contract with State of Vermont (contract EC13-04) for environmental monitoring.

This report includes discussion of the results of groundwater and indoor air monitoring conducted by WEM during 2009. Monitoring locations were at the Wheatley Farm Site, currently a residential property occupied by Mr. James Moorcroft. Work conducted during this year under contract EC13-04 and covered in this report include:

- Monitoring of four (4) groundwater monitoring wells during October 2009.
- Collection of two (2) indoor air samples from the Moorcroft residence during October 2009.

Monitoring is conducted in accordance with WEM's *Work Plan for Environmental Monitoring* ("Work Plan") [1], with the *Field/Lab Coordination Memorandum for Water Monitoring* ("FLCM-Water") [2], and the *Field/Lab Coordination Memorandum for Air Monitoring* ("FLCM-Air") [3].

2.0 GROUNDWATER SAMPLING

Groundwater monitoring was conducted by WEM on October 19, 2009. The following four (4) monitoring wells were monitored: MW-S1, MW-S2, MW-PL1, MW-PL2. All monitoring well locations are shown in the Site Plan in Appendix A. Details and results of the sampling event are described below.

WEM was unable to sample well MW-S3, which is typically sampled as part of the annual monitoring program. The stickup well guard that protects this well was observed to be bent over on its side, resulting in broken PVC well casing. The horses which occupy the field here are to blame for the damage, as they like to use the well guard as a scratching post. The well can be repaired rather than be replaced.

2.1 Groundwater Level Measurement

Prior to sampling on October 19, 2009, the water level in each monitoring well was measured with a water level probe. None of the wells were observed to be dry. Depth to groundwater ranged from 4.84 to 18.29 ft below top-of-casing (ft btoc).

Using top-of-casing elevation data, the measurements were converted into groundwater elevations. Elevation data from October 2009 are shown with historical measurements in Table 1.1 in Appendix B. Compared to the previous round of measurements in October 2008, there was an average decrease in groundwater elevation of 0.99 ft. The largest decrease was noted in

well MW-PL1 (1.55 ft). The overall decrease appears to be seasonal and not part of a long-term trend.

Groundwater elevations were also plotted to develop a groundwater elevation map (see Groundwater Elevation Map – October 2009 in Appendix A). As this map shows, the general direction of overburden groundwater flow was toward the north/northeast, or toward the Second Branch of the White River. The lateral hydraulic gradient between well MW-PL2 and MW-S2, was 0.014 ft/ft, or 1.4%. In the lower meadow in the vicinity of wells MW-S1 and MW-S2, the groundwater flow direction is westerly, also toward the River. The 2009 groundwater flow direction and gradient is typical for this site.

2.2 Groundwater Sample Collection

Monitoring wells were purged and sampled using a low-flow methodology. This involved using a peristaltic pump (Geotech Geopump II) connected to dedicated high density polyethylene (HDPE) tubing within each well that extended to a pre-specified intake depth. The dedicated HDPE tubing was connected to disposable silicon tubing that ran through the head of the peristaltic pump; new silicon tubing was used for each well purged. Purge rates, as specified by site protocols, ranged between 100-250 milliliters/minute (ml/min). Purge rates, purge volumes, and pump intake depths are shown in the field water collection sheets provided in Appendix C. During the purging process, the water level was monitored using a water level probe (Solinst) with a 0.25-inch probe, and geochemical parameters were measured using a water quality meter (Horiba U-22 Model U-22XD) with a flow cell connected to the outlet of the peristaltic pump. The following field geochemical parameters were monitored: dissolved oxygen, specific conductance, temperature, pH, turbidity, and redox potential. The water quality meter was calibrated in the morning prior to sampling.

Wells were allowed to purge until geochemical parameters stabilized, as specified by site protocols. Upon stabilization, the silicon tubing was disconnected from the water meter. Samples were then collected directly from the outlet of the peristaltic pump. Parameter measurements and sample times are shown in the field sheets in Appendix C. Stabilized parameter measurements are shown with historical data in Tables 1.2 through 1.7.

All samples were delivered by WEM to TestAmerica Laboratory (TA) of South Burlington, Vermont (formerly Severn-Trent Laboratories, Inc) for analysis of volatile organic compounds via EPA Method 8260B. Results for PCE, TCE, cis-1,2-DCE and trans-1,2-DCE are discussed below.

Sampling proceeded as per protocol, and there were no deviations from the Work Plan or the FLCM-Water.

2.3 Discussion of Results

Validated laboratory analytical results are summarized in Table 2.0 in Appendix B. Full copies of the laboratory report and the data validation package are presented in the Data Validation Report [4]. Following is a detailed discussion of field and laboratory results.

2.3.1 Field Geochemical Parameters

Field geochemical parameter measurements are summarized in Tables 1.2 through 1.7 in Appendix B. Based on a comparison to historical water quality parameters (2002-2008), the following observation can me made from the October 2009 data:

- **Dissolved oxygen** readings were all within the range of historical measurements with no anomalies or clear trends.
- **Specific conductance** readings were all higher than typical, but no clear increasing trends are noted.
- **pH** readings were within the range of historical measurements for MW-S1 and MW-S2, but were slightly lower than typical for MW-PL1 and MW-PL2.
- **Turbidity** readings were all of a similar magnitude and range as measurements from 2006-2008, but significantly lower than the 2004-2005 values.
- **Redox (ORP)** readings were all within the range of historical measurements with no anomalies or clear trends.

2.3.2 Analytical Results

The analytical results from October 2009 indicate the following:

- **MW-PL1**: the target compound PCE was reported at a concentration of 2.9 micrograms per liter (ug/L). No other target compounds were reported above detection limits.
- **MW-PL2**: no target compounds were reported above detection limits.
- **MW-S1**: no target compounds were reported above detection limits.
- **MW-S2**: no target compounds were reported above detection limits.

The PCE concentration in MW-PL1 is below the Vermont groundwater enforcement standard ("VGES") [6] of 5.0 ug/L. While this compound has been reported in MW-PL1 before, it has never been reported above the VGES. PCE concentrations in MW-PL1 reported between 1997 and the present are shown in the graph presented in Appendix B. The concentration has risen slightly in 2005-2009 as compared to data from 1999-2004. It should be noted that PCE has <u>never</u> been reported in any of the four other monitoring wells at this Site.

It should be mentioned that the non-target petroleum compound toluene that was reported in sample MW-S2 during 2005-06 was not present in the 2009 sample.

2.3.3 QA/QC Samples

As part of the quality assurance/quality control (QA/QC) program, WEM collected a field duplicate sample during the October 2009 sampling event. A duplicate "MW-PLX" was collected in conjunction with MW-PL2. These samples were analyzed by TA using the same method (EPA Method 8260B). According to the Data Validation Report [4], precision in the field duplicate pair was acceptable (less than 30 % RPD) for all target analytes greater than 2 times the quantitation limit.

WEM also collected a trip blank (TB-2) and a field blank (FB-4) during the October 2009 sampling event. While no target compounds were reported in the field blank, the compound TCE was reported (0.26 ug/L; action limit = 1.30 ug/L) below the quantitation limit in the trip blank. While reported in the Data Validation Report as "field contamination", it should be noted that because of unacceptably low recoveries of internal standards, the TCE may be a false positive. The implications of the trip blank detection is discussed in the following section.

2.4 Discussion of Data Validation

The laboratory data from the October 2009 groundwater sampling event were validated by Phoenix Chemistry Services, an independent data validator. The validation was performed in accordance with Tier III guidelines as described by the USEPA Region I. Details are presented in the Data Validation Report [4], the text of which is provided in Appendix D.

Results for the target VOCs were determined to be valid as reported for all groundwater samples collected from the Site on October 19, 2009 (sample delivery group SDG No. WHEA15) with the exception of the following:

- On the basis of field contamination, results for a trichloroethene in samples MW-PL1 and MW-PLX were qualified as less than the quantitation limit (U).

- On the basis of unacceptably low recoveries of all three internal standards, results for all analytes in TB-2 were qualified as estimated (J, UJ).

There were some documentation and compliance issues noted for the sample group, but none that directly affected the validity of the data.

2.5 Recommendations

Based on the above information, overburden groundwater within a portion of the Site continues to show evidence of low levels of dissolved PCE. Given this condition, WEM recommends continuing the groundwater monitoring program as specified in the Work Plan and FLCM-Water. The next sampling event is scheduled for October 2010.

WEM also recommends repair of well MW-S3 prior to the next sampling event. This can be accomplished by removing the well guard, replacing the broken section of PVC well casing, and then re-installing the well guard in concrete with a lower stickup height to avoid it being used as a scratching post by the horses. WEM has developed a work plan to conduct this work which has been approved by the VT DEC.

3.0 INDOOR AIR SAMPLING

Indoor air sampling was conducted from inside the Moorcroft residence by WEM on October 19, 2009. Sampling was conducted in accordance with WEM's Work Plan. Details and results of the air sampling event are described below.

3.1 Air Sample Collection

The indoor air sampling program involves sample collection from two (2) locations inside the Moorcroft residence at the Site. This building was the former Wheatley Farm farmhouse; refer to the Site Plan in Appendix A. Samples are collected from the kitchen of the first floor ("WHTLY1FLR") and from the basement ("WHTLYBSMT").

Samples were collected by WEM using 6-liter stainless steel Silco air canisters. The canisters and flow controllers were procured by WEM from TestAmerica Laboratory (TA) of South Burlington, Vermont prior to sampling. The flow controllers were all calibrated by TA to provide a flow rate that allowed a final canister pressure between -7.0 and -2.0 inches of Mercury (in Hg) below ambient pressure after a run time of approximately 4 hours. The cleanliness of each canister was individually certified by TA. Prior to use of the canisters, WEM reviewed the "Air Canister Cleaning Logs and Clean Canister Certification Report" and the "Mass Flow Controller Set Flow Rate & Leak Check Record" and did not find any problems.

The sampling procedure at each site involved setting up the canister at the designated sampling location, attaching a digital pressure gauge to measure initial pressure and comparing it to the pressure recorded by laboratory, attaching the flow controller, recording initial canister pressure from the analog pressure gauge, recording ambient pressure and temperature, and then opening the valve to initiate the sample collection. Ambient pressure values were obtained in the morning and afternoon from the Knapp State Airport, and ambient temperature was recorded using a digital thermometer or the thermostat in the sampling location. Samples were allowed to run for approximately 4 hours. Upon completion, a second digital pressure gauge measurement is made and recorded along with the analog pressure gauge measurement. Exact times of each sample collection and other recorded field data are shown on the Canister Samples Chain of Custody Record & Field Test Data Sheet in Appendix C.

No significant problems were encountered during the sampling event, and all sampling procedures were in accordance with the *Work Plan* and acceptable final canister pressures were attained.

All samples were delivered by WEM to TA under chain-of-custody procedures for analysis of the four target volatile organic compounds: tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), and trans-1,2-dichloroethene (trans-1,2-DCE). Analysis was by Method TO-15 (Low Level). Results, in parts per billion (ppbv), are discussed below.

3.2 Discussion of Results

Air sampling results from October 2009 are summarized in Table 3.0 in Appendix B. These results have been validated by an independent validator (see Section 3.3). Full copies of the laboratory report are presented in the data validation report [5].

The target compounds PCE, TCE, and trans-1,2-DCE were detected above quantitation limits in both the first floor and second floor samples. With the exception of TCE in the first floor sample, all results are very low and below applicable guidance levels. The TCE concentration in the first floor (2.0 parts per billon (ppbv)) is above the guidance level of 1.0 ppbv.

Based on records dating back to July 2001, the compound TCE has been detected only one other occasion, during sampling in October 2007. Previous to 2007, TCE had not previously been detected in the airspace inside this house or in the groundwater under the property. The recent appearance of TCE is unexpected, and possibly unrelated to the original source of contamination. The significantly lower concentration of TCE in the basement suggests that this chemical is not migrating into the house via a soil/groundwater flowpath, but rather from a different source (solvent, cleaner, etc.). It should be noted that maintenance of vehicles is conducted on the property, and that engine and brake cleaning solvents often have TCE.

3.2.1 QA/QC Samples

As part of the QA/QC program, WEM collected one (1) field duplicate sample (FD-1) during the October 2009 indoor air sampling event. This sample was collected in conjunction with the sample from the basement (WHTLYBSMT). The field duplicate pair was analyzed by TA using the same method. Precision was acceptable (less than 30% RPD) for all results greater than twice the quantitation limit.

WEM also submitted a trip blank (TB-1) on October 19, 2009. No target compounds were detected in the trip blank.

3.3 Discussion of Data Validation

The laboratory data were validated by Phoenix Chemistry Services, an independent data validator. The validation was performed in accordance with Tier III guidelines as described by the USEPA Region I. Details are presented in the data validation report [5], the text of which is included in Appendix D. The full report is on file at the VT DEC offices in Waterbury.

Analytical Results for the target VOCs were determined to be valid as reported for all indoor air collected at the Site on October 19, 2009 (SDG No. 134255). While there were some laboratory documentation deficiencies, there were no issues that directly affected the validity of the analytical data.

3.4 Recommendations

Due to the presence of chlorinated VOCs in the indoor air as described in Section 3.2, WEM recommends continuing the air sampling program as specified in the Work Plan and FLCM-Air. The next sampling event is scheduled for October 2010. Prior to the next sampling event it should be established whether the first floor space of the Moorcroft residence is ever used for automotive maintenance, which may explain the presence of TCE in the air.

4.0 REFERENCES

1. Waite Environmental Management, LLC, *Work Plan for Environmental Monitoring at the UniFirst Plant Site, Williamstown, Vermont, Wheatley Farm Site, Brookfield, Vermont, Bressett Site, Randolph, Vermont,* December 31, 2007.

2. Phoenix Chemistry Services, *Field/Lab Coordination Memorandum for Water Monitoring, UniFirst Plant Site, Williamstown, Vermont, Wheatley Farm Site, Brookfield, Vermont, Bressett Site, Randolph, Vermont,* April 2, 2004.

3. Phoenix Chemistry Services, *Field/Lab Coordination Memorandum for Air Monitoring, UniFirst Plant Site, Williamstown, Vermont, Wheatley Farm Site, Brookfield, Vermont, Bressett Site, Randolph, Vermont,* December 22, 2007.

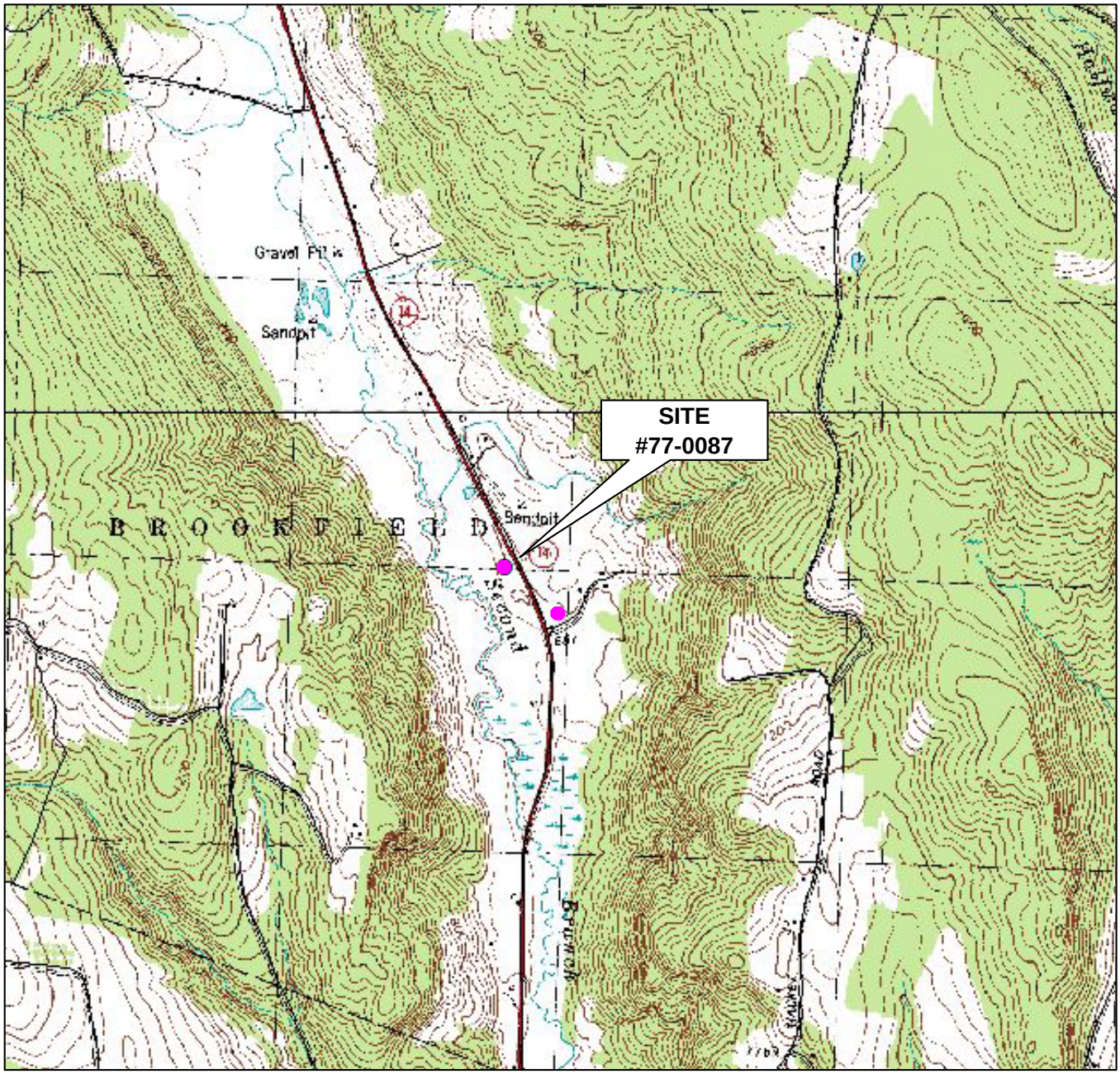
4. Phoenix Chemistry Services, *Data Validation for the UniFirst Project, Bressett and UniFirst Sites, Randolph and Williamstown, VT, Organic Analyses Data, Volatile Organics in Water Samples, Sample Delivery Group Nos. BRES45, UNIF36 , and WHEA15,* January 26, 2010.

5. Phoenix Chemistry Services, *Data Validation for the UniFirst Project, Wheatley Site, Brookfield, VT, Organic Analyses Data, Selected Volatiles in Air Samples, Sample Delivery Group No.134255,* January 19, 2010.

6. State of Vermont, Agency of Natural Resources, Department of Environmental Conservation, *Chapter 12, Groundwater Protection Rule and Strategy,* January 20, 2000.

APPENDIX A:

FIGURES



LEGEND

- ● Site
- ● State-Listed Hazardous Waste Site
- —— Roadway

N

Map Source: *USGS Mapping 7.5 Minute Quadrangles: Brookfield (1983), Randolph Ctr (1983)*

Data Source *Vermont DEC databases, updated 2006.*

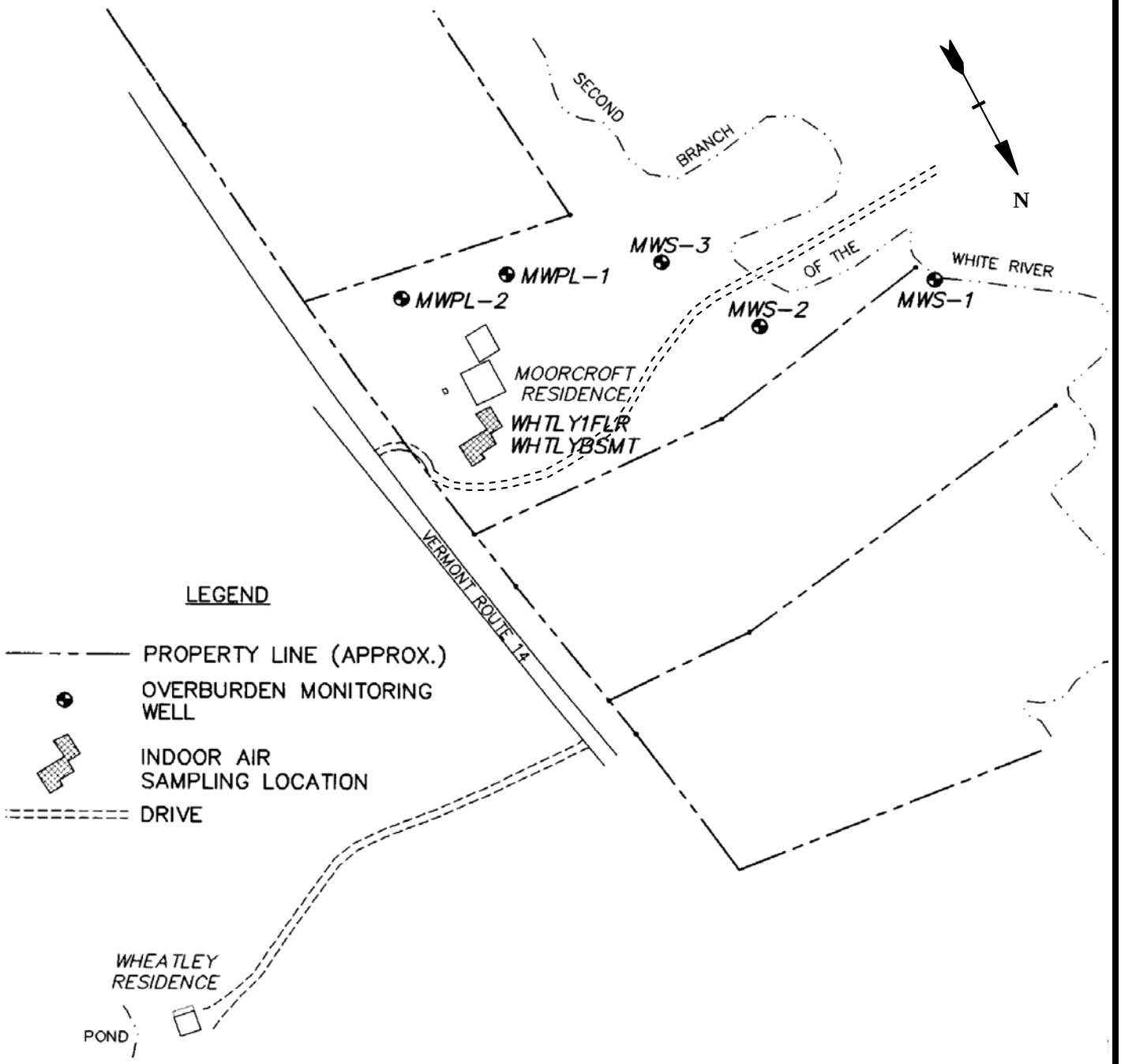
Waite Environmental Management, LLC

SITE LOCATION MAP

Wheatley Site / Moorcroft Residence

Brookfield, Vermont

Date: 03/31/09	Drawing No. 1	Scale: 1:24,000	By: MEW



Notes:
This map is a copy of the Site Plan (April 1999) prepared Tighe & Bond, Inc., and has information provided by The Johnson Co.
All locations approximate

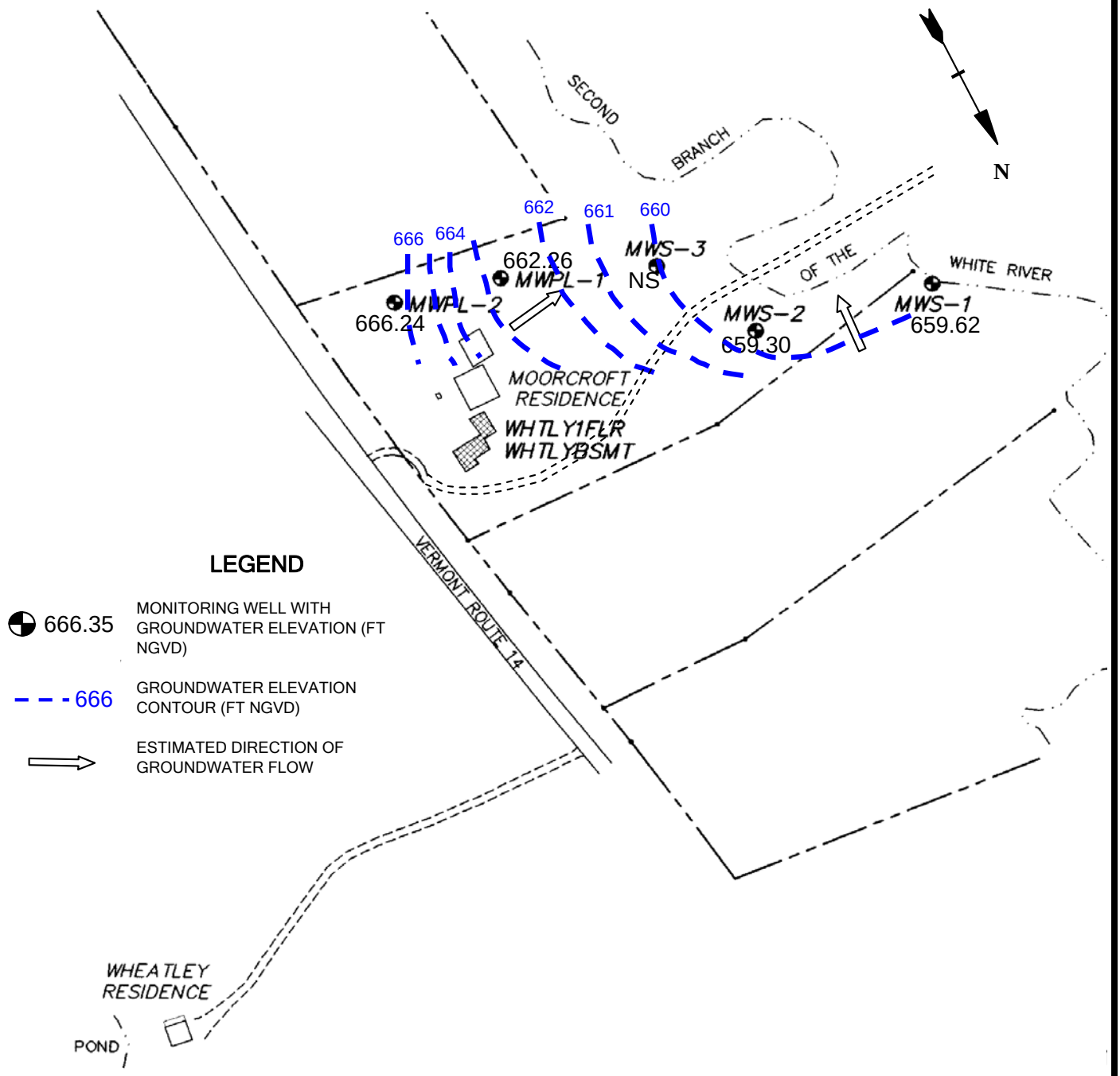
Waite Environmental Management, LLC

SITE PLAN

Wheatley Farm Site

Brookfield, Vermont

Date: 02/16/06	Drawing No.	Scale: 1" = 200'	By: MEW



LEGEND

666.35 — MONITORING WELL WITH GROUNDWATER ELEVATION (FT NGVD)

666 — GROUNDWATER ELEVATION CONTOUR (FT NGVD)

ESTIMATED DIRECTION OF GROUNDWATER FLOW

Notes:
This map is a copy of the Site Plan (April 1999) prepared Tighe & Bond, Inc., and has information provided by The Johnson Co.
Map has been modified by WEM.
All locations approximate

Waite Environmental Management, LLC

GROUNDWATER ELEVATION CONTOUR MAP

Oct-09

Wheatley Farm Site

Brookfield, Vermont

Date: 02/02/10	Drawing No.	Scale: 1" = 200'	By: MEW

APPENDIX B:

TABLES AND GRAPHS

WEM

TABLE 1.1
Groundwater Elevation Measurements: 2004 - 2009
Wheatley Site, Brookfield, Vermont

Location	Type	Units	Oct-04	Oct-05	Apr-06	Oct-06	Oct-07	Oct-08	Oct-09
MW-S1	Monitoring Well	FT	659.95	660.74	660.77	661.89	662.07	660.35	659.62
MW-S2	Monitoring Well	FT	658.93	660.62	659.42	660.79	661.23	660.32	659.30
MW-S3	Monitoring Well	FT	661.41	662.41	659.61	662.08	662.00	661.83	NS
MW-PL1	Monitoring Well	FT	663.06	663.87	663.99	663.56	663.88	663.81	662.26
MW-PL2	Monitoring Well	FT	666.08	665.58	666.10	666.35	665.91	666.91	666.24

Notes:
-All elevations in feet above NGVD; "NGVD" = National Geodetic Vertical Datum (1988).
-"Dry" = well dry during monitoring event; "NA" =not available; "NS" = not sampled.

WEM

TABLE 1.2
Dissolved Oxygen Field Measurements: 2002 - 2009
Wheatley Site, Brookfield, Vermont

Location	Type	Units	Oct-02	Apr-03	Oct-03	Apr-04	Oct-04	Oct-05	Oct-06	Oct-07	Oct-08	Oct-09
MW-S1	Monitoring Well	mg/L	0.61	NS	NA	NS	3.33	0.48	0.29	0.00	0.00	0.00
MW-S2	Monitoring Well	mg/L	9.00	NS	1.63	NS	0.34	0.00	0.42	0.00	1.51	0.00
MW-S3	Monitoring Well	mg/L	0.40	NS	1.38	NS	0.36	0.04	0.19	0.00	0.00	NS
MW-PL1	Monitoring Well	mg/L	4.39	NS	4.06	NS	3.33	1.97	4.71	2.79	1.75	2.45
MW-PL2	Monitoring Well	mg/L	10.61	NS	2.96	NS	7.47	12.76	13.41	10.67	8.17	9.55

Notes:
-"Dry" = well dry during monitoring event; "NA" = not available; "NS = not sampled.
-Data from 2002-2003 collected by Tighe & Bond and reported in "2002 Monitoring Report Summary, Wheatley Farm Site" (March 12, 2003) and "2003 Monitoring Report Summary, Wheatley Farm Site" (March 12, 2004).
-Data starting in 2004 collected by Waite Environmental Management.

WEM

TABLE 1.3
Specific Conductance Field Measurements: 2002 - 2009
Wheatley Site, Brookfield, Vermont

Location	Type	Units	Oct-02	Apr-03	Oct-03	Apr-04	Oct-04	Oct-05	Oct-06	Oct-07	Oct-08	Oct-09
MW-S1	Monitoring Well	us/cm	248	NS	NA	NS	369	296	229	385	319	518
MW-S2	Monitoring Well	us/cm	191	NS	210	NS	268	257	138	273	222	346
MW-S3	Monitoring Well	us/cm	261	NS	257	NS	368	283	203	345	273	NS
MW-PL1	Monitoring Well	us/cm	348	NS	349	NS	498	391	292	509	448	744
MW-PL2	Monitoring Well	us/cm	318	NS	287	NS	401	400	215	399	376	661

Notes:
- All conductivity meaurements in microsiemens per centimeter (us/cm).
-"Dry" = well dry during monitoring event; "NA" = not available; "NS = not sampled..
-Data from 2002-2003 collected by Tighe & Bond and reported in "2002 Monitoring Report Summary, Wheatley Farm Site" (March 12, 2003) and "2003 Monitoring Report Summary, Wheatley Farm Site" (March 12, 2004).
-Data starting in 2004 collected by Waite Environmental Management.

WEM

TABLE 1.4
Temperature Field Measurements: 2002 - 2009
Wheatley Site, Brookfield, Vermont

Location	Type	Units	Oct-02	Apr-03	Oct-03	Apr-04	Oct-04	Oct-05	Oct-06	Oct-07	Oct-08	Oct-09
MW-S1	Monitoring Well	deg C	12.9	NS	NA	NS	16.1	13.6	15.1	11.8	15.3	14.3
MW-S2	Monitoring Well	deg C	13.4	NS	12.0	NS	16.5	14.5	15.1	12.2	15.6	14.2
MW-S3	Monitoring Well	deg C	8.8	NS	8.7	NS	10.9	11.2	11.8	10.2	11.3	NS
MW-PL1	Monitoring Well	deg C	9.9	NS	8.9	NS	11.1	10.7	10.9	9.8	10.1	10.0
MW-PL2	Monitoring Well	deg C	9.9	NS	8.8	NS	10.7	11.0	10.8	10.0	10.7	9.8

Notes:
- All temperature measurements in degrees Celsius (deg C).
-"Dry" = well dry during monitoring event; "NA" = not available; "NS = not sampled.
-Data from 2002-2003 collected by Tighe & Bond and reported in "2002 Monitoring Report Summary, Wheatley Farm Site" (March 12, 2003) and "2003 Monitoring Report Summary, Wheatley Farm Site" (March 12, 2004).
-Data starting in 2004 collected by Waite Environmental Management.

WEM

TABLE 1.5
pH Field Measurements: 2002 - 2009
Wheatley Site, Brookfield, Vermont

Location	Type	Units	Oct-02	Apr-03	Oct-03	Apr-04	Oct-04	Oct-05	Oct-06	Oct-07	Oct-08	Oct-09
MW-S1	Monitoring Well	unitless	6.60	NS	NA	NS	7.25	8.09	8.22	7.65	NA	7.96
MW-S2	Monitoring Well	unitless	6.30	NS	6.25	NS	6.80	7.63	8.09	6.33	NA	6.71
MW-S3	Monitoring Well	unitless	8.36	NS	8.24	NS	8.67	9.44	8.41	8.26	NA	NS
MW-PL1	Monitoring Well	unitless	7.66	NS	7.54	NS	8.06	8.69	7.72	7.56	NA	6.31
MW-PL2	Monitoring Well	unitless	7.44	NS	7.09	NS	7.89	8.16	7.32	7.41	NA	6.43

Notes:
-"Dry" = well dry during monitoring event; "NA" = not available; "NS = not sampled.
-Data from 2002-2003 collected by Tighe & Bond and reported in "2002 Monitoring Report Summary, Wheatley Farm Site" (March 12, 2003) and "2003 Monitoring Report Summary, Wheatley Farm Site" (March 12, 2004).
-Data starting in 2004 collected by Waite Environmental Management.

WEM

TABLE 1.6
Turbidity Field Measurements: 2002 - 2009
Wheatley Site, Brookfield, Vermont

Location	Type	Units	Oct-02	Apr-03	Oct-03	Apr-04	Oct-04	Oct-05	Oct-06	Oct-07	Oct-08	Oct-09
MW-S1	Monitoring Well	NTU	0.6	NS	NA	NS	183	89	21.2	18.1	71.2	11.4
MW-S2	Monitoring Well	NTU	2.0	NS	2.0	NS	81	47	17.0	4.9	0.0	0.0
MW-S3	Monitoring Well	NTU	0.5	NS	1.0	NS	53	21	0.0	1.5	2.9	NS
MW-PL1	Monitoring Well	NTU	2.3	NS	2.5	NS	108	95	0.0	0.0	0.0	1.2
MW-PL2	Monitoring Well	NTU	4.5	NS	0.8	NS	126	178	0.0	0.0	0.0	3.2

Notes:
-All turbidity measurements in nephelometric turbidity units (NTU).
-"Dry" = well dry during monitoring event; "NA" = not available; "NS = not sampled.
-Data from 2002-2003 collected by Tighe & Bond and reported in "2002 Monitoring Report Summary, Wheatley Farm Site" (March 12, 2003) and "2003 Monitoring Report Summary, Wheatley Farm Site" (March 12, 2004).
-Data starting in 2004 collected by Waite Environmental Management.

WEM

TABLE 1.7
Redox Potential Field Measurements: 2002 - 2009
Wheatley Site, Brookfield, Vermont

Location	Type	Units	Oct-02	Apr-03	Oct-03	Apr-04	Oct-04	Oct-05	Oct-06	Oct-07	Oct-08	Oct-09
MW-S1	Monitoring Well	mV	-69	NS	NA	NS	-72	-99	-159	-216	-182	-173
MW-S2	Monitoring Well	mV	12	NS	-31	NS	-43	-134	-123	-103	-50	-68
MW-S3	Monitoring Well	mV	-179	NS	-177	NS	-220	-214	-168	-183	-205	NS
MW-PL1	Monitoring Well	mV	150	NS	137	NS	43	169	150	139	101	155
MW-PL2	Monitoring Well	mV	176	NS	174	NS	128	190	162	150	112	153

Notes:
-All redox potential measurements in millivolts (mV).
-"Dry" = well dry during monitoring event; "NA" = not available; "NS = not sampled.
-Data from 2002-2003 collected by Tighe & Bond and reported in "2002 Monitoring Report Summary, Wheatley Farm Site" (March 12, 2003) and "2003 Monitoring Report Summary, Wheatley Farm Site" (March 12, 2004)..
-Data starting in 2004 collected by Waite Environmental Management.

WEM

TABLE 2.0
MONITORING WELL RESULTS: 2001-2009
Wheatley Farm Site, Brookfield

Location	Parameter Method 8260	Groundwater Enforcement Standard	Units	May-01	Oct-01	Apr-02	Oct-02	Oct-03	Oct-04	Oct-05	Apr-06	Oct-06	Oct-07	Oct-08	Oct-09
MW-S1	**PCE**	**5.0**	ug/L	1.0 U	1.0 J4	1.0 U	1.0 U	NA	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	TCE	**5.0**	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	NA	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	cis-1,2-DCE	**70.0**	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	NA	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	trans-1,2-DCE	**100.0**	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	NA	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
MW-S2	**PCE**	**5.0**	ug/L	1.0 U	1.0 J4	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	TCE	**5.0**	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	cis-1,2-DCE	**70.0**	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	trans-1,2-DCE	**100.0**	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
MW-S3	**PCE**	**5.0**	ug/L	1.0 U	1.0 J4	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	
	TCE	**5.0**	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	
	cis-1,2-DCE	**70.0**	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	
	trans-1,2-DCE	**100.0**	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	
MW-PL1	**PCE**	**5.0**	ug/L	1.0 U	0.24 J1 J4	1.0 U	0.51 J	**1.2**	**1.6**	**1.1**	**2.8**	**2.5**	**2.1**	**3.1**	**2.9**
	TCE	**5.0**	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	cis-1,2-DCE	**70.0**	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	trans-1,2-DCE	**100.0**	ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
MW-PL2	**PCE**	**5.0**	ug/L	1.0 U	DRY	1.0 U	DRY	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	TCE	**5.0**	ug/L	1.0 U	DRY	1.0 U	DRY	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	cis-1,2-DCE	**70.0**	ug/L	1.0 U	DRY	1.0 U	DRY	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	trans-1,2-DCE	**100.0**	ug/L	1.0 U	DRY	1.0 U	DRY	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

Notes:
- "PCE" = tetrachlorethene; "TCE" = tricholorethene; "DCE" = dichloroethene.
-"U" = not detected above listed quantitation limit; "J/J1" = reported concentration is an estimated value; "UJ" = reported quantitation limit is an estimated value; "J4" = values are estimated due to poor initial calibration data.
-"Dry" = well dry during monitoring event; "NA" = not available.
- Data from 2003 collected by Tighe & Bond and provided to WEM in digital format by Severn-Trent laboratory.
- Data starting in 2004 collected by Waite Environmental Management.
- Groundwater Enforcement Standards referenced from Table 1, Chapter 12 - Groundwater Protection Rule and Strategey, December 2000.

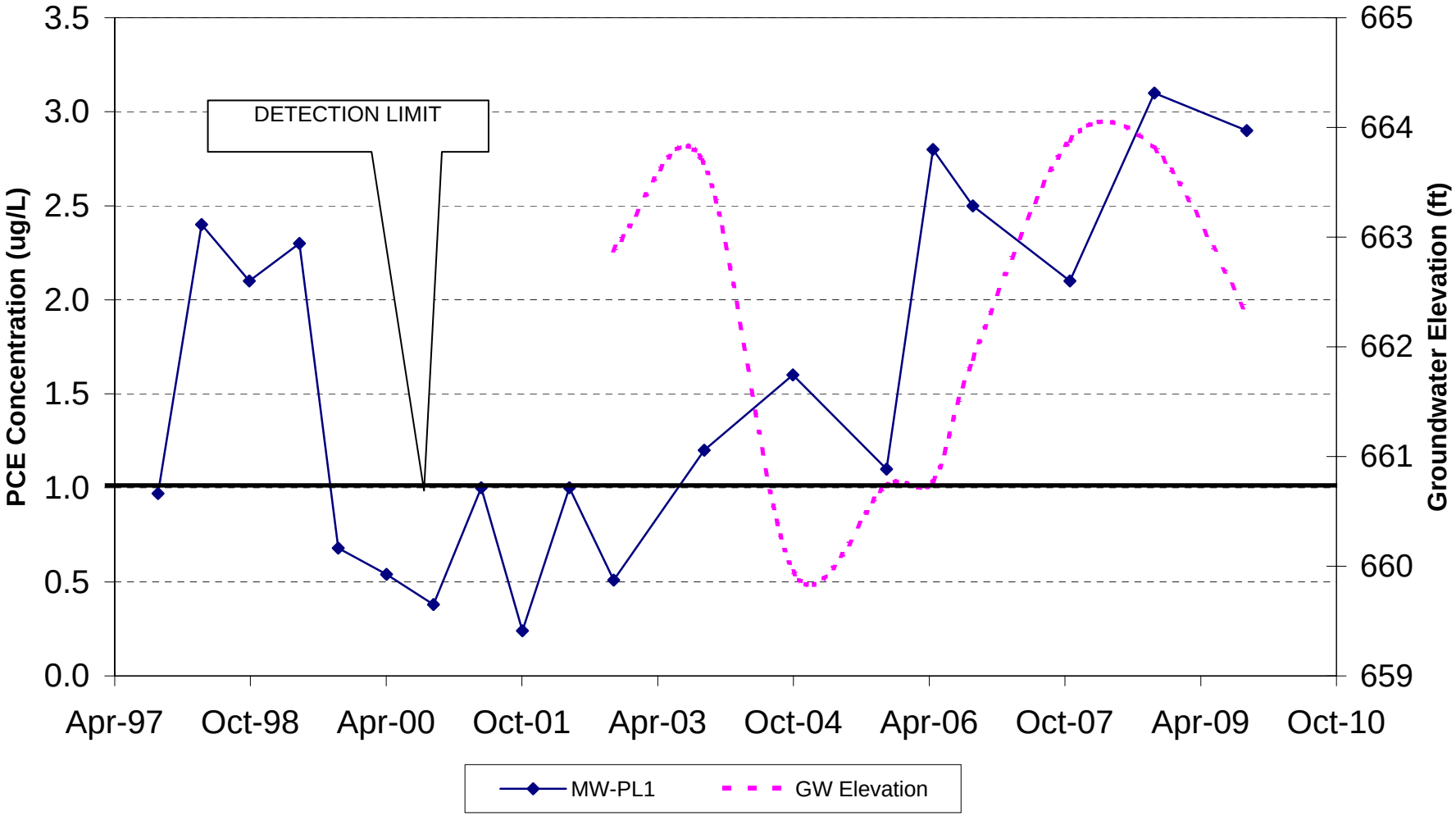
WEM Waite Environmental Management, LLC.

TABLE 3.0
INDOOR AIR QUALITY RESULTS: 2002 - 2009
Wheatley Farm Site, Brookfield, Vermont

Owner	Location	Parameter Method T-014A	Guidance Level	Units	Jan-02	Jul-02	Oct-03	Oct-04	Oct-05	Oct-06	Oct-07	Oct-08	Oct-09
Moorcroft	WHTLY1FLR	Tetrachloroethene	1.0	ppbv	**0.09** J	0.5 U	NS	0.5 U	0.2 U	0.2 U	0.010 U	NS	**0.022**
		Trichloroethene	1.0	ppbv	0.27 U	0.5 U	NS	0.5 U	0.2 U	0.2 U	**0.96**	NS	**2.0**
		cis-1,2-Dichloroethene	9.3	ppbv	0.27 U	0.5 U	NS	0.5 U	0.2 U	0.2 U	0.010 U	NS	0.010 U
		trans-1,2-Dichloroethene	18.4	ppbv	0.27 U	0.5 U	NS	0.5 U	0.2 U	0.2 U	0.010 U	NS	**0.014**
	WHTLYBSMT	Tetrachloroethene	1.0	ppbv	0.32 U	0.5 U	NS	0.5 U	0.2 U	0.2 U	0.010 U	NS	**0.020**
		Trichloroethene	1.0	ppbv	0.32 U	0.5 U	NS	0.5 U	0.2 U	0.2 U	0.010 U	NS	**0.017**
		cis-1,2-Dichloroethene	9.3	ppbv	0.32 U	0.5 U	NS	0.5 U	0.2 U	0.2 U	0.010 U	NS	0.010 U
		trans-1,2-Dichloroethene	18.4	ppbv	0.32 U	0.5 U	NS	0.5 U	0.2 U	0.2 U	0.010 U	NS	**0.028**

Notes:
-"U" = not detected above listed quantitation limit; "J" = reported concentration is an estimated value; "UJ" = reported quantitation limit is an estimated value; "R" = the data are unusable (analyte may or may not be present).
-"NS" = Not Sampled (house unoccupied or access not obtained).
Bold values are reported above quantitation limit; shaded cells are in excess of the guidance level.
Data (qualified) from 2001-2003 was collected by Tighe & Bond and was entered from tabulated data from annual reports.
Data starting in 2004 collected by Waite Environmental Management.
Guidance level for tetrachloroethene and trichloroethene based on results of statewide indoor ambient air survey conducted by the Vermont Dept. Health in 1991-92.
Guidance level for cis- and trans-1,2,-dichloroethene is based on the EPA Region III risk-based concentration for ambient air (2002 RBC table).

PCE in Groundwater: MW-PL1
Wheatley Site, Brookfield, Vermont



Note:
1) Concentrations shown below the detection limit are estimated (J).

APPENDIX C:

FIELD DATA SHEETS

WEM Waite Environmental Management, LLC.

SITE: ~~FILLIPO~~ UNIFIRST / WHEATLEY

FIELD WATER COLLECTION SHEET

(1)

SAMPLING LOCATION	MW-PL2			Pump Intake Depth	19.4'
Date	10/17/05			Pump Type	peri
Sampler	MW			Well Diameter	3/4
Weather	sunny & cold			Well Depth	24
Water Type	(gw)	sw	supply	Initial Depth to Water	18.29
Sampling Method	bailer	(low flow)	grab	Traditional Purge Rate (ml/min / gpm)	200

LOW FLOW PURGING DATA

Time	DTW (ft btp)	Purge Rate (ml/min)	Temp. (deg C)	Specific Cond. (µs/cm)	pH	ORP (mv)	DO (mg/L)	Turbidity (NTU)		Notes
			within 3%	within 3%	1 pH unit	10 mv	within 10%	within 10%		
1108	18.29	200								began
1111	18.41	200	9.34	0.711	6.61	191	9.26	37.3		
1115	18.41	200	9.55	0.670	6.16	175	9.29	16.5		
1119	18.41	200	9.66	0.684	6.30	165	9.40	12.5		
1129	18.41	200	9.78	0.665	6.40	155	9.52	4.2		
1132	18.41	200	9.84	0.658	6.42	154	9.54	6.3		
1134	18.41	200	9.77	0.661	6.43	153	9.55	3.2		complete

SAMPLE COLLECTION	Purge Volume	Temp.	Specific Cond.	pH	ORP	DO	Turbidity		
Final Measurements:	3500	9.77	0.661	6.43	153	9.55	3.2		

Sample Description	Label	Type Container	# Container	Preservative	Analysis Method	Collection Time	COC #
Sample	MW-PL2	VOA	3	HCl	8260	1135	
Additional							
Additional							
Field Duplicate							
MS/MSD							
Field Blank							

General Notes: added trip blank TB-2 to cooler

IIIII

WEM Waite Environmental Management, LLC.

SITE: ~~PHILIPO~~ UNIFIRST/WHEATLEY Page 1 of 1 (2)

FIELD WATER COLLECTION SHEET

SAMPLING LOCATION	MW-PL1	Pump Intake Depth	16.1
Date	10/19/09	Pump Type	Peri.
Sampler	MW	Well Diameter	3/4"
Weather	Sun, 1 cool	Well Depth	17.72
Water Type	(gw) sw supply	Initial Depth to Water	14.25
Sampling Method	bailer (low flow) grab	Traditional Purge Rate (ml/min / gpm)	200

LOW FLOW PURGING DATA

Time	DTW (ft btp)	Purge Rate (ml/min)	Temp. (deg C) within 3%	Specific Cond. (µs/cm) within 3%	pH 1 pH unit	ORP (mv) 10 mv	DO (mg/L) within 10%	Turbidity (NTU) within 10%		Notes
1152	14.25	200	~~9.75~~	~~0.724~~	~~6.30~~	~~160~~	~~3.13~~	~~9.1~~	MW	Sys on
1155	14.28	200	9.75	0.724	6.30	160	3.13	9.1		
1159	14.28	200	9.84	0.735	6.31	158	2.43	44.3		
1202	14.28	200	9.97	0.742	6.31	156	2.42	9.6		
1206	14.28	200	9.95	0.746	6.31	155	2.45	1.7		
1209	14.28	200	9.97	0.744	6.31	155	2.45	1.2		complete

SAMPLE COLLECTION

	Purge Volume	Temp.	Specific Cond.	pH	ORP	DO	Turbidity		
Final Measurements:	3000	9.97	0.744	6.31	155	2.45	1.2		

Sample Description	Label	Type Container	# Container	Preservative	Analysis Method	Collection Time	COC #	
Sample	MW-PL1	VOA	3	HCl	8260B	1210		
Additional								
Additional								
Field Duplicate	MW-PLX	VOA	3	HCl	8260B	"1006"		5/rad
MS/MSD								
Field Blank								

General Notes:

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WEM Waite Environmental Management, LLC.

SITE: ~~FILLIPO~~ WHEATLEY
FIELD WATER COLLECTION SHEET

SAMPLING LOCATION	MW-51	Pump Intake Depth	9.8
Date	10/19/09	Pump Type	peri.
Sampler	MW	Well Diameter	3/4"
Weather	Sunny & cool	Well Depth	10.8'
Water Type	(gw) sw supply	Initial Depth to Water	5.57
Sampling Method	bailer (low flow) grab	Traditional Purge Rate (ml/min / gpm)	200

LOW FLOW PURGING DATA

Time	DTW (ft btp)	Purge Rate (ml/min)	Temp. (deg C)	Specific Cond. (µs/cm)	pH	ORP (mv)	DO (mg/L)	Turbidity (NTU)		Notes
			within 3%	within 3%	1 pH unit	10 mv	within 10%	within 10%		
1302	5.57	200								6 gal
1305	6.42	200	13.94	0.509	7.69	-150	0.80	86.0		
1308	6.68	200	13.87	0.508	7.81	-153	0.08	88.3		
1312	7.04	200	14.00	0.506	7.87	-165	0.01	42.5		
1315	6.79	200	14.05	0.508	7.95	-171	0.05	53.0		
1318	6.99	200	14.15	0.509	7.98	-174	0.00	28.6		
1321	6.99	200	14.22	0.513	7.97	-172	0.08	14.9		
1325	6.99	200	14.26	0.517	7.95	-173	0.00	11.8		
1327	6.99	200	14.25	0.518	7.96	-173	0.00	11.4		

SAMPLE COLLECTION	Purge Volume	Temp.	Specific Cond.	pH	ORP	DO	Turbidity		
Final Measurements:	3500	14.25	0.518	7.96	-173	0.00	11.4		

Sample Description	Label	Type Container	# Container	Preservative	Analysis Method	Collection Time	COC #	
Sample	MW-51	VOA	3	HCl	8260	1330		
Additional								
Additional								
Field Duplicate								
MS/MSD								
Field Blank								

General Notes:

/////

WEM Waite Environmental Management, LLC.

SITE: ~~FILLIPO~~ WHEATLEY
FIELD WATER COLLECTION SHEET

SAMPLING LOCATION	MW-52	Pump Intake Depth	10.8'
Date	10/19/07	Pump Type	peri
Sampler	MW	Well Diameter	3/4"
Weather	Sunny & Cool	Well Depth	11.1'
Water Type	gw / sw / supply	Initial Depth to Water	4.84
Sampling Method	bailer / low flow / grab	Traditional Purge Rate (ml/min / gpm)	200

LOW FLOW PURGING DATA

Time (min)	DTW (ft btp)	Purge Rate (ml/min)	Temp. (deg C)	Specific Cond. (ds/cm)	pH	ORP (mv)	DO (mg/L)	Turbidity (NTU)		Notes
			within 3%	within 3%	1 pH unit	10 mv	within 10%	within 10%		
13:441	4.84	200								begin
444	5.07	200	14.34	0.349	7.11	-70	0.47	7.2		
448	5.07	200	14.31	0.350	6.97	-69	0.00	1.6		
452	5.07	200	14.23	0.343	6.76	-63	0.00	0.0		
455	5.07	200	14.30	0.342	6.72	-66	0.00	0.0		
458	5.07	200	14.21	0.346	6.71	-68	0.00	0.0		complete

SAMPLE COLLECTION

	Purge Volume	Temp.	Specific Cond.	pH	ORP	DO	Turbidity		
Final Measurements:	3000	14.21	0.346	6.71	-68	0.00	0.0		

Sample Description	Label	Type Container	# Container	Preservative	Analysis Method	Collection Time	COC #
Sample	MW-52	VOA	3	HCl	8260	1400	
Additional							
Additional							
Field Duplicate							
MS/MSD	MW-52	VOA	4	"	"	1400	
Field Blank	FB-4	VOA	2	"	"	1410	

General Notes:

APPENDIX D:

DATA VALIDATION REPORT

DATA VALIDATION

FOR

UniFirst Project
Wheatley Site
Brookfield, VT

ORGANIC ANALYSIS DATA
Selected Volatiles in Air Samples

Sample Delivery Group (SDG) No.
134255

Chemical Analyses Performed by:

Test America Burlington
30 Community Drive, Suite 11
South Burlington, VT 05403

FOR

Mr. Gerold Noyes
Waste Management Division
VT Department of Environmental Conservation
103 South Main Street/ West Building
Waterbury, VT 05676-0404

Data Validation Report by:

Phoenix Chemistry Services
126 Covered Bridge Rd.
N. Ferrisburg, VT 05473
(802) 233-2473
Jan. 19, 2010

Reference #2009-1117-001
VOA Air Validation Report/134255/dhg

EXECUTIVE SUMMARY

Phoenix Chemistry Services (Phoenix) has completed the validation of the method TO-15 Low Level (volatiles in air) analysis data prepared by TestAmerica Burlington (formerly STL Burlington) of South Burlington, VT, for 3 air samples and one trip blank (TB) from the Wheatley project site in Brookfield, VT. The laboratory reported the data under Sample Delivery Group (SDG) No. 134255, which was submitted as a single data package received by Phoenix on November 17, 2009, and which includes the following samples:

Sample ID	Laboratory ID
WHTLYBSMT	810818
TB-1	810819
WHTLY1FLR	810820
FD-1	810821

A cross-reference table of sample IDs was provided in the data packages.

The samples in this data set represent the sample collection from October 19, 2009 inside the private residence site in Brookfield, VT. All samples were hand-delivered to the laboratory on the same day as collection.

Findings of the validation effort resulted in the following qualifications of sample results.

- The result for trichloroethene in WHTLY1FLR was rejected (R) and replaced with the acceptable concentration from the more diluted analysis of this sample (WHTLY1FLRDL).

- Results for all other compounds in WHTLY1FLRDL were rejected (R) because acceptable results for these compounds were taken from the original analysis (WHTLY1FLR).

The Overall Evaluation of Data (Section XVI) summarizes the validation results. The validation findings and conclusions for each analytical parameter are detailed in the remaining sections of this report.

Documentation problems observed in the data package are described in Section XVII.

This validation report shall be considered <u>part of the data package</u> for all future distributions of TO - 15 (volatiles in air) analysis data.

INTRODUCTION

Analyses of selected volatiles in air samples were performed according to Method TO-15, the laboratory standard operating procedure (SOP) No. BR-AT-003, Rev. 1 (01/07/2008), and in accordance with requirements in the Field/Laboratory Coordination Memorandum for Air Monitoring (FLCM), December 22, 2007. The target compound list was limited to the following compounds:

cis-1,2-Dichloroethene	Trichloroethene
trans-1,2-Dichloroethene	Tetrachloroethene

Tentative identification of non-target analyte peaks (i.e., tentatively identified compounds, or TICs) was not requested for these analyses.

Phoenix's validation was performed in conformance with Tier III guidelines as defined by USEPA Region I. Data qualifiers are applied as necessary and appropriate. To the extent possible, the data were evaluated in accordance with the "Region I EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses", December, 1996. EPA's National Functional Guidelines for Organic Data Review (EPA 540/R-94/012, 2/94) were also considered during the evaluation, and professional judgment was applied as necessary and appropriate.

The data validation process evaluates data on a technical basis for chemical analyses conducted under the CLP or other well-defined methods. Contract compliance is evaluated only in specific situations. Issues pertaining to contractual compliance are noted where applicable. It is assumed that the data package is presented in accordance with the CLP requirements. It is also assumed that the data package represents the best efforts of the laboratory and has already been subjected to adequate and sufficient quality review prior to submission for validation.

Results of sample analyses are reported by the laboratory as either qualified or unqualified; various qualifier codes are used by the laboratory to denote specific information regarding the analytical results. During the validation process, laboratory data are verified against all available supporting documentation. Based on this evaluation, qualifier codes may be added, deleted or modified by the data validator. Raw data is examined in detail to check calculations, compound identification, and/or transcription errors. Validated results are either qualified or unqualified; if results are unqualified, this means that the reported values may be used without reservation. Final validated results are annotated with the following codes, as defined in the EPA Region I Functional Guidelines:

U - The analyte was analyzed for, but was not detected. The associated numerical value is the sample quantitation limit. The sample quantitation limit accounts for sample specific dilution factors and percent solids corrections or sample sizes that deviate from those required by the method.

J - The associated numerical value is an estimated quantity.

UJ - The analyte was analyzed for, but was not detected. The sample quantitation limit is an estimated quantity.

R - The data are unusable (analyte may or may not be present). Resampling and reanalysis is necessary for verification. The R replaces the numerical value or sample quantitation limit. In some instances (e.g., a dilution) a result may be indicated as "rejected" to avoid confusion when a more quantitatively accurate result is available.

EB, TB, BB - An analyte that was identified in an aqueous equipment (field) blank, trip blank, or bottle blank that was used to assess field contamination associated with soil/sediment samples. These qualifiers are to be applied to soil/sediment sample results only.

These codes are assigned during the validation process and are based on the data review of the results. They are recorded on the Data Summary Forms contained in Attachment A and the Organic Analysis Data Sheets (Form I) in Attachment B of this validation report.

All data users should note two facts. First, **the "R" qualifier means that the laboratory-reported value is completely unusable.** The analysis is invalid due to significant quality control problems, and provides no information as to whether the compound is present or not. Rejected values should not appear on data tables because they have no useful purpose under any circumstances. Second, **no analyte concentration is guaranteed to be accurate even if all associated quality control is acceptable.** While strict quality control conformance provides well-defined confidence in the reported results, any analytical result will always contain some error.

The user is also cautioned that the validation effort is based on the materials provided by the laboratory. Software manipulation, resulting in misleading raw data printouts, cannot be routinely detected during validation; unless otherwise stated in the report, these kinds of issues are outside the scope of this review.

Detailed Findings of Measurement Error Associated with the Analytical Analysis

I. Sample Integrity

The air samples for TO-15 analysis were collected on October 19, 2009 for the October sampling round at one private residence in Brookfield, VT. All analyses were performed within three (3) days after sample collection, which is within the 30 day holding time defined in Method TO-15.

The Canister Samples Chain of Custody Record & TO-15 Field Test Data Sheet (COC) show that the sample canisters were collected and transported according to method specifications. The canisters were picked up from the laboratory five days before sample collection, and the canisters were hand-delivered to the laboratory on the same day as collected.

II. GC/MS Instrument Performance Check (Tuning)

The samples for volatiles in air analysis from SDG No. 134255 were analyzed on a single GC/MS system identified as instrument E. The tuning of this instrument was demonstrated with analysis of 4-bromofluorobenzene (BFB); tunes were analyzed for each 24-hour period during which the samples or associated standards were analyzed. All three (3) BFB tunes were correctly calculated, within acceptance limits, and are reported accurately on the Form V summaries in the data packages.

III. Initial Calibration (IC)

One IC (10/5/09 – 10/6/09) was performed on instrument E in support of the TO-15 sample analyses. The IC was performed at seven concentration levels (0.01, 0.02, 0.05, 0.1, 0.2, 0.5, and 1.0 ppbv). Documentation of all individual IC standards was present in the data package and relative response factor (RRF) as well as percent relative standard deviation (%RSD) values were correctly calculated and accurately reported on the Form VI summary. Three additional calibration levels (0.75, 1.5, and 2.0 ppbv) were analyzed, are listed on the Form V summaries, and are present in the data packages, but were not used in the calculation of the calibration curve, and appropriately do not appear on the Form VI summary.

An Independent Calibration Verification (ICV) sample analysis at 0.20 ppbv for the IC was included in the data package, and all target analytes were recovered within 91 – 97 % recovery of expected values; all target analytes were present in the ICV analysis.

All average RRF values were above the 0.05 minimum criterion, and all %RSDs were below the maximum limit (30%) specified by Region I.

IV. Continuing Calibration (CC)

Two continuing calibration (CC) standards were run in support of the sample analyses reported in this data package. Documentation of the CC standards was present and RRF as well as percent difference (%D) values were reported on the Form VII summaries within the data packages. Sample results were reported

using the average RRF of the calibration curve for quantitation. All RRF values were above the 0.05 minimum criterion, and all %D results were below the maximum limit of 25% specified by Region I.

V. Blanks

Results for two air-matrix laboratory method blanks (MBs) were reported in association with these samples. No target compounds were found in either MB.

One trip blank (TB) was reported in this data package. No target compounds were found in the TB.

VI. Surrogate Compounds

No surrogate compounds are used in this method.

VII. Internal Standards (IS)

All IS areas and retention times (RT) were within the established QC limits for all reported sample analyses in this data package.

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

A matrix spike/matrix spike duplicate (MS/MSD) analysis is not used in this method.

IX. Field Duplicates

Sample FD-1 was identified as a field duplicate of WHTLYBSMT. The target compounds trans-1,2-dichloroethene, trichloroethene, and tetrachloroethene were detected in both analyses of the field duplicate pair WHTLYBSMT and FD-1, and precision (11.3 and 16.2 %RPD) was acceptable for all results greater than twice the quantitation limit in at least one member of the field duplicate pair. Results for trichloroethene were less than twice the quantitation limit in both samples (0.012 ppbv in sample FD-1, and 0.017 ppbv in sample WHTLYBSMT).

X. Sensitivity Check

An MDL study for this TO-15 method was analyzed on 4/4/09 – 4/7/09 and verified on 4/8/09 – 4/17/09. All target analytes in this study had calculated MDLs below the method quantitation limits, and demonstrated acceptable ratios (at least 3:1) of the quantitation limit (QL) to the verified MDL (MDLV), except for cis-1,2-dichloroethene, which exhibited a QL/MDLV ratio of 2.3. This compound was detected with acceptable recovery (121 %R) when spiked at the limit of detection (LOD, 0.010 ppbv). The QL is also supported by the low concentration standard (at 0.010 ppbv) in the initial calibration.

On the basis of acceptable sensitivity and accuracy, as demonstrated by the full MDL study, including the MDLV and limit of quantitation (LOQ) verification studies, all results for the low level TO-15 method (detects and non-detects) not qualified for other reasons, are deemed acceptable as reported.

XI. Performance Evaluation Samples (PES)/Accuracy Check

One sets of zero blind PE samples (commonly known as a laboratory control sample, LCS, and duplicate, LCSD) were prepared and analyzed by the laboratory in support of these analyses. All target analytes were spiked into the QC samples at 0.20 ppbv. Percent recoveries (%R) were correctly calculated for the spiked compounds, accurately reported on the Form III summaries in the data package, and were within the laboratory established QC limits (70 - 130 %R) for all target analytes. All RPD values were acceptable (<25 %RPD).

No external single-blind PES sample was required or submitted with the samples in this data set.

XII. Target Compound Identification

Reported target compounds were correctly identified for all samples in this data set.

XIII. Compound Quantitation and Reported Quantitation Limits

Target compound quantitation and practical quantitation limits (PQLs) were accurately reported on the Form I summaries. Results below the PQL are not reported by the laboratory for the low level TO-15 method. Trichloroethene was detected in sample WHTLY1FLR above the calibration range. The sample was appropriately reanalyzed at a dilution, and the concentration of trichloroethene in the dilution analysis was within the upper half of the calibration range, and both sets of analyses were reported in the data package.

The result for trichloroethene in WHTLY1FLR was rejected (R) due to detection of this compound outside the linear range of the instrument. The result for trichloroethene was replaced with the acceptable concentration from the more diluted analysis of this sample (WHTLY1FLRDL).

Results for all other compounds in WHTLY1FLRDL were rejected (R) because acceptable results for these compounds were taken from the original analysis (WHTLY1FLR).

“E” qualifiers were appropriately applied by the laboratory to sample Form I results when concentrations of target analytes were greater than the instrument calibration range. “D” qualifiers were properly applied by the laboratory to positive results from diluted sample analyses. The validator removed all laboratory-applied “E” and “D” qualifiers. An “X” has been drawn across the entire Form I for the diluted analyses noted above.

The values that the validator has judged to be acceptable are presented on the Data Summary Forms in Attachment A and on the Form 1s in Attachment B. Both sets of forms include results in units of ppbv (parts per billion by volume) and in ug/m^3 (micrograms per cubic meter). Two sets of Form 1s are presented by the laboratory in the data package. One set presents the results in both units, and is included in Attachment

B. The other set presents the results in ppbv only, but includes more sample-related information. Both sets of forms are examined during the data validation process.

All positive results are listed on the Data Summary Forms, whether or not the value or qualifier was changed as a result of the validation. Where no result is listed, the compound was not detected and the reporting limit was not qualified. Sample-specific quantitation limits may be found on the laboratory-generated Form I for each sample (Attachment B) or may be calculated from the information on the DSFs as follows: reported PQL multiplied by the dilution factor (DF).

XIV. Tentatively Identified Compounds (TICs)

Evaluation of unidentified, non-target analyte peaks was not requested or performed for these samples.

XV. System Performance

The analytical system appears to have been working well at the time of these analyses based on evaluation of the available raw data.

XVI. Overall Evaluation of Data

Findings of the validation effort resulted in the following qualifications:

- The result for trichloroethene in WHTLY1FLR was rejected (R) due to detection of this compound outside the linear range of the instrument. The result for trichloroethene was replaced with the acceptable concentration from the more diluted analysis of this sample (WHTLY1FLRDL).

- Results for all other compounds in WHTLY1FLRDL were rejected (R) because acceptable results for these compounds were taken from the original analysis (WHTLY1FLR).

XVII. Documentation

The required records for canister cleanliness were included with the data package, and, as required by the FLCM, calibration check and pre-sampling leak check records for the mass flow controllers supplied by the laboratory were properly included with this data set.

The chain of custody (COC) records were present for all reported samples, and accurately completed, with the following observations:

- The end time for the sampling period was not entered on the COC by the field engineer, as noted by the laboratory. A properly completed COC was emailed to the laboratory at the validator's request, following notification by the laboratory.

Data presentation was acceptable.

These issues do not directly affect the validity of the analytical data.

This validation report should be considered part of the data package for all future distributions of the TO-15 (volatiles in air) analysis data.

DATA VALIDATION

FOR

UniFirst Project
Bressett, Wheatley, and UniFirst Sites
Randolph, Brookfield, and Williamstown, VT

ORGANIC ANALYSIS DATA
Volatile Organics in Water Samples

Sample Delivery Group Nos. BRES45, UNIF36, and WHEA15

Chemical Analyses Performed by:

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FOR

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January 26, 2010
revised February 5, 2010

Reference #s 2009-1118-001, -1210-001, &-002
VOA Validation Report/BRES45_UNIF36_WHEA15/dhg

EXECUTIVE SUMMARY

Phoenix Chemistry Services (Phoenix) has completed the validation of the volatile organics analysis data prepared by TestAmerica Burlington (formerly STL Burlington) for 40 groundwater samples, 10 potable water samples, 1 performance evaluation (PE) sample, 6 field blanks (FB), and 3 trip blanks (TB) from the Bressett Site in Randolph, VT, the UniFirst Site in Williamstown, VT, and the Wheatley Farm site in Brookfield, VT. The laboratory reported the data under Sample Delivery Group (SDG) Nos. BRES45, UNIF36, and WHEA15, which were submitted as three data packages received by Phoenix on November 18 and December 10, 2009. These SDGs include the following samples:

Sample Identifier	Laboratory ID
Method 8260B	
SDG No. BRES45	
MW-103D	810344
MW-104S	810345
MW-104D	810346
MW-102D	810347
MW-102S	810348
MW-101S	810349
MW-101D	810350
MW-4S	810351
MW-4D	810352
MW-3S	810353
MW-3D	810354
FB-2	810355
MW-Z	810356
BRW-3	810357
BRW-2	810358
BRW-1	810359
SDG No. UNIF36	
MW-25884	810360
FB-3	810361
BRW-X	810362
TB-3	811110
PZ-101	811111
PZ-102	811112
W-25	811113
MW-50	811114
W-19	811115
W-20	811116
MW-E	811117
MW-C	811118
W-1	811119
MW-D	811120

Sample Identifier	Laboratory ID
W-Z	811121
FB-5	811122
SEEP-1A	811123
SS-2	811124
W-SEEP	811125
SS-Z	811126
SS-5	811127
SP-4	811128
SP-3	811129
SDG No. WHEA15	
TB-2	810988
MW-PL2	810989
MW-PL1	810990
MW-S1	810991
MW-S2	810992
FB-4	810993
MW-PLX	810994
Method 524.2	
SDG No. BRES45	
TB-1	810338
SHIELDS	810339
WELL Z	810340
FB-1	810341
KITCHEN TAP	810342
PRE-FILTER	810343
SDG No. UNIF36	
WP-5	811130
WP-7	811131
WP-8	811132
WP-13	811133
WP-3	811134
WP-Z	811135
FB-6	811136
W-23	811137

A cross-reference table of sample IDs was provided in the data packages.

Findings of the validation effort resulted in the following qualifications of sample results:

- Results for chloromethane and 1,1,-dichloroethane in samples TB-1, SHIELDS, WELL Z, FB-1, KITCHEN TAP, and PRE-FILTER, and for chloroethane in all samples analyzed by Method 524.2 were qualified as estimated (UJ).

- Results for bromomethane in samples BRW-1, MW-102S, MW-3S, MW-3D, MW-Z, FB-4, MW-PLX, MW-D, FB-5, SEEP-1A, SS-2, W-SEEP, SS-Z, SS-5, SP-4, SP-3, and W-Z were

qualified as estimated (UJ).

- Results for acetone in samples MW-103D, MW-104D, MW-102D, MW-101D, MW-4D, BRW-3, BRW-2, SEEP-1A, SS-2, and SS-5; results for trichloroethene in samples MW-104D, MW-4D, MW-PL1, and MW-PLX; and results for carbon disulfide in MW-103D, BRW-2, and BRW-1 were qualified as less than the quantitation limit, and results for carbon disulfide in WP-3 and WP-Z and for trichloroethene in W-25 were qualified as less than the reported value (U).

- All laboratory-applied "B" qualifiers have been removed by the validator.

- Results for all analytes in MW-D and TB-2 were qualified as estimated (J, UJ).

- Results for trichloroethene and tetrachloroethene in MW-D and W-Z were qualified as estimated (J).

- All non-detected results in all drinking water field samples for trans-1,2-dichloroethene, 1,1,1-trichloroethane, tetrachloroethene, and o-xylene were qualified as less than the adjusted quantitation limit (U), and the quantitation limit was adjusted to 0.71 ug/L.

- Results for m,p-xylenes and total xylenes were rejected (R) in all samples analyzed by Method 524.2.

- Results for 2-butanone in TB-1, SHIELDS, WELL-Z, FB-1, KITCHEN TAP, and PRE-FILTER were qualified as estimated (UJ).

- Results for tetrachloroethene in the original analyses of samples MW-3D and MW-Z were rejected (R), and replaced with the acceptable concentrations from the corresponding diluted samples (MW-3DDL and MW-ZDL).

- Results for all other analytes in samples MW-3DDL and MW-ZDL were rejected (R) and taken from the original analyses (MW-3D and MW-Z).

- "E" qualifiers were appropriately applied by the laboratory to sample Form I results when concentrations of target analytes were greater than the instrument calibration range. "D" qualifiers were properly applied by the laboratory to positive results from diluted sample analyses. The validator removed all laboratory-applied "E" and "D" qualifiers.

- The laboratory appropriately applied "J" qualifiers to the sample Form I's when the concentration of an analyte was less than the sample-specific PQL. The validator did not remove these qualifiers.

The Overall Evaluation of Data (Section XVI) summarizes the validation results. The validation findings and conclusions for each analytical parameter are detailed in the remaining sections of this report.

Documentation problems observed in the data packages are described in Section XVII.

This validation report shall be considered <u>part of the data packages</u> for all future distributions of the volatiles (8260B and 524.2) analysis data.

INTRODUCTION

Analyses were performed according to SW-846 Method 8260B Low Level, as documented in STL SOP 8260B, and SDWA Method 524.2 Rev. 4.1, as documented in STL SOP 524.2, and in accordance with requirements in the Field/Laboratory Coordination Memorandum for Water Monitoring (FLCM), April 2, 2004. The target compound list for the Method 8260B analyses was limited to the OLM03.1 CLP target compound list, and the target compound list for Method 52.4.2 was limited to the OLM03.1 CLP target compound list plus methyl-*tert*-butyl ether (MTBE).

Tentative identification of non-target analyte peaks (i.e., tentatively identified compounds, or TICs) was not requested for these analyses.

Phoenix Chemistry Services' validation was performed in conformance with Tier III guidelines as defined by USEPA Region in the "Region I EPA-NE Data Validation Manual: The Data Quality System", (12/96 Revision). The data were evaluated in accordance with the "Region I EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses", December 1996. EPA's National Functional Guidelines for Organic Data Review (EPA 540/R-99/008, October, 1999) were also considered during the evaluation, and professional judgment was applied as necessary and appropriate.

The data validation process evaluates data on a technical basis for chemical analyses conducted under the CLP or other well-defined methods. Contract compliance is evaluated only in specific situations. Issues pertaining to contractual compliance are noted where applicable. It is assumed that the data package is presented in accordance with the CLP (CLP-like or SW-846) requirements. It is also assumed that the data package represents the best efforts of the laboratory and has already been subjected to adequate and sufficient quality review prior to submission for validation. In instances where SW-846 or other specific methods have been used for the analyses, the validation effort is modified to acknowledge the differences in methodology while maintaining the goals and quality objectives of the CLP.

Results of sample analyses are reported by the laboratory as either qualified or unqualified; various qualifier codes are used by the laboratory to denote specific information regarding the analytical results. During the validation process, laboratory data are verified against all available supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data validator. Raw data is examined in detail to check calculations, compound identification, and/or transcription errors. Validated results are either qualified or unqualified; if results are unqualified, this means that the reported values may be used without reservation. Final validated results are annotated with the following codes, as defined in the EPA Region I Functional Guidelines:

U - The analyte was analyzed for, but was not detected. The associated numerical value is the sample quantitation limit. The sample quantitation limit accounts for sample specific dilution factors and percent solids corrections or sample sizes that deviate from those required by the method.

J - The associated numerical value is an estimated quantity.

UJ - The analyte was analyzed for, but was not detected. The sample quantitation limit is an estimated quantity.

R - The data are unusable (analyte may or may not be present). Resampling and reanalysis is necessary for verification. The R replaces the numerical value or sample quantitation limit. In some instances (e.g., a dilution) a result may be indicated as "rejected" to avoid confusion when a more quantitatively accurate result is available.

EB, TB, BB - An analyte that was identified in an aqueous equipment (field) blank, trip blank, or bottle blank that was used to assess field contamination associated with soil/sediment samples. These qualifiers are to be applied to soil/sediment sample results only.

These codes are assigned during the validation process and are based on the data review of the results. They are recorded on the Data Summary Forms contained in Attachment A and the Organic Analysis Data Sheets (Form I) in Attachment B of this validation report.

All data users should note two facts. First, **the "R" qualifier means that the laboratory-reported value is completely unusable.** The analysis is invalid due to significant quality control problems, and provides no information as to whether the compound is present or not. Rejected values should not appear on data tables because they have no useful purpose under any circumstances. Second, **no analyte concentration is guaranteed to be accurate even if all associated quality control is acceptable.** While strict quality control conformance provides well-defined confidence in the reported results, any analytical result will always contain some error.

The user is also cautioned that the validation effort is based on the materials provided by the laboratory. Software manipulation, resulting in misleading raw data printouts, cannot be routinely detected during validation; unless otherwise stated in the report, these kinds of issues are outside the scope of this review.

Detailed Findings of Measurement Error Associated with the Analytical Analysis

I. Preservation and Technical Holding Times (Sample Integrity)

The samples for volatiles analysis in SDG Nos. BRES45, UNIF36, and WHEA15 were collected on October 13, 14, 19, and 20, 2009. All volatiles analyses were performed within the acceptable holding times for preserved water samples (14 days from collection), as required by Region 1. Although not provided in the case narrative (as required by the CLP SOW), the pH of the samples was measured within three days after receipt at the laboratory, and is recorded in the Sample Preparation sections of the data packages. All recorded sample pH values were <2. The field sample collection sheets also note that the samples were appropriately preserved with HCl.

The cooler temperatures on receipt at the laboratory were checked and documented in the data packages, and were 4.7, 2.7, and 7.6 ^{o}C, which are within the acceptance range of 4 ^{o}C ±2 ^{o}C, with the exception of the cooler at 7.6 ^{o} C. Since the samples in the cooler at 7.6 ^{o}C were all collected within five hours of receipt at the laboratory, had been iced, and cooling was demonstrated, no qualifications were necessary on the basis of the cooler temperature slightly above the acceptance limit.

II. GC/MS Instrument Performance Check (Tuning)

The samples were analyzed on two GC/MS systems identified as instruments L and M. The tuning of these instruments was demonstrated with analysis of 4-bromofluorobenzene (BFB); tunes were analyzed for each shift (12-hour period) during which the samples or associated standards were analyzed. All eleven (11) BFB tunes were correctly calculated, within acceptance limits, and are reported accurately on the Form V summaries in the data packages.

III. Initial Calibration (IC)

One IC (10/23/09) was performed on instrument M and one IC (10/31/09) was performed on instrument L in support of the Method 8260B sample analyses, and two ICs (10/13/09 and 10/27/09) were performed on instrument L in support of the method 524.2 sample analyses reported in these data packages. Documentation of all individual IC standards was present in the data packages and relative response factor (RRF) as well as percent relative standard deviation (%RSD) values were correctly calculated and accurately reported on the Form VI summaries.

One or more target compounds were manually integrated in each of the Method 8260B ICs performed on instruments L and M. The manual integrations appear to be correctly performed, are initialed by the analyst, and are accurately reported with the final area listed on the tabular report and the before and after ion chromatograms included in the data packages.

All % RSDs for both ICs were below the maximum limit (30%) specified by Region I, with the exception of acetone at 30.1 %RSD in the Method 524.2 IC on instrument L on 10/27/09. All RRF's were above the 0.05 minimum technical criterion, with the following exceptions:

Instrument	IC	Average RRF	
		acetone	2-butanone
M (8260B)	10/23/09	acceptable	0.028
L (8260B)	10/31/09	acceptable	0.021
L (524.2)	10/13/09	0.037	0.016
L (524.2)	10/27/09	acceptable	0.017

Pursuant to the Region I validation document, results for 2-butanone in all samples in this data set and for acetone in samples TB-1, SHIELDS, WELL Z, FB-1, KITCHEN TAP, and PRE-FILTER warranted rejection (R) based on the low RRFs achieved. However, acetone and 2-butanone were spiked at a concentration of 5 µg/L in the matrix spikes, matrix spike duplicates, laboratory control samples, and laboratory control sample duplicates analyzed with this data set, and mostly acceptable or high recoveries for both compounds were achieved in these analyses. Therefore, results for acetone and 2-butanone were not qualified on the basis of the low RRFs in the associated ICs on both instruments.

An ICV was analyzed immediately after each IC, as required, and recoveries were correctly calculated and accurately reported in the data packages. All percent recoveries (%R) in the submitted ICVs were within (81 - 112 % R for Method 8260B, and 98 – 126 %R for Method 524.2) laboratory established control limits (75 – 125 % R for Method 8260B and 70 – 130 % R for Method 524.2), with the following exceptions in the Method 524.2 ICVs on instrument L:

ICV	Analyte	Recovery (%R)
10/13/09 12:50	chloromethane	146.3
	chloroethane	135.5
	1,1-dichloroethane	131.1
10/27/09 15:07	chloroethane	130.6

On the basis of recoveries in the ICV outside established criteria, results for chloromethane and 1,1,-dichloroethane in samples TB-1, SHIELDS, WELL Z, FB-1, KITCHEN TAP, and PRE-FILTER, and for chloroethane in all samples analyzed by Method 524.2 were qualified as estimated (UJ).

IV. Continuing Calibration (CC)

Five continuing calibration (CC) standards were run on instrument M in support of the Method 8260B sample analyses, and two CC standards were run on instrument L in support of the Method 524.2 sample analyses reported in this data set. Documentation of the CC standards was present in the data packages and RRF as well as percent difference (%D) values were correctly calculated and accurately reported on the Form VII summaries within the data packages.

The maximum limit for %D in the CC standard allowed by Region 1 is ±25%. All %D results were below this limit for the CC standards on both instruments, with the following exceptions:

Instrument	CC	Analyte	%D
M (8260B)	10/26/09 08:52	bromomethane	-31.1
L (8260B)	11/2/09 08:40	bromomethane	-25.3

All RRFs were above the 0.05 minimum criterion, with the exceptions of acetone and 2-butanone, in the CC standards as shown:

Instrument	CC	RRF	
		acetone	2-butanone
M (8260B)	10/24/09 03:04	acceptable	0.024
	10/24/09 18:14	acceptable	0.025
	10/26/09 08:52	acceptable	0.027
L (8260B)	11/1/09 06:21	0.048	0.017
	11/2/09 08:40	0.049	0.016
L (524.2)	10/21/09 19:52	0.045	0.017
	10/28/09 08:35	acceptable	0.015

For the reasons discussed in Section III, no results for acetone or 2-butanone were qualified on the basis of the low RRFs in the associated ICs and CCs.

On the basis of the unacceptable %D value in the associated CC standard, results for bromomethane in samples BRW-1, MW-102S, MW-3S, MW-3D, MW-Z, FB-4, MW-PLX, MW-D, FB-5, SEEP-1A, SS-2, W-SEEP, SS-Z, SS-5, SP-4, SP-3, and W-Z were qualified as estimated (UJ).

It should be noted that negative % difference values will result in a low bias for positive detects, and a positive % difference will result in a high bias for positive detects.

The Form 7 submitted in SDG No. WHEA15 for the CC analyzed on instrument M on 10/24/09 at 18:14 is incorrect; it contains the results for the CC analyzed on instrument M on 10/26/09 at 08:52. Since quantitation is performed using the initial calibration, no results are affected by this error, and since the correct Form 7 was submitted in SDG No. UNIF36, the validation was performed using this summary form. The laboratory has been informed of this error, and asked to replace the summary forms within the data package.

V. Blanks

Results for eight (8) water-matrix laboratory method blanks (MBs) were reported in association with this set of samples. Acetone was reported below the quantitation limit at 1.1 ug/L, and carbon disulfide was detected below the quantitation limit at 0.23 ug/L in the MB identified as MBLK102409MA.

Three trip blanks (TBs) were reported in these SDGs. The analytes carbon disulfide (0.35 ug/L; action limit = 1.75 ug/L) and trichloroethene (0.26 ug/L; action limit = 1.30 ug/L) were detected at concentrations below the quantitation limit in TB-2, which accompanied the samples in SDG No. WHEA15. It should be noted that this quantitation is based on unacceptably low internal standard recoveries (see section VII), which may cause a high bias.

Six field blanks (FBs) were reported in these SDGs. Acetone was reported below the quantitation limit in FB-1 at 1.7 ug/L, and in FB-2 at 3.8 ug/L (action limit = 38 ug/L).

No holding (storage) blanks (HBs) were reported in these SDGs.

On the basis of field contamination, results for acetone in samples MW-103D, MW-104D, MW-102D, MW-101D, MW-4D, BRW-3, BRW-2, SEEP-1A, SS-2, and SS-5; results for trichloroethene in samples MW-104D, MW-4D, MW-PL1, and MW-PLX; and results for carbon disulfide in MW-103D, BRW-2, and BRW-1 were qualified as less than the quantitation limit, and results for carbon disulfide in WP-3 and WP-Z and for trichloroethene in W-25 were qualified as less than the reported value (U).

The laboratory appropriately applied "B" qualifiers to sample Form 1 results when the analyte was detected in the associated method blank. All laboratory-applied "B" qualifiers have been removed by the validator.

VI. Surrogate Compounds

Percent recoveries (%R) for all surrogate compounds in both analytical methods were correctly calculated, accurately reported on the Form II summaries within the data packages for Method 8260B, and were within acceptance limits for all sample analyses, with the exception that the three surrogates which are used in the Method 8260B analysis were slightly below (72 – 82 %R) the acceptance criteria (80 – 85 %R) in sample MW-D. This sample was initially analyzed at a greater dilution due to incorrect interpretation of the screen results, with acceptable surrogate recoveries; however, a third analysis was not possible because all sample vials had been utilized. The more dilute analysis was included in the Sample Preparation section of the data package SDG No. UNIF36.

On the basis of unacceptably low surrogate recoveries, results for all analytes in MW-D were qualified as estimated (J, UJ).

VII. Internal Standards (IS)

All IS areas and retention times (RT) were within the established QC limits for all reported sample analyses in these data packages, with the exception that all three internal standards in B-2 were slightly below the lower acceptance limit (50 %R). Due to analyst oversight, no reanalysis was attempted within holding time, and a reanalysis out of holding time was not performed.

On the basis of unacceptably low recoveries of all three internal standards, results for all analytes in TB-2 were qualified as estimated (J, UJ).

The surrogate standards were incorrectly included on the summary forms for the Method 524.2 sample analyses in SDG No. UNIF36.

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

Samples W-1, SS-5, MW-4S, and MW-S2 were used for the Method 8260B MS/MSD analyses in this data set. The spiking solutions contained all target compounds at 1 μg/L (except for the ketones at 5 μg/L). Percent recoveries (%R) and relative percent differences (%RPD) between paired recoveries were correctly calculated and accurately reported on the Form III summaries for the spiked analytes.

All recoveries were acceptable (range 69 – 130 %R; overall laboratory-derived control limits: 60 – 145 %R; Region 1 limits 60 – 140 %R) and reproducible (RPD range 0-27%; limit 30% RPD), with the following exceptions:

Parent Sample	Analyte	% R (MS)	% R (MSD)	Laboratory Limits (%R)	% RPD
W-1	tetrachloroethene	-200	-200	80 - 115	
SS-5	1,1-dichloroethene	120	120	80 - 115	
	carbon disulfide		130	80 - 125	
	methylene chloride		120	80 - 115	
	trans-1,2-dichloroethene		120	80 - 115	
	1,1-dichloroethane		120	80 - 115	
	1,2-dichloropropane		120	80 - 115	
MW-4S	chloromethane			55 - 140	36
	1,1-dichloroethene	120	120	80 - 115	
	methylene chloride	120	130	80 - 115	
	trans-1,2-dichloroethene	120	120	80 - 115	
	1,1-dichloroethane		120	80 - 115	
	cis-1,2-dichloroethene	120		80 - 115	
	trichloroethene	120	120	80 - 115	
	1,1,2-trichloroethane		120	80 - 115	
MW-S2	chloroethane		170	75 - 135	
	1,1-dichloroethene	130	140	80 - 115	
	carbon disulfide		130	80 - 125	
	methylene chloride		130	80 - 115	
	trans-1,2-dichloroethene	130	130	80 - 115	
	1,2-dichloroethene (total)	135	130	80 - 115	
	cis-1,2-dichloroethene	140	130	80 - 115	
	chloroform	120	120	80 - 115	
	1,1,1-trichloroethane	120	120	80 - 115	
	carbon tetrachloride		120	80 - 115	
	1,2-dichloroethane		120	80 - 115	
	trichloroethene	130	120	80 - 115	
	1,2-dichloropropane	120		80 - 115	
	cis-1,3-dichloropropene	120		80 - 115	
	toluene	120		80 - 115	
	1,1,2-trichloroethane	130	120	80 - 115	
	tetrachloroethene	210	140	80 - 115	40
	ethylbenzene		120	80 - 115	

On the basis of recoveries within Region 1 criteria, no qualifications were deemed necessary for recoveries of the analytes shown above slightly above laboratory-established limits in the MS or MSD analyses of samples SS-5, MW-4S, and MW-S2. Since chloromethane, chloroethane, and tetrachloroethene were not detected in samples MW-4S and MW-S2, results for these compounds do not warrant qualification on the basis of poor reproducibility and the recoveries above the laboratory-established and Region 1 upper limits in the associated MS or MSD analyses. On the basis of the native concentration being more than four times the spiking level, the result for tetrachloroethene in sample W-1 does not warrant qualification on the basis of its unacceptably low recoveries in the associated MS and MSD analyses.

Samples KITCHENTAP and WP-8 were used for the Method 524.2 MS/MSD analyses in this data set. The spiking solution contained all target compounds at 1 µg/L (except for the ketones at 5 µg/L) for both MS/MSD pairs. Percent recoveries (%R) and relative percent differences (%RPD) between paired recoveries were correctly calculated and accurately reported on the Form III summaries for the spiked analytes.

All recoveries were acceptable (range 86 – 120 %R; overall limits: 70 – 130 %R) and reproducible (RPD range 0-19%; limit 40% RPD), with the exception of acetone in KITCHEN TAPMS, which was recovered at 148 %R.

Since acetone was not detected in sample KITCHEN TAP, the result for acetone in KITCHEN TAP did not warrant qualification on the basis of its recovery above both laboratory and Region 1 upper acceptance limits.

All analytes were spiked into the MS/MSD analyses; therefore non-spiked target compounds could not be evaluated against the parent samples to evaluate laboratory precision.

IX. Field Duplicates

SDG Nos. BRES45, UNIF36, and WHEA15 contained five groundwater and two potable water field duplicate pairs, which were identified by the field sampler as follows:

Field Sample	Field Duplicate
Groundwater	
MW-3	MW-Z
MW-D	W-Z
W-SEEP	SS-Z
MW-PL1	MW-PLX
MW-25884	BRW-X
Potable Water	
SHIELDS	WELL-Z
WP-3	WP-Z

Precision in the field duplicate pairs MW-3 and MW-Z, MW-PL1 and MW-PLX, and WP-3 and WP-Z was acceptable (less than 30 % RPD) for all target analytes greater than 2 times the quantitation limit. The analyte cis-1,2-dichloroethene was reported at greater than twice the quantitation limit in both members of the field duplicate pair MW-D and W-Z; however, total 1,2-dichloroethene was reported at greater than twice the quantitation limit in MW-D due to the contribution of a small concentration (below the quantitation limit) of the *trans* isomer in that sample only. Trichloroethene and tetrachloroethene were reported at greater than twice the quantitation limit in both members of the field duplicate pair MW-D and W-Z, and evidenced poor reproducibility (30.8 % RPD and 35.1 %RPD, respectively). No target compounds greater than 2 times the quantitation limit were detected in any of the remaining samples, so precision could not be evaluated in these field duplicate pairs.

On the basis of unacceptable reproducibility, results for trichloroethene and tetrachloroethene in MW-D and W-Z were qualified as estimated (J).

X. Sensitivity Check

The aqueous MDL for Method 8260B submitted for this project was begun on 4/21/09 and the MDL verification studies were completed on 5/7/09, which is within one year of the sample analyses in this data set. All analytes had calculated and verified MDLs below the method quantitation limits in the studies.

The aqueous MDL and the MDL verification studies for Method 524.2 submitted for this project were completed on 10/9/08, which is just slightly more than one year prior to the sample analyses in this data set. All analytes had calculated and verified MDLs below the Method quantitation limits in the MDL study.

All of the laboratory control samples and the MS and MSD analyses analyzed with the samples for both methods were spiked at 1 µg/L, as required by the FLCM. Recoveries within or above Region 1 acceptance criteria (60 – 140 %R) were obtained for all target analytes in all spiked analyses (except as noted). In addition, the low standard of the initial calibrations for both methods supports the reporting limit for the sample analyses.

XI. Performance Evaluation (PE) Samples/Accuracy Check

Five zero blind PE samples (commonly known as laboratory control sample, LCS) and duplicate (LCSD) pairs were prepared and analyzed by the laboratory at 1 µg/L (ketones at 5 ug/L) on instrument M in support of the Method 8260B sample analyses in this data set. Laboratory established control limits are 60 – 145%R overall; the Region 1 control limits are 60 – 140 %R. Percent recoveries were correctly calculated and accurately reported on Form III summaries in the data packages, and were acceptable (84 – 136 %R) for the LCS and LCSD pairs analyzed on 10/24/09, 10/26/09, 11/1/09, and 11/2/09, with the exception of one-quarter to one-half the analytes, which were slightly above (120 – 130 %R) the upper laboratory limit, but within the Region 1 limits, for the LCS and LCSD pairs analyzed on instrument M on 10/24/09 and 10/26/09. One to three analytes were slightly above the laboratory upper limit, but within Region 1 control limits, in the LCS and LCSD pairs analyzed on instrument L on 11/1/09 and 11/2/09.

No reanalysis was performed for the unacceptably high recoveries in the LCS/LCSD pairs analyzed for Method 8260B. Pursuant to the Region I validation document, results for all analytes detected in sample analyses associated with an LCS or LCSD analysis in which more than one half the analytes are recovered above the upper control limit warrant qualification as estimated (J). However, most recoveries were just slightly above laboratory control limits, and were within Region 1 control limits, so on the basis of professional judgment, no qualifications were applied on the basis of LCS or LCSD recoveries above the laboratory limits but within Region I upper control limits.

No analytes were found outside both laboratory and Region I control limits in any LCS or LCSD analyses. Reproducibility between all Method 8260B LCS and LCSD pairs was acceptable (0 – 26 % RPD).

Three zero blind PE sample (commonly known as laboratory control sample, LCS) and duplicate (LCSD) pairs were prepared and analyzed by the laboratory at 1 µg/L (ketones at 5 ug/L) on instrument L in support of the Method 524.2 sample analyses in this data set. Percent recoveries were correctly calculated and accurately reported on Form III summaries in the data packages, and were within (87 – 140 %R) laboratory established control limits (70 – 130 %R), with the following exceptions:

LCS/LCSD ID	Analyte	% R (LCS)	% R (LCSD)	%RPD
LB102109	chloromethane	160	160	
	chloroethane	150	140	
	acetone	146		
	2-butanone	62		62
LA102809	acetone		132	

Since chloromethane, chloroethane, and acetone were not detected in associated samples, no results warranted qualification on the basis of unacceptably high recoveries in the associated LCS/LCSD pairs. On the basis of the unacceptably low recovery of 2-butanone in the LCS identified as LB102109LCS, results for 2-butanone in TB-1, SHIELDS, WELL-Z, FB-1, KITCHEN TAP, and PRE-FILTER were qualified as estimated (UJ).

One external single-blind PES sample for Method 524.2 was submitted with the samples in this sampling round. The results of the PES are summarized in Appendix C. All spiked compounds were within the vendor's published QC Performance Acceptance Limits (three standard deviations), with the following exceptions:

Analyte	**Result (ug/L)**	**Lab Qualifier**	**% Recovery**	**Certified Value**	**Acceptance Range**
trans-1,2-Dichloroethene	36	E	77.8	46.3	37.0 - 55.6
1,1,1-Trichloroethane	14		77.3	18.1	14.5 - 21.7
Tetrachloroethene	8.5		72.0	11.8	9.44 - 14.2
Ethylbenzene	11.8		78.7	15	12.0 - 18.0
m,p-Xylenes	18		67.2	26.8	n/a
Xylene (total)	22		70.7	31.1	24.9 - 37.3
Styrene	nd		0.0	5.2	3.14 - 7.32
o-Xylene	3.4		78.3	4.34	n/a

n/a = not available nd = not detected

Based on examination of the raw data to determine the value before rounding for reporting, chlorobenzene was recovered just within the acceptance range, at 22.3 ug/L (acceptance range 22.2 - 33.4 ug/L), and ethylbenzene was recovered just below the acceptance range, at 11.8 ug/L, as shown above. Styrene was not detected, and a dilution analysis was not performed to bring the result for trans-1,2-dichloroethene within the established calibration range. The laboratory was informed of these unacceptable results, and responded quickly.

The corrective action plan submitted by the laboratory in response to the validator's request to address the issue of the low recoveries for the analytes shown is included in Attachment C of this report, and is discussed in further detail in the annual QA Summary Report. Pursuant to the Region I validation document, on the basis of recoveries outside the vendor's established limits, non-detected results for trans-1,2-dichloroethene, 1,1,1-trichloroethane, tetrachloroethene, ethylbenzene, total xylene, and styrene in all Method 524.2 sample analyses warrant rejection (R).

However, the PT vendor was consulted by the laboratory, and they acknowledged that the stock standard used for making the whole-volume PT had exhibited lower than normal (although still acceptable)

values when originally used in 2008 for a national water supply PT study, in which approximately 60 laboratories participated. The recoveries for the target analytes trans-1,2-dichloroethene, 1,1,1-trichloroethane, tetrachloroethene, and ethylbenzene were above 70 % recovery, although they were below the vendor's minimum acceptance criteria. Styrene was not detected, and the m,p-xylenes were recovered at 67 %.

Since all Method 524.2 sample analyses, including the PT sample, met all method requirements (with the single exception of the lack of dilution for the high trans-1,2-dichloroethene result), it is the opinion of the laboratory with the concurrence of the data validator that a non-detected result is valid at the concentration represented by the lowest detectable value within method criteria (70 – 130 %R). The adjusted quantitation limit for a 70 % recovery is 0.5 ug/L /70%, or 0.71 ug/L. Since the analytes trans-1,2-dichloroethene, 1,1,1-trichloroethane, tetrachloroethene, and o-xylene were recovered above 70 %R in the PT analysis, the non-detected results in associated field samples are deemed acceptable at a concentration not less than 0.7 ug/L.

On the basis of professional judgment, all non-detected results in all drinking water field samples for trans-1,2-dichloroethene, 1,1,1-trichloroethane, tetrachloroethene, and o-xylene were qualified as less than the adjusted quantitation limit (U), and the quantitation limit was adjusted to a value equivalent to a 70% recovery. Although an acceptance range for the combined m- & p-xylene isomers and the o-xylene isomer were not established by the vendor, on the basis of unacceptably low recovery in the PT sample, results for m,p-xylenes and total xylenes were rejected (R) in all samples analyzed by Method 524.2.

XII. Target Compound Identification

Reported target compounds were correctly identified with supporting spectra present for all samples in these data packages.

XIII. Compound Quantitation and Reported Quantitation Limits

Target compound quantitation and practical quantitation limits (PQLs) were accurately reported on the Form I summaries. Based on screen results, dilution analyses were initially performed for samples MW-102S, MW-101D, MW-3S, MW-D, and W-Z to bring results for tetrachloroethene within the upper half of the calibration range. All dilutions were less than 4-fold, so a full-strength analysis was not required. Tetrachloroethene was detected above the calibration range in the original analyses of samples MW-3D and MW-Z; these samples were reanalyzed at an appropriate dilution to bring tetrachloroethene within the upper half of the calibration range, and both sets of analyses were reported in the data package.

Results for tetrachloroethene initially outside the calibration range in the original analyses of samples MW-3D and MW-Z were rejected (R), and replaced with the acceptable concentrations from the corresponding diluted samples (MW-3DDL and MW-ZDL).

Results for all other analytes in samples MW-3DDL and MW-ZDL were rejected (R) because acceptable results for these compounds were taken from the original analyses (MW-3D and MW-Z).

"E" qualifiers were appropriately applied by the laboratory to sample Form I results when concentrations of target analytes were greater than the instrument calibration range. "D" qualifiers were properly applied by the laboratory to positive results from diluted sample analyses. The validator removed all

laboratory-applied "E" and "D" qualifiers. An "X" has been drawn across the entire Form I for the diluted analyses noted above.

The laboratory appropriately applied "J" qualifiers to the sample Form I's when the concentration of an analyte was less than the sample-specific PQL. The validator did not remove these qualifiers.

The values that the validator has judged to be acceptable are presented on the Data Summary Forms in Attachment A and on the Form 1s in Attachment B.

The Data Summary Forms (DSFs) in Attachment A list all individual sample analytes affected by the applied qualifications. All positive results are listed on these forms, whether or not the value or qualifier was changed as a result of the validation. Where no result is listed, the compound was not detected and the PQL was not qualified. Sample-specific quantitation limits may be found on the laboratory-generated Form I for each sample (Attachment B) or may be calculated for waters from the information on the DSFs as follows: unadjusted PQL (far left column) multiplied by the concentration/dilution factor (DF).

XIV. Tentatively Identified Compounds (TICs)

Evaluation of unidentified, non-target analyte peaks was not requested or performed for these samples.

XV. System Performance

The analytical systems appear to have been operating well at the time of these analyses based on the evaluation of the available raw data.

XVI. Overall Evaluation of Data

Results for volatile organic compounds were determined to be valid as reported for all samples in SDG Nos. BRES45, UNIF36, and WHEA15, with the following exceptions:

- On the basis of recoveries in the ICV outside established criteria, results for chloromethane and 1,1,-dichloroethane in samples TB-1, SHIELDS, WELL Z, FB-1, KITCHEN TAP, and PRE-FILTER, and for chloroethane in all samples analyzed by Method 524.2 were qualified as estimated (UJ).

- On the basis of the unacceptable %D value in the associated CC standard, results for bromomethane in samples BRW-1, MW-102S, MW-3S, MW-3D, MW-Z, FB-4, MW-PLX, MW-D, FB-5, SEEP-1A, SS-2, W-SEEP, SS-Z, SS-5, SP-4, SP-3, and W-Z were qualified as estimated (UJ).

- On the basis of field contamination, results for acetone in samples MW-103D, MW-104D, MW-102D, MW-101D, MW-4D, BRW-3, BRW-2, SEEP-1A, SS-2, and SS-5; results for trichloroethene in samples MW-104D, MW-4D, MW-PL1, and MW-PLX; and results for carbon disulfide in MW-103D, BRW-2, and BRW-1 were qualified as less than the quantitation limit, and results for carbon disulfide in WP-3 and WP-Z and for trichloroethene in W-25 were

qualified as less than the reported value (U).

- The laboratory appropriately applied "B" qualifiers to sample Form 1 results when the analyte was detected in the associated method blank. All laboratory-applied "B" qualifiers have been removed by the validator.

- On the basis of unacceptably low surrogate recoveries, results for all analytes in MW-D were qualified as estimated (J, UJ).

- On the basis of unacceptably low recoveries of all three internal standards, results for all analytes in TB-2 were qualified as estimated (J, UJ).

- On the basis of unacceptable reproducibility, results for trichloroethene and tetrachloroethene in MW-D and W-Z were qualified as estimated (J).

- On the basis of professional judgment, all non-detected results in all drinking water field samples for trans-1,2-dichloroethene, 1,1,1-trichloroethane, tetrachloroethene, and o-xylene were qualified as less than the adjusted quantitation limit (U), and the quantitation limit was adjusted to a value equivalent to a 70% recovery (0.71 ug/L).

- On the basis of unacceptably low recovery in the PT sample, results for m,p-xylenes and total xylenes were rejected (R) in all samples analyzed by Method 524.2.

- On the basis of the unacceptably low recovery of 2-butanone in the LCS identified as LB102109LCS, results for 2-butanone in TB-1, SHIELDS, WELL-Z, FB-1, KITCHEN TAP, and PRE-FILTER were qualified as estimated (UJ).

- Results for tetrachloroethene initially outside the calibration range in the original analyses of samples MW-3D and MW-Z were rejected (R), and replaced with the acceptable concentrations from the corresponding diluted samples (MW-3DDL and MW-ZDL).

- Results for all other analytes in samples MW-3DDL and MW-ZDL were rejected (R) because acceptable results for these compounds were taken from the original analyses (MW-3D and MW-Z).

- "E" qualifiers were appropriately applied by the laboratory to sample Form I results when concentrations of target analytes were greater than the instrument calibration range. "D" qualifiers were properly applied by the laboratory to positive results from diluted sample analyses. The validator removed all laboratory-applied "E" and "D" qualifiers.

- The laboratory appropriately applied "J" qualifiers to the sample Form I's when the concentration of an analyte was less than the sample-specific PQL. The validator did not remove these qualifiers.

Documentation problems observed in the data packages are described in Section XVII.

XVII. Documentation

Chain-of-custody (COC) and internal chain of custody (ICOC) records were present and completed accurately.

Data presentation was acceptable, with the following observations:

- The Form 7 submitted in SDG No. WHEA15 for the CC analyzed on instrument M on 10/24/09 at 18:14 is incorrect; it contains the results for the CC analyzed on instrument M on 10/26/09 at 08:52. Since quantitation is performed using the initial calibration, no results are affected by this error, and since the correct Form 7 was submitted in SDG No. UNIF36, the validation was performed using this summary form. The laboratory has been informed of this error, and asked to replace the summary forms within the data package.

- The Form VIII summaries submitted with the Method 524.2 samples included not just the internal standard areas and RTs, but also the areas and RTs for the four surrogate standards. Corrected forms have been requested from the laboratory.

This validation report should be considered <u>part of the data packages</u> for all future distributions of the volatiles (8260B and 524.2) analysis data.