

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90057-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by a Senior Chemist. Signatures indicate the report is approved for release.



Travis Withers

2017.02.10 14:48:25 -07'00'

Travis Withers, Validation Chemist, TEC-WESTON JV

Date



Peter Chapman, Senior Chemist, TEC-WESTON JV

Date

2/10/17

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 4** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90057-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polycyclic Aromatic Hydrocarbons (PAHs)	8270D SIM	Denver, CO
Explosives	8330B	Denver, CO
Metals	6010C/6020A/7470A	Denver, CO
Alkalinity	2320B	Denver, CO
Hexavalent Chromium	353.2	Denver, CO
Total Cyanide	9012B	Denver, CO
Sulfide	9034	Denver, CO
Nitrate/Nitrite/Sulfate	9056A	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R)

should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	SVOCs	PAHs	Explosives	Metals	Alkalinity	Cr(VI)	Cyanide
LL6mw-007-102416-GW	280-90057-1	10/24/16	Groundwater			✓	✓	✓				✓
LL6mw-003-102416-GW	280-90057-2	10/24/16	Groundwater		✓	✓	✓	✓				✓
LL6mw-499-102416-GW	280-90057-3	10/24/16	Groundwater	Field Duplicate	✓	✓	✓	✓				✓
FBQmw-173-102516-GW	280-90057-4	10/25/16	Groundwater		✓			✓	✓			✓
LL5mw-001-102516-GW	280-90057-5	10/25/16	Groundwater		✓							
LL6mw-008-102516-GW	280-90057-6	10/25/16	Groundwater			✓	✓	✓				✓
FBQmw-167-102516-GW	280-90057-7	10/25/16	Groundwater		✓	✓	✓	✓	✓			✓
FBQmw-171-102516-GW	280-90057-8	10/25/16	Groundwater		✓			✓	✓	✓	✓	✓
Trip Blank	280-90057-9	10/25/16	Water		✓							
FBQmw-166-102516-GW	280-90057-10	10/25/16	Groundwater	MS/MSD	✓	✓	✓	✓				✓

Note: LL6mw-499-102416-GW is a field duplicate of parent sample LL6mw-003-102416-GW.

Samples were also analyzed for natural attenuation parameters; these parameters were not validated.

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
J	IC	Estimated detection; initial calibration verification did not meet acceptance criteria.
J	CC	Estimated detection; continuing calibration verification did not meet acceptance criteria.
J	L	Estimated detection; LCS/LCSD percent recovery or RPD exceedance.
UJ	CC	Estimated non-detection; continuing calibration verification did not meet acceptance criteria.
UJ	L	Estimated non-detection; LCS/LCSD percent recovery or RPD exceedance.
UJ	M	Estimated non-detection; MS/MSD percent recovery or RPD exceedance.
UJ	S	Estimated non-detection; surrogate outlier.

Validation Flag	Reason Code	Description
U	B	Not detected; target analyte was detected in the method or calibration blank.
R	M	Rejected, data is not usable; MS/MSD percent recovery <10%.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on October 26, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

No sample date/time was provided for the trip blank on the COC. Per standard practice, the laboratory logged the sample as the earliest sample date/time.

All sample IDs were changed to have a lower case “mw” instead of an upper case “MW.”

“-GW” was added to the end of all sample IDs to comply with the RIWP.

PCB analysis requested on sample LL5mw-001-102516-GW was canceled due to incorrect sample bottle size provided by the laboratory. This sample fraction was recollected at a later date and then analyzed for PCBs.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- MS/MSD recoveries & RPDs
- Instrument tuning
- Initial calibration verification
- Internal standard recoveries

All analytical or quality parameters requiring further discussion for Method 8260B are described in the sections below.

1.4.1.1 Method Blanks

Methylene chloride (2.45 µg/L) was detected in the method blank at a concentration below the LOQ (5.0 µg/L). Methylene chloride was detected in samples LL6mw-003-102416-GW (0.80

µg/L), LL6mw-499-102416-GW (0.86 µg/L), FBQmw-173-102516-GW (0.95 µg/L), LL5mw-001-102516-GW (0.86 µg/L), FBQmw-167-102516-GW (0.87 µg/L), FBQmw-171-102516-GW (0.82 µg/L), TripBlank (1.1 µg/L), and FBQ-166-102516-GW (0.92 µg/L) at concentrations below the LOQ. These sample results were qualified as non-detect at the LOQ (U B).

1.4.1.2 Trip Blanks

Methylene chloride (1.1 µg/L) was detected in the trip blank at a concentration below the LOQ (5.0 µg/L). This result was qualified as non-detect due to method blank contamination; therefore, no qualification was necessary. See section 1.4.1.1 for method blank contamination details.

1.4.1.3 Surrogate Recoveries

Surrogate 1,2-dichloroethane-d4 was recovered below the QC limits in sample FBQmw-171-102516-GW. All associated sample results were qualified as estimated (UJ S).

1.4.1.4 Laboratory Control Samples

Methylene chloride (130%) was recovered in the LCS above the QC limits (74-124%). All associated samples were either non-detect or qualified as non-detect due to method blank contamination; therefore no qualification was necessary. See section 1.4.1.1 for method blank contamination details.

1.4.1.5 Continuing Calibration Verification

Chloromethane (-23.5%D) was recovered outside of the acceptance criteria ($\pm 20\%$ D) in CCV 280-350280/2 associated with all samples analyzed for VOCs. The associated chloromethane sample results were qualified as estimated (UJ CC).

1.4.1.6 Field Duplicates

One field duplicate (LL6mw-499-102416-GW) was collected and analyzed for VOCs. All parent and field duplicate sample results were non-detect; therefore, no RPDs were calculated.

1.4.1.7 Stage 4 Validation

Re-quantification and recalculation of samples and instrument QC was preformed and confirmed with the outputs provided by the laboratory. Where applicable, chromatograms were assessed for

manual peak integrations, baselines, and interferences. Mass spectra were checked for minimum signal noise, qualitative ion mass presence, and ion abundances. No action was required.

1.4.2 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- Instrument tuning
- Initial calibration verification
- Continuing calibration verification
- Internal standard recoveries

All analytical or quality parameters requiring further discussion for Method 8270D are described in the sections below.

1.4.2.1 Laboratory Control Sample/Laboratory Control Sample Duplicates

Hexachlorocyclopentadiene (42%) exceeded the RPD in LCSD 280-349006/3-A associated with samples LL6-007-102416-GW, LL6mw-003-102416-GW, and LL6mw-499-102416-GW. All associated sample results were non-detect; therefore, no qualification was necessary.

1.4.2.2 Matrix Spike/Matrix Spike Duplicates

An MS/MSD was performed on sample FBQmw-166-102516-GW. Hexachlorocyclopentadiene had a recovery of 0% in the MSD. The parent sample result was qualified as rejected due to the extremely low recovery (R M). It is noted that hexachlorocyclopentadiene is a poor performer for this method.

All other recoveries and RPDs were within QC limits.

1.4.2.3 Field Duplicates

One field duplicate (LL6mw-499-102416-GW) was collected and analyzed for SVOCs. All parent and field duplicate sample results were non-detect; therefore, no RPDs were calculated.

1.4.2.4 Stage 4 Validation

Re-quantification and recalculation of samples and instrument QC was performed and confirmed with the outputs provided by the laboratory. Where applicable, chromatograms were assessed for manual peak integrations, baselines, and interferences. Mass spectra were checked for minimum signal noise, qualitative ion mass presence, and ion abundances. No action was required.

1.4.3 Polycyclic Aromatic Hydrocarbons by Method 8270D SIM

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- LCS recoveries
- Field duplicates
- Instrument tuning
- Initial calibration verification
- Continuing calibration verification
- Internal standard recoveries

All analytical or quality parameters requiring further discussion for Method 8270D SIM are described in the sections below.

1.4.3.1 Surrogate Recoveries

Surrogate nitrobenzene-d5 recovered below the recovery criteria (55-111%) in samples LL6mw-008-102516-GW (48%) and FBQmw-167-102516-GW (54%). All sample results associated with the surrogate exceedance were qualified as estimated (UJ S).

1.4.3.2 Method Blanks

Benzo(a)pyrene (0.120 µg/L) and dibenz(a,h)anthracene (0.00872 µg/L) were detected at a concentration below their respective LOQs (0.10 µg/L and 0.10 µg/L). This method blank is associated with the reanalysis of samples FBQmw-167-102516-GW and FBQmw-166-102516-GW. The associated sample results were non-detect; therefore, no qualification was necessary.

1.4.4 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs

- Method blanks
- Initial calibration verification
- Continuing calibration verification
- 2nd column confirmation

All analytical or quality parameters requiring further discussion for Method 8330B are described in the sections below.

1.4.4.1 Surrogate Recoveries

Surrogate 1,2-dinitrobenzene was recovered below the recovery limits (83-119%) in samples LL6mw-003-102416-GW (55%), LL6mw-499-102416-GW (73%), LL6mw-008-102416-GW (73%), FBQmw-167-102516-GW (82%), and FBQmw-166-102516-GW (78%). The associated sample results were qualified as estimated (UJ S).

1.4.4.2 Laboratory Control Samples

Several analytes were recovered outside of the LCS QC criteria. These exceedances are outlined in the table below:

Analyte	LCS %R	%R Limits	DV Flag
2-Amino-4,6-dinitrotoluene	70	79-120	UJ L
4-Amino-2,6-dinitrotoluene	74	76-125	
1,3-Dinitrobenzene	77	78-120	
2,4-Dinitrotoluene	75	78-120	
2,6-Dinitrotoluene	69	77-127	
2-Nitrotoluene	62	70-127	
3-Nitrotoluene	67	73-125	
4-Nitrotoluene	67	71-127	

%R = Percent recovery

All associated samples were non-detect for the samples outlined in the table above. These sample results were qualified as estimated (J/UJ L).

1.4.4.3 Matrix Spike/Matrix Spike Duplicates

An MS/MSD was performed on sample FBQmw-166-102516-GW. All recoveries and RPDs were within QC limits with the exception of the exceedances outlined in the table below:

Parent Sample	Analyte	MS %R	MSD %R	%R Limits	RPD	RPD Limits	Assigned Flags
FBQmw-166-102516-GW	2-Amino-4,6-dinitrotoluene	74	64	79-120	8	20	UJ M
	4-Amino-2,6-dinitrotoluene	73	65	76-125	6	20	UJ M

1,3-Dinitrotoluene	86	75	78-120	8	20	None
2,4-Dinitrotoluene	73	62	78-120	11	20	UJ M
2,6-Dinitrotoluene	68	59	77-127	9	20	UJ M
Nitrobenzene	74	64	65-134	9	20	None
2-Nitrotoluene	66	61	70-127	3	20	UJ M
3-Nitrotoluene	71	60	73-125	11	20	UJ M
4-Nitrotoluene	66	65	71-127	4	20	UJ M
Tetryl	71	61	64-128	9	20	None

%R = percent recovery

Bolded values are outside control limits

The parent sample results for 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, and 4-nitrotoluene were qualified as estimated (UJ M).

1.4.4.4 Field Duplicates

One field duplicate (LL6mw-499-102416-GW) was collected and analyzed for explosives. All parent and field duplicate sample results were non-detect; therefore, no RPDs were calculated.

1.4.4.5 Holding Times

Samples LL6mw-007-102416-GW, LL6mw-003-102416-GW, LL6mw-499-102416-GW, FBQmw-173-102516-GW, LL6mw-008-102516-GW, FBQmw-167-102516-GW, FBQmw-171-102516-GW, FBQmw-166-102516-GW were re-extracted and reanalyzed outside of holding time due to low surrogate and LCS recoveries in the initial analysis. The reanalysis produced similar results. The initial results were reported.

1.4.4.6 Stage 4 Validation

Re-quantification and recalculation of samples and instrument QC was performed and confirmed with the outputs provided by the laboratory. Where applicable, chromatograms were assessed for manual peak integrations, baselines, and interferences. Mass spectra were checked for minimum signal noise, qualitative ion mass presence, and ion abundances. No action was required.

1.4.5 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- LCS recoveries
- Low level calibration check standard
- Interference check solutions
- Instrument tuning

All analytical or quality parameters requiring further discussion for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.5.1 Method Blanks

Several analytes were detected in the method blanks at concentrations below the LOQ. These detections are outlined in the table below:

Associated Samples	Analyte	Blank Detection (µg/L)	LOQ (µg/L)	Assigned Flags	Samples Qualified
FBQmw-173-102516-GW FBQmw-171-102516-GW	Aluminum	22	300	U B	FBQmw-173-102516-GW FBQmw-171-102516-GW
FBQmw-173-102516-GW FBQmw-171-102516-GW	Calcium	44.5	1000	None	N/A
FBQmw-173-102516-GW FBQmw-171-102516-GW	Magnesium	15.3	500	None	N/A
FBQmw-173-102516-GW FBQmw-167-102516-GW FBQmw-171-102516-GW	Vanadium	0.565	6	U B	FBQmw-173-102516-GW FBQmw-167-102516-GW FBQmw-171-102516-GW

Detections less than the LOQ in associated samples are qualified as not detected at the LOQ (U B).

1.4.5.2 Calibration Blanks

Several analytes were detected in the calibration blanks bracketing the samples. The following table presents the initial and continuing calibration blank detections:

Calibration Blank ID	Associated Samples	Analyte	Blank Detection (µg/L)	LOQ (µg/L)	Assigned Flags	Samples Qualified
ICB 280-350593/12	FBQmw-173-102516-GW FBQmw-167-102516-GW FBQmw-171-102516-GW	Antimony	0.587	2	None	None
CCB 280-350593/72	FBQmw-173-102516-GW	Vanadium	0.841	5	U B	FBQmw-173-102516-GW

	FBQmw-167-102516-GW FBQmw-171-102516-GW					FBQmw-167-102516-GW FBQmw-171-102516-GW
CCB 280-350593/84	FBQmw-173-102516-GW FBQmw-167-102516-GW FBQmw-171-102516-GW	Vanadium	0.82	5	U B	FBQmw-173-102516-GW FBQmw-167-102516-GW FBQmw-171-102516-GW

CCB = continuing calibration blank
ICB = initial calibration blank

Detections less than the LOQ in associated samples were qualified as not detected at the LOQ (U B).

1.4.5.3 Initial/Continuing Calibration Verification

Several analytes recovered outside of the initial/continuing calibration verification acceptance criteria. These exceedances are outlined in the table below:

Calibration Verification ID	Associated Samples	Analyte	%R	%R Limits	Assigned Flags	Sampled Qualified
CCVL 280-349628/120	FBQmw-173-102516-GW FBQmw-171-102516-GW	Iron	203	100-120	J CC	FBQmw-173-102516-GW
CCVL 280-349840/24	FBQmw-167-102516-GW	Aluminum	122	100-120	J CC	FBQmw-167-102516-GW
		Iron	121	100-120	J CC	FBQmw-167-102516-GW
CCVL 280-349840/38	FBQmw-167-102516-GW	Aluminum	121	100-120	J CC	FBQmw-167-102516-GW
ICVL 280-350593/13	FBQmw-173-102516-GW FBQmw-167-102516-GW FBQmw-171-102516-GW	Barium	127	100-120	J IC	FBQmw-173-102516-GW FBQmw-167-102516-GW FBQmw-171-102516-GW
		Beryllium	125	100-120	None	None

%R = percent recovery

Detections were qualified as estimated (J IC/CC).

1.4.5.4 Stage 4 Validation

Re-quantification and recalculation of samples and instrument QC was performed and confirmed with the outputs provided by the laboratory. Where applicable, chromatograms were assessed for manual peak integrations, baselines, and interferences. Mass spectra were checked for minimum signal noise, qualitative ion mass presence, and ion abundances. No action was required.

1.4.6 Alkalinity by Method 2320B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

All analytical or quality parameters requiring further discussion for Method 2320B are described in the sections below.

1.4.6.1 Method Blanks

Alkalinity (2.61 mg/L) was detected in the method blank at a concentration below the LOQ (5.0 mg/L). All associated sample results were above the LOQ; therefore, no qualification was necessary.

1.4.6.2 Stage 4 Validation

Re-quantification and recalculation of samples and instrument QC was performed and confirmed with the outputs provided by the laboratory. Where applicable, chromatograms were assessed for manual peak integrations, baselines, and interferences. Mass spectra were checked for minimum signal noise, qualitative ion mass presence, and ion abundances. No action was required.

1.4.7 Hexavalent Chromium by Method 7196A

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- LODs and LOQs
- Method blanks
- LCS recoveries
- Initial calibration verification

- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks
- Holding times

No parameters required further discussion for Method 7196A.

1.4.7.1 Stage 4 Validation

Re-quantification and recalculation of samples and instrument QC was preformed and confirmed with the outputs provided by the laboratory. Where applicable, chromatograms were assessed for manual peak integrations, baselines, and interferences. Mass spectra were checked for minimum signal noise, qualitative ion mass presence, and ion abundances. No action was required.

1.4.8 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- LCS recoveries
- MS/MSD recoveries and RPDs
- Field duplicates
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

All analytical or quality parameters requiring further discussion for Method 9012B are described in the sections below.

1.4.8.1 Method Blanks

Total cyanide (2.58 µg/L) was detected in method blank MB 280-350115/4-A associated with samples FBQmw-173-102516-GW, LL6mw-008-102516-GW, FBQmw-167-102516-GW, FBQmw-171-102516-GW, and FBQmw-166-102516-GW at a concentration below the LOQ (10 µg/L). Total cyanide was detected in samples FBQmw-173-102516-GW (2.2 µg/L), LL6mw-008-102516-GW (3.2 µg/L), and FBQmw-166-102516-GW (7.3 µg/L) at concentrations below the LOQ. These sample results were qualified as non-detect at the LOQ (U B). All other associated sample results were non-detect; therefore, no qualification was necessary.

1.4.8.2 Stage 4 Validation

Re-quantification and recalculation of samples and instrument QC was performed and confirmed with the outputs provided by the laboratory. Where applicable, chromatograms were assessed for manual peak integrations, baselines, and interferences. Mass spectra were checked for minimum signal noise, qualitative ion mass presence, and ion abundances. No action was required.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90057-1	LL6mw-007-102416-GW	280-90057-1	Water	1,3-Dinitrobenzene	99-65-0	µg/L	0.42	u q	uj	n	0.42	0.2	0.093	Explosives and Propellants	L
280-90057-1	LL6mw-007-102416-GW	280-90057-1	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.42	u q	uj	n	0.42	4.4	0.088	Explosives and Propellants	L
280-90057-1	LL6mw-007-102416-GW	280-90057-1	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u q	uj	n	0.21	4.4	0.068	Explosives and Propellants	L
280-90057-1	LL6mw-007-102416-GW	280-90057-1	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.21	u q	uj	n	0.21	0.12	0.053	Explosives and Propellants	L
280-90057-1	LL6mw-007-102416-GW	280-90057-1	Water	2-Nitrotoluene	88-72-2	µg/L	0.42	u q	uj	n	0.42	0.2	0.09	Explosives and Propellants	L
280-90057-1	LL6mw-007-102416-GW	280-90057-1	Water	3-Nitrotoluene	99-08-1	µg/L	0.42	u q	uj	n	0.42	0.2	0.088	Explosives and Propellants	L
280-90057-1	LL6mw-007-102416-GW	280-90057-1	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.21	u q	uj	n	0.21	0.12	0.061	Explosives and Propellants	L
280-90057-1	LL6mw-007-102416-GW	280-90057-1	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	uj	n	1.1	0.4	0.21	Explosives and Propellants	L
280-90057-1	LL6mw-003-102416-GW	280-90057-2	Water	Chloromethane	74-87-3	µg/L	2	u q	uj	n	2	0.8	0.3	VOCs	CC
280-90057-1	LL6mw-003-102416-GW	280-90057-2	Water	Methylene chloride	75-09-2	µg/L	5	j q	u	n	5	0.8	0.32	VOCs	B
280-90057-1	LL6mw-003-102416-GW	280-90057-2	Water	1,3,5-Trinitrobenzene	99-35-4	µg/L	0.42	u q	uj	n	1.1	0.42	0.21	Explosives and Propellants	S
280-90057-1	LL6mw-003-102416-GW	280-90057-2	Water	1,3-Dinitrobenzene	99-65-0	µg/L	0.42	u q	uj	n	0.42	0.2	0.093	Explosives and Propellants	L S
280-90057-1	LL6mw-003-102416-GW	280-90057-2	Water	2,4,6-Trinitrotoluene	118-96-7	µg/L	0.42	u q	uj	n	0.42	0.2	0.076	Explosives and Propellants	S
280-90057-1	LL6mw-003-102416-GW	280-90057-2	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.42	u q	uj	n	0.42	4.4	0.088	Explosives and Propellants	L S
280-90057-1	LL6mw-003-102416-GW	280-90057-2	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u q	uj	n	0.21	4.4	0.068	Explosives and Propellants	L S
280-90057-1	LL6mw-003-102416-GW	280-90057-2	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.21	u q	uj	n	0.21	0.12	0.053	Explosives and Propellants	L S
280-90057-1	LL6mw-003-102416-GW	280-90057-2	Water	2-Nitrotoluene	88-72-2	µg/L	0.42	u q	uj	n	0.42	0.2	0.09	Explosives and Propellants	L S
280-90057-1	LL6mw-003-102416-GW	280-90057-2	Water	3-Nitrotoluene	99-08-1	µg/L	0.42	u q	uj	n	0.42	0.2	0.088	Explosives and Propellants	L S
280-90057-1	LL6mw-003-102416-GW	280-90057-2	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.21	u q	uj	n	0.21	0.12	0.061	Explosives and Propellants	L S
280-90057-1	LL6mw-003-102416-GW	280-90057-2	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	uj	n	1.1	0.4	0.21	Explosives and Propellants	L S
280-90057-1	LL6mw-003-102416-GW	280-90057-2	Water	HMX	2691-41-0	µg/L	0.42	u q	uj	n	0.42	0.2	0.092	Explosives and Propellants	S
280-90057-1	LL6mw-003-102416-GW	280-90057-2	Water	Nitrobenzene	98-95-3	µg/L	0.42	u q	uj	n	0.42	2	0.096	Explosives and Propellants	S
280-90057-1	LL6mw-003-102416-GW	280-90057-2	Water	Nitroglycerin	55-63-0	µg/L	3.2	u q	uj	n	3.2	2	0.97	Explosives and Propellants	S
280-90057-1	LL6mw-003-102416-GW	280-90057-2	Water	PETN	78-11-5	µg/L	2.1	u q	uj	n	2.1	1.2	0.44	Explosives and Propellants	S
280-90057-1	LL6mw-003-102416-GW	280-90057-2	Water	RDX	121-82-4	µg/L	0.21	u q	uj	n	0.21	0.12	0.055	Explosives and Propellants	S
280-90057-1	LL6mw-003-102416-GW	280-90057-2	Water	Tetryl	479-45-8	µg/L	0.25	u q	uj	n	0.25	0.2	0.084	Explosives and Propellants	S
280-90057-1	LL6mw-499-102416-GW	280-90057-3	Water	Chloromethane	74-87-3	µg/L	2	u q	uj	n	2	0.8	0.3	VOCs	CC
280-90057-1	LL6mw-499-102416-GW	280-90057-3	Water	Methylene chloride	75-09-2	µg/L	5	j q	u	n	5	0.8	0.32	VOCs	B
280-90057-1	LL6mw-499-102416-GW	280-90057-3	Water	1,3,5-Trinitrobenzene	99-35-4	µg/L	1.1	u q	uj	n	1.1	0.4	0.22	Explosives and Propellants	S
280-90057-1	LL6mw-499-102416-GW	280-90057-3	Water	1,3-Dinitrobenzene	99-65-0	µg/L	0.43	u q	uj	n	0.43	0.2	0.096	Explosives and Propellants	L S
280-90057-1	LL6mw-499-102416-GW	280-90057-3	Water	2,4,6-Trinitrotoluene	118-96-7	µg/L	0.43	u q	uj	n	0.43	0.2	0.078	Explosives and Propellants	S
280-90057-1	LL6mw-499-102416-GW	280-90057-3	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.43	u q	uj	n	0.43	4.4	0.09	Explosives and Propellants	L S
280-90057-1	LL6mw-499-102416-GW	280-90057-3	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.22	u q	uj	n	0.22	4.4	0.07	Explosives and Propellants	L S
280-90057-1	LL6mw-499-102416-GW	280-90057-3	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.22	u q	uj	n	0.22	0.12	0.055	Explosives and Propellants	L S
280-90057-1	LL6mw-499-102416-GW	280-90057-3	Water	2-Nitrotoluene	88-72-2	µg/L	0.43	u q	uj	n	0.43	0.2	0.092	Explosives and Propellants	L S
280-90057-1	LL6mw-499-102416-GW	280-90057-3	Water	3-Nitrotoluene	99-08-1	µg/L	0.43	u q	uj	n	0.43	0.2	0.09	Explosives and Propellants	L S
280-90057-1	LL6mw-499-102416-GW	280-90057-3	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.22	u q	uj	n	0.22	0.12	0.062	Explosives and Propellants	L S
280-90057-1	LL6mw-499-102416-GW	280-90057-3	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	uj	n	1.1	0.4	0.22	Explosives and Propellants	L S

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90057-1	LL6mw-499-102416-GW	280-90057-3	Water	HMX	2691-41-0	µg/L	0.43	u q	uj	n	0.43	0.2	0.094	Explosives and Propellants	S
280-90057-1	LL6mw-499-102416-GW	280-90057-3	Water	Nitrobenzene	98-95-3	µg/L	0.43	u q	uj	n	0.43	2	0.098	Explosives and Propellants	S
280-90057-1	LL6mw-499-102416-GW	280-90057-3	Water	Nitroglycerin	55-63-0	µg/L	3.2	u q	uj	n	3.2	2	0.99	Explosives and Propellants	S
280-90057-1	LL6mw-499-102416-GW	280-90057-3	Water	PETN	78-11-5	µg/L	2.2	u q	uj	n	2.2	1.2	0.45	Explosives and Propellants	S
280-90057-1	LL6mw-499-102416-GW	280-90057-3	Water	RDX	121-82-4	µg/L	0.22	u q	uj	n	0.22	0.12	0.056	Explosives and Propellants	S
280-90057-1	LL6mw-499-102416-GW	280-90057-3	Water	Tetryl	479-45-8	µg/L	0.26	u q	uj	n	0.26	0.2	0.085	Explosives and Propellants	S
280-90057-1	FBQmw-173-102516-GW	280-90057-4	Water	Aluminum	7429-90-5	µg/L	300	j	u	n	300	70	18	Metals	B
280-90057-1	FBQmw-173-102516-GW	280-90057-4	Water	Iron	7439-89-6	µg/L	2400	q	j	y	100	85	22	Metals	CC
280-90057-1	FBQmw-173-102516-GW	280-90057-4	Water	Barium	7440-39-3	µg/L	12	v	j	y	3	0.095	0.29	Metals	IC
280-90057-1	FBQmw-173-102516-GW	280-90057-4	Water	Vanadium	7440-62-2	µg/L	6	j	u	n	6	2	0.5	Metals	B
280-90057-1	FBQmw-173-102516-GW	280-90057-4	Water	Chloromethane	74-87-3	µg/L	2	u q	uj	n	2	0.8	0.3	VOCs	CC
280-90057-1	FBQmw-173-102516-GW	280-90057-4	Water	Methylene chloride	75-09-2	µg/L	5	j q	u	n	5	0.8	0.32	VOCs	B
280-90057-1	FBQmw-173-102516-GW	280-90057-4	Water	1,3-Dinitrobenzene	99-65-0	µg/L	0.42	u q	uj	n	0.42	0.2	0.093	Explosives and Propellants	L
280-90057-1	FBQmw-173-102516-GW	280-90057-4	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.42	u q	uj	n	0.42	4.4	0.088	Explosives and Propellants	L
280-90057-1	FBQmw-173-102516-GW	280-90057-4	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u q	uj	n	0.21	4.4	0.068	Explosives and Propellants	L
280-90057-1	FBQmw-173-102516-GW	280-90057-4	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.69	q m	j	y	0.21	0.12	0.053	Explosives and Propellants	L
280-90057-1	FBQmw-173-102516-GW	280-90057-4	Water	2-Nitrotoluene	88-72-2	µg/L	0.42	u q	uj	n	0.42	0.2	0.09	Explosives and Propellants	L
280-90057-1	FBQmw-173-102516-GW	280-90057-4	Water	3-Nitrotoluene	99-08-1	µg/L	0.42	u q	uj	n	0.42	0.2	0.088	Explosives and Propellants	L
280-90057-1	FBQmw-173-102516-GW	280-90057-4	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.79	q m	j	y	0.21	0.12	0.061	Explosives and Propellants	L
280-90057-1	FBQmw-173-102516-GW	280-90057-4	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	uj	n	1.1	0.4	0.21	Explosives and Propellants	L
280-90057-1	FBQmw-173-102516-GW	280-90057-4	Water	Total Cyanide	57-12-5	µg/L	10	j	u	n	10	0.000005	2	Cyanide	B
280-90057-1	LL5mw-001-102516-GW	280-90057-5	Water	Chloromethane	74-87-3	µg/L	2	u q	uj	n	2	0.8	0.3	VOCs	CC
280-90057-1	LL5mw-001-102516-GW	280-90057-5	Water	Methylene chloride	75-09-2	µg/L	5	j q	u	n	5	0.8	0.32	VOCs	B
280-90057-1	LL6mw-008-102516-GW	280-90057-6	Water	Naphthalene	91-20-3	µg/L	0.1	u q	uj	n	0.1	1	0.0081	PAHs	S
280-90057-1	LL6mw-008-102516-GW	280-90057-6	Water	1,3,5-Trinitrobenzene	99-35-4	µg/L	1	u q	uj	n	1	0.4	0.2	Explosives and Propellants	S
280-90057-1	LL6mw-008-102516-GW	280-90057-6	Water	1,3-Dinitrobenzene	99-65-0	µg/L	0.41	u q	uj	n	0.41	0.2	0.091	Explosives and Propellants	L S
280-90057-1	LL6mw-008-102516-GW	280-90057-6	Water	2,4,6-Trinitrotoluene	118-96-7	µg/L	0.41	u q	uj	n	0.41	0.2	0.074	Explosives and Propellants	S
280-90057-1	LL6mw-008-102516-GW	280-90057-6	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.41	u q	uj	n	0.41	4.4	0.086	Explosives and Propellants	L S
280-90057-1	LL6mw-008-102516-GW	280-90057-6	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.2	u q	uj	n	0.2	4.4	0.066	Explosives and Propellants	L S
280-90057-1	LL6mw-008-102516-GW	280-90057-6	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.2	u q	uj	n	0.2	0.12	0.052	Explosives and Propellants	L S
280-90057-1	LL6mw-008-102516-GW	280-90057-6	Water	2-Nitrotoluene	88-72-2	µg/L	0.41	u q	uj	n	0.41	0.2	0.088	Explosives and Propellants	L S
280-90057-1	LL6mw-008-102516-GW	280-90057-6	Water	3-Nitrotoluene	99-08-1	µg/L	0.41	u q	uj	n	0.41	0.2	0.085	Explosives and Propellants	L S
280-90057-1	LL6mw-008-102516-GW	280-90057-6	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.2	u q	uj	n	0.2	0.12	0.059	Explosives and Propellants	L S
280-90057-1	LL6mw-008-102516-GW	280-90057-6	Water	4-Nitrotoluene	99-99-0	µg/L	1	u q	uj	n	1	0.4	0.2	Explosives and Propellants	L S
280-90057-1	LL6mw-008-102516-GW	280-90057-6	Water	HMX	2691-41-0	µg/L	0.41	u q	uj	n	0.41	0.2	0.09	Explosives and Propellants	S
280-90057-1	LL6mw-008-102516-GW	280-90057-6	Water	Nitrobenzene	98-95-3	µg/L	0.41	u q	uj	n	0.41	2	0.093	Explosives and Propellants	S
280-90057-1	LL6mw-008-102516-GW	280-90057-6	Water	Nitroglycerin	55-63-0	µg/L	3.1	u q	uj	n	3.1	2	0.94	Explosives and Propellants	S
280-90057-1	LL6mw-008-102516-GW	280-90057-6	Water	PETN	78-11-5	µg/L	2	u q	uj	n	2	1.2	0.43	Explosives and Propellants	S
280-90057-1	LL6mw-008-102516-GW	280-90057-6	Water	RDX	121-82-4	µg/L	0.2	u q	uj	n	0.2	0.12	0.054	Explosives and Propellants	S
280-90057-1	LL6mw-008-102516-GW	280-90057-6	Water	Tetryl	479-45-8	µg/L	0.25	u q	uj	n	0.25	0.2	0.081	Explosives and Propellants	S

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90057-1	LL6mw-008-102516-GW	280-90057-6	Water	Total Cyanide	57-12-5	µg/L	10	j	u	n	10	0.000005	2	Cyanide	B
280-90057-1	FBQmw-167-102516-GW	280-90057-7	Water	Aluminum	7429-90-5	µg/L	300	j	u	n	300	70	18	Metals	B
280-90057-1	FBQmw-167-102516-GW	280-90057-7	Water	Iron	7439-89-6	µg/L	720	v	j	y	100	85	22	Metals	CC
280-90057-1	FBQmw-167-102516-GW	280-90057-7	Water	Barium	7440-39-3	µg/L	23	v	j	y	3	0.095	0.29	Metals	IC
280-90057-1	FBQmw-167-102516-GW	280-90057-7	Water	Vanadium	7440-62-2	µg/L	6	j	u	n	6	2	0.5	Metals	B
280-90057-1	FBQmw-167-102516-GW	280-90057-7	Water	Chloromethane	74-87-3	µg/L	2	u q	uj	n	2	0.8	0.3	VOCs	CC
280-90057-1	FBQmw-167-102516-GW	280-90057-7	Water	Methylene chloride	75-09-2	µg/L	5	j q	u	n	5	0.8	0.32	VOCs	B
280-90057-1	FBQmw-167-102516-GW	280-90057-7	Water	Naphthalene	91-20-3	µg/L	0.1	u q	uj	n	0.1	1	0.0081	PAHs	S
280-90057-1	FBQmw-167-102516-GW	280-90057-7	Water	1,3,5-Trinitrobenzene	99-35-4	µg/L	1.1	u q	uj	n	1.1	0.4	0.21	Explosives and Propellants	S
280-90057-1	FBQmw-167-102516-GW	280-90057-7	Water	1,3-Dinitrobenzene	99-65-0	µg/L	0.42	u q	u	n	0.42	0.2	0.093	Explosives and Propellants	L S
280-90057-1	FBQmw-167-102516-GW	280-90057-7	Water	2,4,6-Trinitrotoluene	118-96-7	µg/L	0.42	u q	uj	n	0.42	0.2	0.076	Explosives and Propellants	S
280-90057-1	FBQmw-167-102516-GW	280-90057-7	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.42	u q	u	n	0.42	4.4	0.088	Explosives and Propellants	L S
280-90057-1	FBQmw-167-102516-GW	280-90057-7	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u q	u	n	0.21	4.4	0.068	Explosives and Propellants	L S
280-90057-1	FBQmw-167-102516-GW	280-90057-7	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.21	u q	u	n	0.21	0.12	0.053	Explosives and Propellants	L S
280-90057-1	FBQmw-167-102516-GW	280-90057-7	Water	2-Nitrotoluene	88-72-2	µg/L	0.42	u q	u	n	0.42	0.2	0.09	Explosives and Propellants	L S
280-90057-1	FBQmw-167-102516-GW	280-90057-7	Water	3-Nitrotoluene	99-08-1	µg/L	0.42	u q	u	n	0.42	0.2	0.088	Explosives and Propellants	L S
280-90057-1	FBQmw-167-102516-GW	280-90057-7	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.21	u q	u	n	0.21	0.12	0.061	Explosives and Propellants	L S
280-90057-1	FBQmw-167-102516-GW	280-90057-7	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	u	n	1.1	0.4	0.21	Explosives and Propellants	L S
280-90057-1	FBQmw-167-102516-GW	280-90057-7	Water	HMX	2691-41-0	µg/L	0.42	u q	uj	n	0.42	0.2	0.092	Explosives and Propellants	S
280-90057-1	FBQmw-167-102516-GW	280-90057-7	Water	Nitrobenzene	98-95-3	µg/L	0.42	u q	uj	n	0.42	2	0.096	Explosives and Propellants	S
280-90057-1	FBQmw-167-102516-GW	280-90057-7	Water	Nitroglycerin	55-63-0	µg/L	3.2	u q	uj	n	3.2	2	0.97	Explosives and Propellants	S
280-90057-1	FBQmw-167-102516-GW	280-90057-7	Water	PETN	78-11-5	µg/L	2.1	u q	uj	n	2.1	1.2	0.44	Explosives and Propellants	S
280-90057-1	FBQmw-167-102516-GW	280-90057-7	Water	RDX	121-82-4	µg/L	0.21	u q	uj	n	0.21	0.12	0.055	Explosives and Propellants	S
280-90057-1	FBQmw-167-102516-GW	280-90057-7	Water	Tetryl	479-45-8	µg/L	0.25	u q	uj	n	0.25	0.2	0.083	Explosives and Propellants	S
280-90057-1	FBQmw-171-102516-GW	280-90057-8	Water	Aluminum	7429-90-5	µg/L	300	j	u	n	300	70	18	Metals	B
280-90057-1	FBQmw-171-102516-GW	280-90057-8	Water	Barium	7440-39-3	µg/L	28	v	j	y	3	0.095	0.29	Metals	IC
280-90057-1	FBQmw-171-102516-GW	280-90057-8	Water	Vanadium	7440-62-2	µg/L	6	j	u	n	6	2	0.5	Metals	B
280-90057-1	FBQmw-171-102516-GW	280-90057-8	Water	1,1,2-Trichloroethane	79-00-5	µg/L	1	u q	uj	n	1	0.8	0.32	VOCs	S
280-90057-1	FBQmw-171-102516-GW	280-90057-8	Water	1,2-Dichloroethane	107-06-2	µg/L	1	u q	uj	n	1	0.4	0.13	VOCs	S
280-90057-1	FBQmw-171-102516-GW	280-90057-8	Water	1,2-Dichloropropane	78-87-5	µg/L	1	u q	uj	n	1	0.4	0.13	VOCs	S
280-90057-1	FBQmw-171-102516-GW	280-90057-8	Water	4-Methyl-2-pentanone	108-10-1	µg/L	5	u q	uj	n	5	3.2	1	VOCs	S
280-90057-1	FBQmw-171-102516-GW	280-90057-8	Water	Benzene	71-43-2	µg/L	1	u q	uj	n	1	0.4	0.16	VOCs	S
280-90057-1	FBQmw-171-102516-GW	280-90057-8	Water	Bromodichloromethane	75-27-4	µg/L	1	u q	uj	n	1	0.4	0.17	VOCs	S
280-90057-1	FBQmw-171-102516-GW	280-90057-8	Water	Carbon tetrachloride	56-23-5	µg/L	2	u q	uj	n	2	0.4	0.19	VOCs	S
280-90057-1	FBQmw-171-102516-GW	280-90057-8	Water	Chloromethane	74-87-3	µg/L	2	u q	uj	n	2	0.8	0.3	VOCs	CC S
280-90057-1	FBQmw-171-102516-GW	280-90057-8	Water	cis-1,3-Dichloropropene	10061-01-5	µg/L	1	u q	uj	n	1	0.4	0.16	VOCs	S
280-90057-1	FBQmw-171-102516-GW	280-90057-8	Water	Methylene chloride	75-09-2	µg/L	5	j q	uj	n	5	0.8	0.32	VOCs	B S
280-90057-1	FBQmw-171-102516-GW	280-90057-8	Water	Toluene	108-88-3	µg/L	1	u q	uj	n	1	0.4	0.17	VOCs	S
280-90057-1	FBQmw-171-102516-GW	280-90057-8	Water	trans-1,3-Dichloropropene	10061-02-6	µg/L	1	u q	uj	n	1	0.4	0.19	VOCs	S
280-90057-1	FBQmw-171-102516-GW	280-90057-8	Water	Trichloroethene	79-01-6	µg/L	1	u q	uj	n	1	0.4	0.16	VOCs	S

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90057-1	FBQmw-171-102516-GW	280-90057-8	Water	1,3-Dinitrobenzene	99-65-0	µg/L	0.44	u q	uj	n	0.44	0.2	0.097	Explosives and Propellants	L
280-90057-1	FBQmw-171-102516-GW	280-90057-8	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.44	u q	uj	n	0.44	4.4	0.092	Explosives and Propellants	L
280-90057-1	FBQmw-171-102516-GW	280-90057-8	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.22	u q	uj	n	0.22	4.4	0.071	Explosives and Propellants	L
280-90057-1	FBQmw-171-102516-GW	280-90057-8	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.22	u q	uj	n	0.22	0.12	0.056	Explosives and Propellants	L
280-90057-1	FBQmw-171-102516-GW	280-90057-8	Water	2-Nitrotoluene	88-72-2	µg/L	0.44	u q	uj	n	0.44	0.2	0.094	Explosives and Propellants	L
280-90057-1	FBQmw-171-102516-GW	280-90057-8	Water	3-Nitrotoluene	99-08-1	µg/L	0.44	u q	uj	n	0.44	0.2	0.091	Explosives and Propellants	L
280-90057-1	FBQmw-171-102516-GW	280-90057-8	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.22	u q	uj	n	0.22	0.12	0.063	Explosives and Propellants	L
280-90057-1	FBQmw-171-102516-GW	280-90057-8	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	uj	n	1.1	0.4	0.22	Explosives and Propellants	L
280-90057-1	FBQmw-171-102516-GW	280-90057-8	Water	Total Cyanide	57-12-5	µg/L	10	j	u	n	10	0.000005	2	Cyanide	B
280-90057-1	TripBlank	280-90057-9	Water	Chloromethane	74-87-3	µg/L	2	u q	uj	n	2	0.8	0.3	VOCs	CC
280-90057-1	TripBlank	280-90057-9	Water	Methylene chloride	75-09-2	µg/L	5	j q	u	n	5	0.8	0.32	VOCs	B
280-90057-1	FBQmw-166-102516-GW	280-90057-10	Water	Chloromethane	74-87-3	µg/L	2	u q	uj	n	2	0.8	0.3	VOCs	CC
280-90057-1	FBQmw-166-102516-GW	280-90057-10	Water	Methylene chloride	75-09-2	µg/L	5	j q	u	n	5	0.8	0.32	VOCs	B
280-90057-1	FBQmw-166-102516-GW	280-90057-10	Water	Hexachlorocyclopentadiene	77-47-4	µg/L	51	u j	r	n	51	30	10	SVOCs	M
280-90057-1	FBQmw-166-102516-GW	280-90057-10	Water	1,3,5-Trinitrobenzene	99-35-4	µg/L	1.1	u q	uj	n	1.1	0.4	0.21	Explosives and Propellants	S
280-90057-1	FBQmw-166-102516-GW	280-90057-10	Water	1,3-Dinitrobenzene	99-65-0	µg/L	0.42	u q j	uj	n	0.42	0.2	0.094	Explosives and Propellants	L S
280-90057-1	FBQmw-166-102516-GW	280-90057-10	Water	2,4,6-Trinitrotoluene	118-96-7	µg/L	0.42	u q	uj	n	0.42	0.2	0.076	Explosives and Propellants	S
280-90057-1	FBQmw-166-102516-GW	280-90057-10	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.42	u q j	uj	n	0.42	4.4	0.088	Explosives and Propellants	L M S
280-90057-1	FBQmw-166-102516-GW	280-90057-10	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u q j	uj	n	0.21	4.4	0.068	Explosives and Propellants	L M S
280-90057-1	FBQmw-166-102516-GW	280-90057-10	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.21	u q j	uj	n	0.21	0.12	0.053	Explosives and Propellants	M L S
280-90057-1	FBQmw-166-102516-GW	280-90057-10	Water	2-Nitrotoluene	88-72-2	µg/L	0.42	u q j	uj	n	0.42	0.2	0.09	Explosives and Propellants	L M S
280-90057-1	FBQmw-166-102516-GW	280-90057-10	Water	3-Nitrotoluene	99-08-1	µg/L	0.42	u q j	uj	n	0.42	0.2	0.088	Explosives and Propellants	L M S
280-90057-1	FBQmw-166-102516-GW	280-90057-10	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.21	u q j	uj	n	0.21	0.12	0.061	Explosives and Propellants	M L S
280-90057-1	FBQmw-166-102516-GW	280-90057-10	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q j	uj	n	1.1	0.4	0.21	Explosives and Propellants	L M S
280-90057-1	FBQmw-166-102516-GW	280-90057-10	Water	HMX	2691-41-0	µg/L	0.42	u q	uj	n	0.42	0.2	0.092	Explosives and Propellants	S
280-90057-1	FBQmw-166-102516-GW	280-90057-10	Water	Nitrobenzene	98-95-3	µg/L	0.42	u q j	uj	n	0.42	2	0.096	Explosives and Propellants	S
280-90057-1	FBQmw-166-102516-GW	280-90057-10	Water	Nitroglycerin	55-63-0	µg/L	3.2	u q	uj	n	3.2	2	0.97	Explosives and Propellants	S
280-90057-1	FBQmw-166-102516-GW	280-90057-10	Water	PETN	78-11-5	µg/L	2.1	u q	uj	n	2.1	1.2	0.44	Explosives and Propellants	S
280-90057-1	FBQmw-166-102516-GW	280-90057-10	Water	RDX	121-82-4	µg/L	0.21	u q	uj	n	0.21	0.12	0.055	Explosives and Propellants	S
280-90057-1	FBQmw-166-102516-GW	280-90057-10	Water	Tetryl	479-45-8	µg/L	0.25	u q j	uj	n	0.25	0.2	0.084	Explosives and Propellants	S
280-90057-1	FBQmw-166-102516-GW	280-90057-10	Water	Total Cyanide	57-12-5	µg/L	10	j	u	n	10	0.000005	2	Cyanide	B

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90212-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by a Senior Chemist. Signatures indicate the report is approved for release.



Travis Withers

2017.01.18 12:54:48 -07'00'

Travis Withers, Validation Chemist, TEC-WESTON JV

Date



Peter Chapman, Senior Chemist, TEC-WESTON JV

1/10/17

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90212-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polychlorinated Biphenyls (PCBs)	8082A	Denver, CO
Organochlorine Pesticides	8081B	Denver, CO
Explosives	8330B	Denver, CO
Metals	6010C/6020A/7470A	Denver, CO
Hexavalent Chromium	353.2	Denver, CO
Total Cyanide	9012B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	SVOCs (phthalates)	PCBs	Pesticides	Explosives	Metals	Cr(VI)	Cyanide
LL3mw-241-102616-GW	280-90212-1	10/26/16	Groundwater		✓	✓	✓	✓	✓	✓		✓
LL3mw-243-102716-GW	280-90212-2	10/27/16	Groundwater		✓			✓	✓			✓
LL3mw-239-102716-GW	280-90212-3	10/27/16	Groundwater						✓			
LL3mw-244-102716-GW	280-90212-4	10/27/16	Groundwater		✓	✓	✓	✓	✓	✓	✓	✓
LL3mw-233-102716-GW	280-90212-5	10/27/16	Groundwater		✓			✓	✓	✓		✓
TRIP BLANK	280-90212-6	10/26/16	Water	Trip Blank	✓				✓			

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
J	IC	Estimated detection; initial calibration verification did not meet acceptance criteria.
J	CC	Estimated detection; continuing calibration verification did not meet acceptance criteria.
UJ	H	Estimated non-detection; holding time exceeded.
U	B	Not detected; target analyte was detected in the method or calibration blank.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on October 28, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

“-GW” was added to the end of all sample IDs to comply with the RIWP.

PCB analysis requested on sample LL3mw-244-102716-GW was canceled due to the LCS/LCSD & surrogates being spiked at the incorrect concentration and the MS/MSD spike was omitted, rendering the results unusable. No additional sample volume remained to re-extract the sample.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Instrument tuning
- Initial calibration verification
- Internal standard recoveries

All analytical or quality parameters requiring further discussion for Method 8260B are described in the sections below.

1.4.1.1 Method Blanks

Methylene chloride (2.46 µg/L) was detected in the method blank at a concentration below the LOQ (5.0 µg/L). Methylene chloride was also detected at concentrations below the LOQ in samples LL3mw-241-102616-GW (1.1 µg/L), LL3mw-243-102716-GW (0.62 µg/L), LL3mw-244-102716-GW (0.61 µg/L), LL3mw-234-102716-GW (0.66 µg/L), and TRIP BLANK (1.1 µg/L). These samples results were qualified as non-detect at the LOQ (U B). It was noted in the case narrative that the laboratory was experiencing elevated levels of methylene chloride throughout the laboratory at the time of analysis.

1.4.1.2 Trip Blanks

Methylene chloride (1.1 µg/L) was detected in the trip blank at a concentration below the LOQ (5.0 µg/L). This result was qualified as non-detect at the LOQ, due to method blank contamination. See section 1.4.1.1 for the sample qualification.

1.4.1.3 Laboratory Control Sample

Methylene chloride (161%) was recovered in the LCS above the control limits (74-124%). All associated sample results were qualified as non-detect; therefore, no qualification was necessary.

1.4.1.4 Continuing Calibration Verification

Methylene chloride (23.2%D) was recovered outside of the acceptance criteria ($\pm 20\%D$) in CCV 280-350364/2. All associated sample results were qualified as non-detect; therefore, no qualification was necessary.

1.4.2 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- Instrument tuning
- Initial calibration verification
- Continuing calibration verification
- Internal standard recoveries

All analytical or quality parameters requiring further discussion for Method 8270D are described in the sections below.

1.4.2.1 Laboratory Control Sample

Diethyl phthalate (129%) and di-n-butyl phthalate (129%) were recovered above their respective acceptance criteria (56-126% and 59-127%). All associated sample results were non-detect; therefore, no qualification was necessary.

1.4.3 Polychlorinated Biphenyls by Method 8082A

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification

No parameters required further discussion for Method 8082A.

1.4.4 Organochlorine Pesticides by Method 8081B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification

All analytical or quality parameters requiring further discussion for Method 8081B are described in the sections below.

1.4.4.1 Computer Error

The samples MB 280-349316/1-A and PEM 280-350176/45 in analytical batch 280-350176 have the incorrect analysis date. The samples were run after day light savings time and due to computer error, the samples that were analyzed between midnight and 1 AM have the previous date for the injection time. The QC samples were correctly linked to the associated samples by the laboratory.

1.4.5 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- 2nd column confirmation

No parameters required further discussion for Method 8330B.

1.4.6 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- LCS recoveries
- Low level calibration check standard
- Interference check solutions
- Instrument tuning

All analytical or quality parameters requiring further discussion for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.6.1 Method Blanks

Aluminum (22.0 µg/L), calcium (44.5 µg/L), magnesium (15.3 µg/L), and vanadium (0.565 µg/L) were detected in the method blank at concentrations below their respective LOQs (300 µg/L, 1000 µg/L, 500 µg/L, and 6.0 µg/L). Vanadium was detected at concentrations below the LOQ in samples LL3mw-241-102616-GW (0.80 µg/L) and LL3mw-244-102716-GW (0.91 µg/L); these results were qualified as not detected at the LOQ (U B).

All other associated sample results were either non-detect or above the LOQ; therefore, no qualification was necessary.

1.4.6.2 Calibration Blanks

Antimony was detected in ICB 280-350593/12 (0.587 µg/L) at a concentration below the LOQ (2 µg/L). Antimony was also detected in sample LL3mw-244-102716-GW (0.48 µg/L) below the LOQ. This result was qualified as non-detect at the LOQ (U B).

Vanadium was detected in CCB 280-350593/72 (0.841 µg/L) and CCB 280-350593/84 (0.820 µg/L). All associated vanadium results were already qualified as non-detect for method blank contamination; therefore, no qualification was necessary. See section 1.4.6.1 for details.

1.4.6.3 Initial/Continuing Calibration Verification

Iron (203%) recovered above the QC limits (80-120%) in the low level CCV 280-349628/120 associated with samples LL3mw-241-102616-GW, LL3mw-244-102716-GW and LL3mw-234-

102716-GW. Iron was detected in all associated samples. These sample results were qualified as estimated (J CC).

Barium (127 %) and beryllium (125%) were recovered above the QC limits (80-120%) in the low level ICV 280-350593/13 associated with samples LL3mw-241-102616-GW, LL3mw-244-102716-GW and LL3mw-234-102716-GW. Barium was detected in all associated samples. These sample results were qualified as estimated (J IC). Beryllium was non-detect in all associated samples; therefore, no qualification was necessary.

1.4.7 Hexavalent Chromium by Method 7196A

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- LODs and LOQs
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

All analytical or quality issues for Method 7196A are described in the sections below.

1.4.7.1 Holding Times

Sample LL3mw-244-102716-GW was collected on October 27, 2016 at 14:07 (EST) and was analyzed on October 28, 2016 at 13:05 (MST) outside of the 24 hour holding time, but within 2x of the holding time. The sample result was qualified as estimated (UJ H).

1.4.8 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

All analytical or quality parameters requiring further discussion for Method 9012B are described in the sections below.

1.4.8.1 Method Blanks

Total cyanide (3.09 µg/L) was detected in the method blank at a concentration below the LOQ (10 µg/L). Cyanide was detected in the associated sample, LL3mw-241-102616-GW (5.6 µg/L), at a concentration below the LOQ. This sample result was qualified as non-detect at the LOQ (U B).

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	Result	Units	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Group	Reason Code
280-90212-1	LL3mw-234-102716-GW	280-90212-5	Water	Barium	11	µg/L	v	j	y	3	0.95	0.29	Metals	ic
280-90212-1	LL3mw-241-102616-GW	280-90212-1	Water	Barium	7.4	µg/L	v	j	y	3	0.95	0.29	Metals	ic
280-90212-1	LL3mw-244-102716-GW	280-90212-4	Water	Barium	17	µg/L	v	j	y	3	0.95	0.29	Metals	ic
280-90212-1	LL3mw-244-102716-GW	280-90212-4	Water	Chromium, hexavalent	20	µg/L	u h	uj	n	20	4.0	4	Metals	h
280-90212-1	LL3mw-234-102716-GW	280-90212-5	Water	Iron	3400	µg/L	q	j	y	100	85	22	Metals	cc
280-90212-1	LL3mw-241-102616-GW	280-90212-1	Water	Iron	26	µg/L	j q	j	y	100	85	22	Metals	cc
280-90212-1	LL3mw-244-102716-GW	280-90212-4	Water	Iron	24	µg/L	j q	j	y	100	85	22	Metals	cc
280-90212-1	LL3mw-241-102616-GW	280-90212-1	Water	Methylene chloride	5	µg/L	j q	u	n	5	0.80	0.32	VOCs	b
280-90212-1	LL3mw-243-102716-GW	280-90212-2	Water	Methylene chloride	5	µg/L	j	u	n	5	0.80	0.32	VOCs	b
280-90212-1	LL3mw-244-102716-GW	280-90212-4	Water	Methylene chloride	5	µg/L	j	u	n	5	0.80	0.32	VOCs	b
280-90212-1	TRIP BLANK	280-90212-6	Water	Methylene chloride	5	µg/L	j	u	n	5	0.80	0.32	VOCs	b
280-90212-1	LL3mw-241-102616-GW	280-90212-1	Water	Total Cyanide	10	µg/L	j	u	n	10	5.0	2	Total Cyanide	b
280-90212-1	LL3mw-241-102616-GW	280-90212-1	Water	Vanadium	6	µg/L	j	u	n	6	2.0	0.5	Metals	b
280-90212-1	LL3mw-244-102716-GW	280-90212-4	Water	Vanadium	6	µg/L	j	u	n	6	2.0	0.5	Metals	b

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90227-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by a Senior Chemist. Signatures indicate the report is approved for release.



Travis Withers

2017.01.18 12:55:46 -07'00'

Travis Withers, Validation Chemist, TEC-WESTON JV

Date



Peter Chapman, Senior Chemist, TEC-WESTON JV

1/10/17

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90227-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Polycyclic Aromatic Hydrocarbons (PAHs)	8270D SIM	Denver, CO
Organochlorine Pesticides	8081B	Denver, CO
Explosives	8330B	Denver, CO
Total Cyanide	9012B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA*

2014). Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	PAHs	Pesticides	Explosives	Cyanide
LL4mw-201-102616-GW	280-90227-1	10/26/16	Groundwater		✓	✓		✓	✓
LL4mw-193-102716-GW	280-90227-2	10/27/16	Groundwater		✓	✓	✓	✓	✓
LL4mw-200-102716-GW	280-90227-3	10/27/16	Groundwater		✓	✓		✓	✓
LL4mw-197-102716-GW	280-90227-4	10/27/16	Groundwater					✓	✓
LL4mw-199-102716-GW	280-90227-5	10/27/16	Groundwater		✓	✓		✓	✓

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
UJ	L	Estimated non-detection; the MS/MSD recoveries and/or RPD was outside QC limits.
UJ	S	Estimated non-detection; the surrogate recovery was outside QC limits.
U	B	Not detected; target analyte was detected in the method or trip blank.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on October 28, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

“-GW” was added to the end of all sample IDs to comply with the RIWP.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS recoveries
- Instrument tuning
- Initial calibration verification
- Continuing calibration verification
- Internal standard recoveries

All analytical or quality parameters requiring further discussion for Method 8260B are described in the sections below.

1.4.1.1 Method Blanks

Methylene chloride (1.84 µg/L) was detected in the method blank at a concentration below the LOQ (5.0 µg/L). Methylene chloride was also detected at concentrations below the LOQ in samples LL4mw-201-102616-GW (0.83 µg/L), LL4mw-193-102716-GW (0.85 µg/L), LL4mw-200-102716-GW (0.83 µg/L) and LL4mw-199-102716-GW (0.82 µg/L). These samples results were qualified as non-detect at the LOQ (U B).

1.4.1.2 Trip Blanks

No trip blanks were reported in this SDG. Refer to section 1.4.1.2 of the DVR for SDG 280-90212-1 for details regarding the trip blank associated with the samples in this report. The associated trip blank was non-detect for all analytes.

1.4.2 Polycyclic Aromatic Hydrocarbons by Method 8270D SIM

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- Method blanks
- LCS recoveries
- Instrument tuning
- Initial calibration verification

- Continuing calibration verification
- Internal standard recoveries

All analytical or quality parameters requiring further discussion for Method 8270D SIM are described in the sections below.

1.4.2.1 Surrogate Recoveries

Surrogate nitrobenzene-d5 recovered below the acceptance criteria (55-111%) in sample LL4mw-193-102716-GW (49%). All associated sample results were non-detect and were qualified as estimated (UJ S). It was noted that the sample was re-extracted and re-analyzed outside of holding time with passing surrogates and produced concurring results.

1.4.3 Organochlorine Pesticides by Method 8081B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification

All analytical or quality parameters requiring further discussion for Method 8081B are described in the sections below.

1.4.3.1 Computer Error

The samples MB 280-349316/1-A and PEM 280-350176/45 in analytical batch 280-350176 have the incorrect analysis date. The samples were run after day light savings time and due to computer error, the samples that were analyzed between midnight and 1 AM have the previous date for the injection time. The QC samples were correctly linked to the associated samples by the laboratory.

1.4.4 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- Initial calibration verification
- Continuing calibration verification

- 2nd column confirmation

All analytical or quality parameters requiring further discussion for Method 8330B are described in the sections below.

1.4.4.1 Method Blanks

RDX (0.0612 µg/L) was detected in method blank MB 280-349739/1-A at a concentration below the LOQ (0.20). All associated sample results were non-detect for RDX; therefore, no qualification was necessary.

1.4.4.2 Laboratory Control Sample

Several analytes were recovered outside of the QC requirements in LCS 280-349739/2-A associated with samples LL4mw-193-102716-GW, LL4mw-200-102716-GW, LL4mw-197-102716-GW, and LL4mw-199-102716-GW. These exceedances are outlined in the table below:

Analyte	%R (Column 1)	%R (Column 2)	%R Limits
2-Amino-4,6-dinitrotoluene	63	65	79-120
4-Amino-2,6-dinitrotoluene	61	58	16-125
1,3-Dinitrobenzene	78	76	78-120
2,4-Dinitrotoluene	70	73	78-120
2,6-Dinitrotoluene	70	68	77-127
2-Nitrotoluene	55	63	70-127
3-Nitrotoluene	56	67	73-125
4-Nitrotoluene	62	63	71-127

%R = percent recovery

Bolded values are outside control limits.

All associated sample results were non-detect and were qualified as estimated (UJ L).

1.4.4.3 Surrogate Recoveries

Surrogate 1,2-nitrobenzene was recovered below the QC limits (83-119%) in samples LL4mw-200-102716-GW (73%) and LL4mw-197-102716-GW (78%). All associated sample results are non-detect and were qualified as estimated (UJ S).

1.4.5 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- Method blanks
- LCS recoveries
- MS/MSD recoveries & RPDs
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

All analytical or quality parameters requiring further discussion for Method 9012B are described in the sections below.

1.4.5.1 Method Blanks

Total cyanide (3.09 µg/L) was detected in the method blank at a concentration below the LOQ (10 µg/L). Cyanide was detected in the associated sample, LL4mw-201-102616-GW (2.6 µg/L), at a concentration below the LOQ. This sample result was qualified as non-detect at the LOQ (U B).

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	Result	Units	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Group	Reason Code
280-90227-1	LL4mw-193-102716-GW	280-90227-2	Water	Methylene chloride	5	µg/L	j	u	n	5	5	0.32	VOCs	B
280-90227-1	LL4mw-193-102716-GW	280-90227-2	Water	Acenaphthene	0.1	µg/L	u	uj	n	0.1	0.041	0.0043	PAHs	S
280-90227-1	LL4mw-193-102716-GW	280-90227-2	Water	Acenaphthylene	0.1	µg/L	u	uj	n	0.1	0.041	0.0052	PAHs	S
280-90227-1	LL4mw-193-102716-GW	280-90227-2	Water	Anthracene	0.1	µg/L	u	uj	n	0.1	0.041	0.0057	PAHs	S
280-90227-1	LL4mw-193-102716-GW	280-90227-2	Water	Benz(a)anthracene	0.1	µg/L	u	uj	n	0.1	0.012	0.0043	PAHs	S
280-90227-1	LL4mw-193-102716-GW	280-90227-2	Water	Benzo(a)pyrene	0.1	µg/L	u	uj	n	0.1	0.012	0.007	PAHs	S
280-90227-1	LL4mw-193-102716-GW	280-90227-2	Water	Benzo(b)fluoranthene	0.1	µg/L	u	uj	n	0.1	0.012	0.0031	PAHs	S
280-90227-1	LL4mw-193-102716-GW	280-90227-2	Water	Benzo(g,h,i)perylene	0.1	µg/L	u	uj	n	0.1	0.012	0.0063	PAHs	S
280-90227-1	LL4mw-193-102716-GW	280-90227-2	Water	Benzo(k)fluoranthene	0.1	µg/L	u	uj	n	0.1	0.012	0.0064	PAHs	S
280-90227-1	LL4mw-193-102716-GW	280-90227-2	Water	Chrysene	0.1	µg/L	u	uj	n	0.1	0.012	0.0033	PAHs	S
280-90227-1	LL4mw-193-102716-GW	280-90227-2	Water	Dibenz(a,h)anthracene	0.1	µg/L	u	uj	n	0.1	0.012	0.0042	PAHs	S
280-90227-1	LL4mw-193-102716-GW	280-90227-2	Water	Fluoranthene	0.1	µg/L	u	uj	n	0.1	0.012	0.0049	PAHs	S
280-90227-1	LL4mw-193-102716-GW	280-90227-2	Water	Fluorene	0.1	µg/L	u	uj	n	0.1	0.041	0.0056	PAHs	S
280-90227-1	LL4mw-193-102716-GW	280-90227-2	Water	Indeno(1,2,3-cd)pyrene	0.1	µg/L	u	uj	n	0.1	0.041	0.0046	PAHs	S
280-90227-1	LL4mw-193-102716-GW	280-90227-2	Water	Naphthalene	0.1	µg/L	u q	uj	n	0.1	0.012	0.0081	PAHs	S
280-90227-1	LL4mw-193-102716-GW	280-90227-2	Water	Phenanthrene	0.1	µg/L	u	uj	n	0.1	0.020	0.0094	PAHs	S
280-90227-1	LL4mw-193-102716-GW	280-90227-2	Water	Pyrene	0.1	µg/L	u	uj	n	0.1	0.020	0.0062	PAHs	S
280-90227-1	LL4mw-193-102716-GW	280-90227-2	Water	1,3-Dinitrobenzene	0.41	µg/L	u	uj	n	0.41	0.21	0.091	Explosives and propellants	L
280-90227-1	LL4mw-193-102716-GW	280-90227-2	Water	2,4-Dinitrotoluene	0.41	µg/L	u q	uj	n	0.41	0.21	0.086	Explosives and propellants	L
280-90227-1	LL4mw-193-102716-GW	280-90227-2	Water	2,6-Dinitrotoluene	0.21	µg/L	u q	uj	n	0.21	0.21	0.066	Explosives and propellants	L
280-90227-1	LL4mw-193-102716-GW	280-90227-2	Water	2-Amino-4,6-dinitrotoluene	0.21	µg/L	u q	uj	n	0.21	0.12	0.052	Explosives and propellants	L
280-90227-1	LL4mw-193-102716-GW	280-90227-2	Water	2-Nitrotoluene	0.41	µg/L	u q	uj	n	0.41	0.21	0.088	Explosives and propellants	L
280-90227-1	LL4mw-193-102716-GW	280-90227-2	Water	3-Nitrotoluene	0.41	µg/L	u q	uj	n	0.41	0.21	0.086	Explosives and propellants	L
280-90227-1	LL4mw-193-102716-GW	280-90227-2	Water	4-Amino-2,6-dinitrotoluene	0.21	µg/L	u q	uj	n	0.21	0.12	0.059	Explosives and propellants	L
280-90227-1	LL4mw-193-102716-GW	280-90227-2	Water	4-Nitrotoluene	1	µg/L	u q	uj	n	1	0.41	0.21	Explosives and propellants	L
280-90227-1	LL4mw-197-102716-GW	280-90227-4	Water	1,3,5-Trinitrobenzene	1	µg/L	u q	uj	n	1	0.41	0.21	Explosives and propellants	S
280-90227-1	LL4mw-197-102716-GW	280-90227-4	Water	1,3-Dinitrobenzene	0.41	µg/L	u q	uj	n	0.41	0.21	0.091	Explosives and propellants	L S
280-90227-1	LL4mw-197-102716-GW	280-90227-4	Water	2,4,6-Trinitrotoluene	0.41	µg/L	u q	uj	n	0.41	0.20	0.074	Explosives and propellants	S
280-90227-1	LL4mw-197-102716-GW	280-90227-4	Water	2,4-Dinitrotoluene	0.41	µg/L	u q	uj	n	0.41	0.21	0.086	Explosives and propellants	L S
280-90227-1	LL4mw-197-102716-GW	280-90227-4	Water	2,6-Dinitrotoluene	0.21	µg/L	u q	uj	n	0.21	0.21	0.066	Explosives and propellants	L S
280-90227-1	LL4mw-197-102716-GW	280-90227-4	Water	2-Amino-4,6-dinitrotoluene	0.21	µg/L	u q	uj	n	0.21	0.12	0.052	Explosives and propellants	L S
280-90227-1	LL4mw-197-102716-GW	280-90227-4	Water	2-Nitrotoluene	0.41	µg/L	u q	uj	n	0.41	0.21	0.088	Explosives and propellants	L S
280-90227-1	LL4mw-197-102716-GW	280-90227-4	Water	3-Nitrotoluene	0.41	µg/L	u q	uj	n	0.41	0.21	0.085	Explosives and propellants	L S
280-90227-1	LL4mw-197-102716-GW	280-90227-4	Water	4-Amino-2,6-dinitrotoluene	0.21	µg/L	u q	uj	n	0.21	0.12	0.059	Explosives and propellants	L S
280-90227-1	LL4mw-197-102716-GW	280-90227-4	Water	4-Nitrotoluene	1	µg/L	u q	uj	n	1	0.41	0.21	Explosives and propellants	L S
280-90227-1	LL4mw-197-102716-GW	280-90227-4	Water	HMX	0.41	µg/L	u q	uj	n	0.41	0.20	0.09	Explosives and propellants	S
280-90227-1	LL4mw-197-102716-GW	280-90227-4	Water	Nitrobenzene	0.41	µg/L	u q	uj	n	0.41	0.21	0.093	Explosives and propellants	S
280-90227-1	LL4mw-197-102716-GW	280-90227-4	Water	Nitroglycerin	3.1	µg/L	u q	uj	n	3.1	2.0	0.94	Explosives and propellants	S
280-90227-1	LL4mw-197-102716-GW	280-90227-4	Water	PETN	2.1	µg/L	u q	uj	n	2.1	1.2	0.43	Explosives and propellants	S
280-90227-1	LL4mw-197-102716-GW	280-90227-4	Water	RDX	0.21	µg/L	u q	uj	n	0.21	0.12	0.054	Explosives and propellants	S
280-90227-1	LL4mw-197-102716-GW	280-90227-4	Water	Tetryl	0.25	µg/L	u q	uj	n	0.25	0.20	0.081	Explosives and propellants	S
280-90227-1	LL4mw-199-102716-GW	280-90227-5	Water	Methylene chloride	5	µg/L	j	u	n	5	5	0.32	VOCs	B
280-90227-1	LL4mw-200-102716-GW	280-90227-3	Water	HMX	0.42	µg/L	u q	uj	n	0.42	0.20	0.092	Explosives and propellants	S
280-90227-1	LL4mw-199-102716-GW	280-90227-5	Water	1,3-Dinitrobenzene	0.41	µg/L	u	uj	n	0.41	0.21	0.091	Explosives and propellants	L
280-90227-1	LL4mw-199-102716-GW	280-90227-5	Water	2,4-Dinitrotoluene	0.41	µg/L	u q	uj	n	0.41	0.21	0.086	Explosives and propellants	L
280-90227-1	LL4mw-199-102716-GW	280-90227-5	Water	2,6-Dinitrotoluene	0.2	µg/L	u q	uj	n	0.2	0.21	0.066	Explosives and propellants	L
280-90227-1	LL4mw-199-102716-GW	280-90227-5	Water	2-Amino-4,6-dinitrotoluene	0.2	µg/L	u q	uj	n	0.2	0.12	0.052	Explosives and propellants	L
280-90227-1	LL4mw-199-102716-GW	280-90227-5	Water	2-Nitrotoluene	0.41	µg/L	u q	uj	n	0.41	0.21	0.088	Explosives and propellants	L
280-90227-1	LL4mw-199-102716-GW	280-90227-5	Water	3-Nitrotoluene	0.41	µg/L	u q	uj	n	0.41	0.21	0.085	Explosives and propellants	L

280-90227-1	LL4mw-199-102716-GW	280-90227-5	Water	4-Amino-2,6-dinitrotoluene	0.2	µg/L	u q	uj	n	0.2	0.12	0.059	Explosives and propellants	L
280-90227-1	LL4mw-199-102716-GW	280-90227-5	Water	4-Nitrotoluene	1	µg/L	u q	uj	n	1	0.41	0.2	Explosives and propellants	L
280-90227-1	LL4mw-200-102716-GW	280-90227-3	Water	Methylene chloride	5	µg/L	j	u	n	5	5	0.32	VOCs	B
280-90227-1	LL4mw-200-102716-GW	280-90227-3	Water	1,3,5-Trinitrobenzene	1	µg/L	u q	uj	n	1	0.41	0.21	Explosives and propellants	S
280-90227-1	LL4mw-200-102716-GW	280-90227-3	Water	1,3-Dinitrobenzene	0.42	µg/L	u q	uj	n	0.42	0.21	0.093	Explosives and propellants	L S
280-90227-1	LL4mw-200-102716-GW	280-90227-3	Water	2,4,6-Trinitrotoluene	0.42	µg/L	u q	uj	n	0.42	0.20	0.076	Explosives and propellants	S
280-90227-1	LL4mw-200-102716-GW	280-90227-3	Water	2,4-Dinitrotoluene	0.42	µg/L	u q	uj	n	0.42	0.21	0.088	Explosives and propellants	L S
280-90227-1	LL4mw-200-102716-GW	280-90227-3	Water	2,6-Dinitrotoluene	0.21	µg/L	u q	uj	n	0.21	0.21	0.068	Explosives and propellants	L S
280-90227-1	LL4mw-200-102716-GW	280-90227-3	Water	2-Amino-4,6-dinitrotoluene	0.21	µg/L	u q	uj	n	0.21	0.12	0.053	Explosives and propellants	L S
280-90227-1	LL4mw-200-102716-GW	280-90227-3	Water	2-Nitrotoluene	0.42	µg/L	u q	uj	n	0.42	0.21	0.09	Explosives and propellants	S
280-90227-1	LL4mw-200-102716-GW	280-90227-3	Water	3-Nitrotoluene	0.42	µg/L	u q	uj	n	0.42	0.21	0.088	Explosives and propellants	S
280-90227-1	LL4mw-200-102716-GW	280-90227-3	Water	4-Amino-2,6-dinitrotoluene	0.21	µg/L	uj	uj	n	0.21	0.12	0.061	Explosives and propellants	L S
280-90227-1	LL4mw-200-102716-GW	280-90227-3	Water	4-Nitrotoluene	1	µg/L	u q	uj	n	1	0.41	0.21	Explosives and propellants	S
280-90227-1	LL4mw-200-102716-GW	280-90227-3	Water	Nitrobenzene	0.42	µg/L	u q	uj	n	0.42	0.21	0.096	Explosives and propellants	S
280-90227-1	LL4mw-200-102716-GW	280-90227-3	Water	Nitroglycerin	3.1	µg/L	u q	uj	n	3.1	2.0	0.97	Explosives and propellants	S
280-90227-1	LL4mw-200-102716-GW	280-90227-3	Water	PETN	2.1	µg/L	u q	uj	n	2.1	1.2	0.44	Explosives and propellants	S
280-90227-1	LL4mw-200-102716-GW	280-90227-3	Water	RDX	0.21	µg/L	u q	uj	n	0.21	0.12	0.055	Explosives and propellants	S
280-90227-1	LL4mw-200-102716-GW	280-90227-3	Water	Tetryl	0.25	µg/L	u q	uj	n	0.25	0.20	0.083	Explosives and propellants	S
280-90227-1	LL4mw-201-102616-GW	280-90227-1	Water	Methylene chloride	5	µg/L	j	u	n	5	5	0.32	VOCs	B
280-90227-1	LL4mw-201-102616-GW	280-90227-1	Water	Total cyanide	10	µg/L	j	u	n	10	5	2	Wet chemistry	B

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90232-1

Prepared For:



National Guard Bureau
NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture
2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by the Project Chemist. Signatures indicate the report is approved for release.



Erica Fisher, Validator, TEC-WESTON JV

02/09/2017

Date



Pete Chapman, Chemist, TEC-WESTON JV

2/9/17

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90232-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Total Cyanide	9012B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend

using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	Cyanide
LL5mw-002-102616-GW	280-90232-1	10/26/16	Groundwater		✓	✓
LL5mw-006-102716-GW	280-90232-2	10/27/16	Groundwater		✓	✓
TRIP BLANK	280-90232-3	10/27/16	Groundwater		✓	

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
UJ	CC	Estimated non-detection; continuing calibration verification did not meet acceptance criteria.
U	B	Not detected; target analyte was detected in the method or calibration blank.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on October 28, 2016; the samples were received in good condition, under chain-of-custody (COC), and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

The laboratory were requested to add “GW” to the end of the sample identification numbers, which had not been noted on the COC. In addition, the trip blank that travelled with the samples was not noted on the COC. The laboratory logged the sample as TRIP BLANK and assigned a collection date and time of 10/27/2016, 00:00.

The COC requested PCB analysis on the submitted samples; however, this analysis was placed on hold and later cancelled due to sample re-collection.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- LCS recoveries
- Instrument tuning
- Initial calibration
- Initial calibration verification
- Closing calibration verification

All analytical or quality issues for Method 8260B are described in the sections below.

1.4.1.1 Surrogate Recoveries

Surrogates 4-bromofluorobenzene (117%) and toluene-d8 (119%) recovered above their respective QC limits (85-114% and 8-112%) in sample LL5mw-006-102616-GW. Associated analytes were not detected in the sample, therefore no qualification is necessary.

1.4.1.2 Method Blanks

Methylene chloride was detected in method blank MB 280-350526/6 (1.84 µg/L) at a concentration below the LOQ (5.0 µg/L). Methylene chloride was detected at concentrations less than the LOQ in associated samples LL5mw-002-102616-GW and TRIP BLANK. The results are qualified as non-detects at the LOQ due to blank contamination (U B).

1.4.1.3 Continuing Calibration Verification

Chloromethane (-20.7%) exceeded the QC limit ($\pm 20\%$) in continuing calibration verification sample CCV 280-350742/2 associated with sample LL5mw-006-102616. All associated results were non-detect for chloromethane and are qualified as estimated (UJ CC)

1.4.1.4 Trip Blank

Methylene chloride (1.2 $\mu\text{g/L}$) was detected in the trip blank at a concentration below the LOQ (5 $\mu\text{g/L}$). Methylene chloride has been qualified as not-detected at the LOQ based on method blank contamination. Refer to Section 1.4.1.2. The associated sample, LL5mw-006-102616-GW is qualified as not detected at the LOQ due to blank contamination (U B).

1.4.2 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- LCS recoveries
- Low and high level control sample recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

All analytical or quality issues for Method 9012B are described in the sections below.

1.4.2.1 Method Blanks

Cyanide (3.09 $\mu\text{g/L}$) was detected in method blank MB 280-350408/4-A. Cyanide (2 $\mu\text{g/L}$) was also detected in associated sample LL5mw-002-102616 below the LOQ. The sample result is qualified as estimated at the LOQ due to blank contamination (U B).

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90232-1	LL5mw-002-102616-GW	280-90232-1	Water	Total Cyanide	57-12-5	µg/L	10	j	u	n	10	5	2	Cyanide	B
280-90232-1	LL5mw-002-102616-GW	280-90232-1	Water	Methylene chloride	75-09-2	µg/L	5	j	u	n	5	0.8	0.32	VOCs	B
280-90232-1	LL5mw-006-102616-GW	280-90232-2	Water	Chloromethane	74-87-3	µg/L	0.8	u q	uj	n	2	0.8	0.3	VOCs	CC
280-90232-1	LL5mw-006-102616-GW	280-90232-2	Water	Methylene chloride	75-09-2	µg/L	5	j	u	n	5	0.8	0.32	VOCs	B
280-90232-1	TRIP BLANK	280-90232-3	Unknown	Methylene chloride	75-09-2	µg/L	5	j	u	n	5	0.8	0.32	VOCs	B

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90279-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by a Senior Chemist. Signatures indicate the report is approved for release.



Travis Withers

2017.01.18 12:56:59 -07'00'

Travis Withers, Validation Chemist, TEC-WESTON JV

Date



Peter Chapman, Senior Chemist, TEC-WESTON JV

1/10/17

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90279-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polycyclic Aromatic Hydrocarbons (PAHs)	8270D SIM	Denver, CO
Explosives	8330B	Denver, CO
Metals	6010C/6020A/7470A	Denver, CO
Hexavalent Chromium	353.2	Denver, CO
Total Cyanide	9012B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	SVOCs (full list)	SVOCs (phthalates)	PAHs	Explosives	Metals	Cr(VI)	Cyanide
WBGmw-014-102816-GW	280-90279-1	10/28/16	Groundwater						✓			
WBGmw-014DUP-102816-GW	280-90279-2	10/28/16	Groundwater	Field Duplicate					✓			
WBGmw-007-102816-GW	280-90279-3	10/28/16	Groundwater		✓	✓		✓	✓	✓		✓
WBGmw-499-102816-GW	280-90279-4	10/28/16	Groundwater	Field Duplicate						✓		
WBGmw-006-102816-GW	280-90279-5	10/28/16	Groundwater		✓		✓		✓	✓		✓
WBGmw-021-102816-GW	280-90279-6	10/28/16	Groundwater		✓		✓		✓	✓		✓
WBGmw-018-102816-GW	280-90279-7	10/28/16	Groundwater						✓	✓	✓	
WBGmw-019-102816-GW	280-90279-8	10/28/16	Groundwater		✓				✓			✓
WBGmw-020-102816-GW	280-90279-9	10/28/16	Groundwater				✓		✓	✓		
WBGmw-009-102816-GW	280-90279-10	10/28/16	Groundwater		✓		✓		✓	✓		✓
Trip Blank	280-90279-11	10/28/16	Water	Trip Blank	✓							

Note: WBGmw-014DUP-102816-GW is a field duplicate of parent sample WBGmw-014-102816-GW

WBGmw-499-102816-GW is a field duplicate of parent sample WBGmw-007-102816-GW

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
J	IC	Estimated detection; initial calibration verification did not meet acceptance criteria.
UJ	CC	Estimated non-detection; continuing calibration verification did not meet acceptance criteria.
UJ	S	Estimated non-detection; surrogate outlier.
U	B	Not detected; target analyte was detected in the method or calibration blank.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on October 29, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

“-GW” was added to the end of all sample IDs to comply with the RIWP.

PCB analysis requested on samples WBGmw-006-102816-GW, WBGmw-021-102816-GW, and WBGmw-020-102816-GW were canceled due to the LCS/LCSD & surrogates being spiked at the incorrect concentration and the MS/MSD spike was omitted, rendering the results unusable. No additional sample volume remained to re-extract the sample.

Sample ID WBGmw-007DUP-102816 was changed to WBGmw-499-102816-GW.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS recoveries
- Instrument tuning
- Initial calibration verification
- Internal standard recoveries

All analytical or quality parameters requiring further discussion for Method 8260B are described in the sections below.

1.4.1.1 Trip Blanks

Methylene chloride (0.72 µg/L) was detected in the trip blank at a concentration below the LOQ (5.0 µg/L). All associated sample results were non-detect; therefore, no qualification was necessary.

1.4.1.2 Continuing Calibration Verification

Chloromethane (-20.7%D) was recovered outside of the acceptance criteria ($\pm 20\%$ D) in CCV 280-350742/2 associated with sample Trip Blank. The associated chloromethane sample result was qualified as estimated (UJ CC).

1.4.2 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS recoveries
- Instrument tuning
- Initial calibration verification
- Continuing calibration verification
- Internal standard recoveries

All analytical or quality parameters requiring further discussion for Method 8270D are described in the sections below.

1.4.2.1 Matrix Spike/Matrix Spike Duplicates

No MS/MSDs were reported in this SDG.

1.4.2.2 Field Duplicates

No field duplicates were reported in this SDG.

1.4.3 Polycyclic Aromatic Hydrocarbons by Method 8270D SIM

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- LODs and LOQs
- LCS recoveries
- Instrument tuning
- Initial calibration verification
- Continuing calibration verification
- Internal standard recoveries

All analytical or quality parameters requiring further discussion for Method 8270D SIM are described in the sections below.

1.4.3.1 Surrogate Recoveries

Surrogate nitrobenzene-d5 recovered below the recovery criteria (55-111%) in sample WBGmw-007-102816-GW (38%). The sample was re-extracted and reanalyzed outside of the holding time and yielded similar results. The associated sample results from the original analysis were qualified as estimated (UJ S).

1.4.3.2 Method Blanks

Benzo(a)pyrene (0.120 µg/L) and dibenz(a,h)anthracene (0.00872 µg/L) were detected at a concentration below their respective LOQs (0.10 µg/L and 0.10 µg/L). This method blank is associated with the reanalysis of sample WBGmw-007-102816-GW. The associated sample results were non-detect; therefore, no qualification was necessary.

1.4.3.3 Holding Times

Sample WBGmw-007-102816-GW was re-extracted and reanalyzed outside of holding time. The results from the initial analysis were reported; therefore, no qualification was necessary.

1.4.4 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- 2nd column confirmation

All analytical or quality parameters requiring further discussion for Method 8330B are described in the sections below.

1.4.4.1 Surrogate Recoveries

Surrogate 1,2-dinitrobenzene was recovered below the recovery limits (83-119%) in sample WBG-019-102816-GW (77%). The associated sample results were qualified as estimated (UJ S).

1.4.4.2 Field Duplicates

One field duplicate (WBGmw-041DUP-102816-GW) was collected and analyzed for explosives. All parent and field duplicate sample results were non-detect; therefore, no RPDs were calculated.

1.4.5 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- LCS recoveries
- Low level calibration check standard
- Interference check solutions
- Instrument tuning
- Continuing calibration verification

All analytical or quality parameters requiring further discussion for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.5.1 Method Blanks

Sodium (116 µg/L) and vanadium (0.565 µg/L) were detected in the method blank at concentrations below their respective LOQs (5000 µg/L and 6.0 µg/L). Sodium and vanadium were detected at concentrations below or equal to the LOQs in several associated samples. These detections are outlined in the table below:

Analyte	Sample ID	Result (µg/L)	LOQ (µg/L)	Validation Flag
Sodium	WBGmw-007-102816-GW	4900	5000	U B
	WBGmw-499-102816-GW	5000		
	WBGmw-021-102816-GW	5000		
	WBGmw-018-102816-GW	2200		
	WBGmw-020-102816-GW	3900		
Vanadium	WBGmw-007-102816-GW	0.53	6	U B
	WBGmw-499-102816-GW	0.68		
	WBGmw-006-102816-GW	0.8		
	WBGmw-021-102816-GW	0.7		
	WBGmw-018-102816-GW	0.62		
	WBGmw-020-102816-GW	0.64		
	WBGmw-009-102816-GW	0.77		

The results in the table above were qualified as non-detected at the LOQ (U B).

All other associated sample results were either non-detect or above the LOQ; therefore, no qualification was necessary.

1.4.5.2 Calibration Blanks

Several analytes were detected in the calibration blanks bracketing the samples. The following table presents the initial and continuing calibration blank detections:

Calibration Blank ID	Associated Samples	Analyte	Blank Detection (µg/L)	LOQ (µg/L)	Assigned Flags	Samples Qualified
CCB 280-350738/107	WBGmw-007-102816-GW WBGmw-499-102816-GW WBGmw-006-102816-GW WBGmw-021-102816-GW WBGmw-018-102816-GW	Sodium	124	5000	U B	WBGmw-007-102816-GW WBGmw-499-102816-GW WBGmw-021-102816-GW WBGmw-018-102816-GW
CCB 280-350738/121	WBGmw-020-102816-GW WBGmw-009-102816-GW	Sodium	121	5000	U B	WBGmw-020-102816-GW
CCB 280-350738/132	WBGmw-020-102816-GW WBGmw-009-102816-GW	Magnesium	14.3	500	N/A	None
		Sodium	117	5000	U B	WBGmw-020-102816-GW
ICB 280-350593/12	WBGmw-007-102816-GW WBGmw-499-102816-GW WBGmw-006-102816-GW WBGmw-021-102816-GW WBGmw-018-102816-GW WBGmw-020-102816-GW WBGmw-009-102816-GW	Antimony	0.587	2	N/A	None
CCB 280-350593/95	WBGmw-007-102816-GW WBGmw-499-102816-GW WBGmw-006-102816-GW WBGmw-021-102816-GW	Vanadium	0.578	5	U B	WBGmw-007-102816-GW WBGmw-499-102816-GW WBGmw-006-102816-GW WBGmw-021-102816-GW

	WBGmw-018-102816-GW WBGmw-020-102816-GW WBGmw-009-102816-GW					WBGmw-018-102816-GW WBGmw-020-102816-GW WBGmw-009-102816-GW
CCB 280-350593/106	WBGmw-007-102816-GW WBGmw-499-102816-GW WBGmw-006-102816-GW WBGmw-021-102816-GW WBGmw-018-102816-GW WBGmw-020-102816-GW WBGmw-009-102816-GW	Vanadium	0.692	5	U B	WBGmw-007-102816-GW WBGmw-499-102816-GW WBGmw-006-102816-GW WBGmw-021-102816-GW WBGmw-018-102816-GW WBGmw-020-102816-GW WBGmw-009-102816-GW
CCB 280-350789/71	WBGmw-007-102816-GW WBGmw-499-102816-GW WBGmw-006-102816-GW WBGmw-021-102816-GW WBGmw-018-102816-GW WBGmw-020-102816-GW WBGmw-009-102816-GW	Vanadium	0.06	5	U B	WBGmw-007-102816-GW WBGmw-499-102816-GW WBGmw-006-102816-GW WBGmw-021-102816-GW WBGmw-018-102816-GW WBGmw-020-102816-GW WBGmw-009-102816-GW

CCB = continuing calibration blank

ICB = initial calibration blank

Detections less than the LOQ in associated samples are qualified as not detected at the LOQ (U B).

1.4.5.3 Initial Calibration Verification

Barium (127%) and beryllium recovered above the QC limits (80-120%) in the low level ICV 280-350593/13 associated with samples WBGmw-007-102816-GW, WBGmw-499-102816-GW, WBGmw-006-102816-GW, WBGmw-021-102816-GW, WBGmw-018-102816-GW, WBGmw-020-102816-GW, and WBGmw-009-102816-GW. Barium was detected in all associated sample. These sample results were qualified as estimated (J IC). Beryllium was non-detect in all associated samples; therefore, no qualification was necessary.

1.4.5.4 Matrix Spike/Matrix Spike Duplicates

An MS/MSD was performed on sample WBGmw-007-102816-GW for Method 7470A only. All recoveries and RPDs were within QC limits.

1.4.5.5 Field Duplicates

One field duplicate (WBGmw-499-102816-GW) was collected and analyzed for metals. For detections greater than 5x the LOQ in both samples, an RPD was calculated. For detections less than 5x the LOQ, the difference in values was compared to \pm the LOQ. The following table shows the detections in parent and field duplicate samples:

Primary/Duplicate Sample ID	Analyte	Primary Sample Result ($\mu\text{g/L}$)	Field Duplicate Result ($\mu\text{g/L}$)	LOQ ($\mu\text{g/L}$)	RPD (%)	RPD Limit (%) ¹
WBGmw-007-102816-GW /WBGmw-499-102816-GW	Aluminum	57 J	19 J	300	N/A	\pm LOQ
	Calcium	59000	60000	1000	1.7	20
	Iron	420	360	100	N/A	\pm LOQ
	Magnesium	19000	19000	500	0.0	20
	Potassium	1200 J	1300 J	3000	N/A	\pm LOQ
	Arsenic	5.6	5.3	5	N/A	\pm LOQ
	Barium	37	37	3	0.0	20
	Cobalt	0.29 J	0.26 J	1	N/A	\pm LOQ
	Manganese	120	130	3.5	8.0	20
	Nickel	0.34 J	3 U	3	N/A	\pm LOQ
	Silver	0.09 J	0.067 J	5	N/A	\pm LOQ

¹ The RPD limit is 20% for detections greater than 5x the LOQ; \pm the LOQ for detections less than 5x the LOQ.

J Laboratory flag indicating the result is less than the LOQ and is estimated.

U Laboratory flag indicating the result is not detected.

N/A Not applicable

All calculated RPDs and difference in detections met criteria. No validation flags were assigned.

1.4.6 Hexavalent Chromium by Method 7196A

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- LODs and LOQs
- Method blanks
- LCS recoveries
- MS/MSD recoveries and RPDs
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

- Holding times

No parameters required further discussion for Method 7196A.

1.4.7 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

No parameters requiring further discussion for Method 9012B.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	Result	Units	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Group	Reason Code
280-90279-1	WBGmw-009-102816-GW	280-90279-10	Water	Vanadium	6	µg/L	j	u	n	6	6.0	0.5	Metals	B
280-90279-1	WBGmw-009-102816-GW	280-90279-10	Water	Barium	15	µg/L	v	j	y	3	3.0	0.29	Metals	IC
280-90279-1	Trip Blank	280-90279-11	Water	Chloromethane	2	µg/L	u q	uj	n	2	2.0	0.3	VOCs	CC
280-90279-1	WBGmw-007-102816-GW	280-90279-3	Water	Sodium	5000	µg/L	j	u	n	5000	350	92	Metals	B
280-90279-1	WBGmw-007-102816-GW	280-90279-3	Water	Vanadium	6	µg/L	j	u	n	6	6.0	0.5	Metals	B
280-90279-1	WBGmw-007-102816-GW	280-90279-3	Water	Barium	37	µg/L	v	j	y	3	3.0	0.29	Metals	IC
280-90279-1	WBGmw-007-102816-GW	280-90279-3	Water	Naphthalene	0.1	µg/L	u q	uj	n	0.1	0.012	0.0081	PAHs	S
280-90279-1	WBGmw-499-102816-GW	280-90279-4	Water	Sodium	5000	µg/L	v	u	n	5000	350	92	Metals	B
280-90279-1	WBGmw-499-102816-GW	280-90279-4	Water	Vanadium	6	µg/L	j	u	n	6	6.0	0.5	Metals	B
280-90279-1	WBGmw-499-102816-GW	280-90279-4	Water	Barium	37	µg/L	v	j	y	3	3.0	0.29	Metals	IC
280-90279-1	WBGmw-006-102816-GW	280-90279-5	Water	Vanadium	6	µg/L	j	u	n	6	6.0	0.5	Metals	B
280-90279-1	WBGmw-006-102816-GW	280-90279-5	Water	Barium	21	µg/L	v	j	y	3	3.0	0.29	Metals	IC
280-90279-1	WBGmw-021-102816-GW	280-90279-6	Water	Barium	54	µg/L	v	j	y	3	3.0	0.29	Metals	IC
280-90279-1	WBGmw-021-102816-GW	280-90279-6	Water	Sodium	5000	µg/L	v	u	n	5000	350	92	Metals	B
280-90279-1	WBGmw-021-102816-GW	280-90279-6	Water	Vanadium	6	µg/L	j	u	n	6	6.0	0.5	Metals	B
280-90279-1	WBGmw-018-102816-GW	280-90279-7	Water	Sodium	2200	µg/L	j	u	n	5000	350	92	Metals	B
280-90279-1	WBGmw-018-102816-GW	280-90279-7	Water	Vanadium	6	µg/L	j	u	n	6	6.0	0.5	Metals	B
280-90279-1	WBGmw-018-102816-GW	280-90279-7	Water	Barium	25	µg/L	v	j	y	3	3.0	0.29	Metals	IC
280-90279-1	WBGmw-019-102816-GW	280-90279-8	Water	1,3,5-Trinitrobenzene	1.1	µg/L	u q	uj	n	1.1	0.43	0.22	Explosives and Propellants	S
280-90279-1	WBGmw-019-102816-GW	280-90279-8	Water	1,3-Dinitrobenzene	0.43	µg/L	u q	uj	n	0.43	0.22	0.096	Explosives and Propellants	S
280-90279-1	WBGmw-019-102816-GW	280-90279-8	Water	2,4,6-Trinitrotoluene	0.43	µg/L	u q	uj	n	0.43	0.22	0.079	Explosives and Propellants	S
280-90279-1	WBGmw-019-102816-GW	280-90279-8	Water	2,4-Dinitrotoluene	0.43	µg/L	u q	uj	n	0.43	0.22	0.091	Explosives and Propellants	S
280-90279-1	WBGmw-019-102816-GW	280-90279-8	Water	2,6-Dinitrotoluene	0.22	µg/L	u q	uj	n	0.22	0.22	0.07	Explosives and Propellants	S
280-90279-1	WBGmw-019-102816-GW	280-90279-8	Water	2-Amino-4,6-dinitrotoluene	0.22	µg/L	u q	uj	n	0.22	0.13	0.055	Explosives and Propellants	S
280-90279-1	WBGmw-019-102816-GW	280-90279-8	Water	2-Nitrotoluene	0.43	µg/L	u q	uj	n	0.43	0.22	0.093	Explosives and Propellants	S
280-90279-1	WBGmw-019-102816-GW	280-90279-8	Water	3-Nitrotoluene	0.43	µg/L	u q	uj	n	0.43	0.22	0.09	Explosives and Propellants	S
280-90279-1	WBGmw-019-102816-GW	280-90279-8	Water	4-Amino-2,6-dinitrotoluene	0.22	µg/L	u q	uj	n	0.22	0.13	0.063	Explosives and Propellants	S
280-90279-1	WBGmw-019-102816-GW	280-90279-8	Water	4-Nitrotoluene	1.1	µg/L	u q	uj	n	1.1	0.43	0.22	Explosives and Propellants	S
280-90279-1	WBGmw-019-102816-GW	280-90279-8	Water	HMX	0.43	µg/L	u q	uj	n	0.43	0.22	0.095	Explosives and Propellants	S
280-90279-1	WBGmw-019-102816-GW	280-90279-8	Water	Nitrobenzene	0.43	µg/L	u q	uj	n	0.43	0.22	0.099	Explosives and Propellants	S
280-90279-1	WBGmw-019-102816-GW	280-90279-8	Water	Nitroglycerin	3.3	µg/L	u q	uj	n	3.3	2.2	1	Explosives and Propellants	S
280-90279-1	WBGmw-019-102816-GW	280-90279-8	Water	PETN	2.2	µg/L	u q	uj	n	2.2	1.3	0.45	Explosives and Propellants	S
280-90279-1	WBGmw-019-102816-GW	280-90279-8	Water	RDX	0.22	µg/L	u q	uj	n	0.22	0.13	0.057	Explosives and Propellants	S
280-90279-1	WBGmw-019-102816-GW	280-90279-8	Water	Tetryl	0.26	µg/L	u q	uj	n	0.26	0.22	0.086	Explosives and Propellants	S
280-90279-1	WBGmw-020-102816-GW	280-90279-9	Water	Sodium	5000	µg/L	j	u	n	5000	350	92	Metals	B
280-90279-1	WBGmw-020-102816-GW	280-90279-9	Water	Vanadium	6	µg/L	j	u	n	6	2.0	0.5	Metals	B
280-90279-1	WBGmw-020-102816-GW	280-90279-9	Water	Barium	17	µg/L	v	j	y	3	3.0	0.29	Metals	IC

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90285-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by a Senior Chemist. Signatures indicate the report is approved for release.



Travis Withers

2017.01.18 12:58:02 -07'00'

Travis Withers, Validation Chemist, TEC-WESTON JV

Date



Peter Chapman, Senior Chemist, TEC-WESTON JV

1/10/17

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90285-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Polycyclic Aromatic Hydrocarbons	8270D SIM	Denver, CO
Explosives	8330B	Denver, CO
Total Cyanide	9012B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above

referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	PAHs	Explosives	Cyanide
LL4mw-194-102816-GW	280-90285-1	10/28/16	Groundwater	MS/MSD	✓	✓	✓	✓
LL4mw-194-102816-GW-D	280-90285-2	10/28/16	Groundwater	Field Duplicate	✓	✓	✓	✓

Note: LL4mw-194-102816-GW-D is a field duplicate of parent sample LL4mw-194-102816-GW

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
UJ	M	Estimated non-detection; MS/MSD percent recovery or RPD exceedance.
UJ	S	Estimated detection; surrogate outlier.
U	B	Not detected; target analyte was detected in the method or calibration blank.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on October 29, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

“-GW” was added to the end of all sample IDs to comply with the RIWP.

The COC sample ID LL4mw-194-102816-D was listed on the containers as LL4mw-194DUP-102816. The sample was logged per the COC.

The sample time for LL4mw-194-102816 and LL4-499-102816-GW were recorded as 0915 on the COC and 0920 on the container IDs. The samples were logged per the COC.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- Laboratory control samples
- Matrix spike/matrix spike duplicate
- LODs and LOQs
- Instrument tuning
- Initial calibration verification
- Continuing calibration verification
- Internal standard recoveries

All analytical or quality parameters requiring further discussion for Method 8260B are described in the sections below.

1.4.1.1 Method Blanks

Methylene chloride (1.23 µg/L) was detected in the method blank at a concentration below the LOQ (5.0 µg/L). Methylene chloride was also detected at concentrations below the LOQ in samples LL4mw-194-102816-GW (0.51 µg/L) (and its reanalysis (0.60 µg/L)) and LL4mw-194-102816-D (0.66 µg/L). These samples results were qualified as non-detect at the LOQ (U B).

1.4.1.2 Trip Blanks

No trip blanks were reported in this SDG. Refer to section 1.4.1.1 of the DVR for SDG 280-90279-1 for details regarding the trip blank associated with the samples in this report. Methylene chloride (0.72 µg/L) was detected in the associated trip blank at a concentration below the LOQ (5.0 µg/L). Methylene chloride was also detected at concentrations below the LOQ in samples LL4mw-194-102816-GW (0.51 µg/L) (and its reanalysis (0.60 µg/L)) and LL4mw-194-102816-D (0.66 µg/L). These samples results were qualified as non-detect at the LOQ (U B).

1.4.1.3 Surrogate Recoveries

Surrogate 4-bromofluorobenzene recovered below the QC limits (85-114%) in sample LL4mw-194-102816-GW (84%). All associated sample results were non-detect and were qualified as estimated (UJ S).

Due to the low surrogate recovery, sample LL4mw-194-102816-GW was reanalyzed to yield a low surrogate recovery again (81%). The results from the initial analysis were reported.

1.4.1.4 Field Duplicates

One field duplicate (LL4mw-194-102816-D) was collected and analyzed for VOCs. All parent and field duplicate sample results were non-detect; therefore, no RPDs were calculated.

1.4.2 Polycyclic Aromatic Hydrocarbons by Method 8270D SIM

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS recoveries
- Instrument tuning
- Initial calibration verification
- Continuing calibration verification
- Internal standard recoveries

All analytical or quality parameters requiring further discussion for Method 8270D are described in the sections below.

1.4.2.1 Matrix Spike/Matrix Spike Duplicates

An MS/MSD was performed on sample LL4mw-194-102816-GW. All recoveries and RPDs were within QC limits.

1.4.2.2 Field Duplicates

One field duplicate (LL4mw-194-102816-D) was collected and analyzed for PAHs. All parent and field duplicate sample results were non-detect; therefore, no RPDs were calculated.

1.4.3 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- 2nd column confirmation

All analytical or quality parameters requiring further discussion for Method 8330B are described in the sections below.

1.4.3.1 Surrogate Recoveries

Surrogate 1,2-dinitrobenzene recovered below the QC limits (83-119%) in LL4mw-194-102816-D (82%). All associated sample results were non-detect and were qualified as estimated (UJ S).

1.4.3.2 Matrix Spike/Matrix Spike Duplicates

An MS/MSD was performed on sample LL4-194-102816-GW. All MS/MSD recoveries and RPDs were within control limits with the exception of the exceedances presented in the following table:

Parent Sample	Analyte	MS %R	MSD %R	%R QC Limits	RPD	RPD Limits	Assigned Flags
LL4mw-194-102816-GW	2-Amino-4,6-dinitrotoluene	70	99	79-120	32	20	UJ M
	2,6-dinitrotoluene	110	83	77-127	29	20	None

%R = percent recovery

Bolded values are outside control limits

The MSD recovery and RPD was outside QC limits for 2-Amino-4,6-dinitrotoluene. This analyte in the associated parent sample were qualified as estimated (UJ M).

The RPD for 2,6-dinitrotoluene exceeded the RPD limit. The parent sample was non-detect for 2,6-dinitrotoluene; therefore, no qualification was necessary.

1.4.3.3 Field Duplicates

One field duplicate (LL4mw-194-102816-GW) was collected and analyzed for explosives. All associated parent and field duplicate sample results were non-detect; therefore, no qualification was necessary.

1.4.4 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

All analytical or quality parameters requiring further discussion for Method 9012B are described in the sections below.

1.4.4.1 Matrix Spike/Matrix Spike Duplicates

An MS/MSD was performed on samples LL4mw-194-102816-GW and LL4mw-499-102816-GW. All recoveries and RPDs were within QC limits.

1.4.4.2 Field Duplicates

One field duplicate (LL4mw-194-102816-D) was collected and analyzed for cyanide. For detections greater than 5x the LOQ in both samples, an RPD was calculated. For detections less than 5x the LOQ, the difference in values was compared to \pm the LOQ. The following table shows the detections in parent and field duplicate samples:

Primary/Duplicate Sample ID	Analyte	Primary Sample Result ($\mu\text{g/L}$)	Field Duplicate Result ($\mu\text{g/L}$)	LOQ ($\mu\text{g/L}$)	RPD (%)	RPD Limit (%)
LL4mw-194-102816-GW /LL4mw-194-102816-D	Cyanide	2.2 J	5 U	5	N/A	\pm LOQ

¹ The RPD limit is 20% for detections greater than 5x the LOQ; \pm the LOQ for detections less than 5x the LOQ.

J Laboratory flag indicating the result is less than the LOQ and is estimated.

U Laboratory flag indicating the result is not detected.

N/A Not applicable

All calculated RPDs and difference in detections met criteria. No validation flags were assigned.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	Result	Units	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Group	Reason Code
280-90285-1	LL4mw-194-102816-GW	280-90285-1	Water	1,1,2,2-Tetrachloroethane	1	µg/L	u q	uj	n	1	0.80	0.2	VOCs	S
280-90285-1	LL4mw-194-102816-GW	280-90285-1	Water	Methylene chloride	5	µg/L	j	u	n	5	0.80	0.32	VOCs	B
280-90285-1	LL4mw-194-102816-GW	280-90285-1	Water	2-Amino-4,6-dinitrotoluene	0.22	µg/L	u j	uj	n	0.22	0.13	0.055	Explosives and Propellants	M
280-90285-1	LL4mw-194-102816-GW-D	280-90285-2	Water	1,3,5-Trinitrobenzene	1.1	µg/L	u q	uj	n	1.1	0.43	0.21	Explosives and Propellants	S
280-90285-1	LL4mw-194-102816-GW-D	280-90285-2	Water	1,3-Dinitrobenzene	0.43	µg/L	u q	uj	n	0.43	0.21	0.095	Explosives and Propellants	S
280-90285-1	LL4mw-194-102816-GW-D	280-90285-2	Water	2,4,6-Trinitrotoluene	0.43	µg/L	u q	uj	n	0.43	0.21	0.077	Explosives and Propellants	S
280-90285-1	LL4mw-194-102816-GW-D	280-90285-2	Water	2,4-Dinitrotoluene	0.43	µg/L	u q	uj	n	0.43	0.21	0.089	Explosives and Propellants	S
280-90285-1	LL4mw-194-102816-GW-D	280-90285-2	Water	2,6-Dinitrotoluene	0.21	µg/L	u q	uj	n	0.21	0.21	0.069	Explosives and Propellants	S
280-90285-1	LL4mw-194-102816-GW-D	280-90285-2	Water	2-Amino-4,6-dinitrotoluene	0.21	µg/L	u q	uj	n	0.21	0.13	0.054	Explosives and Propellants	S
280-90285-1	LL4mw-194-102816-GW-D	280-90285-2	Water	2-Nitrotoluene	0.43	µg/L	u q	uj	n	0.43	0.21	0.091	Explosives and Propellants	S
280-90285-1	LL4mw-194-102816-GW-D	280-90285-2	Water	3-Nitrotoluene	0.43	µg/L	u q	uj	n	0.43	0.21	0.089	Explosives and Propellants	S
280-90285-1	LL4mw-194-102816-GW-D	280-90285-2	Water	4-Amino-2,6-dinitrotoluene	0.21	µg/L	u q	uj	n	0.21	0.13	0.061	Explosives and Propellants	S
280-90285-1	LL4mw-194-102816-GW-D	280-90285-2	Water	4-Nitrotoluene	1.1	µg/L	u q	uj	n	1.1	0.43	0.21	Explosives and Propellants	S
280-90285-1	LL4mw-194-102816-GW-D	280-90285-2	Water	HMX	0.43	µg/L	u q	uj	n	0.43	0.21	0.093	Explosives and Propellants	S
280-90285-1	LL4mw-194-102816-GW-D	280-90285-2	Water	Nitrobenzene	0.43	µg/L	u q	uj	n	0.43	0.21	0.097	Explosives and Propellants	S
280-90285-1	LL4mw-194-102816-GW-D	280-90285-2	Water	Nitroglycerin	3.2	µg/L	u q	uj	n	3.2	2.1	0.98	Explosives and Propellants	S
280-90285-1	LL4mw-194-102816-GW-D	280-90285-2	Water	PETN	2.1	µg/L	u q	uj	n	2.1	1.3	0.44	Explosives and Propellants	S
280-90285-1	LL4mw-194-102816-GW-D	280-90285-2	Water	RDX	0.21	µg/L	u q	uj	n	0.21	0.13	0.056	Explosives and Propellants	S
280-90285-1	LL4mw-194-102816-GW-D	280-90285-2	Water	Tetryl	0.26	µg/L	u q	uj	n	0.26	0.21	0.084	Explosives and Propellants	S
280-90285-1	LL4mw-194-102816-GW-D	280-90285-1	Water	Methylene chloride	5	µg/L	j	u	n	5	0.80	0.32	VOCs	B

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90286-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by a Senior Chemist. Signatures indicate the report is approved for release.



Travis Withers

2017.01.18 12:59:02 -07'00'

Travis Withers, Validation Chemist, TEC-WESTON JV

Date



Peter Chapman, Senior Chemist, TEC-WESTON JV

1/10/17

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90286-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polycyclic Aromatic Hydrocarbons (PAHs)	8270D SIM	Denver, CO
Explosives	8330B	Denver, CO
Total Cyanide	9012B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA*

2014). Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	SVOCs	PAHs	Explosives	Cyanide
FBQmw-176-102816-GW	280-90286-1	10/28/16	Groundwater		✓	✓	✓	✓	✓

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
J	H	Estimated detection; holding time exceeded.
UJ	S	Estimated non-detection; surrogate outlier.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on October 29, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

“-GW” was added to the end of all sample IDs to comply with the RIWP.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- Method blanks
- LCS recoveries
- Surrogate recoveries
- LODs and LOQs
- Instrument tuning
- Initial calibration verification
- Continuing calibration verification
- Internal standard recoveries

All analytical or quality parameters requiring further discussion for Method 8260B are described in the sections below.

1.4.1.1 Trip Blanks

No trip blanks were reported in this SDG. Refer to section 1.4.1.1 of the DVR for SDG 280-90279-1 for details regarding the trip blank associated with the samples in this report. Methylene chloride (0.72 µg/L) was detected in the associated trip blank at a concentration below the LOQ (5.0 µg/L). All associated were non-detect for methylene chloride; therefore, no qualification was necessary.

1.4.2 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS recoveries
- Instrument tuning
- Initial calibration verification
- Continuing calibration verification
- Internal standard recoveries

No parameters required further discussion for Method 8270D.

1.4.3 Polycyclic Aromatic Hydrocarbons by Method 8270D SIM

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- LODs and LOQs
- Method blanks
- LCS recoveries
- Instrument tuning
- Initial calibration verification
- Continuing calibration verification
- Internal standard recoveries

All analytical or quality parameters requiring further discussion for Method 8270D SIM are described in the sections below.

1.4.3.1 Method Blanks

Benzo(a)pyrene (0.0120 µg/L) and dibenz(a,h)anthracene (0.00872 µg/L) were detected in the method blank (MB 280-351012/1-A) associated with the re-extraction of sample FBQmw-176-102816-GW. All associated sample results were non-detect; therefore, no qualification was necessary.

1.4.3.2 Surrogate Recoveries

Surrogate nitrobenzene-d5 was recovered below the acceptance criteria (55-111%) in sample FBQmw-176-102816-GW (51%). The sample was re-extracted and reanalyzed outside of the holding time with passing surrogates and concurring results. All associated sample results were qualified as estimated (UJ S).

1.4.3.3 Holding Time

Due to low surrogate recovery, sample FBQmw-176-102816-GW was re-extracted and reanalyzed outside of the holding time. The results confirmed and the initial sample results were reported.

1.4.4 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- 2nd column confirmation

No parameters required further discussion for Method 8330B.

1.4.5 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- LODs and LOQs
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

All analytical or quality parameters requiring further discussion for Method 9012B are described in the sections below.

1.4.5.1 Holding Times

Sample FBQmw-176-102816-GW was originally analyzed within the holding time constraints, but due to obvious sample contamination in the initial analysis, the sample was reanalyzed one day outside of the holding time. The associated sample result was qualified as estimated (J H).

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	Result	Units	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Group	Reason Code
280-90286-1	FBQmw-176-102816-GW		Water	Naphthalene	0.1	µg/L	u q	uj	n	0.1	012	0.0082	PAHs	S
280-90286-1	FBQmw-176-102816-GW		Water	Total Cyanide	37	µg/L	h	j	y	10	5.0	2	Total Cyanide	H

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90288-1

Prepared For:



National Guard Bureau
NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture
2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by a Senior Chemist. Signatures indicate the report is approved for release.



Travis Withers

2017.01.18 13:00:05 -07'00'

Travis Withers, Validation Chemist, TEC-WESTON JV

Date



Peter Chapman, Senior Chemist, TEC-WESTON JV

1/10/17

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90288-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Perchlorate	6860	Denver, CO
Explosives	8330B	Denver, CO
Metals	6010C/6020A/7470A	Denver, CO
Total Cyanide	9012B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data*

Review (EPA 2014) and USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014). Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	SVOCs (phthalates)	Perchlorate	Explosives	Metals	Cyanide
LL3mw-246-102816-GW	280-90288-1	10/28/16	Groundwater	MS/MSD	✓	✓	✓	✓	✓	✓
LL3mw-237-102816-GW	280-90288-2	10/28/16	Groundwater		✓			✓		✓
LL3mw-246DUP-102816-GW	280-90288-3	10/28/16	Groundwater	Field Dup	✓	✓	✓	✓	✓	✓

Note: LL3mw-246DUP-102816-GW is a field duplicate of parent sample LL3mw-246-102816-GW

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
J	M	Estimated detection; matrix spike/matrix spike duplicate recovery or RPD exceedance.
J	S	Estimated detection; surrogate outlier.
J	CC	Estimated detection; continuing calibration verification did not meet acceptance criteria.
UJ	M	Estimated detection; matrix spike/matrix spike duplicate recovery or RPD exceedance.
UJ	S	Estimated non-detection; surrogate outlier.
U	B	Not detected; target analyte was detected in the method or calibration blank.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on October 29, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

“-GW” was added to the end of all sample IDs to comply with the RIWP.

PCB analysis requested on samples LL3mw-246-102816-GW and LL3mw-246DUP-102816-GW were canceled due to the LCS/LCSD & surrogates being spiked at the incorrect concentration and the MS/MSD spike was omitted, rendering the results unusable. No additional sample volume remained to re-extract the sample.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- LCS recoveries
- MS/MSD recoveries and RPDs
- Instrument tuning
- Initial calibration verification
- Continuing calibration verification
- Internal standard recoveries

All analytical or quality parameters requiring further discussion for Method 8260B are described in the sections below.

1.4.1.1 Method Blanks

Methylene chloride (1.23 µg/L) was detected in the method blank at a concentration below the LOQ (5.0 µg/L). Methylene chloride was detected in samples LL3mw-246-102816-GW (0.52 µg/L), LL3mw-237-102816-GW (0.52 µg/L), and LL3mw-346DUP-102816-GW (0.45 µg/L) at concentrations below the LOQ. These sample results were qualified as non-detect at the LOQ (U B).

1.4.1.2 Trip Blanks

No trip blanks were reported in this SDG. Refer to section 1.4.1.1 of the DVR for SDG 280-90279-1 for details regarding the trip blank associated with the samples in this report. Methylene chloride (0.72 µg/L) was detected in the associated trip blank at a concentration below the LOQ (5.0 µg/L). Methylene chloride was detected in samples LL3mw-246-102816-GW (0.52 µg/L), LL3mw-237-102816-GW (0.52 µg/L), and LL3mw-346DUP-102816-GW (0.45 µg/L) at concentrations below the LOQ. These sample results were qualified as non-detect at the LOQ (U B).

1.4.1.3 Field Duplicates

One field duplicate (LL3mw-246DUP-102816-GW) was collected and analyzed for VOCs. All associated parent and field duplicate sample results were non-detect; therefore, no RPDs were calculated.

1.4.2 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS recoveries
- MS/MSD recoveries and RPDs
- Instrument tuning
- Initial calibration verification
- Continuing calibration verification
- Internal standard recoveries

All analytical or quality parameters requiring further discussion for Method 8270D are described in the sections below.

1.4.2.1 Field Duplicates

One field duplicate (LL3mw-246DUP-102816-GW) was collected and analyzed for VOCs. All associated parent and field duplicate sample results were non-detect; therefore, no RPDs were calculated.

1.4.3 Perchlorate by Method 6860

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Lower control interference check standard
- Method blanks
- LCS recoveries
- Equipment blanks
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks
- Internal standard recoveries
- Instrument tuning

All analytical or quality parameters requiring further discussion for Method 6860 are described in the sections below.

1.4.3.1 Matrix Spike/Matrix Spike Duplicates

An MS/MSD was performed on sample LL3mw-246-102816-GW. The table below outlines the MS/MSD recoveries and RPD:

Parent Sample	Analyte	MS %R	MSD %R	%R QC Limits	RPD	RPD Limits	Assigned Flags
LL3mw-246-102816-GW	Perchlorate	107	192	84-119	29	20	J M

%R = percent recovery

Bolded values are outside control limits

The MSD recovery and RPD were above the acceptance criteria. The parent sample result was qualified as estimated (J M).

1.4.3.2 Field Duplicates

One field duplicate (LL3mw-246DUP-102816-GW) was collected and analyzed for perchlorate. For detections greater than 5x the LOQ in both samples, an RPD was calculated. For detections less than 5x the LOQ, the difference in values was compared to \pm the LOQ. The following table shows the detections in parent and field duplicate samples:

Primary/Duplicate Sample ID	Analyte	Primary Sample Result (µg/L)	Field Duplicate Result (µg/L)	LOQ (µg/L)	RPD (%)	RPD Limit (%) ¹
LL3mw-246-102816-GW /LL3mw-246DUP-102816-GW	Perchlorate	0.073	0.07	0.05	N/A	±LOQ

¹ The RPD limit is 20% for detections greater than 5x the LOQ; ± the LOQ for detections less than 5x the LOQ.

J Laboratory flag indicating the result is less than the LOQ and is estimated.

N/A Not applicable

1.4.4 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- LODs and LOQs
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- 2nd column confirmation

All analytical or quality parameters requiring further discussion for Method 8330B are described in the sections below.

1.4.4.1 Surrogate Recoveries

Surrogate 1,2-dinitrobenzene was recovered above the recovery limits (83-119%) in sample LL3mw-237-102816-GW (121%) The associated sample results were qualified as estimated (J/UJ S).

1.4.4.2 Matrix Spike/Matrix Spike Duplicates

An MS/MSD was performed on sample LL3mw-246-102816-GW. All recoveries and RPDs were within acceptance criteria with the exception of those outlined in the table below:

Parent Sample	Analyte	MS %R	MSD %R	%R QC Limits	RPD	RPD Limits	Assigned Flags
LL3mw-246-102816-GW	2-Amino-4,6-dinitrotoluene	61	51	79-120	8.9	20	UJ M
	4-Amino-2,6-dinitrotoluene	95	49	76-125	32	20	UJ M
	1,3-Dinitrobenzene	93	45	78-120	35	20	UJ M
	2,4-Dinitrotoluene	78	40	78-120	32	20	UJ M
	2,6-Dinitrotoluene	113	36	77-127	52	20	UJ M
	HMX	87	39	65-135	38	20	UJ M
	Nitrobenzene	79	43	65-134	30	20	UJ M
	Nitroglycerin	98	44	74-127	38	20	UJ M
	2-Nitrotoluene	69	40	70-127	27	20	UJ M

3-Nitrotoluene	69	42	73-125	24	20	UJ M
4-Nitrotoluene	70	41	71-127	26	20	UJ M
PETN	97	43	73-127	39	20	UJ M
RDX	89	41	68-130	37	20	J M
Tertyl	89	42	64-128	36	20	UJ M
1,3,5-Trinitrobenzene	94	43	73-125	37	20	UJ M
2,4,6-Trinitrotoluene	94	44	71-123	36	20	UJ M

%R = percent recovery

Bolded values are outside control limits.

The parent sample results were qualified as estimated (J/UJ M).

1.4.4.3 Field Duplicates

One field duplicate (LL3mw-246DUP-102816-GW) was collected and analyzed for explosives. For detections greater than 5x the LOQ in both samples, an RPD was calculated. For detections less than 5x the LOQ, the difference in values was compared to \pm the LOQ. The following table shows the detections in parent and field duplicate samples:

Primary/Duplicate Sample ID	Analyte	Primary Sample Result ($\mu\text{g/L}$)	Field Duplicate Result ($\mu\text{g/L}$)	LOQ ($\mu\text{g/L}$)	RPD (%)	RPD Limit (%) ¹
LL3mw-246-102816-GW /LL3mw-246DUP-102816-GW	RDX	0.16 J	0.21 U	0.21	N/A	\pm LOQ
	2-Amino-4,6-dinitrotoluene	0.28	0.21 U	0.21	N/A	\pm LOQ
	4-Amino-2,6-dinitrotoluene	0.26	0.21 U	0.21	N/A	\pm LOQ

¹ The RPD limit is 20% for detections greater than 5x the LOQ; \pm the LOQ for detections less than 5x the LOQ.

J Laboratory flag indicating the result is less than the LOQ and is estimated.

U Laboratory flag indicating the result is not detected.

N/A Not applicable

All calculated RPDs and difference in detections met criteria. No validation flags were assigned.

1.4.5 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- LCS recoveries
- Low level calibration check standard
- Interference check solutions
- Instrument tuning
- Initial calibration verification

All analytical or quality parameters requiring further discussion for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.5.1 Method Blanks

Several analytes were detected in method blanks at concentrations below the LOQ. These method blank detections are outlined in the table below:

Method Blank	Analyte	Blank Detection (µg/L)	LOQ (µg/L)	Assigned Flags	Samples Qualified
MB 280-350312/1-A	Sodium	116	5000	U B	LL3mw-246-102816-GW
					LL3mw-246DUP-102816-GW
MB 280-349784/1-A	Chromium	2.89	10	N/A	None
	Copper	0.914	2	U B	LL3mw-246-102816-GW
					LL3mw-246DUP-102816-GW
	Zinc	2.04	20	U B	LL3mw-246-102816-GW
LL3mw-246DUP-102816-GW					
Manganese	0.705	3.5	U B	LL3mw-246DUP-102816-GW	

MB = method blank

The sample results listed in the table above were qualified as non-detected at the LOQ (U B).

All other associated sample results were either non-detect or above the LOQ; therefore, no qualification was necessary.

1.4.5.2 Calibration Blanks

Several analytes were detected in the calibration blanks bracketing the samples. The following table outlines the initial and continuing calibration blank detections:

Calibration Blank	Associated Samples	Analyte	Blank Detection (µg/L)	LOQ (µg/L)	Assigned Flags	Samples Qualified
CCB 280-350738/121	LL3mw-246-102816-GW LL3mw-246DUP-102816-GW	Sodium	121	5000	U B	LL3mw-246-102816-GW LL3mw-246DUP-102816-GW
CCB 280-350738/132	LL3mw-246-102816-GW	Magnesium	14.3	500	N/A	None

	LL3mw-246DUP-102816-GW					
		Sodium	117	5000	U B	LL3mw-246-102816-GW LL3mw-246DUP-102816-GW
CCB 280-351011/88	LL3mw-246-102816-GW LL3mw-246DUP-102816-GW	Thallium	0.054	1	U B	LL3mw-246-102816-GW LL3mw-246DUP-102816-GW

CCB = continuing calibration blank

Detections less than the LOQ in associated samples are qualified as not detected at the LOQ (U B).

All other associated sample results were either non-detect or above the LOQ; therefore, no qualification was necessary.

1.4.5.3 Continuing Calibration Verification

Barium (129%) recovered above the QC limits (80-120%) in the low level CCV 280-351276/25 associated with samples LL3mw-246-102816-GW and LL3mw-246DUP-102816-GW. Barium was detected in all associated samples. These sample results were qualified as estimated (J CC).

Manganese recovered above the QC limits (80-120%) in the low level CCV 280-351276/38 associated with samples LL3mw-246-102816-GW and LL3mw-246DUP-102816-GW. Manganese was detected in sample LL3mw-246-102816-GW. This sample result was qualified as estimated (J CC). The manganese detection in sample LL3mw-246DUP-102816-GW was qualified as non-detect due to method blank contamination; therefore, no qualification was necessary. See section 1.4.6.1 for method blank contamination details.

1.4.5.4 Matrix Spike/Matrix Spike Duplicates

An MS/MSD was performed on sample LL3mw-246-102816-GW. All MS/MSD recoveries and RPDs were within QC limits with the exception of the exceedances presented in the following table:

Parent Sample	Analyte	MS %R	MSD %R	%R QC Limits	RPD RPD	RPD Limits	Assigned Flags
---------------	---------	-------	--------	--------------	---------	------------	----------------

LL3mw-246-102816-GW	Chromium	68	64	85-116	3	20	J M
---------------------	----------	-----------	-----------	--------	---	----	-----

%R = percent recovery

Bolded values are outside control limits.

The MS/MSD recoveries were below the QC limits for chromium. Chromium was detected in the parent sample; this result was qualified as estimated (J M).

1.4.5.5 Field Duplicates

One field duplicate (LL3-246DUP-102816-GW) was collected and analyzed for metals. For detections greater than 5x the LOQ in both samples, an RPD was calculated. For detections less than 5x the LOQ, the difference in values was compared to \pm the LOQ. The following table shows the detections in parent and field duplicate samples:

Primary/Duplicate Sample ID	Analyte	Primary Sample Result ($\mu\text{g/L}$)	Field Duplicate Result ($\mu\text{g/L}$)	LOQ ($\mu\text{g/L}$)	RPD (%)	RPD Limit (%) ¹
LL3mw-246-102816-GW/ LL3mw-246DUP-102816-GW	Calcium	22000	21000	1000	4.7	20
	Iron	100 U	45	100	N/A	\pm LOQ
	Magnesium	8300	8300	500	0.0	20
	Potassium	1300 J	1400 J	3000	N/A	\pm LOQ
	Sodium	3600 J	3600 J	5000	N/A	\pm LOQ
	Antimony	0.72 J	0.6 J	6	N/A	\pm LOQ
	Barium	19	19	3	0.0	20
	Chromium	15	13	10	N/A	\pm LOQ
	Cobalt	0.065 J	0.072 J	1	N/A	\pm LOQ
	Copper	1.6 J	0.79 J	2	N/A	\pm LOQ
	Lead	0.19 J	3 U	3	N/A	\pm LOQ
	Manganese	4.4	3.2 J	3.5	N/A	\pm LOQ
	Nickel	2.2 J	2.6 J	3	N/A	\pm LOQ
	Thallium	0.058 J	0.092 J	1	N/A	\pm LOQ
	Vanadium	1.1 J	0.63 J	6	N/A	\pm LOQ
Zinc	3.9 J	3 J	20	N/A	\pm LOQ	

¹ The RPD limit is 20% for detections greater than 5x the LOQ; \pm the LOQ for detections less than 5x the LOQ.

J Laboratory flag indicating the result is less than the LOQ and is estimated.

U Laboratory flag indicating the result is not detected.

N/A Not applicable

All calculated RPDs and difference in detections met criteria. No validation flags were assigned.

1.4.5.6 Interference Check Solutions

Manganese (1.2 µg/L) was detected in the interference check standard A (ISC-A) at a concentration greater than the LOD (1 µg/L). The lab confirmed this element is a trace impurity and is consistent with concentrations found by the manufacturer of the ICS-A solution. Based on reviewer's professional judgment, no qualification was necessary.

1.4.6 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- Method blanks
- LCS recoveries
- MS/MSD recoveries and RPDs
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

All analytical or quality parameters requiring further discussion for Method 9012B are described in the sections below.

1.4.6.1 Field Duplicates

One field duplicate (LL3-246DUP-102816-GW) was collected and analyzed for total cyanide. For detections greater than 5x the LOQ in both samples, an RPD was calculated. For detections less than 5x the LOQ, the difference in values was compared to ± the LOQ. The following table shows the detections in parent and field duplicate samples:

Primary/Duplicate Sample ID	Analyte	Primary Sample Result (µg/L)	Field Duplicate Result (µg/L)	LOQ (µg/L)	RPD (%)	RPD Limit (%)
LL3mw-246-102816-GW/ LL3mw-246DUP-102816-GW	Total cyanide	6 J	5 U	10	N/A	±LOQ

¹ The RPD limit is 20% for detections greater than 5x the LOQ; ± the LOQ for detections less than 5x the LOQ.

J Laboratory flag indicating the result is less than the LOQ and is estimated.

U Laboratory flag indicating the result is not detected.

N/A Not applicable

All calculated RPDs and difference in detections met criteria. No validation flags were assigned.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	AnalyticMethod	Reason Code
280-90288-1	LL3mw-246-102816-GW	280-90288-1	Water	Sodium	7440-23-5	µg/L	5000	j	u	n	5000	350	92	Metals	B
280-90288-1	LL3mw-246-102816-GW	280-90288-1	Water	Chromium	7440-47-3	µg/L	15	j	j	y	10	1.8	0.5	Metals	M
280-90288-1	LL3mw-246-102816-GW	280-90288-1	Water	Copper	7440-50-8	µg/L	2	j	u	n	2	1.8	0.56	Metals	B
280-90288-1	LL3mw-246-102816-GW	280-90288-1	Water	Thallium	7440-28-0	µg/L	1	j	u	n	1	0.2	0.05	Metals	B
280-90288-1	LL3mw-246-102816-GW	280-90288-1	Water	Zinc	7440-66-6	µg/L	20	j	u	n	20	8	2	Metals	B
280-90288-1	LL3mw-246-102816-GW	280-90288-1	Water	Barium	7440-39-3	µg/L	19	v	j	y	3	0.095	0.29	Metals	CC
280-90288-1	LL3mw-246-102816-GW	280-90288-1	Water	Manganese	7439-96-5	µg/L	4.4	q	j	y	3.5	0.095	0.31	Metals	CC
280-90288-1	LL3mw-246-102816-GW	280-90288-1	Water	Perchlorate	14797-73-0	µg/L	0.073	j	j	y	0.05	0.01	0.004	Perchlorate	M
280-90288-1	LL3mw-246-102816-GW	280-90288-1	Water	Methylene chloride	75-09-2	µg/L	5	j	u	n	5	0.8	0.32	VOCs	B
280-90288-1	LL3mw-246-102816-GW	280-90288-1	Water	1,3,5-Trinitrobenzene	99-35-4	µg/L	1.1	u j	uj	n	1.1	0.4	0.21	Explosives	M
280-90288-1	LL3mw-246-102816-GW	280-90288-1	Water	1,3-Dinitrobenzene	99-65-0	µg/L	0.43	u j	uj	n	0.43	0.2	0.095	Explosives	M
280-90288-1	LL3mw-246-102816-GW	280-90288-1	Water	2,4,6-Trinitrotoluene	118-96-7	µg/L	0.43	u j	uj	n	0.43	0.2	0.078	Explosives	M
280-90288-1	LL3mw-246-102816-GW	280-90288-1	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.43	u j	uj	n	0.43	4.4	0.09	Explosives	M
280-90288-1	LL3mw-246-102816-GW	280-90288-1	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u j	uj	n	0.21	4.4	0.069	Explosives	M
280-90288-1	LL3mw-246-102816-GW	280-90288-1	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.21	u j	uj	n	0.21	0.12	0.054	Explosives	M
280-90288-1	LL3mw-246-102816-GW	280-90288-1	Water	2-Nitrotoluene	88-72-2	µg/L	0.43	u j	uj	n	0.43	0.2	0.092	Explosives	M
280-90288-1	LL3mw-246-102816-GW	280-90288-1	Water	3-Nitrotoluene	99-08-1	µg/L	0.43	u j	uj	n	0.43	0.2	0.089	Explosives	M
280-90288-1	LL3mw-246-102816-GW	280-90288-1	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.21	u j	uj	n	0.21	0.12	0.062	Explosives	M
280-90288-1	LL3mw-246-102816-GW	280-90288-1	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u j	uj	n	1.1	0.4	0.21	Explosives	M
280-90288-1	LL3mw-246-102816-GW	280-90288-1	Water	HMX	2691-41-0	µg/L	0.43	u j	uj	n	0.43	0.2	0.094	Explosives	M
280-90288-1	LL3mw-246-102816-GW	280-90288-1	Water	Nitrobenzene	98-95-3	µg/L	0.43	u j	uj	n	0.43	2	0.098	Explosives	M
280-90288-1	LL3mw-246-102816-GW	280-90288-1	Water	Nitroglycerin	55-63-0	µg/L	3.2	u j	uj	n	3.2	2	0.99	Explosives	M
280-90288-1	LL3mw-246-102816-GW	280-90288-1	Water	PETN	78-11-5	µg/L	2.1	u j	uj	n	2.1	1.2	0.45	Explosives	M
280-90288-1	LL3mw-246-102816-GW	280-90288-1	Water	RDX	121-82-4	µg/L	0.16	j m	j	y	0.21	0.12	0.056	Explosives	M
280-90288-1	LL3mw-246-102816-GW	280-90288-1	Water	Tetryl	479-45-8	µg/L	0.26	u j	uj	n	0.26	0.2	0.085	Explosives	M
280-90288-1	LL3mw-237-102816-GW	280-90288-2	Water	Methylene chloride	75-09-2	µg/L	5	j	u	n	5	0.8	0.32	VOCs	B
280-90288-1	LL3mw-237-102816-GW	280-90288-2	Water	1,3,5-Trinitrobenzene	99-35-4	µg/L	1.4	u q	uj	n	1.4	0.4	0.29	Explosives	S
280-90288-1	LL3mw-237-102816-GW	280-90288-2	Water	1,3-Dinitrobenzene	99-65-0	µg/L	0.58	u q	uj	n	0.58	0.2	0.13	Explosives	S
280-90288-1	LL3mw-237-102816-GW	280-90288-2	Water	2,4,6-Trinitrotoluene	118-96-7	µg/L	0.58	u q	uj	n	0.58	0.2	0.1	Explosives	S
280-90288-1	LL3mw-237-102816-GW	280-90288-2	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.58	u q	uj	n	0.58	4.4	0.12	Explosives	S
280-90288-1	LL3mw-237-102816-GW	280-90288-2	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.29	u q	uj	n	0.29	4.4	0.093	Explosives	S
280-90288-1	LL3mw-237-102816-GW	280-90288-2	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.3	q	j	y	0.29	0.12	0.073	Explosives	S
280-90288-1	LL3mw-237-102816-GW	280-90288-2	Water	2-Nitrotoluene	88-72-2	µg/L	0.58	u q	uj	n	0.58	0.2	0.12	Explosives	S
280-90288-1	LL3mw-237-102816-GW	280-90288-2	Water	3-Nitrotoluene	99-08-1	µg/L	0.58	u q	uj	n	0.58	0.2	0.12	Explosives	S
280-90288-1	LL3mw-237-102816-GW	280-90288-2	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.35	q	j	y	0.29	0.12	0.084	Explosives	S
280-90288-1	LL3mw-237-102816-GW	280-90288-2	Water	4-Nitrotoluene	99-99-0	µg/L	1.4	u q	uj	n	1.4	0.4	0.29	Explosives	S
280-90288-1	LL3mw-237-102816-GW	280-90288-2	Water	HMX	2691-41-0	µg/L	0.58	u q	uj	n	0.58	0.2	0.13	Explosives	S
280-90288-1	LL3mw-237-102816-GW	280-90288-2	Water	Nitrobenzene	98-95-3	µg/L	0.58	u q	uj	n	0.58	2	0.13	Explosives	S
280-90288-1	LL3mw-237-102816-GW	280-90288-2	Water	Nitroglycerin	55-63-0	µg/L	4.3	u q	uj	n	4.3	2	1.3	Explosives	S

280-90288-1	LL3mw-237-102816-GW	280-90288-2	Water	PETN	78-11-5	µg/L	2.9	u q	uj	n	2.9	1.2	0.6	Explosives	S
280-90288-1	LL3mw-237-102816-GW	280-90288-2	Water	RDX	121-82-4	µg/L	0.29	u q	uj	n	0.29	0.12	0.076	Explosives	S
280-90288-1	LL3mw-237-102816-GW	280-90288-2	Water	Tetryl	479-45-8	µg/L	0.35	u q	uj	n	0.35	0.2	0.11	Explosives	S
280-90288-1	LL3mw-246DUP-102816-GW	280-90288-3	Water	Sodium	7440-23-5	µg/L	5000	j	u	n	5000	350	92	Metals	B
280-90288-1	LL3mw-246DUP-102816-GW	280-90288-3	Water	Copper	7440-50-8	µg/L	2	j	u	n	2	1.8	0.56	Metals	B
280-90288-1	LL3mw-246DUP-102816-GW	280-90288-3	Water	Thallium	7440-28-0	µg/L	1	j	u	n	1	0.2	0.05	Metals	B
280-90288-1	LL3mw-246DUP-102816-GW	280-90288-3	Water	Zinc	7440-66-6	µg/L	20	j	u	n	20	8	2	Metals	B
280-90288-1	LL3mw-246DUP-102816-GW	280-90288-3	Water	Barium	7440-39-3	µg/L	19	v	j	y	3	0.095	0.29	Metals	CC
280-90288-1	LL3mw-246DUP-102816-GW	280-90288-3	Water	Manganese	7439-96-5	µg/L	3.5	j q	u	n	3.5	0.095	0.31	Metals	B
280-90288-1	LL3mw-246DUP-102816-GW	280-90288-3	Water	Methylene chloride	75-09-2	µg/L	5	j	u	n	5	0.8	0.32	VOCs	B

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90289-1

Prepared For:



National Guard Bureau
NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture
2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by a Senior Chemist. Signatures indicate the report is approved for release.



Travis Withers

2017.02.10 13:41:26 -07'00'

Travis Withers, Validation Chemist, TEC-WESTON JV

Date



Peter Chapman, Senior Chemist, TEC-WESTON JV

Date

2/10/17

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90289-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Explosives	8330B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend

using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	Explosives
LL2mw-268-102816-GW	280-90289-1	10/28/16	Groundwater		✓	✓

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on October 29, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

“-GW” was added to the end of all sample IDs to comply with the RIWP.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LCS recoveries
- Method Blanks
- LODs and LOQs
- Instrument tuning
- Internal standard area counts
- Instrument calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification

All analytical or quality issues for Method 8260B are described in the sections below.

1.4.1.1 Trip Blanks

The trip blank associated with samples reported in this SDG is reported in SDG 280-90279-1. Methylene chloride (0.72 µg/L) was detected in the trip blank at a concentration below the LOQ (5.0 µg/L). All associated sample results were non-detect; therefore, no qualification was necessary.

1.4.2 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria:

- Holding times
- Method blanks
- LCS recoveries
- LODs and LOQs
- Surrogate recoveries
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Second column confirmation

No parameters required further discussion for Method 8330B.

No data qualifiers were added in SDG 280-90289-1.

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90337-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by the Project Chemist. Signatures indicate the report is approved for release.



Travis Withers

2017.01.23 09:33:15 -07'00'

Travis Withers, Validation Chemist, TEC-WESTON JV

Date



Pete Chapman, Project Chemist, TEC-WESTON JV

1/16/17

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90337-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polychlorinated Biphenyls (PCBs)	8082A	Denver, CO
Organochlorine Pesticides	8081B	Denver, CO
Explosives	8330B	Denver, CO
Metals	6010C/6020A/7470A	Denver, CO
Hexavalent Chromium	353.2	Denver, CO
Total Cyanide	9012B	Denver, CO
Alkalinity	2320B	Denver, CO
Sulfide	9034	Denver, CO
Anions	9056A	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R)

should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	SVOCs (phthalates)	PCBs	Pesticides	Explosives	Metals	Cr(VI)	Cyanide	Alkalinity
LL1mw-080-103116	280-90337-1	10/31/16	Groundwater					✓	✓		✓	
LL1mw-087-103116	280-90337-2	10/31/16	Groundwater		✓	✓		✓	✓		✓	
LL1mw-064-103116	280-90337-3	10/31/16	Groundwater		✓	✓		✓	✓		✓	
LL1mw-086-103116	280-90337-4	10/31/16	Groundwater		✓	✓		✓			✓	✓
LL1mw-083-103116	280-90337-5	10/31/16	Groundwater		✓	✓	✓	✓	✓	✓	✓	✓
LL1mw-086-103116-GF	280-90337-6	10/31/16	Groundwater						✓			
LL1mw-086-103116-GW	280-90337-7	10/31/16	Groundwater						✓			

Notes: LL3mw-238-111516-GF was filtered in the field through a 5-micron filter; these filtered results are considered “total” results.

Samples were also analyzed for natural attenuation parameters; these parameters were not validated.

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
J	IC	Estimated detection; initial calibration verification did not meet acceptance criteria.
J	CC	Estimated detection; continuing calibration verification did not meet acceptance criteria.
J	L	Estimated detection; LCS/LCSD percent recovery or RPD exceedance.
UJ	L	Estimated non-detection; LCS/LCSD percent recovery or RPD exceedance.
U	B	Not detected; target analyte was detected in the method or calibration blank.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 1, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

“-GW” was added to the end of all sample IDs to comply with the RIWP.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS recoveries
- Instrument tuning
- Initial calibration verification
- Continuing calibration verification
- Internal standard recoveries

No parameters required further discussion for Method 8270D.

1.4.2 Polychlorinated Biphenyls by Method 8082A

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification

No parameters required further discussion for Method 8082A.

1.4.3 Organochlorine Pesticides by Method 8081B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks

- LCS recoveries
- Initial calibration verification
- Continuing calibration verification

All analytical or quality parameters requiring further discussion for Method 8081B are described in the sections below.

1.4.3.1 Internal Standards

The internal standard was recovered outside of the control limits on the secondary column in sample LL1mw-086-103116. The internal standard was recovered within acceptance limits on the primary column. As such, the associated samples were reported from the primary column.

1.4.4 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- 2nd column confirmation

All analytical or quality parameters requiring further discussion for Method 8330B are described in the sections below.

1.4.4.1 Method Blanks

RDX (0.606 µg/L), and 1,3,5-trinitrotoluene (0.335 µg/L) were detected in the method blank at concentrations below their respective LOQs (0.20 µg/L, 1.0 µg/L). All associated samples were either non-detect or had detections above the LOQ for RDX and 1,3,5-trinitrotoluene; therefore, no qualification was necessary.

2,6-Dinitrotoluene (0.241 µg/L) was detected in the method blank at a concentration above the LOQ (0.20 µg/L). All associated sample results were non-detect for 2,6-dinitrotoluene; therefore, no qualification was necessary.

1.4.4.2 Surrogate Recoveries

Surrogate 1,2-dinitrobenzene (137%) recovered above acceptance criteria (83-119%) in sample LL1mw-086-103116. All associated sample results were non-detect; therefore, no qualification was necessary.

1.4.4.3 Laboratory Control Samples/Laboratory Control Sample Duplicates

Several analytes recovered outside of the acceptance criteria in the LCS/LCSD. The following table outlines these exceedances:

Analyte	LCS %R	LCSD %R	%R QC Limits	RPD	RPD Limits
2-Amino-4,6-dinitrotoluene	75	81	79-120	8	20
4-Amino-2,6-dinitrotoluene	73	78	76-125	7	20
2-Nitrotoluene	64	84	70-127	28	20
3-Nitrotoluene	63	85	73-125	29	20
4-Nitrotoluene	63	88	71-127	33	20

%R = percent recovery

Bolded values are outside control limits

The LCSD recovery and RPD were within acceptance limits for analytes 2-amino-4,6-dinitrotoluene and 4-amino-2,6-dinitrotoluene; therefore, no qualification was necessary.

The LCS recovery and RPD were outside of acceptance limits for analytes 2-nitrotoluene, 3-nitrotoluene, and 4-nitrotoluene. All associated, undetected sample results for these analytes were qualified as estimated (UJ L).

1.4.5 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- LCS recoveries
- Low level calibration check standard
- Instrument tuning

All analytical or quality parameters requiring further discussion for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.5.1 Method Blanks

Chromium (2.89 µg/L), copper (0.914 µg/L), zinc (2.04 µg/L), and manganese (0.705 µg/L) were detected in the method blank at concentrations below their respective LOQs (10 µg/L, 2.0 µg/L, 20 µg/L, 3.5 µg/L). These analytes were detected in several associated samples at concentrations below the LOQ. These detections are outlined in the table below:

Analyte	Sample ID	Detection (µg/L)
Chromium	LL1mw-087-103116	1.9
	LL1mw-086-103116-GF	1.4
Copper	LL1mw-080-103116	1.8
	LL1mw-087-103116	1.6
Zinc	LL1mw-080-103116	4.3
	LL1mw-087-103116	9.2

The sample results in the above table were qualified as non-detect at the LOQ (U B).

All other associated sample results were either non-detect or above the LOQ; therefore, no qualification was necessary.

1.4.5.2 Calibration Blanks

Thallium was detected in CCB 280-351011/88 (0.0540 µg/L) at a concentration below the LOQ (1.0 µg/L). Thallium was also detected in samples LL1mw-080-103116 (0.28 µg/L), LL1mw-087-103116 (0.11 µg/L), LL1mw-083-103116 (0.19 µg/L), and LL1mw-086-103116-GW (0.14 µg/L) at concentrations below the LOQ. This result was qualified as non-detect at the LOQ (U B).

1.4.5.3 Initial/Continuing Calibration Verification

Several analytes were recovered outside of the control limits in the calibration verifications. The table below outlines these exceedances:

Calibration Verification ID	Associated Samples	Analyte	% R	% R Limits	Assigned Flags	Sampled Qualified
ICVL 280-351011/12	LL1mw-080-103116 LL1mw-087-103116 LL1mw-064-103116 LL1mw-083-103116	Beryllium	124	80-120	J IC	LL1mw-080-103116 LL1mw-087-103116 LL1mw-083-103116 LL1mw-086-103116-GW

	LL1mw-086-103116-GF LL1mw-086-103116-GW					
CCVL 280-351011/89	LL1mw-064-103116 LL1mw-083-103116 LL1mw-086-103116-GF LL1mw-086-103116-GW	Barium	126	80-120	J CC	LL1mw-064-103116 LL1mw-083-103116 LL1mw-086-103116-GF LL1mw-086-103116-GW
CCVL 280-351276/25	LL1mw-080-103116 LL1mw-087-103116	Barium	129	80-120	J CC	LL1mw-080-103116 LL1mw-087-103116
CCVL 280-351276/38	LL1mw-080-103116 LL1mw-087-103116	Manganese	130	80-120	J CC	LL1mw-080-103116 LL1mw-087-103116

%R = percent recovery

All detected sample results associated with the exceedances were qualified as estimated (J IC/CC).

1.4.5.4 Interference Check Solutions

Manganese (1.42 µg/L) was detected in the interference check standard A (ISC-A) at a concentration greater than the LOD (1 µg/L). The lab confirmed this element is a trace impurity and is consistent with concentrations found by the manufacturer of the ICS-A solution. Based on reviewer's professional judgment, no qualification was necessary.

1.4.6 Hexavalent Chromium by Method 7196A

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- LODs and LOQs
- Method blanks
- LCS recoveries
- Holding times
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

No parameters required further discussion for Method 7196A.

1.4.7 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

All analytical or quality parameters requiring further discussion for Method 9012B are described in the sections below.

1.4.7.1 Method Blanks

Total cyanide (5.29 µg/L) was detected in the method blank at a concentration below the LOQ (10 µg/L). Total cyanide was detected in samples LL1mw-080-103116 (2.9 µg/L), LL1mw-087-103116 (8.7 µg/L), LL1mw-064-103116 (5.7 µg/L), LL1mw-086-103116 (3.3 µg/L) and LL1mw-083-103116 (4.7 µg/L) at concentrations below the LOQ. These sample results were qualified as non-detect at the LOQ (U B).

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	Result	Units	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Group	Reason Code
280-90337-1	LL1mw-080-103116	280-90337-1	Water	Barium	13	µg/L	v	j	y	3	0.95	0.29	6020A	CC
280-90337-1	LL1mw-080-103116	280-90337-1	Water	Beryllium	0.12	µg/L	j	j	y	1	0.30	0.08	6020A	IC
280-90337-1	LL1mw-080-103116	280-90337-1	Water	Copper	2	µg/L	j	u	n	2	1.8	0.56	6020A	B
280-90337-1	LL1mw-080-103116	280-90337-1	Water	Manganese	740	µg/L	q	j	y	3.5	0.95	0.31	6020A	CC
280-90337-1	LL1mw-080-103116	280-90337-1	Water	Thallium	1	µg/L	j	u	n	1	0.2	0.05	6020A	B
280-90337-1	LL1mw-080-103116	280-90337-1	Water	Zinc	20	µg/L	j	u	n	20	8.0	2	6020A	B
280-90337-1	LL1mw-080-103116	280-90337-1	Water	Total Cyanide	10	µg/L	j b	u	n	10	5	2	9012B	B
280-90337-1	LL1mw-087-103116	280-90337-2	Water	Barium	37	µg/L	v	j	y	3	0.95	0.29	6020A	CC
280-90337-1	LL1mw-087-103116	280-90337-2	Water	Beryllium	0.097	µg/L	j	j	y	1	0.30	0.08	6020A	IC
280-90337-1	LL1mw-087-103116	280-90337-2	Water	Chromium	10	µg/L	j	u	n	10	1.8	0.5	6020A	B
280-90337-1	LL1mw-087-103116	280-90337-2	Water	Copper	2	µg/L	j	u	n	2	1.8	0.56	6020A	B
280-90337-1	LL1mw-087-103116	280-90337-2	Water	Manganese	560	µg/L	q	j	y	3.5	0.95	0.31	6020A	CC
280-90337-1	LL1mw-087-103116	280-90337-2	Water	Thallium	1	µg/L	j	u	n	1	0.2	0.05	6020A	B
280-90337-1	LL1mw-087-103116	280-90337-2	Water	Zinc	20	µg/L	j	u	n	20	8.0	2	6020A	B
280-90337-1	LL1mw-087-103116	280-90337-2	Water	Total Cyanide	10	µg/L	j b	u	n	10	5	2	9012B	B
280-90337-1	LL1mw-064-103116	280-90337-3	Water	Barium	55	µg/L	v	j	y	3	0.95	0.29	6020A	CC
280-90337-1	LL1mw-064-103116	280-90337-3	Water	Total Cyanide	10	µg/L	j b	u	n	10	5	2	9012B	B
280-90337-1	LL1mw-086-103116	280-90337-4	Water	Total Cyanide	10	µg/L	j b	u	n	10	5	2	9012B	B
280-90337-1	LL1mw-083-103116	280-90337-5	Water	Barium	17	µg/L	v	j	y	3	0.95	0.29	6020A	CC
280-90337-1	LL1mw-083-103116	280-90337-5	Water	Beryllium	0.34	µg/L	j	j	y	1	0.30	0.08	6020A	IC
280-90337-1	LL1mw-083-103116	280-90337-5	Water	Thallium	1	µg/L	j	u	n	1	0.2	0.05	6020A	B
280-90337-1	LL1mw-083-103116	280-90337-5	Water	2-Nitrotoluene	0.45	µg/L	u q	uj	n	0.45	0.26	0.096	8330B	L
280-90337-1	LL1mw-083-103116	280-90337-5	Water	3-Nitrotoluene	0.45	µg/L	u q	uj	n	0.45	0.26	0.094	8330B	L
280-90337-1	LL1mw-083-103116	280-90337-5	Water	4-Nitrotoluene	1.1	µg/L	u q	uj	n	1.1	0.52	0.23	8330B	L
280-90337-1	LL1mw-083-103116	280-90337-5	Water	Total Cyanide	10	µg/L	j b	u	n	10	5	2	9012B	B
280-90337-1	LL1mw-086-103116-GF	280-90337-6	Water	Barium	52	µg/L	v	j	y	3	0.95	0.29	6020A	CC
280-90337-1	LL1mw-086-103116-GF	280-90337-6	Water	Chromium	10	µg/L	j	u	n	10	1.8	0.5	6020A	B
280-90337-1	LL1mw-086-103116-GW	280-90337-7	Water	Barium	350	µg/L	v	j	y	3	0.95	0.29	6020A	CC
280-90337-1	LL1mw-086-103116-GW	280-90337-7	Water	Beryllium	0.46	µg/L	j	j	y	1	0.30	0.08	6020A	IC
280-90337-1	LL1mw-086-103116-GW	280-90337-7	Water	Thallium	1	µg/L	j	u	n	1	0.2	0.05	6020A	B

µg/L = micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90350-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by a Senior Chemist. Signatures indicate the report is approved for release.



Travis Withers

2017.02.10 13:42:26 -07'00'

Travis Withers, Validation Chemist, TEC-WESTON JV

Date



Peter Chapman, Senior Chemist, TEC-WESTON JV

Date

2/10/17

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90350-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Organochlorine Pesticides	8081B	Denver, CO
Explosives	8330B	Denver, CO
Metals	6010C/6020A/7470A	Denver, CO
Total Cyanide	9012B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgement.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA*

2014). Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	Pesticides	Explosives	Metals	Cyanide
FBQmw-168-103116	280-90350-1	10/31/16	Groundwater		✓		✓		✓
FBQmw-172-103116	280-90350-2	10/31/16	Groundwater		✓	✓	✓	✓	✓

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
J	CC	Estimated detection; continuing calibration verification did not meet acceptance criteria.
UJ	L	Estimated non-detection; LCS/LCSD percent recovery or RPD exceedance.
U	B	Not detected; target analyte was detected in the method or calibration blank.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 1, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LCS recoveries
- LODs and LOQs
- Instrument tuning
- Internal standard area counts
- Instrument calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification

All analytical or quality issues for Method 8260B are described in the sections below.

1.4.1.1 Method Blanks

Methylene chloride (0.420 µg/L) was detected in the method blank at a concentration below the LOQ (5.0 µg/L). Methylene chloride was also detected in sample FBQmw-168-103116 (1.0 µg/L) and FBQmw-172-103116 (1.3 µg/L) at a concentration below the LOQ. These sample results were qualified as non-detect at the LOQ (U B).

1.4.1.2 Trip Blanks

The trip blank associated with samples reported in this SDG is reported in SDG 280-90351-1. Methylene chloride (1.4 µg/L) was detected in the trip blank at a concentration below the LOQ (5.0 µg/L). This result was qualified as non-detect at the LOQ due to method blank contamination; therefore, no qualification was necessary.

1.4.2 Organochlorine Pesticides by Method 8081B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank

- LCS/LCSD recoveries and RPDs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Internal standards
- Endrin/DDT breakdown check
- Second column confirmation

No parameters required further discussion for Method 8081B.

1.4.3 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Instrument calibration
- Initial calibration verification
- Continuing calibration verification
- Second column confirmation

All analytical or quality issues for Method 8330B are described in the sections below.

1.4.3.1 Method Blank

RDX (0.0606 µg/L) was detected in the method blank at a concentration below the LOQ (0.20 µg/L). All associated sample results were non-detect for RDX; therefore, no qualification was necessary.

1.4.3.2 Laboratory Control Sample

Several analytes were recovered below the acceptance limits in the LCS. These exceedances are outlined in the table below:

Analyte	LCS %R	LCSD %R	%R Limits	RPD	RPD Limits	Assigned Flags
2-Nitrotoluene	61	78	70-127	25	20	UJ L
3-Nitrotoluene	62	81	73-125	26	20	UJ L
4-Nitrotoluene	69	86	71-127	22	20	UJ L

%R = percent recovery

Bolded values are exceedances

All sample results associated with the exceedances in the table above were qualified as estimated (UJ L).

1.4.4 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- LCS recoveries
- Lower control interference check standard
- Contract required detection limit standard
- Instrument tuning

All analytical or quality issues for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.4.1 Method Blanks

Chromium (2.89 µg/L), copper (0.914 µg/L), zinc (2.04 µg/L), and manganese (0.705 µg/L) were detected in the method blank at concentrations below their respective LOQs (10 µg/L, 2.0 µg/L, 20 µg/L, 3.5 µg/L). Chromium (3.6 µg/L), copper (0.87 µg/L), zinc (8.5 µg/L) were detected in the associated sample, FBQmw-172-103116. These detections were qualified as non-detect at the LOQ (U B). Manganese was detected in the associated sample at a concentration above the LOQ; therefore, no qualification was necessary.

1.4.4.2 Calibration Blanks

Thallium (0.0540 µg/L) was detected in calibration blank, CCB 280-351011/88, at a concentration below the LOQ (1.0 µg/L). Thallium was not detected in the associated sample; therefore, no qualification was necessary.

1.4.4.3 Initial/Continuing Calibration Verification

Several analytes were recovered outside of the acceptance limits in the calibration verifications associated with sample FBQmw-172-103116. The following table outlines these exceedances:

Calibration Verification	Analyte	%R	%R Limits	Assigned Flags
ICVL 280-351011/12	Beryllium	124	80-120	None
CCVL 280-351011/76	Manganese	123	80-120	J CC
CCVL 280-351011/89	Barium	126	80-120	J CC

Beryllium was non-detect in the associated sample; therefore, no qualification was necessary.

Manganese and barium were detected in the associated sample. These results were qualified as estimated (J CC).

1.4.4.4 Interference Check Solutions

Manganese (1.52 µg/L) was detected in the interference check standard A (ISC-A) at a concentration greater than the LOD (1 µg/L). The lab confirmed this element is a trace impurity and is consistent with concentrations found by the manufacturer of the ICS-A solution. Based on reviewer's professional judgment, no qualification was necessary.

1.4.5 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

No parameters required further discussion for Method 9012B.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90350-1	FBQmw-168-103116	280-90350-1	Water	Methylene chloride	75-09-2	µg/L	5	j	u	n	5	0.8	0.32	VOCs	B
280-90350-1	FBQmw-168-103116	280-90350-1	Water	2-Nitrotoluene	88-72-2	µg/L	0.43	u q	uj	n	0.44	0.2	0.094	Explosives and Propellants	L
280-90350-1	FBQmw-168-103116	280-90350-1	Water	3-Nitrotoluene	99-08-1	µg/L	0.43	u q	uj	n	0.44	0.2	0.091	Explosives and Propellants	L
280-90350-1	FBQmw-168-103116	280-90350-1	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	uj	n	1.1	0.4	0.22	Explosives and Propellants	L
280-90350-1	FBQmw-172-103116	280-90350-2	Water	Barium	7440-39-3	µg/L	65	v	j	y	3	0.095	0.29	Metals	CC
280-90350-1	FBQmw-172-103116	280-90350-2	Water	Chromium	7440-47-3	µg/L	10	j	u	n	10	1.8	0.5	Metals	B
280-90350-1	FBQmw-172-103116	280-90350-2	Water	Copper	7440-50-8	µg/L	2	j	u	n	2	1.8	0.56	Metals	B
280-90350-1	FBQmw-172-103116	280-90350-2	Water	Manganese	7439-96-5	µg/L	2600	q	j	y	3.5	0.095	0.31	Metals	CC
280-90350-1	FBQmw-172-103116	280-90350-2	Water	Zinc	7440-66-6	µg/L	20	j	u	n	20	8	2	Metals	B
280-90350-1	FBQmw-172-103116	280-90350-2	Water	Methylene chloride	75-09-2	µg/L	5	j	u	n	5	0.8	0.32	VOCs	B
280-90350-1	FBQmw-172-103116	280-90350-2	Water	2-Nitrotoluene	88-72-2	µg/L	0.43	u q	uj	n	0.43	0.2	0.092	Explosives and Propellants	L
280-90350-1	FBQmw-172-103116	280-90350-2	Water	3-Nitrotoluene	99-08-1	µg/L	0.43	u q	uj	n	0.43	0.2	0.09	Explosives and Propellants	L
280-90350-1	FBQmw-172-103116	280-90350-2	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	uj	n	1.1	0.4	0.22	Explosives and Propellants	L

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90351-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by the Project Chemist. Signatures indicate the report is approved for release.



Travis Withers

2017.01.23 09:34:58 -07'00'

Travis Withers, Validation Chemist, TEC-WESTON JV

Date



Pete Chapman, Project Chemist, TEC-WESTON JV

1/16/17

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90351-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polychlorinated Biphenyls (PCBs)	8082A	Denver, CO
Explosives	8330B	Denver, CO
Metals	6010C/6020A/7470A	Denver, CO
Total Cyanide	9012B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data*

Review (EPA 2014) and USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014). Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	SVOCs (phthalates)	PCBs	Explosives	Metals	Cyanide
LL2mw-059-103116-GW	280-90351-1	10/31/16	Groundwater			✓	✓	✓	✓	✓
LL2mw-060-103116-GW	280-90351-2	10/31/16	Groundwater		✓	✓	✓	✓	✓	✓
LL2mw-269-103116-GW	280-90351-3	10/31/16	Groundwater			✓	✓	✓	✓	✓
LL2mw-267-103116-GW	280-90351-4	10/31/16	Groundwater			✓	✓	✓	✓	✓
TRIP BLANK	280-90351-5	10/31/16	Water	Trip Blank	✓					

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
J	CC	Estimated detection; continuing calibration verification did not meet acceptance criteria.
UJ	CC	Estimated non-detection; continuing calibration verification did not meet acceptance criteria.
UJ	L	Estimated non-detection; LCS/LCSD percent recovery or RPD exceedance.
UJ	S	Estimated non-detection; surrogate outlier.
U	B	Not detected; target analyte was detected in the method or calibration blank.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 1, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

The sample time was not recorded on the following sample labels: The sample time was not recorded on the following: one of two amber glass 1 L unpreserved for LL2mw-059-103116-GW, two of two amber glass 250 mL unpreserved for LL2mw-060-103116-GW, one of one plastic 250 mL NaOH preserved for LL2mw-060-103116-GW. These samples logged per COC.

“-GW” was added to the end of all sample IDs to comply with the RIWP.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Instrument tuning
- Initial calibration verification
- Internal standard recoveries

All analytical or quality parameters requiring further discussion for Method 8260B are described in the sections below.

1.4.1.1 Method Blanks

Methylene chloride was detected in the method blanks MB 280-351136/6 (0.880 µg/L) and MB 280-351248/6 (2.32 µg/L) at a concentrations below the LOQ (5.0 µg/L). Methylene chloride was also detected at concentrations below the LOQ in samples LL2mw-060-103116-GW (3.6 µg/L) and TRIP BLANK-103116 (1.4 µg/L). These samples results were qualified as non-detect at the LOQ (U B).

1.4.1.2 Trip Blanks

Methylene chloride (1.4 µg/L) was detected in the trip blank at a concentration below the LOQ (5.0 µg/L). This result was qualified as non-detect at the LOQ, due to method blank contamination. See section 1.4.1.1 for the sample qualification.

1.4.1.3 Surrogate Recoveries

Surrogate toluene-d8 recovered above the acceptance limits (89-112%) in sample LL2mw-060-103116-GW (115%). All associated sample results were non-detect; therefore, no qualification was necessary.

Surrogate 1,2-dichloroethane recovered below the acceptance limits (81-118%) in sample TRIP BLANK-103116 (80%). All associated sample results were qualified as estimated (UJ S).

Surrogate 4-bromofluorobenzene recovered below the acceptance limits (85-114%) in sample TRIP BLANK-103116 (84%). All associated sample results were qualified as estimated (UJ S).

1.4.1.4 Laboratory Control Sample

Methylene chloride (164%) was recovered in the LCS above the control limits (74-124%). All associated sample results were qualified as non-detect due to blank contamination; therefore, no qualification was necessary.

1.4.1.5 Continuing Calibration Verification

Methylene chloride (34.2%D) was recovered above the acceptance criteria ($\pm 20\%D$) in CCV 280-351248/10. All associated sample results were qualified as non-detect due to blank contamination; therefore, no qualification was necessary.

Methylene chloride (72.5%D) was recovered above the acceptance criteria ($\pm 50\%D$) in CCVC 280-351248/39. All associated sample results were qualified as non-detect due to blank contamination; therefore, no qualification was necessary.

Chloromethane (-22.2%D) was recovered below the acceptance criteria ($\pm 20\%D$) in CCV 280-351248/10. All associated sample results were qualified as estimated (UJ CC).

1.4.2 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS recoveries
- Instrument tuning
- Initial calibration verification
- Continuing calibration verification
- Internal standard recoveries

No parameters required further discussion for Method 8270D.

1.4.3 Polychlorinated Biphenyls by Method 8082A

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification

No parameters required further discussion for Method 8082A.

1.4.4 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Initial calibration verification
- Continuing calibration verification
- 2nd column confirmation

All analytical or quality parameters requiring further discussion for Method 8330B are described in the sections below.

1.4.4.1 Method Blanks

RDX (0.606 µg/L), and 1,3,5-trinitrotoluene (0.335 µg/L) were detected in the method blank at concentrations below their respective LOQs (0.20 µg/L, 1.0 µg/L). All associated samples were

either non-detect or had detections above the LOQ for RDX and 1,3,5-trinitrotoluene; therefore, no qualification was necessary.

2,6-Dinitrotoluene (0.241 µg/L) was detected in the method blank at a concentration above the LOQ (0.20 µg/L). All associated sample results were non-detect for 2,6-dinitrotoluene; therefore, no qualification was necessary.

1.4.4.2 Laboratory Control Samples/Laboratory Control Sample Duplicates

Several analytes recovered outside of the acceptance criteria in the LCS/LCSD. The following table outlines these exceedances:

Analyte	LCS %R	LCSD %R	%R QC Limits	RPD	RPD Limits
2-Amino-4,6-dinitrotoluene	75	81	79-120	8	20
4-Amino-2,6-dinitrotoluene	73	78	76-125	7	20
2-Nitrotoluene	64	84	70-127	28	20
3-Nitrotoluene	63	85	73-125	29	20
4-Nitrotoluene	63	88	71-127	33	20

%R = percent recovery

Bolded values are outside control limits

The LCSD recovery and RPD were within acceptance limits for analytes 2-amino-4,6-dinitrotoluene and 4-amino-2,6-dinitrotoluene; therefore, no qualification was necessary.

The LCS recovery and RPD were outside of acceptance limits for analytes 2-nitrotoluene, 3-nitrotoluene, and 4-nitrotoluene. All associated sample results for these analytes were qualified as estimated (UJ L).

1.4.5 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- LCS recoveries
- Low level calibration check standard
- Instrument tuning

All analytical or quality parameters requiring further discussion for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.5.1 Method Blanks

Chromium (2.89 µg/L), copper (0.914 µg/L), zinc (2.04 µg/L), and manganese (0.705 µg/L) were detected in the method blank at concentrations below their respective LOQs (10 µg/L, 2.0 µg/L, 20 µg/L, 3.5 µg/L). These analytes were detected in several associated samples at concentrations below the LOQ. These detections are outlined in the table below:

Analyte	Sample ID	Detection (µg/L)
Chromium	LL2mw-059-103116-GW	7.3
	LL2mw-060-103116-GW	8.9
	LL2mw-267-103116-GW	2.7
Copper	LL2mw-060-103116-GW	0.59
	LL2mw-267-103116-GW	0.84
Zinc	LL2mw-267-103116-GW	5.7

The sample results in the above table were qualified as non-detect at the LOQ (U B).

All other associated sample results were either non-detect or above the LOQ; therefore, no qualification was necessary.

1.4.5.2 Calibration Blanks

Thallium was detected in CCB 280-351011/88 (0.0540 µg/L) at a concentration below the LOQ (1.0 µg/L). All associated sample results were non-detect; therefore, no qualification was necessary.

1.4.5.3 Initial/Continuing Calibration Verification

Several analytes were recovered outside of the control limits in the calibration verifications. The table below outlines these exceedances:

Calibration Verification ID	Associated Samples	Analyte	% R	% R Limits	Assigned Flags	Sampled Qualified
ICVL 280-351011/12	LL2mw-059-103116-GW LL2mw-060-103116-GW LL2mw-269-103116-GW LL2mw-267-103116-GW	Beryllium	124	80-120	N/A	None

CCVL 280-351011/89	LL2mw-059-103116-GW LL2mw-060-103116-GW LL2mw-269-103116-GW LL2mw-267-103116-GW	Barium	126	80-120	J CC	LL2mw-059-103116-GW LL2mw-060-103116-GW LL2mw-269-103116-GW LL2mw-267-103116-GW
--------------------	--	--------	-----	--------	------	--

N/A = Not applicable

%R = percent recovery

All detected sample results associated with the exceedances were qualified as estimated (J CC).

1.4.5.4 Interference Check Solutions

Manganese (1.52 µg/L) was detected in the interference check standard A (ISC-A) at a concentration greater than the LOD (1 µg/L). The lab confirmed this element is a trace impurity and is consistent with concentrations found by the manufacturer of the ICS-A solution. Based on reviewer's professional judgment, no qualification was necessary.

1.4.6 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- LCS recoveries
- MS/MSD recoveries and RPDs
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

All analytical or quality parameters requiring further discussion for Method 9012B are described in the sections below.

1.4.6.1 Method Blanks

Total cyanide (5.29 µg/L) was detected in the method blank at a concentration below the LOQ (10 µg/L). Cyanide was detected in the associated samples LL2mw-059-103116-GW (9.7 µg/L), LL2mw060-103116-GW (4.9 µg/L), and LL2mw-269-103116-GW (2.0 µg/L) at concentrations below the LOQ. These sample results were qualified as non-detect at the LOQ (U B).

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90351-1	LL2mw-059-103116-GW	280-90351-1	Water	2-Nitrotoluene	88-72-2	µg/L	0.43	u q	uj	n	0.43	0.2	0.093	Explosives and Propellants	L
280-90351-1	LL2mw-059-103116-GW	280-90351-1	Water	3-Nitrotoluene	99-08-1	µg/L	0.43	u q	uj	n	0.43	0.2	0.09	Explosives and Propellants	L
280-90351-1	LL2mw-059-103116-GW	280-90351-1	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	uj	n	1.1	0.4	0.22	Explosives and Propellants	L
280-90351-1	LL2mw-059-103116-GW	280-90351-1	Water	Barium	7440-39-3	µg/L	4.4	v	J	y	3	0.095	0.29	Metals	CC
280-90351-1	LL2mw-059-103116-GW	280-90351-1	Water	Chromium	7440-47-3	µg/L	10	j	U	n	10	1.8	0.5	Metals	B
280-90351-1	LL2mw-059-103116-GW	280-90351-1	Water	Total Cyanide	57-12-5	µg/L	10	j b	U	n	10	0.000005	2	Total Cyanide	B
280-90351-1	LL2mw-060-103116-GW	280-90351-2	Water	2-Nitrotoluene	88-72-2	µg/L	0.47	u q	uj	n	0.47	0.2	0.1	Explosives and Propellants	L
280-90351-1	LL2mw-060-103116-GW	280-90351-2	Water	3-Nitrotoluene	99-08-1	µg/L	0.47	u q	uj	n	0.47	0.2	0.098	Explosives and Propellants	L
280-90351-1	LL2mw-060-103116-GW	280-90351-2	Water	4-Nitrotoluene	99-99-0	µg/L	1.2	u q	uj	n	1.2	0.4	0.23	Explosives and Propellants	L
280-90351-1	LL2mw-060-103116-GW	280-90351-2	Water	Barium	7440-39-3	µg/L	23	v	J	y	3	0.095	0.29	Metals	CC
280-90351-1	LL2mw-060-103116-GW	280-90351-2	Water	Chromium	7440-47-3	µg/L	10	j	U	n	10	1.8	0.5	Metals	B
280-90351-1	LL2mw-060-103116-GW	280-90351-2	Water	Copper	7440-50-8	µg/L	2	j	U	n	2	1.8	0.56	Metals	B
280-90351-1	LL2mw-060-103116-GW	280-90351-2	Water	Total Cyanide	57-12-5	µg/L	10	j b	U	n	10	0.000005	2	Total Cyanide	B
280-90351-1	LL2mw-060-103116-GW	280-90351-2	Water	Methylene chloride	75-09-2	µg/L	5	j q	U	n	5	0.8	0.32	VOCs	B
280-90351-1	LL2mw-060-103116-GW	280-90351-2	Water	Chloromethane	74-87-3	µg/L	2	u q	uj	n	2	0.8	0.3	VOCs	
280-90351-1	LL2mw-269-103116-GW	280-90351-3	Water	2-Nitrotoluene	88-72-2	µg/L	0.43	u q	uj	n	0.43	0.2	0.093	Explosives and Propellants	L
280-90351-1	LL2mw-269-103116-GW	280-90351-3	Water	3-Nitrotoluene	99-08-1	µg/L	0.43	u q	uj	n	0.43	0.2	0.091	Explosives and Propellants	L
280-90351-1	LL2mw-269-103116-GW	280-90351-3	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	uj	n	1.1	0.4	0.22	Explosives and Propellants	L
280-90351-1	LL2mw-269-103116-GW	280-90351-3	Water	Barium	7440-39-3	µg/L	210	v	J	y	3	0.095	0.29	Metals	CC
280-90351-1	LL2mw-269-103116-GW	280-90351-3	Water	Total Cyanide	57-12-5	µg/L	10	j b	U	n	10	0.000005	2	Total Cyanide	B
280-90351-1	LL2mw-267-103116-GW	280-90351-4	Water	2-Nitrotoluene	88-72-2	µg/L	0.44	u q	uj	n	0.44	0.2	0.093	Explosives and Propellants	L
280-90351-1	LL2mw-267-103116-GW	280-90351-4	Water	3-Nitrotoluene	99-08-1	µg/L	0.44	u q	uj	n	0.44	0.2	0.091	Explosives and Propellants	L
280-90351-1	LL2mw-267-103116-GW	280-90351-4	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	uj	n	1.1	0.4	0.22	Explosives and Propellants	L
280-90351-1	LL2mw-267-103116-GW	280-90351-4	Water	Barium	7440-39-3	µg/L	23	v	J	y	3	0.095	0.29	Metals	CC
280-90351-1	LL2mw-267-103116-GW	280-90351-4	Water	Chromium	7440-47-3	µg/L	10	j	U	n	10	1.8	0.5	Metals	B
280-90351-1	LL2mw-267-103116-GW	280-90351-4	Water	Copper	7440-50-8	µg/L	2	j	U	n	2	1.8	0.56	Metals	B
280-90351-1	LL2mw-267-103116-GW	280-90351-4	Water	Zinc	7440-66-6	µg/L	20	j	U	n	20	8	2	Metals	B
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	1,1,1-Trichloroethane	71-55-6	µg/L	1	u	uj	n	1	0.4	0.16	VOCs	S
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	1,1,2,2-Tetrachloroethane	79-34-5	µg/L	1	u q	uj	n	1	0.8	0.2	VOCs	S
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	1,1,2-Trichloroethane	79-00-5	µg/L	1	u q	uj	n	1	0.8	0.32	VOCs	S
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	1,1-Dichloroethane	75-34-3	µg/L	1	u	uj	n	1	0.8	0.16	VOCs	S
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	1,1-Dichloroethene	75-35-4	µg/L	1	u	uj	n	1	0.8	0.14	VOCs	S
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	1,2-Dibromoethane	106-93-4	µg/L	1	u	uj	n	1	0.4	0.18	VOCs	S
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	1,2-Dichloroethane	107-06-2	µg/L	1	u q	uj	n	1	0.4	0.13	VOCs	S
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	1,2-Dichloroethene	540-59-0	µg/L	1	u	uj	n	1	0.2	0.15	VOCs	S
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	1,2-Dichloropropane	78-87-5	µg/L	1	u q	uj	n	1	0.4	0.13	VOCs	S
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	2-Butanone	78-93-3	µg/L	6	u	uj	n	6	4	1.8	VOCs	S
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	2-Hexanone	591-78-6	µg/L	5	u	uj	n	5	4	1.4	VOCs	S
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	4-Methyl-2-pentanone	108-10-1	µg/L	5	u q	uj	n	5	3.2	1	VOCs	S
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	Acetone	67-64-1	µg/L	10	u	uj	n	10	6.4	1.9	VOCs	S
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	Benzene	71-43-2	µg/L	1	u q	uj	n	1	0.4	0.16	VOCs	S
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	Bromodichloromethane	75-27-4	µg/L	1	u q	uj	n	1	0.4	0.17	VOCs	S
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	Bromoform	75-25-2	µg/L	1	u	uj	n	1	0.4	0.19	VOCs	S

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	Bromomethane	74-83-9	µg/L	2	u	uj	n	2	0.8	0.21	VOCs	S
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	Carbon disulfide	75-15-0	µg/L	2	u	uj	n	2	1.6	0.45	VOCs	S
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	Carbon tetrachloride	56-23-5	µg/L	2	u q	uj	n	2	0.4	0.19	VOCs	S
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	Chlorobenzene	108-90-7	µg/L	1	u	uj	n	1	0.4	0.17	VOCs	S
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	Chlorobromomethane	74-97-5	µg/L	1	u	uj	n	1	0.2	0.1	VOCs	S
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	Chloroethane	75-00-3	µg/L	2	u	uj	n	2	1.6	0.41	VOCs	S
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	Chloroform	67-66-3	µg/L	1	u	uj	n	1	0.4	0.16	VOCs	S
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	Chloromethane	74-87-3	µg/L	2	u	uj	n	2	0.8	0.3	VOCs	S CC
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	cis-1,3-Dichloropropene	10061-01-5	µg/L	1	u q	uj	n	1	0.4	0.16	VOCs	S
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	Dibromochloromethane	124-48-1	µg/L	1	u	uj	n	1	0.4	0.17	VOCs	S
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	Ethylbenzene	100-41-4	µg/L	1	u	uj	n	1	0.4	0.16	VOCs	S
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	Methylene chloride	75-09-2	µg/L	5	j	U	n	5	0.8	0.32	VOCs	M
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	Styrene	100-42-5	µg/L	1	u	uj	n	1	0.4	0.17	VOCs	S
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	Tetrachloroethene	127-18-4	µg/L	1	u	uj	n	1	0.4	0.2	VOCs	S
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	Toluene	108-88-3	µg/L	1	u q	uj	n	1	0.4	0.17	VOCs	S
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	trans-1,3-Dichloropropene	10061-02-6	µg/L	1	u q	uj	n	1	0.4	0.19	VOCs	S
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	Trichloroethene	79-01-6	µg/L	1	u q	uj	n	1	0.4	0.16	VOCs	S
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	Vinylchloride	75-01-4	µg/L	1.5	u	uj	n	1.5	0.2	0.1	VOCs	S
280-90351-1	TRIP BLANK-103116	280-90351-5	Water	Xylene (Total)	1330-20-7	µg/L	2	u	uj	n	2	0.8	0.19	VOCs	S

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90409-1

Prepared For:



National Guard Bureau
NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture
2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by the Project Chemist. Signatures indicate the report is approved for release.



Erica Fisher, Validator, TEC-WESTON JV

01/31/2017

Date



Heather Miner, Project Chemist, TEC-WESTON JV

4/31/17

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90409-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polychlorinated Biphenyls (PCBs)	8082A	Denver, CO
Explosives	8330B	Denver, CO
Metals	6010C/6020A/7470A	Denver, CO
Hexavalent Chromium	353.2	Denver, CO
Total Cyanide	9012B	Denver, CO
Perchlorate	6860	Denver, CO
Sulfide	9034	Denver, CO
Alkalinity	2320B	Denver, CO
Anions	9056A	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R)

should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	SVOCs (phthalates)	PCBs	Explosives	Metals	Cr(VI)	Cyanide	Perchlorate
LL2mw-271-110116-GW	280-90409-1	11/01/16	Groundwater		✓	✓	✓	✓		✓	✓
LL2mw-261-103116-GW	280-90409-2	10/31/16	Groundwater		✓	✓	✓	✓		✓	
LL2mw-500-103116-GW	280-90409-3	10/31/16	Groundwater	Field Duplicate				✓			
FBQmw-175-110116GW	280-90409-4	11/01/16	Groundwater					✓	✓	✓	

Note: LL2mw-500-103116-GW is a field duplicate of parent sample LL2mw-261-103116-GW
 Samples were also analyzed for natural attenuation parameters; these parameters were not validated.

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
J	CC	Estimated detection; continuing calibration verification did not meet acceptance criteria.
UJ	L	Estimated non-detection; LCS/LCSD % recovery or RPD did not meet acceptance criteria.
J	D	Estimated detection; duplicate RPD exceeded.
U	B	Not detected at the LOQ; target analyte was detected in the method or trip blank.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 2, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

At the time of receipt, the laboratory noted that the sample labels varied from that on the COC in that “GW” was not recorded on the sample labels but was included on the COC. In addition, samples LL2mw-271-110116-GW and LL2-500-103116-GW did not have the sample time recorded on the labels, but this information was recorded on the COC. The laboratory logged samples as per the COC.

The sample time for FBQmw-175-110116-GW was noted on the label but not the COC. The laboratory logged the sample as per the bottle label.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS recoveries
- Instrument tuning
- Initial calibration verification
- Continuing calibration verification
- Internal standard recoveries
- Laboratory Control Samples

All analytical or quality parameters requiring further discussion for Method 8270D are described in the sections below.

1.4.1.1 *Matrix Spike/Matrix Spike Duplicates*

No MS/MSDs were reported in this SDG.

1.4.1.2 *Field Duplicates*

No field duplicates were reported in this SDG.

1.4.2 Polychlorinated Biphenyls by Method 8082A

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS recoveries
- Instrument tuning
- Initial calibration verification
- Continuing calibration verification
- Internal standard recoveries
- Laboratory control samples

Sulfuric acid clean-up was performed on samples (LL2mw-271-110116-GW, LCS 280-350443/2-A and MB 280-350443/1-A) to reduce matrix interferences. Clean-up was performed in accordance with EPA Method 3665A and no analytical or other quality issues were observed, therefore, no validation flags were assigned.

All analytical or quality parameters requiring further discussion for Method 8082A are described in the sections below.

1.4.2.1 Matrix Spike/Matrix Spike Duplicates

No MS/MSDs were reported in this SDG.

1.4.2.2 Field Duplicates

No field duplicates were reported in this SDG.

1.4.3 Perchlorate by Method 8082A

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- Lower control interference check standard
- Method blank
- LCS recoveries
- Initial calibration blank
- Initial calibration verification
- Continuing calibration verification
- Continuing calibration blank
- Low-level continuing calibration verification
- Internal standards

All analytical or quality parameters requiring further discussion for Method 8082A are described in the sections below. It is noted that perchlorate was manually integrated.

1.4.3.1 Matrix Spike/Matrix Spike Duplicates

No MS/MSDs were reported in this SDG.

1.4.3.2 Field Duplicates

No field duplicates were reported in this SDG.

1.4.4 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Sample preparation (aqueous samples)
- Surrogate recoveries
- LODs and LOQs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Surrogate spikes
- 2nd column confirmation

All analytical or quality parameters requiring further discussion for Method 8330B are described in the sections below.

1.4.4.1 Lab Control Sample/Laboratory Control Sample Duplicates

Recoveries and RPDs were outside the acceptance criteria for several analytes in both laboratory control samples (LCS) and laboratory control sample duplicates (LCSD). The following table shows analytes outside the acceptance criteria in samples LCS 280-349987/2-A and LCSD 280-349987/3-A:

Associated Samples	Analyte	%R	%R QC Limits	RPD	RPD Limits	Assigned Flags
LL2mw-271-110116-GW LL2mw-261-110116-GW	2-amino-4,6-dinitrotoluene	78	79-120	7	20	None*
	2-nitrotoluene	61	70-127	25	20	UJ/L
	3-nitrotoluene	62	73-125	26	20	UJ/L
	4-nitrotoluene	69	71-127	22	20	UJ/L

Because the LCSD recovery and RPD were within control limits, no qualifiers were assigned for 2-amino-4,6-dinitrotoluene. As the associated samples were reported as undetected for these analytes, the 2-nitrotoluene, 3-nitrotoluene and 4-nitrotoluene results have been qualified as estimated non-detect (UJ L).

Analysis batch number 352866 is also reported in this SDG and relates to samples analyzed for RDX only. Although several other analytes in this batch reported LCS recoveries and LCS/LCSD pair RPDs outside the QC limits, the LCS recovery and LCS/LCSD pair RPD for RDX is within QC limits. As such, no validation flags are necessary.

1.4.4.2 Method Blanks

Method blank MB 280-349987/1-A reported a concentration of RDX (0.0606 µg/L) and 1,3,5-trinitrobenzene (0.335 µg/L) less than one half of the LOQ (0.2 µg/L and 1.0 µg/L, respectively). The primary samples reported RDX and 1,3,5-trinitrobenzene as not detected; therefore, no validation flags were applied.

The laboratory reported a concentration of 2,6-dinitrotoluene (0.241 µg/L) in MB 280-349987/1-A, above both the LOQ (0.20 µg/L) and the PAL (0.24 µg/L). However, the primary column was reported as ND. As the primary samples reported 2,6-dinitrotoluene as not detected, the samples were not re-analyzed by the laboratory, and no validation flags have been applied.

1.4.4.3 Matrix Spike/Matrix Spike Duplicates

No MS/MSDs were reported in this SDG.

1.4.4.4 Field Duplicates

No field duplicates were reported in this SDG.

1.4.5 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs

- Initial calibration
- Instrument tuning
- LCS/LCSD recoveries and RPDs
- Contract Required Quantitation Limits check standards
- Interference check standards

All analytical or quality parameters requiring further discussion for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.5.1 Method Blanks

Chromium (1.12 µg/L) and magnesium (0.356 µg/L) were detected in method blank MB 280-349785/1-A at concentrations above the method detection limits but less than one-half of their respective LOQs (10 µg/L and 3.5 µg/L). Magnesium was detected above the LOQ in all samples, therefore no qualification was necessary.

Chromium was detected at concentrations below the LOQ in samples LL2mw-500-103116-GW (4.6 µg/L) and FBQmw-175-110116-GW (1.0 µg/L); these samples were qualified as not detected at the LOQ (U B). All other associated sample results were above the chromium LOQ; therefore no qualification was necessary.

1.4.5.2 Calibration Blanks

Beryllium was detected in CCB 280-351011/126 (0.0880 µg/L) at a concentration below the LOQ (1.0 µg/L). Beryllium was also detected in sample FBQmw-175-110116-GW (0.092 µg/L) below the LOQ. This result was qualified as non-detect at the LOQ (U B).

Thallium was detected in CCB 280-351011/113 (0.0510 µg/L) at a concentration below the LOQ (1.0 µg/L). Thallium was also detected in sample LL2mw-261-103116-GW (0.077 µg/L) below the LOQ. This result was qualified as non-detect at the LOQ (U B).

The remaining samples were all reported as non-detects for beryllium and thallium, therefore no qualification was necessary.

1.4.5.3 Initial/Continuing Calibration Verification

Beryllium (124%) recovered above the QC limits (80-120%) in the low level ICVL 280-351011/12 associated with samples LL2mw-271-110116-GW, LL2mw-261-103116-GW, LL2mw-500-103116-GW and FBQmw-175-110116-GW. Beryllium was not-detected in samples LL2mw-271-

110116-GW, LL2mw-261-103116-GW and LL2mw-500-103116-GW, therefore no qualification was necessary. Beryllium was detected in sample FBQmw-175-110116-GW (0.092 µg/L) less than the LOD (1.0 µg/L). However, as this has been qualified as non-detect at the LOQ due to beryllium being detected in the method blank (U B), no further qualification is considered to be necessary.

Barium (79%) recovered below the QC limits (80-120%) in the low level CCVL 280-351011/114 associated with all samples (LL2mw-271-110116-GW, LL2mw-261-103116-GW, LL2mw-500-103116-GW and FBQmw-175-110116-GW). Barium was detected in all associated samples. These samples were qualified as estimated (J CC).

Barium (78%), Beryllium (79%) and Manganese (138%) recovered outside the control limits (80-120%) in the low level CCVL 280-351011/127. Manganese (130%) also recovered above the QC limits (80-120%) in the CCV 280-3512776/38 associated with sample FBQmw175-110116-GW. Barium and Manganese were detected in all associated samples. These samples were qualified as estimated (J CC). Beryllium was not-detected in samples LL2mw-271-110116-GW, LL2mw-261-103116-GW and LL2mw-500-103116-GW, therefore no qualification was necessary. Beryllium was detected in sample FBQmw-175-110116-GW (0.092 µg/L) less than the LOD (1.0 µg/L). However, as this has been qualified as non-detect at the LOQ due to beryllium being detected in the method blank (U B), no further qualification is considered to be necessary.

1.4.5.4 Interference Check Solutions

Manganese was detected in interference check standard A (ICS-A) samples ICSA 280-351011/17 (1.42 µg/L), ICSA 280-351011/128 (1.52 µg/L) and ICSA 280-351276/18 (1.20 µg/L) greater than the LOD (0.95 µg/L). The laboratory acknowledges that manganese is a trace impurity in the ICSA standard and that results are not indicative of matrix interference. All manganese results were qualified as estimated based on continuing calibration verification criteria not being met. Based on reviewer's professional judgement, no qualification was considered to be necessary.

1.4.5.5 Matrix Spike/Matrix Spike Duplicates

No MS/MSDs were reported in this SDG.

1.4.5.6 Field Duplicate

One field duplicate (LL2mw-500-103116-GW) was collected and analyzed for metals. For detections greater than 5x the LOQ in both samples, an RPD was calculated. For detections less than 5x the LOQ, the difference in values was compared to \pm the LOQ. The following table shows the detections in the parent and field duplicate samples:

Primary/Duplicate Sample ID	Analyte	Primary Sample Result ($\mu\text{g/L}$)	Field Duplicate Result ($\mu\text{g/L}$)	LOQ ($\mu\text{g/L}$)	RPD (%)	Absolute Difference	QC Criteria (%) ¹
LL2mw-261-103116-GW / LL2mw-500-103116-GW	Calcium	63000	65000	1000	3.1	N/A	20%
	Iron	3600	4100	100	13	N/A	20%
	Magnesium	20000	21000	500	4.9	N/A	20%
	Potassium	1400 (J)	1500 (J)	3000	N/A	100	\pm LOQ
	Sodium	12000	13000	5000	N/A	1000	\pm LOQ
	Arsenic	14	16	5.0	N/A	2	\pm LOQ
	Barium	21	19	3.0	10	N/A	20%
	Chromium	22	4.6 (J)	10	N/A	17.4	\pm LOQ
	Cobalt	1.3	1.3	1.0	N/A	0	\pm LOQ
	Copper	0.98 (J)	1.8 (U)	2.0	N/A	0.82	\pm LOQ
	Lead	0.18 (J)	0.23 (J)	3.0	N/A	0.05	\pm LOQ
	Manganese	450	460	3.5	2.2	N/A	20%
	Nickel	3.9	3.8	3.0	N/A	0.1	\pm LOQ
	Thallium	0.077 (J)	0.20 (U)	1.0	N/A	0.123	\pm LOQ
	Vanadium	1.7 (J)	2.0 (U)	6.0	N/A	0.3	\pm LOQ
Zinc	2.2 (J)	8.0 (U)	20	N/A	5.8	\pm LOQ	

¹ The RPD limit is 20% for detections greater than 5x the LOQ; \pm the LOQ for detections less than 5x the LOQ.

J Laboratory flag indicating the result is less than the LOQ and is estimated.

U Laboratory flag indicating the result is not detected.

N/A Not applicable.

Bold font indicates an exceedance of the quality control criteria.

All calculated RPDs and differences in detections met criteria, with the exception of chromium, in which the difference in detection exceeded the LOQ. The associated samples (LL2mw-261-103116-GW and LL2mw-500-103116-GW) have been qualified as estimated (J D).

1.4.5.7 Laboratory Control/Laboratory Control Duplicate Samples

No LCS/LCSDs were reported in this SDG.

1.4.6 Hexavalent Chromium by Method 7196A

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Method blank
- LCS/LCSD recoveries and RPDs
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

All analytical or quality issues for Method 7196A are described in the sections below.

1.4.6.1 LOD/LOQ

The hexavalent chromium LOD and LOQ is elevated as a result of matrix interference necessitating the dilution of the sample by a factor of 2 prior to analysis. However, it is noted that the project action level (PAL) (0.013 µg/L) is significantly below both the UFP-QAPP LOD (4 µg/L) and the reported LOD (8.0 µg/L).

1.4.6.2 Matrix Spike/Matrix Spike Duplicates

No MS/MSDs were reported in this SDG.

1.4.6.3 Field Duplicates

No field duplicates were reported in this SDG.

1.4.7 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- LCS recoveries
- Low and high level control samples
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank

All analytical or quality parameters requiring further discussion for Method 9012B are described in the sections below.

1.4.7.1 Method Blanks

Total cyanide (5.29 µg/L) was detected in method blank sample MB 280-350982/4-A at a concentration below the LOQ (10 µg/L). Cyanide was detected in the associated sample, LL2mw-261-1103116-GW (2.7 µg/L), at a concentration below the LOQ. This sample result was qualified as non-detect at the LOQ (U B).

1.4.7.2 Matrix Spike/Matrix Spike Duplicates

No MS/MSDs were reported in this SDG.

1.4.7.3 Field Duplicates

No field duplicates were reported in this SDG.

1.4.8 Alkalinity by Method SM 2320B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- LCS recoveries
- Low and high level control samples
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank

All analytical or quality parameters requiring further discussion for Method 9012B are described in the sections below.

1.4.8.1 Method Blanks

Alkalinity (5.29 µg/L) was detected in method blank sample MB 280-351255/5 at a concentration above the LOQ (5.0 µg/L). Alkalinity was also detected in the associated sample FBQmw-175-110116-GW (24 µg/L), at a concentration above the LOQ. As the sample result was greater than 2x the blank detection, no qualification is necessary.

1.4.8.2 Calibration Blanks

Alkalinity (5.80 µg/L) was detected in the CCB (CCB 280-351255/14) at a concentration above the LOQ (5.0 µg/L). Alkalinity was also detected in associated sample FBQmw-175-110116-GW (24 µg/L) above the LOQ. The laboratory reported that alkalinity was not reanalyzed because the

alkalinity in the CCB is insignificant in comparison to the alkalinity of the sample. As the sample result was greater than 2x the blank detection, no qualification is necessary.

1.4.8.3 Laboratory Duplicate

A duplicate of sample FBQmw-110116-GW was prepared by the laboratory and analyzed for alkalinity. The RPD (67%) was above the acceptable limit of 20%. The laboratory report that the duplicate sample was run for high alkalinity based on the parent result but contained relatively low alkalinity, giving a high RPD for the duplicate. This sample result was qualified as estimated (J D).

1.4.8.4 Matrix Spike/Matrix Spike Duplicates

No MS/MSDs were reported in this SDG.

1.4.8.5 Field Duplicates

No field duplicates were reported in this SDG.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90409-1	LL2mw-271-110116-GW	280-90409-1	Water	Barium	7440-39-3	µg/L	3.6	v	j	y	3	0.095	0.29	Metals	CC
280-90409-1	LL2mw-271-110116-GW	280-90409-1	Water	Manganese	7439-96-5	µg/L	560	q	j	y	3.5	0.095	0.31	Metals	CC
280-90409-1	LL2mw-271-110116-GW	280-90409-1	Water	2-Nitrotoluene	88-72-2	µg/L	0.45	u q	uj	n	0.45	0.2	0.097	Explosives and Propellants	L
280-90409-1	LL2mw-271-110116-GW	280-90409-1	Water	3-Nitrotoluene	99-08-1	µg/L	0.45	u q	uj	n	0.45	0.2	0.094	Explosives and Propellants	L
280-90409-1	LL2mw-271-110116-GW	280-90409-1	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	uj	n	1.1	0.4	0.23	Explosives and Propellants	L
280-90409-1	LL2mw-261-103116-GW	280-90409-2	Water	Barium	7440-39-3	µg/L	21	v	j	y	3	0.095	0.29	Metals	CC
280-90409-1	LL2mw-261-103116-GW	280-90409-2	Water	Chromium	7440-47-3	µg/L	22	v	j	y	10	1.8	0.5	Metals	D
280-90409-1	LL2mw-261-103116-GW	280-90409-2	Water	Manganese	7439-96-5	µg/L	450	q	j	y	3.5	0.095	0.31	Metals	CC
280-90409-1	LL2mw-261-103116-GW	280-90409-2	Water	Thallium	7440-28-0	µg/L	1	j	u	n	1	0.2	0.05	Metals	B
280-90409-1	LL2mw-261-103116-GW	280-90409-2	Water	2-Nitrotoluene	88-72-2	µg/L	0.44	u q	uj	n	0.44	0.2	0.095	Explosives and Propellants	L
280-90409-1	LL2mw-261-103116-GW	280-90409-2	Water	3-Nitrotoluene	99-08-1	µg/L	0.44	u q	uj	n	0.44	0.2	0.093	Explosives and Propellants	L
280-90409-1	LL2mw-261-103116-GW	280-90409-2	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	uj	n	1.1	0.4	0.22	Explosives and Propellants	L
280-90409-1	LL2mw-261-103116-GW	280-90409-2	Water	Total Cyanide	57-12-5	µg/L	10	j b	u	n	10	0.000005	2	Cyanide	B
280-90409-1	LL2mw-500-103116-GW	280-90409-3	Water	Barium	7440-39-3	µg/L	19	v	j	y	3	0.095	0.29	Metals	CC
280-90409-1	LL2mw-500-103116-GW	280-90409-3	Water	Chromium	7440-47-3	µg/L	10	j	uj	n	10	1.8	0.5	Metals	B D
280-90409-1	LL2mw-500-103116-GW	280-90409-3	Water	Manganese	7439-96-5	µg/L	460	q	j	y	3.5	0.095	0.31	Metals	CC
280-90409-1	FBQmw-175-110116-GW	280-90409-4	Water	Barium	7440-39-3	µg/L	11	v	j	y	3	0.095	0.29	Metals	CC
280-90409-1	FBQmw-175-110116-GW	280-90409-4	Water	Beryllium	7440-41-7	µg/L	1	j	u	n	1	0.3	0.08	Metals	B
280-90409-1	FBQmw-175-110116-GW	280-90409-4	Water	Chromium	7440-47-3	µg/L	10	j	u	n	10	1.8	0.5	Metals	B
280-90409-1	FBQmw-175-110116-GW	280-90409-4	Water	Manganese	7439-96-5	µg/L	9.9	q	j	y	3.5	0.095	0.31	Metals	CC
280-90409-1	FBQmw-175-110116-GW	280-90409-4	Water	Alkalinity (as CaCO3)		mg/L	24	b	j	y	5	3.2	1.1	Alkalinity	D

µg/L - micrograms per liter
mg/L - milligrams per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90415-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by a Senior Chemist. Signatures indicate the report is approved for release.



Travis Withers

2017.01.13 10:32:52 -07'00'

Travis Withers, Validation Chemist, TEC-WESTON JV

Date



Peter Chapman, Senior Chemist, TEC-WESTON JV

1/10/17

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90415-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polychlorinated Biphenyls (PCBs)	8082A	Denver, CO
Explosives	8330B	Denver, CO
Metals	6010C/6020A/7470A	Denver, CO
Cyanide	9012B	Denver, CO
Pesticides	8081B	Denver, CO
Alkalinity	2320B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	SVOCs (phthalates)	PCBs	Pesticides	Explosives	Metals	Cyanide	Alkalinity
LL1mw-088-110116-GW	280-90415-1	11/01/16	Groundwater		✓	✓	✓	✓	✓	✓	✓

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
J	CC	Estimated detection; continuing calibration verification did not meet acceptance criteria.
UJ	CC	Estimated non-detection; continuing calibration verification did not meet acceptance criteria.
UJ	L	Estimated non-detection; The associated LCS/LCSD recoveries and/or RPD were outside QC limits.
U	B	Not detected; target analyte was detected in the method or calibration blank.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 2, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

The sample time for sample LL1mw-088-110116-GW was not recorded on the COC. The time was recorded on the bottle labels as 1308 and the samples were logged accordingly.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS recoveries
- Instrument tuning
- Initial calibration verification
- Continuing calibration verification
- Internal standard recoveries

No parameters required further discussion for Method 8270D.

1.4.2 Polychlorinated Biphenyls by Method 8082A

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification

All analytical or quality parameters requiring further discussion for Method 8082A are described in the sections below.

1.4.2.1 Sample Preparation

Sample LL1mw-088-110116-GW underwent a sulfuric acid clean-up (EPA 3665A) prior to analysis to reduce matrix interferences.

1.4.3 Organochlorine Pesticides by Method 8081B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification

No parameters required further discussion for Method 8081B.

1.4.4 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Initial calibration verification
- Continuing calibration verification
- 2nd column confirmation

All analytical or quality parameters requiring further discussion for Method 8330B are described in the sections below.

1.4.4.1 Method Blanks

RDX (0.606 µg/L), and 1,3,5-trinitrotoluene (0.335 µg/L) were detected in the method blank at concentrations below their respective LOQs (0.20 µg/L, 1.0 µg/L). All associated samples were either non-detect for RDX and 1,3,5-trinitrotoluene; therefore, no qualification was necessary.

2,6-Dinitrotoluene (0.241 µg/L) was detected in the method blank at a concentration above the LOQ (0.20 µg/L). All associated sample results were non-detect for 2,6-dinitrotoluene; therefore, no qualification was necessary.

1.4.4.2 Laboratory Control Samples/Laboratory Control Sample Duplicates

Several analytes recovered outside of the acceptance criteria in the LCS/LCSD. The following table outlines these exceedances:

Analyte	LCS %R	LCSD %R	%R QC Limits	RPD	RPD Limits
---------	--------	---------	--------------	-----	------------

2-Amino-4,6-dinitrotoluene	75	81	79-120	8	20
4-Amino-2,6-dinitrotoluene	73	78	76-125	7	20
2-Nitrotoluene	64	84	70-127	28	20
3-Nitrotoluene	63	85	73-125	29	20
4-Nitrotoluene	63	88	71-127	33	20

%R = percent recovery

Bolded values are outside control limits

The LCSD recovery and RPD were within acceptance limits for analytes 2-amino-4,6-dinitrotoluene and 4-amino-2,6-dinitrotoluene; therefore, no qualification was necessary.

The LCS recovery and RPD were outside of acceptance limits for analytes 2-nitrotoluene, 3-nitrotoluene, and 4-nitrotoluene. All associated sample results for these analytes were qualified as estimated (UJ L).

1.4.5 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- LCS recoveries
- Low level calibration check standard
- Interference check solutions
- Instrument tuning

All analytical or quality parameters requiring further discussion for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.5.1 Method Blanks

Sodium (341 µg/L), chromium (1.12 µg/L), and manganese (0.356 µg/L) were detected in the method blank at concentrations below their respective LOQs (5000 µg/L, 10 µg/L, 3.5 µg/L). Chromium was detected in sample LL1mw-088-110116-GW (1.6 µg/L) at a concentration below the LOQ; this result was qualified as not-detect at the LOQ (U B).

All other associated sample results were either non-detect or above the LOQ; therefore, no qualification was necessary.

1.4.5.2 Calibration Blanks

Several analytes were detected in calibration blanks at concentrations below the LOQ. The table below outlines these detections:

Calibration Blank	Associated Samples	Analyte	Detection (µg/L)	LOQ (µg/L)	Assigned Flags	Samples Qualified
CCB 280-351484/77	LL1mw-088-110116-GW	Potassium	263	3000	N/A	None
		Sodium	356	5000	N/A	None
CCB 280-351484/90	LL1mw-088-110116-GW	Sodium	180	5000	N/A	None
CCB 280-351011/113	LL1mw-088-110116-GW	Thallium	0.051	1	N/A	None
CCB 280-351011/126	LL1mw-088-110116-GW	Beryllium	0.88	1	N/A	None

N/A = Not applicable

All associated sample results were non-detect; therefore, no qualification was necessary.

1.4.5.3 Initial/Continuing Calibration Verification

Several analytes were recovered outside of the control limits in the calibration verifications. The table below outlines these exceedances:

Calibration Verification ID	Associated Samples	Analyte	%R	%R Limits	Assigned Flags	Samples Qualified
CCVL 280-351484/78	LL1mw-088-110116-GW	Iron	123	80-120	J CC	LL1mw-088-110116-GW
CCVL 280-351484/91	LL1mw-088-110116-GW	Iron	125	80-120	J CC	LL1mw-088-110116-GW
ICVL 280-351011/12	LL1mw-088-110116-GW	Beryllium	124	80-120	N/A	None
CCVL 280-351011/114	LL1mw-088-110116-GW	Barium	79	80-120	J CC	LL1mw-088-110116-GW
CCVL 280-351011/127	LL1mw-088-110116-GW	Barium	78	80-120	J CC	LL1mw-088-110116-GW
		Beryllium	79	80-120	UJ CC	LL1mw-088-110116-GW
		Manganese	138	80-120	J CC	LL1mw-088-110116-GW

%R = Percent recovery

N/A = Not applicable

All detected sample results associated with the exceedances were qualified as estimated (UJ/J CC).

1.4.5.4 Interference Check Solutions

Manganese (1.52 µg/L) was detected in the interference check standard A (ISC-A) at a concentration greater than the LOD (1 µg/L). The lab confirmed this element is a trace impurity

and is consistent with concentrations found by the manufacturer of the ICS-A solution. Based on reviewer's professional judgment, no qualification was necessary.

1.4.6 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

No parameters required further discussion for Method 9012B.

1.4.7 Alkalinity by Method SM 2320B

The following parameters were evaluated and met the required criteria:

- Holding time
- LODs and LOQs
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

All analytical or quality parameters requiring further discussion for Method SM 2320 are described in the sections below.

1.4.7.1 Method Blanks

Alkalinity (2.52 µg/L) was detected in the method blank at a concentration below the LOQ (5.0 µg/L). Because alkalinity was detected in the associated sample, LL1mw-088-11016-GW (300 µg/L), at a concentration above the LOQ, no qualifiers were assigned.

1.4.7.2 Calibration Blanks

Alkalinity (ranging from 2.03 µg/L to 2.35 µg/L) was detected in the initial and continuing calibration blanks at concentrations below the LOQ (5.0 µg/L). Because alkalinity was detected in the associated sample, LL1mw-088-11016-GW (300 µg/L), at a concentration above the LOQ, no qualifiers were assigned.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90415-1	LL1mw-088-110116-GW	280-90415-1	Water	2-Nitrotoluene	88-72-2	µg/L	0.45	u q	u j	n	0.45	0.2	0.095	Explosives and Propellants	L
280-90415-1	LL1mw-088-110116-GW	280-90415-1	Water	3-Nitrotoluene	99-08-1	µg/L	0.45	u q	u j	n	0.45	0.2	0.093	Explosives and Propellants	L
280-90415-1	LL1mw-088-110116-GW	280-90415-1	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	u j	n	1.1	0.4	0.22	Explosives and Propellants	L
280-90415-1	LL1mw-088-110116-GW	280-90415-1	Water	Iron	7439-89-6	µg/L	2700	v	i	y	100	85	22	Metals	CC
280-90415-1	LL1mw-088-110116-GW	280-90415-1	Water	Barium	7440-39-3	µg/L	48	v	i	y	3	0.095	0.29	Metals	CC
280-90415-1	LL1mw-088-110116-GW	280-90415-1	Water	Beryllium	7440-41-7	µg/L	1	u	uj	n	1	0.3	0.08	Metals	CC
280-90415-1	LL1mw-088-110116-GW	280-90415-1	Water	Chromium	7440-47-3	µg/L	10	j	u	n	10	1.8	0.5	Metals	B

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90420-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by the Project Chemist. Signatures indicate the report is approved for release.



Travis Withers

2017.01.19 11:53:21 -07'00'

Travis Withers, Validation Chemist, TEC-WESTON JV

Date



Heather A. Miner

2017.01.19 12:20:22 -07'00'

Heather Miner, Project Chemist, TEC-WESTON JV

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90420-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polycyclic Aromatic Hydrocarbons (PAHs)	8270D SIM	Denver, CO
Organochlorine Pesticides	8081B	Denver, CO
Explosives	8330B	Denver, CO
Metals	6010C/6020A/7470A	Denver, CO
Total Cyanide	9012B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	SVOCs (phthalates)	PAHs	Pesticides	Explosives	Metals	Cr(VI)	Cyanide
NTAmw-109-110116-GW	280-90420-1	11/01/16	Groundwater		✓							
NTAmw-114-110116-GW	280-90420-2	11/01/16	Groundwater		✓		✓		✓			✓
NTAmw-113-110116-GW	280-90420-3	11/01/16	Groundwater		✓		✓	✓	✓	✓		✓
NTAmw-500-110116-GW	280-90420-4	11/01/16	Groundwater	Field Duplicate	✓		✓	✓	✓	✓		✓
NTAmw-118-110116-GW	280-90420-5	11/01/16	Groundwater		✓		✓		✓	✓		✓
NTAmw-115-110116-GW	280-90420-6	11/01/16	Groundwater		✓		✓		✓			✓
NTAmw-117-110116-GW	280-90420-7	11/01/16	Groundwater		✓		✓		✓	✓		✓
NTAmw-119-110116-GW	280-90420-8	11/01/16	Groundwater		✓	✓	✓		✓	✓		✓
NTAmw-116-110116-GW	280-90420-9	11/01/16	Groundwater		✓	✓	✓		✓			✓
TRIP BLANK	280-90420-10	11/01/16	Groundwater	Trip Blank	✓							

Note: NTAmw-500-110116 is the field duplicate of parent sample NTAmw-113-110116-GW.

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
J	CC	Estimated detection; continuing calibration verification did not meet acceptance criteria.
UJ	CC	Estimated non-detection; continuing calibration verification did not meet acceptance criteria.
UJ	L	Estimated non-detection; LCS/LCSD percent recovery or RPD exceedance.
US	S	Estimated non-detection; the surrogate recovery was outside QC limits.
U	B	Not detected; target analyte was detected in the method or calibration blank.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 2, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

PCB analysis requested on samples NTAmw-109-110116-GW, NTAmw-114-110116-GW, NTAmw-113-110116-GW, NTAmw-500-110116-GW, NTAmw-118-110116-GW, NTAmw-115-110116-GW, NTAmw-117-110116-GW, NTAmw-119-110116-GW, and NTAmw-116-110116-GW were canceled due to incorrect sample bottles provided by the laboratory.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Instrument tuning
- Internal standard area counts
- Initial calibration
- Initial calibration verification

All analytical or quality parameters requiring further discussion for Method 8260B are described in the sections below.

1.4.1.1 Method Blanks

Methylene chloride (4.31 µg/L) was detected in method blank MB 280-35148/16, associated with samples NTAmw-109-110116-GW, NTAmw-114-110116-GW, NTAmw-113-110116-GW, NTAmw-500-110116-GW, NTAmw-118-110116-GW, NTAmw-115-110116-GW, and NTAmw-117-110116-GW at a concentration below the LOQ (5.0 µg/L). Methylene chloride was also detected at concentrations below the LOQ in samples NTAmw-109-110116-GW (0.84 µg/L), NTAmw-114-110116-GW (0.79 µg/L), NTAmw-113-110116-GW (0.85 µg/L), NTAmw-500-110116-GW (0.77 µg/L), NTAmw-118-110116-GW (0.75 µg/L), NTAmw-115-110116-GW (0.66 µg/L), and NTAmw-117-110116-GW (0.71 µg/L). These samples results were qualified as non-detect at the LOQ (U B).

Methylene chloride (5.12 µg/L) was detected in method blank MB 280-35491/8, associated with samples NTAmw-119-110116-GW, NTAmw-116-110116-GW, and TB-110116 at a

concentration above the LOQ (5.0 µg/L). Methylene chloride was detected at concentrations below the LOQ in samples NTAmw-116-110116-GW (0.82 µg/L) and TB-110116 (0.59 µg/L). These samples results were qualified as non-detect at the LOQ (U B).

1.4.1.2 Trip Blanks

Methylene chloride (0.59 µg/L) was detected in the trip blank at a concentration below the LOQ (5.0 µg/L). This result was qualified as non-detect at the LOQ, due to method blank contamination. See Section 1.4.1.1 for the sample qualification.

1.4.1.3 Surrogate Recoveries

Surrogates 1,2-dichloroethane-d4 (132%), 4-bromofluorobenzene (121%), and toluene-d8 (117%) recovered above their respective QC limits (81-118%, 85-114%, 89-112%) in sample NTAmw-116-110116-GW. All associated sample results were non-detect; therefore, no qualification was necessary.

1.4.1.4 Laboratory Control Sample

Methylene chloride recovered above the control limits (74-124%) in LCS 280-351481/4 (193%) and LCS 280-351491/6 (188%). All associated sample results were qualified as non-detect; therefore, no qualification was necessary.

1.4.1.5 Continuing Calibration Verification

Methylene chloride (37.5%D) was recovered outside of the acceptance criteria ($\pm 20\%D$) in CCV 280-351481/2. All associated sample results were qualified as non-detect; therefore, no qualification was necessary.

Methylene chloride (52.7%D) was recovered outside of the acceptance criteria ($\pm 50\%D$) in closing CCV 280-351491/35. All associated sample results were qualified as non-detect; therefore, no qualification was necessary.

2-Hexanone (21.7%D) was recovered outside of the acceptance criteria ($\pm 20\%D$) in CCV 280-351491/2. All associated sample results were qualified as non-detect; therefore, no qualification was necessary.

1.4.2 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- LCS recoveries
- Instrument tuning
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Internal standard area counts

No analytical or quality parameters required further discussion for Method 8270D.

1.4.3 Polycyclic Aromatic Hydrocarbons by Method 8270D SIM

The following parameters were evaluated and met the required criteria:

- Holding times
- Dilutions
- LODs and LOQs
- Method blank
- LCS recoveries
- Instrument tuning
- Internal standards
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification

All analytical or quality issues for Method 8270D are described in the sections below.

1.4.3.1 Surrogate Recoveries

Surrogate nitrobenzene-d5 recovered below acceptance limits (55-111%) in samples NTAmw-113-110116-GW (53%), NTAmw-115-110116-GW (52%), NTAmw-119-110116-GW (41%), and NTAmw-116-110116-GW (39%). All associated sample results were qualified as estimated (UJ S).

Surrogate 2-fluorobiphenyl (43%) recovered below acceptance limits (53-106%) in sample NTAmw-116-110116-GW. All associated sample results were qualified as estimated (UJ S).

1.4.4 Organochlorine Pesticides by Method 8081B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs

- Surrogate recoveries
- Dilutions
- Method blank
- LCS recoveries
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Internal standards
- Endrin/DDT breakdown check
- Second column confirmation

No analytical or quality parameters required further discussion for Method 8081B.

1.4.5 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- 2nd column confirmation

All analytical or quality issues for Method 8330B are described in the sections below.

1.4.5.1 Method Blanks

Nitrobenzene (0.598 µg/L) was detected in the method blank at a concentration above the LOQ (0.40 µg/L). All associated sample results were non-detect for nitrobenzene; therefore, no qualification was necessary.

1,3,5-Trinitrobenzene (0.236 µg/L) and RDX (0.101 µg/L) were detected in the method blank at concentrations below their respective LOQs (1.0 µg/L, 0.20 µg/L). All associated sample results were non-detect for 1,3,5-trinitrobenzene and RDX; therefore, no qualification was necessary.

1.4.5.2 Laboratory Control Sample

2-Amino-4,6-dinitrotoluene (76%) and 4-amino-2,6-dinitrotoluene (73%) recovered below their respective acceptance limits (79-120%, 76-125%). All associated sample results were qualified as estimated (UJ L).

1.4.6 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs

- LCS recoveries
- Initial calibration blanks
- Lower control interference check standard
- Contract required detection limit standard
- Instrument tuning

All analytical or quality issues for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.6.1 Method Blanks

Sodium (341 µg/L), chromium (1.12 µg/L), and manganese (0.356 µg/L) were detected in the method blank at concentrations below their respective LOQs (5000 µg/L, 10 µg/L, 3.5 µg/L). Chromium was detected at concentrations below the LOQ in samples NTAmw-113-110116-GW (0.71 µg/L), NTAmw-500-110116-GW (0.97 µg/L), and NTAmw-118-110116-GW (1.1 µg/L); these results were qualified as non-detect at the LOQ (U B).

All other associated sample results were either non-detect or above the LOQ; therefore, no qualification was necessary.

1.4.6.2 Calibration Blanks

Several analytes were detected in the calibration blanks bracketing the samples. The following table presents the initial and continuing calibration blank detections:

Calibration Blank	Associated Samples	Analyte	Blank Detection (µg/L)	LOQ (µg/L)	Assigned Flags	Samples Qualified
CCB 280-351484/77	NTAmw-113-110116-GW NTAmw-500-110116-GW NTAmw-118-110116-GW NTAmw-117-110116-GW NTAmw-119-110116-GW	Potassium	263	3000	U B	NTAmw-113-110116-GW NTAmw-500-110116-GW NTAmw-118-110116-GW NTAmw-117-110116-GW NTAmw-119-110116-GW
		Sodium	356	5000	N/A	None
CCB 280-351484/90		Sodium	180	5000	N/A	None

CCB 280-351011/113		Thallium	0.051	1	N/A	None
CCB 280-351011/126		Beryllium	0.088	1	N/A	None

CCB = continuing calibration blank

Detections less than the LOQ in associated samples are qualified as not detected at the LOQ (U B).

1.4.6.3 Initial/Continuing Calibration Verification

Several analytes were detected in the calibration verifications bracketing the samples. The following table presents the initial and continuing calibration verification exceedances:

Calibration Verification	Associated Samples	Analyte	% R	%R Limits	Assigned Flags	Samples Qualified
CCVL 280-351484/78	NTAmw-113-110116-GW NTAmw-500-110116-GW NTAmw-118-110116-GW NTAmw-117-110116-GW NTAmw-119-110116-GW	Iron	123	80-120	J CC	NTAmw-113-110116-GW NTAmw-500-110116-GW NTAmw-118-110116-GW NTAmw-117-110116-GW NTAmw-119-110116-GW
		Sodium	130	80-120	J CC	NTAmw-113-110116-GW NTAmw-500-110116-GW NTAmw-118-110116-GW NTAmw-117-110116-GW NTAmw-119-110116-GW
CCVL 280-351484/91	NTAmw-113-110116-GW NTAmw-500-110116-GW NTAmw-118-110116-GW NTAmw-117-110116-GW NTAmw-119-110116-GW	Iron	125	80-120	J CC	NTAmw-113-110116-GW NTAmw-500-110116-GW NTAmw-118-110116-GW NTAmw-117-110116-GW NTAmw-119-110116-GW
ICVL 280-351011/12	NTAmw-113-110116-GW NTAmw-500-110116-GW	Beryllium	124	80-120	N/A	None

	NTAmw-118-110116-GW NTAmw-117-110116-GW NTAmw-119-110116-GW					
CCVL 280-351011/114	NTAmw-113-110116-GW NTAmw-500-110116-GW NTAmw-118-110116-GW NTAmw-117-110116-GW NTAmw-119-110116-GW	Barium	79	80-120	JCC	NTAmw-113-110116-GW NTAmw-500-110116-GW NTAmw-118-110116-GW NTAmw-117-110116-GW NTAmw-119-110116-GW
CCVL 280-351011/127	NTAmw-113-110116-GW NTAmw-500-110116-GW NTAmw-118-110116-GW NTAmw-117-110116-GW NTAmw-119-110116-GW	Barium	78	80-120	JCC	NTAmw-113-110116-GW NTAmw-500-110116-GW NTAmw-118-110116-GW NTAmw-117-110116-GW NTAmw-119-110116-GW
		Beryllium	79	80-120	UJCC	NTAmw-113-110116-GW NTAmw-500-110116-GW NTAmw-118-110116-GW NTAmw-117-110116-GW NTAmw-119-110116-GW
		Manganese	138	80-120	JCC	NTAmw-113-110116-GW NTAmw-500-110116-GW NTAmw-118-110116-GW NTAmw-117-110116-GW NTAmw-119-110116-GW

CCVL = low-level continuing calibration verification

ICVL = low-level initial calibration verification

N/A = not applicable

%R = percent recovery

If the exceedance was recovered above acceptance limits, all associated, detected sample results were qualified as estimated (J CC). If the exceedance was recovered below acceptance limits, all associated sample results were qualified as estimated (UJ CC).

1.4.6.4 Interference Check Solutions

Manganese (1.52 µg/L) was detected in the interference check standard A (ISC-A) at a concentration greater than the LOD (1 µg/L). The lab confirmed this element is a trace impurity and is consistent with concentrations found by the manufacturer of the ICS-A solution. Based on reviewer's professional judgment, no qualification was necessary.

1.4.7 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blanks
- LCS recoveries
- MS/MSD recoveries & RPDs
- Equipment blanks
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

No analytical or quality parameters required further discussion for Method 9012B.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90420-1	NTAmw-109-110116-GW	280-90420-1	Water	Methylene chloride	75-09-2	µg/L	5	j b q	u	n	5	0.8	0.32	VOCs	B
280-90420-1	TB-110116	280-90420-10	Water	Methylene chloride	75-09-2	µg/L	5	j q b	u	n	5	0.8	0.32	VOCs	B
280-90420-1	NTAmw-114-110116-GW	280-90420-2	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.21	u q	uj	n	0.21	0.12	0.053	Explosives and Propellants	L
280-90420-1	NTAmw-114-110116-GW	280-90420-2	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.21	u q	uj	n	0.21	0.12	0.06	Explosives and Propellants	L
280-90420-1	NTAmw-114-110116-GW	280-90420-2	Water	Methylene chloride	75-09-2	µg/L	5	j b q	u	n	5	0.8	0.32	VOCs	B
280-90420-1	NTAmw-113-110116-GW	280-90420-3	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.21	u q	uj	n	0.21	0.12	0.053	Explosives and Propellants	L
280-90420-1	NTAmw-113-110116-GW	280-90420-3	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.21	u q	uj	n	0.21	0.12	0.06	Explosives and Propellants	L
280-90420-1	NTAmw-113-110116-GW	280-90420-3	Water	Barium	7440-39-3	µg/L	35	v	j	y	3	0.1	0.29	Metals	CC
280-90420-1	NTAmw-113-110116-GW	280-90420-3	Water	Beryllium	7440-41-7	µg/L	1	u	uj	n	1	0.3	0.08	Metals	CC
280-90420-1	NTAmw-113-110116-GW	280-90420-3	Water	Chromium	7440-47-3	µg/L	10	j	u	n	10	1.8	0.5	Metals	B
280-90420-1	NTAmw-113-110116-GW	280-90420-3	Water	Iron	7439-89-6	µg/L	1500	v	j	y	100	85	22	Metals	CC
280-90420-1	NTAmw-113-110116-GW	280-90420-3	Water	Manganese	7439-96-5	µg/L	350	q	j	y	3.5	0.1	0.31	Metals	CC
280-90420-1	NTAmw-113-110116-GW	280-90420-3	Water	Potassium	7440-09-7	µg/L	3000	j	u	n	3000	940	240	Metals	B
280-90420-1	NTAmw-113-110116-GW	280-90420-3	Water	Sodium	7440-23-5	µg/L	12000	v	j	y	5000	350	92	Metals	CC
280-90420-1	NTAmw-113-110116-GW	280-90420-3	Water	Naphthalene	91-20-3	µg/L	0.11	u q	uj	n	0.11	1	0.0088	PAHs	S
280-90420-1	NTAmw-113-110116-GW	280-90420-3	Water	Methylene chloride	75-09-2	µg/L	5	j b q	u	n	5	0.8	0.32	VOCs	B
280-90420-1	NTAmw-500-110116-GW	280-90420-4	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.2	u q	uj	n	0.2	0.12	0.052	Explosives and Propellants	L
280-90420-1	NTAmw-500-110116-GW	280-90420-4	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.2	u q	uj	n	0.2	0.12	0.059	Explosives and Propellants	L
280-90420-1	NTAmw-500-110116-GW	280-90420-4	Water	Barium	7440-39-3	µg/L	31	v	j	y	3	0.1	0.29	Metals	CC
280-90420-1	NTAmw-500-110116-GW	280-90420-4	Water	Beryllium	7440-41-7	µg/L	1	u	uj	n	1	0.3	0.08	Metals	CC
280-90420-1	NTAmw-500-110116-GW	280-90420-4	Water	Chromium	7440-47-3	µg/L	10	j	u	n	10	1.8	0.5	Metals	B
280-90420-1	NTAmw-500-110116-GW	280-90420-4	Water	Iron	7439-89-6	µg/L	1600	v	j	y	100	85	22	Metals	CC
280-90420-1	NTAmw-500-110116-GW	280-90420-4	Water	Manganese	7439-96-5	µg/L	350	q	j	y	3.5	0.1	0.31	Metals	CC
280-90420-1	NTAmw-500-110116-GW	280-90420-4	Water	Potassium	7440-09-7	µg/L	3000	j	u	n	3000	940	240	Metals	B
280-90420-1	NTAmw-500-110116-GW	280-90420-4	Water	Sodium	7440-23-5	µg/L	13000	v	j	y	5000	350	92	Metals	CC
280-90420-1	NTAmw-500-110116-GW	280-90420-4	Water	Methylene chloride	75-09-2	µg/L	5	j b q	u	n	5	0.8	0.32	VOCs	B
280-90420-1	NTAmw-118-110116-GW	280-90420-5	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.2	u q	uj	n	0.2	0.12	0.051	Explosives and Propellants	L
280-90420-1	NTAmw-118-110116-GW	280-90420-5	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.2	u q	uj	n	0.2	0.12	0.058	Explosives and Propellants	L
280-90420-1	NTAmw-118-110116-GW	280-90420-5	Water	Barium	7440-39-3	µg/L	17	v	j	y	3	0.1	0.29	Metals	CC
280-90420-1	NTAmw-118-110116-GW	280-90420-5	Water	Beryllium	7440-41-7	µg/L	1	u	uj	n	1	0.3	0.08	Metals	CC
280-90420-1	NTAmw-118-110116-GW	280-90420-5	Water	Chromium	7440-47-3	µg/L	10	j	u	n	10	1.8	0.5	Metals	B
280-90420-1	NTAmw-118-110116-GW	280-90420-5	Water	Iron	7439-89-6	µg/L	220	v	j	y	100	85	22	Metals	CC
280-90420-1	NTAmw-118-110116-GW	280-90420-5	Water	Manganese	7439-96-5	µg/L	580	q	j	y	3.5	0.1	0.31	Metals	CC
280-90420-1	NTAmw-118-110116-GW	280-90420-5	Water	Potassium	7440-09-7	µg/L	3000	j	u	n	3000	940	240	Metals	B
280-90420-1	NTAmw-118-110116-GW	280-90420-5	Water	Sodium	7440-23-5	µg/L	10000	v	j	y	5000	350	92	Metals	CC
280-90420-1	NTAmw-118-110116-GW	280-90420-5	Water	Methylene chloride	75-09-2	µg/L	5	j b q	u	n	5	0.8	0.32	VOCs	B
280-90420-1	NTAmw-115-110116-GW	280-90420-6	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.21	u	uj	n	0.21	0.12	0.052	Explosives and Propellants	L
280-90420-1	NTAmw-115-110116-GW	280-90420-6	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.21	u	uj	n	0.21	0.12	0.059	Explosives and Propellants	L

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90420-1	NTAmw-115-110116-GW	280-90420-6	Water	Naphthalene	91-20-3	µg/L	0.1	u q	uj	n	0.1	1	0.008	PAHs	S
280-90420-1	NTAmw-115-110116-GW	280-90420-6	Water	Methylene chloride	75-09-2	µg/L	5	j b q	u	n	5	0.8	0.32	VOCs	B
280-90420-1	NTAmw-117-110116-GW	280-90420-7	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.22	u	uj	n	0.22	0.12	0.055	Explosives and Propellants	L
280-90420-1	NTAmw-117-110116-GW	280-90420-7	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.22	u	uj	n	0.22	0.12	0.062	Explosives and Propellants	L
280-90420-1	NTAmw-117-110116-GW	280-90420-7	Water	Barium	7440-39-3	µg/L	92	v	j	y	3	0.1	0.29	Metals	CC
280-90420-1	NTAmw-117-110116-GW	280-90420-7	Water	Beryllium	7440-41-7	µg/L	1	u	j	n	1	0.3	0.08	Metals	CC
280-90420-1	NTAmw-117-110116-GW	280-90420-7	Water	Iron	7439-89-6	µg/L	110	v	j	y	100	85	22	Metals	CC
280-90420-1	NTAmw-117-110116-GW	280-90420-7	Water	Manganese	7439-96-5	µg/L	290	q	j	y	3.5	0.1	0.31	Metals	CC
280-90420-1	NTAmw-117-110116-GW	280-90420-7	Water	Potassium	7440-09-7	µg/L	3000	j	u	n	3000	940	240	Metals	B
280-90420-1	NTAmw-117-110116-GW	280-90420-7	Water	Sodium	7440-23-5	µg/L	11000	v	j	y	5000	350	92	Metals	CC
280-90420-1	NTAmw-117-110116-GW	280-90420-7	Water	Methylene chloride	75-09-2	µg/L	5	j b q	u	n	5	0.8	0.32	VOCs	B
280-90420-1	NTAmw-119-110116-GW	280-90420-8	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.22	u	uj	n	0.22	0.12	0.057	Explosives and Propellants	L
280-90420-1	NTAmw-119-110116-GW	280-90420-8	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.22	u	uj	n	0.22	0.12	0.065	Explosives and Propellants	L
280-90420-1	NTAmw-119-110116-GW	280-90420-8	Water	Barium	7440-39-3	µg/L	83	v	j	y	3	0.1	0.29	Metals	CC
280-90420-1	NTAmw-119-110116-GW	280-90420-8	Water	Beryllium	7440-41-7	µg/L	1	u	j	n	1	0.3	0.08	Metals	CC
280-90420-1	NTAmw-119-110116-GW	280-90420-8	Water	Iron	7439-89-6	µg/L	1100	v	j	y	100	85	22	Metals	CC
280-90420-1	NTAmw-119-110116-GW	280-90420-8	Water	Manganese	7439-96-5	µg/L	340	q	j	y	3.5	0.1	0.31	Metals	CC
280-90420-1	NTAmw-119-110116-GW	280-90420-8	Water	Potassium	7440-09-7	µg/L	3000	j	u	n	3000	940	240	Metals	B
280-90420-1	NTAmw-119-110116-GW	280-90420-8	Water	Sodium	7440-23-5	µg/L	6900	v	j	y	5000	350	92	Metals	CC
280-90420-1	NTAmw-119-110116-GW	280-90420-8	Water	Naphthalene	91-20-3	µg/L	0.1	u q	uj	n	0.1	1	0.0081	PAHs	S
280-90420-1	NTAmw-116-110116-GW	280-90420-9	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.21	u	uj	n	0.21	0.12	0.054	Explosives and Propellants	L
280-90420-1	NTAmw-116-110116-GW	280-90420-9	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.21	u	uj	n	0.21	0.12	0.062	Explosives and Propellants	L
280-90420-1	NTAmw-116-110116-GW	280-90420-9	Water	Acenaphthene	83-32-9	µg/L	0.11	u q	uj	n	0.11	1	0.0045	PAHs	S
280-90420-1	NTAmw-116-110116-GW	280-90420-9	Water	Acenaphthylene	208-96-8	µg/L	0.11	u q	uj	n	0.11	1	0.0055	PAHs	S
280-90420-1	NTAmw-116-110116-GW	280-90420-9	Water	Anthracene	120-12-7	µg/L	0.11	u q	uj	n	0.11	1	0.006	PAHs	S
280-90420-1	NTAmw-116-110116-GW	280-90420-9	Water	Fluoranthene	206-44-0	µg/L	0.11	u q	uj	n	0.11	0.5	0.0052	PAHs	S
280-90420-1	NTAmw-116-110116-GW	280-90420-9	Water	Fluorene	86-73-7	µg/L	0.11	u q	uj	n	0.11	1	0.0059	PAHs	S
280-90420-1	NTAmw-116-110116-GW	280-90420-9	Water	Naphthalene	91-20-3	µg/L	0.11	u q	uj	n	0.11	1	0.0086	PAHs	S
280-90420-1	NTAmw-116-110116-GW	280-90420-9	Water	Phenanthrene	85-01-8	µg/L	0.11	u q	uj	n	0.11	1	0.01	PAHs	S
280-90420-1	NTAmw-116-110116-GW	280-90420-9	Water	Pyrene	129-00-0	µg/L	0.11	u q	uj	n	0.11	1	0.0066	PAHs	S
280-90420-1	NTAmw-116-110116-GW	280-90420-9	Water	Methylene chloride	75-09-2	µg/L	5	j q b	u	n	5	0.8	0.32	VOCs	B

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90465-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Project Chemist and Secondary QC Review was performed by the Validation Chemist. Signatures indicate the report is approved for release.



Heather A. Miner

2017.01.26 12:33:15 -07'00'

Heather Miner, Project Chemist, TEC-WESTON JV

Date



Travis Withers

2017.01.26 12:40:02 -07'00'

Travis Withers, Validation Chemist, TEC-WESTON JV

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90465-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polychlorinated Biphenyls (PCBs)	8082A	Denver, CO
Organochlorine Pesticides	8081B	Denver, CO
Explosives	8330B	Denver, CO
Metals	6010C/6020A/7470A	Denver, CO
Hexavalent Chromium	353.2	Denver, CO
Total Cyanide	9012B	Denver, CO
Alkalinity	2320B	Denver, CO
Sulfide	9034	Denver, CO
Anions	9056A	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R)

should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	SVOCs (phthalates, phenols)	PAHs	PCBs	Pesticides	Explosives	Metals	Cr(VI)	Cyanide	Alkalinity
RQLmw-014-110216-GW	280-90465-1	11/02/16	Groundwater							✓	✓	✓		✓
RQLmw-016-110216-GW	280-90465-2	11/02/16	Groundwater							✓	✓		✓	
RQLmw-500-110216-GW	280-90465-3	11/02/16	Groundwater	Field Duplicate	✓	✓	✓	✓	✓	✓	✓		✓	
RQLmw-501-110216-GW	280-90465-4	11/02/16	Groundwater	Field Duplicate						✓	✓	✓		✓
RQLmw-007-110216-GW	280-90465-5	11/02/16	Groundwater	MS/MSD	✓	✓	✓	✓	✓	✓	✓		✓	
RQLmw-009-110216-GW	280-90465-6	11/02/16	Groundwater		✓	✓	✓	✓	✓	✓	✓		✓	
TRIP BLANK	280-90465-7	11/02/16	Water		✓									

Note: RQLmw-501-110216-GW is a field duplicate of parent sample RQLmw-014-110216-GW

RQLmw-500-110216-GW is a field duplicate of parent sample RQLmw-007-110216-GW

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
J	CC	Estimated detection; continuing calibration verification did not meet acceptance criteria.
J	M	Estimated detection; The associated MS/MSD recoveries and/or RPD were outside QC limits.
J	S	Estimated detection; the surrogate recovery was outside QC limits.
R	L	Rejected result, result is not usable; the associated LCS/LCSD recovery was extremely low.
UJ	L	Estimated non-detection; the associated LCS/LCSD recovery and/or RPD were outside QC limits.
U	B	Not detected; target analyte was detected in the method or calibration blank.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 3, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

PCB analysis requested on sample RQLmw-015-110216-GW was cancelled due to insufficient sample volume being collected to achieve the project required reporting limits. The laboratory reports that 2 x 250 ml volume containers were received; however, 1 L bottles are required to meet reporting limits.

The laboratory reported that the number of sample containers noted on the COC differed from that received. A total of 16 bottles were received for samples RQLmw-500-110216-GW, RQLmw-007 MS-110216-GW, RQLmw-007 MSD-110216-GW, and RQLmw-007-110216-GW, not 15 as written on the COC.

As a collection time was not provided for the trip blank that travelled with the samples, the laboratory assigned a collection time of the earliest associated groundwater sample (08:35).

Sample RQLmw-009-110216-GW was inadvertently spiked with target analytes for PCBs. No sample volume remained for re-extraction. The PCB analysis on this sample was not reported.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- Instrument tuning
- LCS recoveries
- Initial calibration
- Initial and continuing calibration verification
- Internal Standards

All analytical or quality parameters requiring further discussion for Method 8260B are described in the sections below.

1.4.1.1 Surrogates

The 1,2-Dichloroethane-d4 surrogate recovery was above the acceptable range (81-118%) associated with sample RQLmw-007-110216-GW (128%). All associated sample results were non-detect; therefore, no qualification was necessary.

1.4.1.2 Method Blanks

Methylene chloride (0.956 µg/L) was detected in the method blank at a concentration below the LOQ (5.0 µg/L). Methylene chloride was also detected at concentrations below the LOQ in samples RQLmw-500-110216-GW (0.56 µg/L), RQLmw-007-10216-GW (0.83 µg/L), RQLmw-009-110216-GW (0.63 µg/L) and the TRIP BLANK TB-110216 (0.64 µg/L). These samples results were qualified as non-detect at the LOQ (U B).

1.4.1.3 Trip Blanks

Methylene chloride (0.64 µg/L) was detected in the trip blank at a concentration below the LOQ (5.0 µg/L). This result was qualified as non-detect at the LOQ, due to method blank contamination. See section 1.4.1.2 for the sample qualification.

1.4.1.4 Matrix Spike/Matrix Spike Duplicates

An MS/MSD was performed on sample RQLmw-007-110216-GW and analyzed for VOCs.

The matrix spike recovery for bromochloromethane (127%) recovered above the QC limits (78-123%) in the matrix spike sample. Bromochloromethane was not detected in the parent sample RQLmw-007-110215-GW, therefore no qualification was necessary.

1.4.1.5 Field Duplicates

One field duplicate (RQLmw-500-110216-GW), associated with parent sample RQLmw-007-110216-GW, was collected and analyzed for VOCs. All analytes were non-detect or qualified as non-detect in the parent or field duplicate samples.

1.4.2 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks

- Instrument tuning
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Internal standard recoveries

All analytical or quality parameters requiring further discussion for Method 8270D are described in the sections below.

1.4.2.1 Laboratory Control Sample

Hexachlorocyclopentadiene (0%) was not recovered in the LCS (10-120%). Because of extremely low recovery (less than 10%), all associated hexachlorocyclopentadiene results were rejected (R L). It is noted that hexachlorocyclopentadiene is a known poor performing compound.

1.4.2.2 Matrix Spike/Matrix Spike Duplicates

An MS/MSD was performed on sample RQLmw-007-110716-GW. 3,3'-Dichlorobenzidine was recovered below control limits (27-129%) in the MSD (24%) and benzyl alcohol was recovered above control limits (31-112%) in the MSD (113%). Because the MS recoveries and the RPDs were within control limits, no qualifications were deemed necessary.

1.4.2.3 Field Duplicates

One field duplicate (RQLmw-500-110216-GW), associated with parent sample RQLmw-007-110216-GW, was analyzed for SVOCs. No detections were reported in either the parent or duplicate sample.

1.4.3 Polycyclic Aromatic Hydrocarbons (PAHs) by Method 8270D SIM

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blank
- LCS recoveries
- MS/MSD recoveries and RPDs
- Instrument tuning
- Internal standards
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification

All analytical or quality parameters requiring further discussion for Method 8270D SIM are described in the sections below.

1.4.3.1 Surrogates

Several surrogates were recovered outside control limits as presented in the following table:

Sample ID	Surrogate	%R	%R QC Limits	Assigned Flags
RQLmw-500-110216-GW	2-Fluorobiphenyl	50	53-106	J/UJ S
	Nitrobenzene-d5	43	55-111	J/UJ S
RQLmw-007-110216-GW	Nitrobenzene-d5	44	55-111	J/UJ S

Bolded values exceed QC limits.

Results associated with the surrogate outliers are qualified as estimated (J S).

1.4.3.2 Field Duplicates

One field duplicate (RQLmw-500-110216-GW), associated with parent sample RQLmw-007-110216-GW, was analyzed for PAHs. No detections were reported in either the parent or duplicate sample.

1.4.4 Organochlorine Pesticides by Method 8081B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- MS/MSD recoveries and RPDs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- DDT/Endrin breakdown

All analytical or quality parameters requiring further discussion for Method 8081B are described in the sections below.

1.4.4.1 Laboratory Control Sample

Several analytes were recovered below QC limits in the LCS. The table below presents the LCS exceedances:

Analyte	LCS %R	%R QC Limits	Assigned Flags
Dieldrin	50	60-136	UJ L
Endrin	0	60-138	R L
Endrin ketone	140	58-134	None

%R = percent recovery

Bolded values are outside control limits.

The LCS recovery for endrin was extremely low (less than 10%). Endrin results in associated samples are rejected (R L). The LCS recovery for dieldrin is below the lower control limit; associated results are qualified as estimated (J/UJ L). Endrin ketone was not detected in any associated sample; therefore, no qualifications were required.

The laboratory was contacted about the unusually low LCS recovery for endrin. The laboratory noted that other parameters (e.g., endrin breakdown recoveries) were acceptable indicating the failure was not due to instrument contamination. The laboratory speculated the failure may be due to contamination present on the glassware used in the extraction procedure.

1.4.4.2 Field Duplicates

One field duplicate (RQLmw-500-110216-GW), associated with parent sample RQLmw-007-110216-GW, was analyzed for pesticides. No detections were reported in either the parent or duplicate sample.

1.4.5 Polychlorinated Biphenyls by Method 8082A

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS recoveries
- MS/MSD recoveries and RPDs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification

All analytical or quality parameters requiring further discussion for Method 8082A are described in the sections below.

1.4.5.1 Field Duplicates

One field duplicate (RQLmw-500-110216-GW), associated with parent sample RQLmw-007-110216-GW, was analyzed for PCBs. No detections were reported in either the parent or duplicate sample.

1.4.6 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Second column confirmation

All analytical or quality parameters requiring further discussion for Method 8330B are described in the sections below.

1.4.6.1 Laboratory Control Sample

Laboratory Control Sample

Several analytes were recovered below QC limits in the LCS. The table below presents the LCS exceedances:

Analyte	LCS %R	%R QC Limits	Assigned Flags
2,4-Dinitrotoluene	70	78-120	J/UJ L
2,6-Dinitrotoluene	67	77-127	J/UJ L
2-Nitrotoluene	55	70-127	J/UJ L
3-Nitrotoluene	55	73-125	J/UJ L
4-Nitrotoluene	56	71-127	J/UJ L

%R = percent recovery

Bolded values are outside control limits.

The LCS recoveries for 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, and 4-nitrotoluene are below their lower control limit; associated results are qualified as estimated (J/UJ L).

1.4.6.2 Matrix Spike/Matrix Spike Duplicates

An MS/MSD was performed on sample RWLmw-007-110216-GW. All MS/MSD recoveries and RPDs were within control limits with the exception of the exceedances presented in the following table:

Parent Sample	Analyte	MS %R	MSD %R	%R QC Limits	RPD	RPD Limits	Assigned Flags
---------------	---------	-------	--------	--------------	-----	------------	----------------

RWLmw-007-110216-GW	1,3,5-Trinitrobenzene	72	82	73-125	13	20	None
	2,6-Dinitrotoluene	75	77	77-127	3	20	None
	3-Nitrotoluene	272	317	73-125	16	20	Detections only
	Nitroglycerin	77	114	74-127	40	20	Detections only

%R = percent recovery

Bolded values are outside control limits.

The MS recoveries were outside control limits for 1,3,5-trinitrobenzene and 2,6-dinitrotoluene. Because the MS recovery and the RPD were within control limits, no qualifications were deemed necessary. The MS/MSD recoveries were above the control limits for 3-nitrotoluene; however, 3-nitrotoluene was not detected in the parent sample, no qualifications were required. The RPD for nitroglycerin exceeded the RPD limit. Nitroglycerin was not detected in the parent sample; therefore, no qualifications were required.

1.4.6.3 Field Duplicates

Two field duplicates (RQLmw-501-110216-GW and RQLmw-500-110216-GW), associated with parent samples RQLmw-014-110216-GW and RQLmw-007-110216-GW, respectively, were analyzed for explosives. No detections were reported in either the parent or duplicate samples.

1.4.7 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- LCS recoveries
- Initial calibration verification
- Initial calibration blanks
- Low level calibration check standard
- Interference check solutions
- Instrument tuning
- Serial dilutions

All analytical or quality parameters requiring further discussion for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.7.1 Method Blanks

Sodium (341 µg/L) was detected in the method blank at a concentration below the LOQ (5000 µg/L). Sodium was detected at a concentration below the LOQ in sample RQLmw-009-110216-GW (2300

µg/L); this result was qualified as not detected at the LOQ (U B). All other associated sample results were detected above the LOQ; therefore, no qualification was necessary.

1.4.7.2 Calibration Blanks

Sodium was detected in CCBs 280-351484/90 (180 µg/L) and 280-351484/104 (101 µg/L). All associated sodium results originally detected at concentrations less than the LOQ were already qualified as non-detect for method blank contamination; therefore, no qualification was necessary. See Section Method Blanks for details.

1.4.7.3 Continuing Calibration Verification

Iron (125% and 122%) recovered above the QC limits (80-120%) in the low level CCVs 280-351484/91 and 280-351484/105, respectively. Iron was detected in all associated samples. These sample results were qualified as estimated (J CC).

Barium (77%) was recovered below the QC limits (80-120%) in the low level CCV 280-351538/45 associated with samples RQLmw-014-110216-GW and RWLmw-016-110216-GW. Barium results in associated samples were qualified as estimated (J/UJ CC).

Manganese (129%) was recovered above QC limits (80-120%) in the low level CCV 280-351538/57 associated with all samples reported in this SDG. All detected manganese results were qualified as estimated (J CC).

Barium (129%) was recovered above QC limits (80-120%) in the low level CCV 280-351538/69 associated with samples RQLmw-500-110216-GW, RQLmw-501-110216-GW, RWLmw-007-110216-GW, and RQLmw-009-110216-GW. All detected barium results were qualified as estimated (J CC).

1.4.7.4 Matrix Spike/Matrix Spike Duplicates

An MS/MSD was performed on sample RQLmw-009-110216-GW. All MS/MSD recoveries and RPDs were within control limits with the exception of the exceedances presented in the following table:

Parent Sample	Analyte	MS %R	MSD %R	%R QC Limits	RPD	RPD Limits	Assigned Flags
---------------	---------	-------	--------	--------------	-----	------------	----------------

RQLmw-009-110216-GW	Aluminum	84	85	86-115	2	20	J/UJ M
	Calcium	77	87	87-113	3	20	None
	Barium	125	127	86-114	1	20	Detections only

%R = percent recovery

Bolded values are outside control limits.

The MSD recoveries and the RPDs were outside QC limits for aluminum. Aluminum in the associated parent sample is qualified as estimated (J M). Because the MS recovery and the RPD were within control limits for calcium, no qualifications were deemed necessary. Barium was detected in the parent sample; therefore, barium results are qualified as estimated (J M). It be noted that the parent concentrations exceeded four times the spike concentration for iron and manganese; these MS/MSD recoveries could not be evaluated.

1.4.7.5 Post-Digestion Spike

A PDS was performed on sample RQLmw-009-110216-GW. All recoveries were within control limits. It should be noted that the parent concentrations for iron and manganese exceeded four times the spike concentrations; these PDS recoveries could not be evaluated.

1.4.7.1 Interference Check Standards

Manganese was detected in the interference check standard A (ISC-A) at a concentration (1.73 µg/L) greater than the LOD (0.95 µg/L). The laboratory noted manganese is a verified trace impurity and is not indicative of matrix interference. Based on reviewer's professional judgment, no qualification was necessary.

1.4.7.2 Field Duplicates

Two field duplicates (RQLmw-501-110216-GW and RQLmw-500-110216-GW), associated with parent samples RQLmw-014-110216-GW and RQLmw-007-110216-GW, respectively, were analyzed for total metals. For detections greater than 5x the LOQ in both samples, an RPD was calculated. For detections less than 5x the LOQ, the difference in values was compared to ± the LOQ. The following table shows the detections in the parent and field duplicate samples:

Primary/Duplicate Sample ID	Analyte	Primary Sample	Field Duplicate	LOQ (µg/L)	RPD (%)	RPD Limit (%) ¹
-----------------------------	---------	----------------	-----------------	------------	---------	----------------------------

		Result (µg/L)	Result (µg/L)			
RQLmw-014- 110216-GW /RQLmw-501- 110216-GW	Calcium	56000	55000	1000	2	20
	Iron	290	280	100	4	± LOQ
	Magnesium	18000	18000	500	0	20
	Potassium	4900	4800	3000	N/A	± LOQ
	Sodium	5200	9000	5000	N/A	± LOQ
	Barium	3.7	4.8	3	N/A	± LOQ
	Cobalt	1.8	1.9	1	N/A	± LOQ
	Manganese	3100	3100	3.5	0	20
	Nickel	9	10	3	N/A	± LOQ
	Thallium	0.2 U	0.056 J	1	N/A	± LOQ
	Zinc	5.3	20	20	N/A	± LOQ
RQLmw-007- 110216-GW /RQLmw-500- 110216-GW	Aluminum	19 J	19 J	300	N/A	± LOQ
	Calcium	140000	140000	1000	0	20
	Iron	19000	18000	100	5	20
	Magnesium	84000	87000	500	4	20
	Potassium	6900	7200	3000	N/A	± LOQ
	Sodium	5500	5600	5000	N/A	± LOQ
	Arsenic	56	53	5	6	20
	Barium	62	62	3	0	20
	Chromium	1.8 U	5.3 J		N/A	± LOQ
	Cobalt	6.1	6.4	1	5	20
	Lead	0.7 U	0.46 J	3	N/A	± LOQ
	Manganese	1500	1400	3.5	7	20
	Nickel	13	14	3	N/A	± LOQ
	Thallium	0.11 J	0.15 J	1	N/A	± LOQ
Zinc	42	45	20	N/A	± LOQ	

¹ The RPD limit is 20% for detections greater than 5x the LOQ; ± the LOQ for detections less than 5x the LOQ.

J Laboratory flag indicating the result is less than the LOQ and is estimated.

U Laboratory flag indicating the result is not detected.

N/A Not applicable

All calculated RPDs and difference in detections met criteria. No validation flags were assigned.

1.4.8 Hexavalent Chromium by Method 7196A

The following parameters were evaluated and met the required criteria

- Holding time
- LODs and LOQs
- Method blank
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification

- Initial calibration blank
- Continuing calibration blanks

All analytical or quality issues for Method 7196A are described in the sections below.

1.4.8.1 Field Duplicates

One field duplicate (RQLmw-501-110216-GW), associated with parent samples RQLmw-014-110216-GW, was analyzed for hexavalent chromium. No detections were reported in either the parent or duplicate samples.

1.4.9 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blank
- LCS recoveries
- MS/MSD recoveries and RPDs
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

All analytical or quality parameters requiring further discussion for Method 9012B are described in the sections below.

1.4.9.1 Field Duplicates

One field duplicate was collected (RQLmw-500-110216-GW), associated with parent sample RQLmw-007-110216-GW and analyzed for cyanide. For detections greater than 5x the LOQ in both samples, an RPD was calculated. For detections less than 5x the LOQ, the difference in values was compared to \pm the LOQ. The following table shows the detections in parent and field duplicate samples:

Primary/Duplicate Sample ID	Analyte	Primary Sample Result ($\mu\text{g/L}$)	Field Duplicate Result ($\mu\text{g/L}$)	LOQ ($\mu\text{g/L}$)	RPD (%)	RPD Limit (%) ¹
RQLmw-007-110216-GW /RQLmw-500-110216-GW	Cyanide	5.9 J	10	10	N/A	\pm LOQ

¹ The RPD limit is 20% for detections greater than 5x the LOQ; \pm the LOQ for detections less than 5x the LOQ.

J Laboratory flag indicating the result is less than the LOQ and is estimated.

N/A Not applicable

All calculated RPDs and difference in detections met criteria. No validation flags were assigned.

1.4.10 Alkalinity by Method SM 2320B

The following parameters were evaluated and met the required criteria:

- Holding time
- LODs and LOQs
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

All analytical or quality parameters requiring further discussion for Method SM 2320 are described in the sections below.

1.4.10.1 Method Blanks

Alkalinity (1.57 µg/L) was detected in the method blank at a concentration below the LOQ (5.0 µg/L). Because alkalinity was detected in the associated samples, RQLmw-014-110216-GW and RQLmw-501-110216-GW, at concentrations above the LOQ, no qualifiers were assigned.

1.4.10.2 Calibration Blanks

Alkalinity (1.68 µg/L) was detected in the continuing calibration blank at a concentration below the LOQ (5.0 µg/L). Because alkalinity was detected in the associated samples, RQLmw-014-110216-GW and RQLmw-501-110216-GW, at concentrations above the LOQ, no qualifiers were assigned.

1.4.10.3 Field Duplicates

One field duplicate was collected (RQLmw-501-110216-GW), associated with parent sample RQLmw-014-110216-GW and analyzed for alkalinity. For detections greater than 5x the LOQ in both samples, an RPD was calculated. For detections less than 5x the LOQ, the difference in values was compared to ± the LOQ. The following table shows the detections in parent and field duplicate samples:

Primary/Duplicate Sample ID	Analyte	Primary Sample	Field Duplicate	LOQ (µg/L)	RPD (%)	RPD Limit (%) ¹
-----------------------------	---------	----------------	-----------------	------------	---------	----------------------------

		Result (µg/L)	Result (µg/L)			
RQLmw-014- 110216-GW /RQLmw-501- 110216-GW	Alkalinity	99	97	5	2	20

¹ The RPD limit is 20% for detections greater than 5x the LOQ; ± the LOQ for detections less than 5x the LOQ.

All calculated RPDs and difference in detections met criteria. No validation flags were assigned.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	AnalyticMethod	Reason Code
280-90465-1	RQLmw-014-110216-GW	280-90465-1	Water	Iron	7439-89-6	µg/L	290	v	j	y	100	85	22	Metals	CC
280-90465-1	RQLmw-014-110216-GW	280-90465-1	Water	Barium	7440-39-3	µg/L	3.7	v	j	y	3	0.1	0.29	Metals	CC
280-90465-1	RQLmw-014-110216-GW	280-90465-1	Water	Manganese	7439-96-5	µg/L	3100	q	j	y	3.5	0.1	0.31	Metals	CC
280-90465-1	RQLmw-014-110216-GW	280-90465-1	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.41	u q	uj	n	0.41	4.4	0.086	Explosives	L
280-90465-1	RQLmw-014-110216-GW	280-90465-1	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u q	uj	n	0.21	4.4	0.067	Explosives	L
280-90465-1	RQLmw-014-110216-GW	280-90465-1	Water	2-Nitrotoluene	88-72-2	µg/L	0.41	u q	uj	n	0.41	0.2	0.088	Explosives	L
280-90465-1	RQLmw-014-110216-GW	280-90465-1	Water	3-Nitrotoluene	99-08-1	µg/L	0.41	u q	uj	n	0.41	0.2	0.086	Explosives	L
280-90465-1	RQLmw-014-110216-GW	280-90465-1	Water	4-Nitrotoluene	99-99-0	µg/L	1	u q	uj	n	1	0.4	0.21	Explosives	L
280-90465-1	RQLmw-016-110216-GW	280-90465-2	Water	Iron	7439-89-6	µg/L	8100	v	j	y	100	85	22	Metals	CC
280-90465-1	RQLmw-016-110216-GW	280-90465-2	Water	Barium	7440-39-3	µg/L	11	v	j	y	3	0.1	0.29	Metals	CC
280-90465-1	RQLmw-016-110216-GW	280-90465-2	Water	Manganese	7439-96-5	µg/L	5600	q	j	y	3.5	0.1	0.31	Metals	CC
280-90465-1	RQLmw-016-110216-GW	280-90465-2	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u q	uj	n	0.21	4.4	0.067	Explosives	L
280-90465-1	RQLmw-016-110216-GW	280-90465-2	Water	2-Nitrotoluene	88-72-2	µg/L	0.42	u q	uj	n	0.42	0.2	0.089	Explosives	L
280-90465-1	RQLmw-016-110216-GW	280-90465-2	Water	3-Nitrotoluene	99-08-1	µg/L	0.42	u q	uj	n	0.42	0.2	0.087	Explosives	L
280-90465-1	RQLmw-016-110216-GW	280-90465-2	Water	4-Nitrotoluene	99-99-0	µg/L	1	u q	uj	n	1	0.4	0.21	Explosives	L
280-90465-1	RQLmw-500-110216-GW	280-90465-3	Water	Iron	7439-89-6	µg/L	18000	v	j	y	100	85	22	Metals	CC
280-90465-1	RQLmw-500-110216-GW	280-90465-3	Water	Barium	7440-39-3	µg/L	62	v	j	y	3	0.1	0.29	Metals	CC
280-90465-1	RQLmw-500-110216-GW	280-90465-3	Water	Manganese	7439-96-5	µg/L	1400	q	j	y	3.5	0.1	0.31	Metals	CC
280-90465-1	RQLmw-500-110216-GW	280-90465-3	Water	Dieldrin	60-57-1	µg/L	0.053	u q	uj	n	0.05	0.02	0.005	Pesticides	L
280-90465-1	RQLmw-500-110216-GW	280-90465-3	Water	Endrin	72-20-8	µg/L	0.053	u q	r	n	0.05	0.02	0.003	Pesticides	L
280-90465-1	RQLmw-500-110216-GW	280-90465-3	Water	Methylene chloride	75-09-2	µg/L	5	j	u	n	5	0.8	0.32	VOCs	B
280-90465-1	RQLmw-500-110216-GW	280-90465-3	Water	Hexachlorocyclopentadiene	77-47-4	µg/L	49	u q	r	n	49	30	9.8	SVOCs	L
280-90465-1	RQLmw-500-110216-GW	280-90465-3	Water	Acenaphthene	83-32-9	µg/L	0.1	u q	uj	n	0.1	1	0.004	PAHs	S
280-90465-1	RQLmw-500-110216-GW	280-90465-3	Water	Acenaphthylene	208-96-8	µg/L	0.1	u q	uj	n	0.1	1	0.005	PAHs	S
280-90465-1	RQLmw-500-110216-GW	280-90465-3	Water	Anthracene	120-12-7	µg/L	0.1	u q	uj	n	0.1	1	0.006	PAHs	S
280-90465-1	RQLmw-500-110216-GW	280-90465-3	Water	Fluoranthene	206-44-0	µg/L	0.1	u q	uj	n	0.1	0.5	0.005	PAHs	S
280-90465-1	RQLmw-500-110216-GW	280-90465-3	Water	Fluorene	86-73-7	µg/L	0.1	u q	uj	n	0.1	1	0.006	PAHs	S
280-90465-1	RQLmw-500-110216-GW	280-90465-3	Water	Naphthalene	91-20-3	µg/L	0.1	u q	uj	n	0.1	1	0.008	PAHs	S
280-90465-1	RQLmw-500-110216-GW	280-90465-3	Water	Phenanthrene	85-01-8	µg/L	0.1	u q	uj	n	0.1	1	0.009	PAHs	S
280-90465-1	RQLmw-500-110216-GW	280-90465-3	Water	Pyrene	129-00-0	µg/L	0.1	u q	uj	n	0.1	1	0.006	PAHs	S
280-90465-1	RQLmw-500-110216-GW	280-90465-3	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.22	u q	uj	n	0.22	4.4	0.07	Explosives	L
280-90465-1	RQLmw-500-110216-GW	280-90465-3	Water	2-Nitrotoluene	88-72-2	µg/L	0.44	u q	uj	n	0.44	0.2	0.093	Explosives	L
280-90465-1	RQLmw-500-110216-GW	280-90465-3	Water	3-Nitrotoluene	99-08-1	µg/L	0.44	u q	uj	n	0.44	0.2	0.091	Explosives	L
280-90465-1	RQLmw-500-110216-GW	280-90465-3	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	uj	n	1.1	0.4	0.22	Explosives	L
280-90465-1	RQLmw-501-110216-GW	280-90465-4	Water	Iron	7439-89-6	µg/L	280	v	j	y	100	85	22	Metals	CC
280-90465-1	RQLmw-501-110216-GW	280-90465-4	Water	Barium	7440-39-3	µg/L	4.8	v	j	y	3	0.1	0.29	Metals	CC
280-90465-1	RQLmw-501-110216-GW	280-90465-4	Water	Manganese	7439-96-5	µg/L	3100	q	j	y	3.5	0.1	0.31	Metals	CC
280-90465-1	RQLmw-501-110216-GW	280-90465-4	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.42	u q	uj	n	0.42	4.4	0.089	Explosives	L
280-90465-1	RQLmw-501-110216-GW	280-90465-4	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u q	uj	n	0.21	4.4	0.068	Explosives	L

280-90465-1	RQLmw-501-110216-GW	280-90465-4	Water	2-Nitrotoluene	88-72-2	µg/L	0.42	u q	uj	n	0.42	0.2	0.09	Explosives	L
280-90465-1	RQLmw-501-110216-GW	280-90465-4	Water	3-Nitrotoluene	99-08-1	µg/L	0.42	u q	uj	n	0.42	0.2	0.088	Explosives	L
280-90465-1	RQLmw-501-110216-GW	280-90465-4	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	uj	n	1.1	0.4	0.21	Explosives	L
280-90465-1	RQLmw-007-110216-GW	280-90465-5	Water	Iron	7439-89-6	µg/L	19000	j	j	y	100	85	22	Metals	CC
280-90465-1	RQLmw-007-110216-GW	280-90465-5	Water	Barium	7440-39-3	µg/L	62	j	j	y	3	0.1	0.29	Metals	CC
280-90465-1	RQLmw-007-110216-GW	280-90465-5	Water	Manganese	7439-96-5	µg/L	1500	i q	j	y	3.5	0.1	0.31	Metals	CC
280-90465-1	RQLmw-007-110216-GW	280-90465-5	Water	Dieldrin	60-57-1	µg/L	0.051	u q	uj	n	0.05	0.02	0.005	Pesticides	L
280-90465-1	RQLmw-007-110216-GW	280-90465-5	Water	Endrin	72-20-8	µg/L	0.051	u q	r	n	0.05	0.02	0.002	Pesticides	L
280-90465-1	RQLmw-007-110216-GW	280-90465-5	Water	Methylene chloride	75-09-2	µg/L	5	j	u	n	5	0.8	0.32	VOCs	B
280-90465-1	RQLmw-007-110216-GW	280-90465-5	Water	Hexachlorocyclopentadiene	77-47-4	µg/L	50	u q	r	n	50	30	9.9	SVOCs	L
280-90465-1	RQLmw-007-110216-GW	280-90465-5	Water	Naphthalene	91-20-3	µg/L	0.1	u q	uj	n	0.1	1	0.008	PAHs	S
280-90465-1	RQLmw-007-110216-GW	280-90465-5	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u j q	uj	n	0.21	4.4	0.067	Explosives	L
280-90465-1	RQLmw-007-110216-GW	280-90465-5	Water	2-Nitrotoluene	88-72-2	µg/L	0.42	u q	uj	n	0.42	0.2	0.089	Explosives	L
280-90465-1	RQLmw-007-110216-GW	280-90465-5	Water	3-Nitrotoluene	99-08-1	µg/L	0.42	u j q	uj	n	0.42	0.2	0.087	Explosives	L
280-90465-1	RQLmw-007-110216-GW	280-90465-5	Water	4-Nitrotoluene	99-99-0	µg/L	1	u q	uj	n	1	0.4	0.21	Explosives	L
280-90465-1	RQLmw-009-110216-GW	280-90465-6	Water	Aluminum	7429-90-5	µg/L	26	j	j	y	300	70	18	Metals	M
280-90465-1	RQLmw-009-110216-GW	280-90465-6	Water	Iron	7439-89-6	µg/L	11000	v	j	y	100	85	22	Metals	CC
280-90465-1	RQLmw-009-110216-GW	280-90465-6	Water	Sodium	7440-23-5	µg/L	5000	j	u	n	5000	350	92	Metals	B
280-90465-1	RQLmw-009-110216-GW	280-90465-6	Water	Barium	7440-39-3	µg/L	63	v	j	y	3	0.1	0.29	Metals	CC M
280-90465-1	RQLmw-009-110216-GW	280-90465-6	Water	Manganese	7439-96-5	µg/L	910	q	j	y	3.5	0.1	0.31	Metals	CC
280-90465-1	RQLmw-009-110216-GW	280-90465-6	Water	Dieldrin	60-57-1	µg/L	0.05	u q	uj	n	0.05	0.02	0.005	Pesticides	L
280-90465-1	RQLmw-009-110216-GW	280-90465-6	Water	Endrin	72-20-8	µg/L	0.05	u q	r	n	0.05	0.02	0.002	Pesticides	L
280-90465-1	RQLmw-009-110216-GW	280-90465-6	Water	Methylene chloride	75-09-2	µg/L	5	j	u	n	5	0.8	0.32	VOCs	B
280-90465-1	RQLmw-009-110216-GW	280-90465-6	Water	Hexachlorocyclopentadiene	77-47-4	µg/L	49	u q	r	n	49	30	9.8	SVOCs	L
280-90465-1	RQLmw-009-110216-GW	280-90465-6	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.22	u q	uj	n	0.22	4.4	0.07	Explosives	L
280-90465-1	RQLmw-009-110216-GW	280-90465-6	Water	2-Nitrotoluene	88-72-2	µg/L	0.44	u q	uj	n	0.44	0.2	0.093	Explosives	L
280-90465-1	RQLmw-009-110216-GW	280-90465-6	Water	3-Nitrotoluene	99-08-1	µg/L	0.44	u q	uj	n	0.44	0.2	0.091	Explosives	L
280-90465-1	RQLmw-009-110216-GW	280-90465-6	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	uj	n	1.1	0.4	0.22	Explosives	L
280-90465-1	TB-110216	280-90465-7	Water	Methylene chloride	75-09-2	µg/L	5	j	u	n	5	0.8	0.32	VOCs	B

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90467-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Project Chemist and Secondary QC Review was performed by the Validation Chemist. Signatures indicate the report is approved for release.



Erica Fisher, Validator, TEC-WESTON JV

02/08/2017

Date



Pete Chapman, Validation Chemist, TEC-WESTON JV

2/8/17

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90467-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polychlorinated Biphenyls (PCBs)	8082A	Denver, CO
Polycyclic Aromatic Hydrocarbons (PAHs)	8270D SIM	Denver, CO
Organochlorine Pesticides	8081B	Denver, CO
Explosives	8330B	Denver, CO
Total Cyanide	9012B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data*

Review (EPA 2014) and USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014). Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	SVOCs (phthalates, nitroaromatics, phenols)	PAHs	PCBs	Pesticides	Explosives	Cyanide
LL9mw-003-110216-GW	280-90467-1	11/02/16	Groundwater		✓	✓			✓	
LL9mw-004-110216-GW	280-90467-2	11/02/16	Groundwater		✓	✓			✓	
LL9mw-005-110216-GW	280-90467-3	11/02/16	Groundwater		✓	✓			✓	
LL2mw-270-110216-GW	280-90467-4	11/02/16	Groundwater				✓	✓	✓	✓

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
UJ	L	Estimated non-detection; LCS/LCSD percent recovery or RPD outside QC limits.
UJ	S	Estimated non-detection; surrogate outlier.
UJ	C	Estimated non-detection; continuing calibration verification did not meet acceptance criteria.
R	L	Rejected; LCS/LCSD percent recovery or RPD outside QC limits.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 3, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blank
- Surrogate recoveries
- Instrument tuning
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Internal standard area counts
- Equipment blank

All analytical or quality parameters requiring further discussion for Method 8270D are described in the sections below.

1.4.1.1 Laboratory Control Sample

Hexachlorocyclopentadiene (0%) was recovered below the lower QC limit (10%) in laboratory control sample LCS 280-350530/2-A. The LCS recovery for hexachlorocyclopentadiene was extremely low. Hexachlorocyclopentadiene results in associated samples (LL9mw-003-110216-GW, LL9mw-004-110216-GW and LL9mw-005-110216-GW) are rejected (R L). The laboratory report that hexachlorocyclopentadiene is a poor performing analyte for this method and therefore re-extraction and analysis was not performed.

1.4.2 Polycyclic Aromatic Hydrocarbons by Method 8270D SIM

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blank
- Instrument tuning
- Internal standards
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification

All analytical or quality issues for Method 8270D SIM are described in the sections below.

1.4.2.1 Surrogate Recoveries

Surrogate nitrobenzene-d5 recovered below the acceptance criteria (55-111%) in samples LL9mw-003-110216-GW (52%) and LL9mw-004-110216-GW (51%). All associated sample results were qualified as estimated (UJ S).

1.4.2.2 Laboratory Control Samples

The Naphthalene (21%) RPD for the LCS/LCSD pair (280-350467/3-A) exceeded the QC limit (20%) associated with samples LL9mw-003-110216-GW, LLmw-004-110216-GW and LL9mw-005-110216-GW. However, as all other QC limits were met, no qualification was considered necessary.

1.4.2.3 Field Duplicates

No field duplicates were reported in the SDG.

1.4.3 Organochlorine Pesticides by Method 8081B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Method blank
- Initial calibration
- Internal standards
- Endrin/DDT breakdown check
- Second column confirmation

All analytical or quality issues for Method 8081B are described in the sections below.

1.4.3.1 Laboratory Control Samples

As shown in the table below, laboratory control sample LCS 280-350397/2-A associated with sample LL2mw-270-110216-GW reported recoveries outside the applicable QC limits.

Analyte	LCS %R	%R QC Limits	Assigned Flags
Dieldrin	50	60-136	UJ L
Endrin	0	60-138	R L
Endrin Keytone	140	58-134	None

%R = percent recovery

The LCS recovery for endrin was extremely low (less than 10%). Endrin results in associated sample (LL2mw-270-110216-GW) are rejected (R L). The LCS recovery for dieldrin is below the lower control limit and was not detected in the associated sample. Therefore dieldrin is qualified as estimated non-detect (UJ L). Endrin ketone recovery exceeded the QC limit and was not detected in the associated sample; therefore, no qualifications were required.

1.4.3.2 Initial/Continuing Calibration Verification

Endosulfan II (20.6%) failed the QC limit ($\pm 20\%D$) for continuing calibration verification sample CCVIS 280-351274/13. This CCV sample is associated with sample LL2mw-270-110216-GW, in which endosulfan II was not detected. The sample has been qualified as an estimated non-detect (UJ CC). The laboratory report in the case narrative that the data is reported from the secondary column, which was in control.

1.4.3.3 Matrix Spike/Matrix Spike Duplicates

No MS/MSDs were reported in this SDG.

1.4.3.4 Field Duplicates

No field duplicates were reported in this SDG.

1.4.4 Polychlorinated Biphenyls by Method 8082A

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- LCS/LCSD recoveries and RPDs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Second column confirmation

All analytical or quality parameters requiring further discussion for Method 8082A are described in the sections below.

1.4.4.1 Matrix Spike/Matrix Spike Duplicates

No MS/MSDs were reported in this SDG.

1.4.4.2 Field Duplicates

No field duplicates were reported in this SDG.

1.4.5 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Initial calibration
- Method blank
- Initial calibration verification
- Continuing calibration verification
- Second column confirmation

All analytical or quality issues for Method 8330B are described in the sections below.

1.4.5.1 Laboratory Control Sample

The following table shows analytes that recovered below the QC limits in laboratory control sample LCS 280-350417/2-A:

Associated Samples	Analyte	LCS %R	%R QC Limits	Assigned Flags
LL9mw-003-110216-GW LL9mw-005-110216-GW LL2mw-270-110216-GW	2,4-Dinitrotoluene	70	78-120	UJ L
LL9mw-003-110216-GW	2,6-dinitrotoluene	67	77-127	UJ L
LL9mw-004-110216-GW	2-nitrotoluene	55	70-127	UJ L
LL9mw-005-110216-GW	3-nitrotoluene	55	73-125	UJ L
LL2mw-270-110216-GW	4-nitrotoluene	56	71-127	UJ L

%R = percent recovery

All sample results associated with the exceedances in the table above were qualified as estimated (UJ L).

1.4.5.1 Matrix Spike/Matrix Spike Duplicates

No MS/MSDs were reported in this SDG

1.4.5.2 Field Duplicates

No field duplicates were reported in this SDG.

1.4.6 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

No further analytical or quality parameters requiring further discussion for Method 9012B were required.

1.4.6.1 Matrix Spike/Matrix Spike Duplicates

No MS/MSDs were reported in this SDG.

1.4.6.2 Field Duplicates

No field duplicates were reported in this SDG.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90467-1	LL9mw-003-110216-GW	280-90467-1	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.43	u q	uj	n	0.43		0.09	Explosives and Propellants	L
280-90467-1	LL9mw-003-110216-GW	280-90467-1	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u q	uj	n	0.21		0.069	Explosives and Propellants	L
280-90467-1	LL9mw-003-110216-GW	280-90467-1	Water	2-Nitrotoluene	88-72-2	µg/L	0.43	u q	uj	n	0.43		0.092	Explosives and Propellants	L
280-90467-1	LL9mw-003-110216-GW	280-90467-1	Water	3-Nitrotoluene	99-08-1	µg/L	0.43	u q	uj	n	0.43		0.09	Explosives and Propellants	L
280-90467-1	LL9mw-003-110216-GW	280-90467-1	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	uj	n	1.1		0.21	Explosives and Propellants	L
280-90467-1	LL9mw-003-110216-GW	280-90467-1	Water	Naphthalene	91-20-3	µg/L	0.1	u q	uj	n	0.1		0.0081	PAHs	S
280-90467-1	LL9mw-003-110216-GW	280-90467-1	Water	Hexachlorocyclopentadiene	77-47-4	µg/L	49	u q	r	n	49		9.9	SVOCs	L
280-90467-1	LL9mw-004-110216-GW	280-90467-2	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u q	uj	n	0.21		0.067	Explosives and Propellants	L
280-90467-1	LL9mw-004-110216-GW	280-90467-2	Water	2-Nitrotoluene	88-72-2	µg/L	0.41	u q	uj	n	0.41		0.089	Explosives and Propellants	L
280-90467-1	LL9mw-004-110216-GW	280-90467-2	Water	3-Nitrotoluene	99-08-1	µg/L	0.41	u q	uj	n	0.41		0.086	Explosives and Propellants	L
280-90467-1	LL9mw-004-110216-GW	280-90467-2	Water	4-Nitrotoluene	99-99-0	µg/L	1	u q	uj	n	1		0.21	Explosives and Propellants	L
280-90467-1	LL9mw-004-110216-GW	280-90467-2	Water	Naphthalene	91-20-3	µg/L	0.11	u q	uj	n	0.11		0.0086	PAHs	S
280-90467-1	LL9mw-004-110216-GW	280-90467-2	Water	Hexachlorocyclopentadiene	77-47-4	µg/L	49	u q	r	n	49		9.7	SVOCs	L
280-90467-1	LL9mw-005-110216-GW	280-90467-3	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.42	u q	uj	n	0.42		0.088	Explosives and Propellants	L
280-90467-1	LL9mw-005-110216-GW	280-90467-3	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u q	uj	n	0.21		0.067	Explosives and Propellants	L
280-90467-1	LL9mw-005-110216-GW	280-90467-3	Water	2-Nitrotoluene	88-72-2	µg/L	0.42	u q	uj	n	0.42		0.089	Explosives and Propellants	L
280-90467-1	LL9mw-005-110216-GW	280-90467-3	Water	3-Nitrotoluene	99-08-1	µg/L	0.42	u q	uj	n	0.42		0.087	Explosives and Propellants	L
280-90467-1	LL9mw-005-110216-GW	280-90467-3	Water	4-Nitrotoluene	99-99-0	µg/L	1	u q	uj	n	1		0.21	Explosives and Propellants	L
280-90467-1	LL9mw-005-110216-GW	280-90467-3	Water	Hexachlorocyclopentadiene	77-47-4	µg/L	48	u q	r	n	48		9.7	SVOCs	L
280-90467-1	LL2mw-270-110216-GW	280-90467-4	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.42	u q	uj	n	0.42		0.088	Explosives and Propellants	L
280-90467-1	LL2mw-270-110216-GW	280-90467-4	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u q	uj	n	0.21		0.068	Explosives and Propellants	L
280-90467-1	LL2mw-270-110216-GW	280-90467-4	Water	2-Nitrotoluene	88-72-2	µg/L	0.42	u q	uj	n	0.42		0.09	Explosives and Propellants	L
280-90467-1	LL2mw-270-110216-GW	280-90467-4	Water	3-Nitrotoluene	99-08-1	µg/L	0.42	u q	uj	n	0.42		0.088	Explosives and Propellants	L
280-90467-1	LL2mw-270-110216-GW	280-90467-4	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	uj	n	1.1		0.21	Explosives and Propellants	L
280-90467-1	LL2mw-270-110216-GW	280-90467-4	Water	Dieldrin	60-57-1	µg/L	0.051	u q	uj	n	0.051		0.0047	Pesticides	L
280-90467-1	LL2mw-270-110216-GW	280-90467-4	Water	Endosulfan II	33213-65-9	µg/L	0.051	u	uj	n	0.051		0.0068	Pesticides	CC
280-90467-1	LL2mw-270-110216-GW	280-90467-4	Water	Endrin	72-20-8	µg/L	0.051	u q	r	n	0.051		0.0025	Pesticides	L

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90529-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

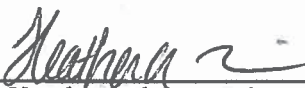
TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by the Project Chemist. Signatures indicate the report is approved for release.



Pete Chapman, Validation Chemist, TEC-WESTON JV

1/13/17

Date



Heather Miner, Project Chemist, TEC-WESTON JV

1/13/17

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90529-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polychlorinated Biphenyls (PCBs)	8082A	Denver, CO
PAHs	8270D SIM	Denver, CO
Explosives	8330B	Denver, CO
Metals	6010C/6020A/7470A	Denver, CO
Hexavalent Chromium	353.2	Denver, CO
Total Cyanide	9012B	Denver, CO
Alkalinity	2320B	Denver, CO
Sulfide	9034	Denver, CO
Anions	9056A	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R)

should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	SVOCs (phthalates, phenols)	PCBs	PAHs	Explosives	Metals	Cr(VI)	Cyanide	Alkalinity
RQLmw-015-110316-GW	280-90529-1	11/03/16	Groundwater				✓						
RQLmw-012-110316-GW	280-90529-2	11/03/16	Groundwater		✓	✓	✓	✓	✓	✓	✓	✓	✓

Note: Samples were also analyzed for natural attenuation parameters; these parameters were not validated.

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
UJ	S	Estimated non-detection; surrogate spike outlier.
UJ	L	Estimated non-detection; LCS outlier.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 4, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

“-GW” was added to the end of all sample IDs to comply with the RIWP.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Instrument tuning
- Initial calibration verification
- Laboratory Control Sample
- Internal standard recoveries

All analytical or quality parameters requiring further discussion for Method 8260B are described in the sections below.

1.4.1.1 Method Blanks

Methylene chloride (0.97 µg/L) was detected in the method blank at a concentration below the LOQ (5.0 µg/L). Methylene chloride was detected at a concentration above the LOQ in sample RQLmw-012-110316-GW (5.2 µg/L). This sample result was not qualified based on the fact that the result was greater than two times the method blank result.

1.4.1.2 Trip Blanks

The trip blank associated with samples reported in this SDG is reported in SDG 280-90532-1. No detections were reported in the trip blank sample.

1.4.1.3 Continuing Calibration Verification

1,2-Dichloroethane (20.9%D) and Bromochloromethane (21.0%D) were recovered outside of the acceptance criteria ($\pm 20\%$ D) in a CCV. The associated sample result was reported as non-detect; therefore, no qualification was necessary.

1.4.2 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries

- LODs and LOQs
- Method blanks
- LCS recoveries
- Instrument tuning
- Initial calibration verification
- Laboratory Control Sample
- Internal standard recoveries

All analytical or quality parameters requiring further discussion for Method 8270D are described in the sections below.

1.4.2.1 Continuing Calibration Verification

Hexachlorocyclopentadiene (20.2%D) and 4-Nitrophenol (29.9%D) were recovered outside of the acceptance criteria ($\pm 20\%$ D) in CCV 280-352516/3. The associated sample results were reported as non-detects; therefore, no qualification was necessary.

1.4.3 Polychlorinated Biphenyls by Method 8082A

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification

All analytical or quality parameters requiring further discussion for Method 8082A are described in the sections below.

1.4.3.1 Surrogate Recoveries

Surrogate Decachlorobiphenyl (DCB) was recovered below the acceptance criteria (36-140%) in sample RQLmw-012-110316-GW (28%). All associated sample results were non-detect and were qualified as estimated (UJ S).

1.4.4 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- LCS recoveries

- Initial calibration verification
- Continuing calibration verification
- 2nd column confirmation

All analytical or quality parameters requiring further discussion for Method 8330B are described in the sections below.

1.4.4.1 Method Blanks

RDX (0.07 µg/L) was detected in the method blank at a concentration below the LOQ (0.20 µg/L). RDX was not detected in sample RQLmw-012-110316-GW (5.2 µg/L). This sample result was not qualified based on the fact that the result was non-detect.

1.4.4.2 Laboratory Control Sample

Seven compounds were recovered outside of the QC requirements in LCS 280-350786/3-A and LCSD 280-350786/4-A associated with sample RQLmw-012-110316-GW. These exceedances are outlined in the table below:

Analyte	%R (Column 1)	%R (Column 2)	%R Limits
2,4-Dinitrotoluene	75	74	78-120
2,6-Dinitrotoluene	76	74	77-127
2-Amino-4,6-dinitrotoluene	72	68	79-120
2-Nitrotoluene	60	63	70-127
3-Nitrotoluene	61	66	73-125
4-Amino-2,6-dinitrotoluene	72	68	76-125
4-Nitrotoluene	67	69	71-127

All associated sample results were non-detect and were qualified as estimated (UJ L).

1.4.5 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- Method Blanks
- LCS recoveries
- Initial/Continuing Calibration
- Low level calibration check standard
- Interference check solutions
- Instrument tuning

No parameters required further discussion for Methods 6010C, 6020A, and/or 7470A.

1.4.6 Hexavalent Chromium by Method 7196A

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- LODs and LOQs
- Holding Times
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

No parameters required further discussion for Method 7196A.

1.4.7 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

No parameters required further discussion for Method 9012B.

1.4.8 Alkalinity by Method SM 2320B

The following parameters were evaluated and met the required criteria:

- Holding time
- LODs and LOQs
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification

All analytical or quality parameters requiring further discussion for Method SM 2320 are described in the sections below.

1.4.8.1 Method Blanks

Alkalinity (1.51 µg/L) was detected in the method blank at a concentration below the LOQ (5.0 µg/L). Alkalinity was also detected below the method blank at a concentration below the LOQ in sample RQLmw-012-110316-GW (1.7 µg/L); this result was qualified as non-detect at the LOQ (U B).

1.4.8.2 Calibration Blanks

Alkalinity (1.66 µg/L) was detected in the continuing calibration blank at a concentration below the LOQ (5.0 µg/L). The alkalinity result for sample RQLmw-012-110316-GW was already qualified as non-detect due to method blank contamination; therefore, no qualification was necessary.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90529-1	RQLmw-012-110316-GW	280-90529-2	Water	Aroclor-1016	12674-11-2	µg/L	0.14	u q	uj	n	0.14	0.1	0.04	PCBs	S
280-90529-1	RQLmw-012-110316-GW	280-90529-2	Water	Aroclor-1221	11104-28-2	µg/L	0.14	u q	uj	n	0.14	0.1	0.04	PCBs	S
280-90529-1	RQLmw-012-110316-GW	280-90529-2	Water	Aroclor-1232	11141-16-5	µg/L	0.14	u q	uj	n	0.14	0.1	0.04	PCBs	S
280-90529-1	RQLmw-012-110316-GW	280-90529-2	Water	Aroclor-1242	53469-21-9	µg/L	0.14	u q	uj	n	0.14	0.1	0.04	PCBs	S
280-90529-1	RQLmw-012-110316-GW	280-90529-2	Water	Aroclor-1248	12672-29-6	µg/L	0.14	u q	uj	n	0.14	0.1	0.04	PCBs	S
280-90529-1	RQLmw-012-110316-GW	280-90529-2	Water	Aroclor-1254	11097-69-1	µg/L	0.14	u q	uj	n	0.14	0.1	0.04	PCBs	S
280-90529-1	RQLmw-012-110316-GW	280-90529-2	Water	Aroclor-1260	11096-82-5	µg/L	0.14	u q	uj	n	0.14	0.1	0.04	PCBs	S
280-90529-1	RQLmw-012-110316-GW	280-90529-2	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.41	u q	uj	n	0.41	4.4	0.087	Explosives	L
280-90529-1	RQLmw-012-110316-GW	280-90529-2	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u q	uj	n	0.21	4.4	0.067	Explosives	L
280-90529-1	RQLmw-012-110316-GW	280-90529-2	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.21	u q	uj	n	0.21	0.12	0.053	Explosives	L
280-90529-1	RQLmw-012-110316-GW	280-90529-2	Water	2-Nitrotoluene	88-72-2	µg/L	0.41	u q	uj	n	0.41	0.2	0.089	Explosives	L
280-90529-1	RQLmw-012-110316-GW	280-90529-2	Water	3-Nitrotoluene	99-08-1	µg/L	0.41	u q	uj	n	0.41	0.2	0.086	Explosives	L
280-90529-1	RQLmw-012-110316-GW	280-90529-2	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.21	u q	uj	n	0.21	0.12	0.06	Explosives	L
280-90529-1	RQLmw-012-110316-GW	280-90529-2	Water	4-Nitrotoluene	99-99-0	µg/L	1	u q	uj	n	1	0.4	0.21	Explosives	L
280-90529-1	RQLmw-012-110316-GW	280-90529-2	Water	Alkalinity	N/A	mg/L	5	j	u	n	5	2.2	1.1	Alkalinity	B

µg/L - micrograms per liter
mg/L - milligrams per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90531-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by the Project Chemist. Signatures indicate the report is approved for release.



Erica Fisher, Validator, TEC-WESTON JV

02/10/2017

Date



Pete Chapman, Project Chemist, TEC-WESTON JV

2/10/17

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90531-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Explosives	8330B	Denver, CO
Total Cyanide	9012B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend

using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	Explosives	Cyanide
MBS-006-110316-GW	280-90531-1	11/03/16	Groundwater		✓	✓
MBS-004-110316-GW	280-90531-2	11/03/16	Groundwater		✓	✓

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
UJ	L	Estimated non-detection; LCS/LCSD percent recovery or RPD exceedance.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 4, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

The laboratory noted at the time of receipt that the sample times written on the sample container and COC differed for sample MBS-004-110316-GW. The laboratory logged the sample as per the information written on the COC.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Second column confirmation

All analytical or quality parameters requiring further discussion for Method 8330B are described in the sections below.

1.4.1.1 Method Blanks

Method blank MB 280-349987/1-A reported a concentration of RDX (0.0606 µg/L) and 1,3,5-trinitrobenzene (0.335 µg/L) less than one half of the LOQ (0.2 µg/L and 1.0 µg/L, respectively). The primary samples reported RDX and 1,3,5-trinitrobenzene as not detected; therefore, no validation flags were applied.

Method blank MB 280-349987/1-A also reported a concentration of 2,6-dinitrotoluene (0.241 µg/L) above both the LOQ (0.20 µg/L) and the PAL (0.24 µg/L). However, the primary column was reported as ND. As the primary samples reported 2,6-dinitrotoluene as not detected, no validation flags have been applied.

1.4.1.2 Laboratory Control Samples

Recoveries and RPDs were outside the acceptance criteria for several analytes in both laboratory control samples (LCS) and laboratory control sample duplicates (LCSD). The following table shows analytes outside the acceptance criteria in samples LCS 280-349987/2-A and LCSD 280-349987/3-A:

Associated Samples	Analyte	LCS %R	LCSD %R	%R QC Limits	RP D	RPD Limits	Assigned Flags
MBS-004-110316-GW	2-amino-4,6-dinitrotoluene	78	84	79-120	7	20	None*
MBS-006-110316-GW	2-nitrotoluene	61	78	70-127	25	20	UJ L
	3-nitrotoluene	62	81	73-125	26	20	UJ L
	4-nitrotoluene	69	86	71-127	22	20	UJ L

%R = percent recovery

Bolded values are outside control limits.

Because the LCSD recovery and RPD were within control limits, no qualifiers were assigned for 2-amino-4,6-dinitrotoluene. The associated samples were reported as undetected for 2-nitrotoluene, 3-nitrotoluene and 4-nitrotoluene, therefore, the results have been qualified as estimated non-detect (UJ L).

Analysis batch number 352866 is also reported in this SDG and relates to samples analyzed for RDX only. Although several other analytes in this batch reported LCS recoveries and LCS/LCSD pair RPDs outside the QC limits, the LCS recovery and LCS/LCSD pair RPD for RDX is within QC limits. As such, no validation flags are necessary.

1.4.1.3 Field Duplicates

No field duplicates were reported in this SDG.

1.4.1.4 Matrix Spike/Matrix Spike Duplicates

No MS/MSDs were reported in this SDG.

1.4.2 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Low and high level control samples
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

All analytical or quality parameters requiring further discussion for Method 9012B are described in the sections below.

1.4.2.1 Field Duplicate

No field duplicates were reported in this SDG.

1.4.2.2 Matrix Spike/Matrix Spike Duplicate

One MS/MSD pair was analyzed for cyanide. The sample recoveries and RPD were within QC limits.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90531-1	MBS-006-110316-GW	280-90531-1	Water	2-Nitrotoluene	88-72-2	µg/L	0.45	u q	uj	n	0.45	0.2	0.095	Explosives and Propellants	L
280-90531-1	MBS-006-110316-GW	280-90531-1	Water	3-Nitrotoluene	99-08-1	µg/L	0.45	u q	uj	n	0.45	0.2	0.093	Explosives and Propellants	L
280-90531-1	MBS-006-110316-GW	280-90531-1	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	uj	n	1.1	0.4	0.22	Explosives and Propellants	L
280-90531-1	MBS-004-110316-GW	280-90531-2	Water	2-Nitrotoluene	88-72-2	µg/L	0.44	u q	uj	n	0.44	0.2	0.094	Explosives and Propellants	L
280-90531-1	MBS-004-110316-GW	280-90531-2	Water	3-Nitrotoluene	99-08-1	µg/L	0.44	u q	uj	n	0.44	0.2	0.092	Explosives and Propellants	L
280-90531-1	MBS-004-110316-GW	280-90531-2	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	uj	n	1.1	0.4	0.22	Explosives and Propellants	L

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90532-1

Prepared For:



National Guard Bureau
NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture
2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by the Project Chemist. Signatures indicate the report is approved for release.



Erica Fisher, Validator, TEC-WESTON JV

02/07/2017

Date



Pete Chapman, Project Chemist, TEC-WESTON JV

2/7/17

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90532-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polycyclic Aromatic Hydrocarbons (PAHs)	8270D SIM	Denver, CO
Organochlorine Pesticides	8081B	Denver, CO
Explosives	8330B	Denver, CO
Total Cyanide	9012B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data*

Review (EPA 2014) and USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014). Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	SVOCs (phthalates, nitroaromatics, phenols)	PAHs	Pesticides	Explosives	Cyanide
LL11mw-005-110316-GW	280-90532-1	11/03/16	Groundwater		✓	✓	✓		✓	✓
LL11mw-003-110316-GW	280-90532-2	11/03/16	Groundwater		✓	✓	✓		✓	✓
LL11mw-002-110316-GW	280-90532-3	11/03/16	Groundwater			✓	✓	✓	✓	✓
LL11mw-001-110316-GW	280-90532-4	11/03/16	Groundwater			✓	✓			
LL11mw-010-110316-GW	280-90532-5	11/03/16	Groundwater		✓	✓	✓		✓	✓
TRIP BLANK	280-90532-6	11/03/16	Water	Trip Blank	✓					

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
UJ	CC	Estimated non-detection; continuing calibration verification did not meet acceptance criteria.
UJ	S	Estimated non-detection; surrogate outlier.
UJ	L	Estimated non-detection; LCS/LCSD percent recovery or RPD exceedance.
R	L	Data is rejected; LCS/LCSD percent recovery or RPD exceedance.
U	B	Not detected; target analyte was detected in the method or calibration blank.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 4, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

The COC submitted with the samples requested VOC and cyanide analysis on sample LL11mw-001-110316, however, sample volume was not submitted to allow these analyses to be undertaken. Therefore, these analyses were cancelled at the time of receipt.

A trip blank sample was received by the laboratory with the samples, however, it was not listed on the COC. The laboratory logged the trip blank in with the samples and submitted it for VOC analysis.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria:

- Holding times
- LCS recoveries and RPDs
- LODs and LOQs
- Instrument tuning
- Internal standard area counts
- Initial calibration
- Initial calibration verification
- Closing calibration verification

All analytical or quality issues for Method 8260B are described in the sections below.

1.4.1.1 Surrogate Recoveries

The following surrogate recoveries were below the lower limits of the QC ranges associated with all samples:

Surrogate (QC Limit %R)	Associated Sample	Surrogate Recovery (%R)	Assigned Flag
Toluene-d8 (89-112)	LL11mw-005-110316-GW	88	UJ S
	LL11mw-003-110316-GW	82	UJ S
	LL11mw-010-110316-GW	83	UJ S
4-Bromofluorobenzene (85-114)	LL11mw-005-110316-GW	77	UJ S
	LL11mw-003-110316-GW	75	UJ S
	LL11mw-010-110316-GW	74	UJ S

%R = percent recovery

All associated analytes were not-detected in the samples and therefore qualified estimated non-detects (UJ S), with the exception of methylene chloride, which was detected in all samples less than the LOQ. The methylene chloride sample results are qualified non-detect at the LOQ due to method blank contamination. Therefore no further qualification is considered necessary (see section 1.4.1.2).

It is also noted that the surrogate 1,2-dichloroethane-d4 (126%) recovered above the acceptance criteria (81-118%) in method blank MB 280-351911.

1.4.1.2 Method Blanks

Methylene chloride was detected in method blanks MB 280-351855/6 (0.647 µg/L) and MB 280-351911/6 (0.972 µg/L) at concentrations less than half the LOQ (5.0 µg/L). Methylene chloride was not detected in the trip blank, therefore no qualification was necessary. Methylene chloride was detected in samples LL11mw-005-110316GW (4.2 µg/L), LL11mw-003-110316GW (4.7 µg/l) and LL11mw-010-110316GW (3.6 µg/L) below the LOQ. These sample results are qualified as non-detections at the LOQ (U B).

1.4.1.3 Continuing Calibration Verification

The following table presents the analytes detected in the continuing calibration verifications bracketing the samples:

Calibration Verification	Associated Samples	Analyte	%D	%D Limit	Assigned Flags
CCV 280-351911/2	TRIP BLANK	Chloromethane	-21.8	±20	UJ CC
CCV 280-351911/2	LL11mw-005-110316-GW	Bromochloromethane	21.0	±20	UJ CC
	LL11mw-003-110316-GW LL11mw-010-110316-GW	1,2-dichloroethane	20.9	±20	UJ CC

CCV = continuing calibration verification

%D = percent difference

The analytes were not detected in any of the associated samples, all relevant sample results have been qualified estimated non-detect (UJ CC).

1.4.1.4 Matrix Spike/Matrix Spike Duplicate Samples

No MS/MSDs were reported in this SDG.

1.4.1.5 Field Duplicates

No field duplicates were reported in this SDG.

1.4.2 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Method blank
- LCS/LCSD recoveries and RPDs
- Instrument tuning
- Initial calibration
- Initial calibration verification
- Closing calibration verification
- Internal standard area counts

All analytical or quality parameters requiring further discussion for Method 8270D are described in the sections below.

1.4.2.1 Continuing Calibration Verification

The following table presents the analytes detected in the continuing calibration verifications bracketing the samples:

Calibration Verification	Associated Samples	Analyte	%D	%D Limit	Assigned Flags
CCV 280-352516/3	LL11mw-005-110316-GW	Hexachlorocyclopentadiene	20.2	±20	UJ CC
	LL11mw-003-110316-GW	4-Nitrophenol	29.1	±20	UJ CC
	LL11mw-002-110316-GW				
	LL11mw-001-110316-GW				
	LL11mw-010-110316-GW				

CCV = continuing calibration verification

%D = percent difference

The analytes were not detected in any of the associated samples, all relevant sample results have been qualified estimated non-detect (UJ CC).

1.4.2.2 Matrix Spike/Matrix Spike Duplicate Samples

No MS/MSDs were reported in this SDG.

1.4.2.3 Field Duplicates

No field duplicates were reported in this SDG.

1.4.3 Polycyclic Aromatic Hydrocarbons by Method 8270D SIM

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blank
- LCS/LCSD recoveries and RPDs
- Instrument tuning
- Internal standards
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification

All analytical or quality issues for Method 8270D SIM are described in the sections below.

1.4.3.1 Surrogate Recoveries

Surrogate nitrobenzene-d5 recovered below the acceptance criteria (55-111%) in samples LL11mw-003-110316-GW (47%), LL11mw-002-110316-GW (50%), LL11mw-001-110316-GW (50%) and LL11mw-010-110316-GW (51%). Surrogate 2-fluorobiphenyl recovered below the acceptance criteria (53-106%) in samples LL11mw-003-110316-GW (47%) and LL11mw-010-110316-GW (49%). It is noted that nitrobenzene-d5 was manually integrated. All associated sample results were qualified as estimated (J/UJ S).

1.4.3.2 Matrix Spike/Matrix Spike Duplicate Samples

No MS/MSDs were reported in this SDG.

1.4.3.3 Field Duplicates

No field duplicates were reported in this SDG.

1.4.4 Organochlorine Pesticides by Method 8081B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Method blank
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Internal standards
- Endrin/DDT breakdown check
- Second column confirmation

All analytical or quality issues for Method 8081B are described in the sections below.

1.4.4.1 Laboratory Control Sample

Dieldrin (50%) and endrin (0%) recovered below their respective recovery limits (60-136%, 60-138%) in the LCS. Associated sample LL11mw-002-110316-GW was qualified estimated non-detect for dieldrin (UJ L). The endrin result has been qualified rejected (R L) due to extremely low recovery (<10%).

Endrin keytone (140%) recovered above the recovery limits (58-134%) in the LCS sample. Endrin ketone was not detected in the associated sample; no qualification was necessary.

1.4.4.2 Matrix Spike/Matrix Spike Duplicate Samples

No MS/MSDs were reported in this SDG.

1.4.4.3 Field Duplicates

No field duplicates were reported in this SDG.

1.4.5 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Second column confirmation

All analytical or quality issues for Method 8330B are described in the sections below.

1.4.5.1 Surrogate Recoveries

Surrogate 1,2-dinitrobenzene recovered below the acceptance criteria (83-119%) in sample LL11mw-010-110316-GW (81%). All analytes were reported as non-detects for this sample and have been qualified as estimated non-detects (UJ S).

1.4.5.2 Method Blank

RDX (0.0708 µg/L) was detected in the method blank at a concentration below the LOQ (0.20 µg/L). All associated sample results were non-detect for RDX; therefore, no qualification was necessary.

1.4.5.3 Laboratory Control Sample

Several analytes were recovered below the acceptance limits in the LCS and LCSD. These exceedances are outlined in the table below:

Analyte	LCS %R	LCSD %R	%R Limits	Assigned Flags
2,4-Dinitrotoluene	75	74	78-120	UJ L
2,6-Dinitrotoluene	76	74	77-127	UJ L
2-Amino-4,6-dinitrotoluene	72	68	79-120	UJ L
2-Nitrotoluene	60	63	70-127	UJ L
3-Nitrotoluene	61	66	73-125	UJ L
4-Amino-2,6-dinitrotoluene	72	68	76-125	UJ L
4-Nitrotoluene	67	69	71-127	UJ L

%R = percent recovery

All sample results associated with the exceedances in the table above were qualified as estimated (UJ L).

The LCS/LCSD RPDs were all within the acceptance criterion (20%).

1.4.5.4 Matrix Spike/Matrix Spike Duplicate Samples

No MS/MSDs were reported in this SDG.

1.4.5.5 Field Duplicates

No field duplicates were reported in this SDG.

1.4.6 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blank
- MS/MSD recoveries and RPDs
- LCS recoveries
- Low and high level control sample recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

No analytical or quality issues for Method 9012B were observed.

1.4.6.1 Field Duplicates

No field duplicates were reported in this SDG.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90532-1	LL11mw-005-110316-GW	280-90532-1	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.21	u q	uj	n	0.43	0.21	0.089	Explosives and Propellants	L
280-90532-1	LL11mw-005-110316-GW	280-90532-1	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u q	uj	n	0.21	0.21	0.069	Explosives and Propellants	L
280-90532-1	LL11mw-005-110316-GW	280-90532-1	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.13	u q	uj	n	0.21	0.13	0.054	Explosives and Propellants	L
280-90532-1	LL11mw-005-110316-GW	280-90532-1	Water	2-Nitrotoluene	88-72-2	µg/L	0.21	u q	uj	n	0.43	0.21	0.091	Explosives and Propellants	L
280-90532-1	LL11mw-005-110316-GW	280-90532-1	Water	3-Nitrotoluene	99-08-1	µg/L	0.21	u q	uj	n	0.43	0.21	0.089	Explosives and Propellants	L
280-90532-1	LL11mw-005-110316-GW	280-90532-1	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.13	u q	uj	n	0.21	0.13	0.062	Explosives and Propellants	L
280-90532-1	LL11mw-005-110316-GW	280-90532-1	Water	4-Nitrotoluene	99-99-0	µg/L	0.43	u q	uj	n	1.1	0.43	0.21	Explosives and Propellants	L
280-90532-1	LL11mw-005-110316-GW	280-90532-1	Water	4-Nitrophenol	100-02-7	µg/L	4	u q	uj	n	49	4	1.2	SVOCs	CC
280-90532-1	LL11mw-005-110316-GW	280-90532-1	Water	Hexachlorocyclopentadiene	77-47-4	µg/L	30	u q	uj	n	49	30	9.9	SVOCs	CC
280-90532-1	LL11mw-005-110316-GW	280-90532-1	Water	1,1,2,2-Tetrachloroethane	79-34-5	µg/L	0.8	u q	uj	n	1	0.8	0.2	VOCs	S
280-90532-1	LL11mw-005-110316-GW	280-90532-1	Water	1,2-Dibromoethane	106-93-4	µg/L	0.4	u q	uj	n	1	0.4	0.18	VOCs	S
280-90532-1	LL11mw-005-110316-GW	280-90532-1	Water	1,2-Dichloroethane	107-06-2	µg/L	0.4	u q	uj	n	1	0.4	0.13	VOCs	CC S
280-90532-1	LL11mw-005-110316-GW	280-90532-1	Water	2-Hexanone	591-78-6	µg/L	4	u q	uj	n	5	4	1.4	VOCs	S
280-90532-1	LL11mw-005-110316-GW	280-90532-1	Water	Bromoform	75-25-2	µg/L	0.4	u q	uj	n	1	0.4	0.19	VOCs	S
280-90532-1	LL11mw-005-110316-GW	280-90532-1	Water	Chlorobenzene	108-90-7	µg/L	0.4	u q	uj	n	1	0.4	0.17	VOCs	S
280-90532-1	LL11mw-005-110316-GW	280-90532-1	Water	Chlorobromomethane	74-97-5	µg/L	0.2	u q	uj	n	1	0.2	0.1	VOCs	CC S
280-90532-1	LL11mw-005-110316-GW	280-90532-1	Water	Dibromochloromethane	124-48-1	µg/L	0.4	u q	uj	n	1	0.4	0.17	VOCs	S
280-90532-1	LL11mw-005-110316-GW	280-90532-1	Water	Ethylbenzene	100-41-4	µg/L	0.4	u q	uj	n	1	0.4	0.16	VOCs	S
280-90532-1	LL11mw-005-110316-GW	280-90532-1	Water	Methylene chloride	75-09-2	µg/L	5	j	u	n	5	0.8	0.32	VOCs	B
280-90532-1	LL11mw-005-110316-GW	280-90532-1	Water	Styrene	100-42-5	µg/L	0.4	u q	uj	n	1	0.4	0.17	VOCs	S
280-90532-1	LL11mw-005-110316-GW	280-90532-1	Water	Tetrachloroethene	127-18-4	µg/L	0.4	u q	uj	n	1	0.4	0.2	VOCs	S
280-90532-1	LL11mw-003-110316-GW	280-90532-2	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.21	u q	uj	n	0.42	0.21	0.089	Explosives and Propellants	L
280-90532-1	LL11mw-003-110316-GW	280-90532-2	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u q	uj	n	0.21	0.21	0.068	Explosives and Propellants	L
280-90532-1	LL11mw-003-110316-GW	280-90532-2	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.13	u q	uj	n	0.21	0.13	0.054	Explosives and Propellants	L
280-90532-1	LL11mw-003-110316-GW	280-90532-2	Water	2-Nitrotoluene	88-72-2	µg/L	0.21	u q	uj	n	0.42	0.21	0.09	Explosives and Propellants	L
280-90532-1	LL11mw-003-110316-GW	280-90532-2	Water	3-Nitrotoluene	99-08-1	µg/L	0.21	u q	uj	n	0.42	0.21	0.088	Explosives and Propellants	L
280-90532-1	LL11mw-003-110316-GW	280-90532-2	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.13	u q	uj	n	0.21	0.13	0.061	Explosives and Propellants	L
280-90532-1	LL11mw-003-110316-GW	280-90532-2	Water	4-Nitrotoluene	99-99-0	µg/L	0.42	u q	uj	n	1.1	0.42	0.21	Explosives and Propellants	L
280-90532-1	LL11mw-003-110316-GW	280-90532-2	Water	Acenaphthene	83-32-9	µg/L	0.042	u q	uj	n	0.11	0.042	0.0044	PAHs	S
280-90532-1	LL11mw-003-110316-GW	280-90532-2	Water	Acenaphthylene	208-96-8	µg/L	0.042	u q	uj	n	0.11	0.042	0.0054	PAHs	S
280-90532-1	LL11mw-003-110316-GW	280-90532-2	Water	Anthracene	120-12-7	µg/L	0.042	u q	uj	n	0.11	0.042	0.0059	PAHs	S
280-90532-1	LL11mw-003-110316-GW	280-90532-2	Water	Fluoranthene	206-44-0	µg/L	0.013	u q	uj	n	0.11	0.013	0.0051	PAHs	S
280-90532-1	LL11mw-003-110316-GW	280-90532-2	Water	Fluorene	86-73-7	µg/L	0.042	u q	uj	n	0.11	0.042	0.0058	PAHs	S
280-90532-1	LL11mw-003-110316-GW	280-90532-2	Water	Naphthalene	91-20-3	µg/L	0.013	u q	uj	n	0.11	0.013	0.0084	PAHs	S
280-90532-1	LL11mw-003-110316-GW	280-90532-2	Water	Phenanthrene	85-01-8	µg/L	0.021	u q	uj	n	0.11	0.021	0.0098	PAHs	S
280-90532-1	LL11mw-003-110316-GW	280-90532-2	Water	Pyrene	129-00-0	µg/L	0.021	u q	uj	n	0.11	0.021	0.0064	PAHs	S
280-90532-1	LL11mw-003-110316-GW	280-90532-2	Water	4-Nitrophenol	100-02-7	µg/L	3.9	u q	uj	n	48	3.9	1.2	SVOCs	CC
280-90532-1	LL11mw-003-110316-GW	280-90532-2	Water	Hexachlorocyclopentadiene	77-47-4	µg/L	29	u q	uj	n	48	29	9.7	SVOCs	CC

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90532-1	LL11mw-003-110316-GW	280-90532-2	Water	1,1,2,2-Tetrachloroethane	79-34-5	µg/L	0.8	u q	uj	n	1	0.8	0.2	VOCs	S
280-90532-1	LL11mw-003-110316-GW	280-90532-2	Water	1,2-Dibromoethane	106-93-4	µg/L	0.4	u q	uj	n	1	0.4	0.18	VOCs	S
280-90532-1	LL11mw-003-110316-GW	280-90532-2	Water	1,2-Dichloroethane	107-06-2	µg/L	0.4	u q	uj	n	1	0.4	0.13	VOCs	CC S
280-90532-1	LL11mw-003-110316-GW	280-90532-2	Water	2-Hexanone	591-78-6	µg/L	4	u q	uj	n	5	4	1.4	VOCs	S
280-90532-1	LL11mw-003-110316-GW	280-90532-2	Water	Bromoform	75-25-2	µg/L	0.4	u q	uj	n	1	0.4	0.19	VOCs	S
280-90532-1	LL11mw-003-110316-GW	280-90532-2	Water	Chlorobenzene	108-90-7	µg/L	0.4	u q	uj	n	1	0.4	0.17	VOCs	S
280-90532-1	LL11mw-003-110316-GW	280-90532-2	Water	Chlorobromomethane	74-97-5	µg/L	0.2	u q	uj	n	1	0.2	0.1	VOCs	CC S
280-90532-1	LL11mw-003-110316-GW	280-90532-2	Water	Dibromochloromethane	124-48-1	µg/L	0.4	u q	uj	n	1	0.4	0.17	VOCs	S
280-90532-1	LL11mw-003-110316-GW	280-90532-2	Water	Ethylbenzene	100-41-4	µg/L	0.4	u q	uj	n	1	0.4	0.16	VOCs	S
280-90532-1	LL11mw-003-110316-GW	280-90532-2	Water	Methylene chloride	75-09-2	µg/L	5	j	u	n	5	0.8	0.32	VOCs	B
280-90532-1	LL11mw-003-110316-GW	280-90532-2	Water	Styrene	100-42-5	µg/L	0.4	u q	uj	n	1	0.4	0.17	VOCs	S
280-90532-1	LL11mw-003-110316-GW	280-90532-2	Water	Tetrachloroethene	127-18-4	µg/L	0.4	u q	uj	n	1	0.4	0.2	VOCs	S
280-90532-1	LL11mw-002-110316-GW	280-90532-3	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.21	u q	uj	n	0.42	0.21	0.089	Explosives and Propellants	L
280-90532-1	LL11mw-002-110316-GW	280-90532-3	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u q	uj	n	0.21	0.21	0.068	Explosives and Propellants	L
280-90532-1	LL11mw-002-110316-GW	280-90532-3	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.13	u q	uj	n	0.21	0.13	0.054	Explosives and Propellants	L
280-90532-1	LL11mw-002-110316-GW	280-90532-3	Water	2-Nitrotoluene	88-72-2	µg/L	0.21	u q	uj	n	0.42	0.21	0.091	Explosives and Propellants	L
280-90532-1	LL11mw-002-110316-GW	280-90532-3	Water	3-Nitrotoluene	99-08-1	µg/L	0.21	u q	uj	n	0.42	0.21	0.088	Explosives and Propellants	L
280-90532-1	LL11mw-002-110316-GW	280-90532-3	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.13	u q	uj	n	0.21	0.13	0.061	Explosives and Propellants	L
280-90532-1	LL11mw-002-110316-GW	280-90532-3	Water	4-Nitrotoluene	99-99-0	µg/L	0.42	u q	uj	n	1.1	0.42	0.21	Explosives and Propellants	L
280-90532-1	LL11mw-002-110316-GW	280-90532-3	Water	Naphthalene	91-20-3	µg/L	0.013	u q	uj	n	0.11	0.013	0.0088	PAHs	S
280-90532-1	LL11mw-002-110316-GW	280-90532-3	Water	Dieldrin	60-57-1	µg/L	0.016	u q	uj	n	0.051	0.016	0.0047	Pesticides	L
280-90532-1	LL11mw-002-110316-GW	280-90532-3	Water	Endrin	72-20-8	µg/L	0.024	u q	r	n	0.051	0.024	0.0024	Pesticides	L
280-90532-1	LL11mw-002-110316-GW	280-90532-3	Water	4-Nitrophenol	100-02-7	µg/L	4	u q	uj	n	50	4	1.2	SVOCs	CC
280-90532-1	LL11mw-002-110316-GW	280-90532-3	Water	Hexachlorocyclopentadiene	77-47-4	µg/L	30	u q	uj	n	50	30	10	SVOCs	CC
280-90532-1	LL11mw-001-110316-GW	280-90532-4	Water	Naphthalene	91-20-3	µg/L	0.013	u q	uj	n	0.11	0.013	0.0085	PAHs	S
280-90532-1	LL11mw-001-110316-GW	280-90532-4	Water	4-Nitrophenol	100-02-7	µg/L	3.9	u q	uj	n	49	3.9	1.2	SVOCs	CC
280-90532-1	LL11mw-001-110316-GW	280-90532-4	Water	Hexachlorocyclopentadiene	77-47-4	µg/L	29	u q	uj	n	49	29	9.8	SVOCs	CC
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	1,3,5-Trinitrobenzene	99-35-4	µg/L	0.42	u q	uj	n	1.1	0.42	0.21	Explosives and Propellants	S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	1,3-Dinitrobenzene	99-65-0	µg/L	0.21	u q	uj	n	0.42	0.21	0.094	Explosives and Propellants	S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	2,4,6-Trinitrotoluene	118-96-7	µg/L	0.21	u q	uj	n	0.42	0.21	0.076	Explosives and Propellants	S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.21	u q	uj	n	0.42	0.21	0.088	Explosives and Propellants	L S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u q	uj	n	0.21	0.21	0.068	Explosives and Propellants	L S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.13	u q	uj	n	0.21	0.13	0.054	Explosives and Propellants	L S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	2-Nitrotoluene	88-72-2	µg/L	0.21	u q	uj	n	0.42	0.21	0.09	Explosives and Propellants	L S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	3-Nitrotoluene	99-08-1	µg/L	0.21	u q	uj	n	0.42	0.21	0.088	Explosives and Propellants	L S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.13	u q	uj	n	0.21	0.13	0.061	Explosives and Propellants	L S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	4-Nitrotoluene	99-99-0	µg/L	0.42	u q	uj	n	1.1	0.42	0.21	Explosives and Propellants	L S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	HMX	2691-41-0	µg/L	0.21	u q	uj	n	0.42	0.21	0.092	Explosives and Propellants	S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	Nitrobenzene	98-95-3	µg/L	0.21	u q	uj	n	0.42	0.21	0.096	Explosives and Propellants	S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	Nitroglycerin	55-63-0	µg/L	2.1	u q	uj	n	3.2	2.1	0.97	Explosives and Propellants	S

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	PETN	78-11-5	µg/L	1.3	u q	uj	n	2.1	1.3	0.44	Explosives and Propellants	S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	RDX	121-82-4	µg/L	0.13	u q	uj	n	0.21	0.13	0.055	Explosives and Propellants	S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	Tetryl	479-45-8	µg/L	0.21	u q	uj	n	0.25	0.21	0.084	Explosives and Propellants	S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	Acenaphthene	83-32-9	µg/L	0.041	u q	uj	n	0.1	0.041	0.0043	PAHs	S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	Acenaphthylene	208-96-8	µg/L	0.041	u q	uj	n	0.1	0.041	0.0053	PAHs	S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	Anthracene	120-12-7	µg/L	0.041	u q	uj	n	0.1	0.041	0.0058	PAHs	S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	Fluoranthene	206-44-0	µg/L	0.012	u q	uj	n	0.1	0.012	0.005	PAHs	S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	Fluorene	86-73-7	µg/L	0.041	u q	uj	n	0.1	0.041	0.0057	PAHs	S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	Naphthalene	91-20-3	µg/L	0.012	u q	uj	n	0.1	0.012	0.0083	PAHs	S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	Phenanthrene	85-01-8	µg/L	0.021	u q	uj	n	0.1	0.021	0.0096	PAHs	S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	Pyrene	129-00-0	µg/L	0.021	u q	uj	n	0.1	0.021	0.0063	PAHs	S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	4-Nitrophenol	100-02-7	µg/L	3.9	u q	uj	n	48	3.9	1.2	SVOCs	CC
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	Hexachlorocyclopentadiene	77-47-4	µg/L	29	u q	uj	n	48	29	9.7	SVOCs	CC
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	1,1,2,2-Tetrachloroethane	79-34-5	µg/L	0.8	u q	uj	n	1	0.8	0.2	VOCs	S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	1,2-Dibromoethane	106-93-4	µg/L	0.4	u q	uj	n	1	0.4	0.18	VOCs	S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	1,2-Dichloroethane	107-06-2	µg/L	0.4	u q	uj	n	1	0.4	0.13	VOCs	CC S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	2-Hexanone	591-78-6	µg/L	4	u q	uj	n	5	4	1.4	VOCs	S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	Bromoform	75-25-2	µg/L	0.4	u q	uj	n	1	0.4	0.19	VOCs	S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	Chlorobenzene	108-90-7	µg/L	0.4	u q	uj	n	1	0.4	0.17	VOCs	S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	Chlorobromomethane	74-97-5	µg/L	0.2	u q	uj	n	1	0.2	0.1	VOCs	CC S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	Dibromochloromethane	124-48-1	µg/L	0.4	u q	uj	n	1	0.4	0.17	VOCs	S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	Ethylbenzene	100-41-4	µg/L	0.4	u q	uj	n	1	0.4	0.16	VOCs	S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	Methylene chloride	75-09-2	µg/L	5	j	u	n	5	0.8	0.32	VOCs	B
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	Styrene	100-42-5	µg/L	0.4	u q	uj	n	1	0.4	0.17	VOCs	S
280-90532-1	LL11mw-010-110316-GW	280-90532-5	Water	Tetrachloroethene	127-18-4	µg/L	0.4	u q	uj	n	1	0.4	0.2	VOCs	S
280-90532-1	TRIP BLANK	280-90532-6	Water	Chloromethane	74-87-3	µg/L	0.8	u q	uj	n	2	0.8	0.3	VOCs	CC

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008
Task Order Number: 0003

Laboratory SDG 280-90534-1

Prepared For:



National Guard Bureau
NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture
2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by the Project Chemist. Signatures indicate the report is approved for release.



Pete Chapman, Validation Chemist, TEC-WESTON JV

1/13/17
Date



Heather A. Miner

2017.01.23 10:23:47 -07'00'

Heather Miner, Project Chemist, TEC-WESTON JV

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90534-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Explosives	8330B	Denver, CO
Metals	6010C/6020A/7470A	Denver, CO
Total Cyanide	9012B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA*

2014). Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	SVOCs (phthalates, nitroaromatics)	Explosives	Metals	Cyanide
L10mw-006-110316-GW	280-90534-1	11/03/16	Groundwater						✓
L10mw-500-110316-GW	280-90534-2	11/03/16	Groundwater						✓
L10mw-001-110316-GW	280-90534-3	11/03/16	Groundwater		✓		✓	✓	✓
L10mw-003-110316-GW	280-90534-4	11/03/16	Groundwater		✓	✓	✓	✓	✓

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
U	B	Not detected; target analyte was detected in the method or calibration blank.
UJ	S	Estimated non-detection; surrogate spike outlier.
UJ	L	Estimated non-detection; LCS/LCSD outlier.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 4, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

“-GW” was added to the end of all sample IDs to comply with the RIWP.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- Instrument tuning
- Initial calibration verification
- Internal standard recoveries
- LCS/LCSD recoveries

All analytical or quality parameters requiring further discussion for Method 8260B are described in the sections below.

1.4.1.1 Method Blanks

Methylene chloride (0.97 µg/L) was detected in the method blank at a concentration below the LOQ (5.0 µg/L). Methylene chloride was also detected at concentrations below the LOQ in samples L10mw-001-110316-GW (4.5 µg/L) and L10mw-003-110316-GW (2.9 µg/L). These samples results were qualified as non-detect at the LOQ (U B).

1.4.1.2 Trip Blanks

The trip blank associated with samples reported in this SDG is reported in SDG 280-90532-1. No detections were reported in the trip blank sample.

1.4.1.3 Continuing Calibration Verification

1,2-dichloroethane (20.9%D) and chlorobromomethane (21.0%D) were recovered outside of the acceptance criteria ($\pm 20\%$ D) in CCV 280-351911/6. All associated sample results were qualified as non-detect; therefore, no qualification was necessary.

1.4.1.4 Surrogate Recoveries

Surrogate recoveries of 80% for 4-bromofluorobenzene (85-114%) and 88% for Toluene-d8 (89-112%) were recovered below their acceptance criteria in sample L10mw-001-110316-GW. All associated sample results were non-detect and were qualified as estimated (UJ S).

1.4.2 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS recoveries
- Instrument tuning
- Initial calibration verification
- Continuing calibration verification
- Internal standard recoveries

No analytical or quality parameters required further discussion for Method 8270D.

1.4.3 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- 2nd column confirmation

All analytical or quality parameters requiring further discussion for Method 8330B are described in the sections below.

1.4.3.1 Method Blanks

RDX (0.07 µg/L) was detected in the method blank at a concentration below the LOQ (0.2 µg/L). RDX was not detected in the LOQ in samples. No sample results were qualified based on this method blank result.

1.4.3.2 Laboratory Control Sample

Seven compounds were recovered outside of the QC requirements in LCS 280-350786/3-A and LCSD 280-350786/4-A associated with sample LL10mw-001-110316-GW and LL10mw-003-110316-GW. These exceedances are outlined in the table below:

Analyte	LCS%R	LCSD%R	%R Limits
2,4-Dinitrotoluene	75	74	78-120
2,6-Dinitrotoluene	76	74	77-127

2-Amino-4,6-dinitrotoluene	72	68	79-120
2-Nitrotoluene	60	63	70-127
3-Nitrotoluene	61	66	73-125
4-Amino-2,6-dinitrotoluene	72	68	76-125
4-Nitrotoluene	67	69	71-127

All associated sample results were non-detect and were qualified as estimated (UJ L).

1.4.4 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- Method Blanks
- LCS recoveries
- Initial/Continuing calibration
- Low level calibration check standard
- Interference check solutions
- Instrument tuning

No analytical or quality parameters required further discussion for Methods 6010C, 6020A, and/or 7470A.

1.4.5 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

No analytical or quality parameters required further discussion for Method 9012B.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90534-1	L10mw-001-110316-GW	280-90534-3	Water	1,1,2,2-Tetrachloroethane	79-34-5	µg/L	1	u q	uj	n	1	0.8	0.2	VOCs	S
280-90534-1	L10mw-001-110316-GW	280-90534-3	Water	1,2-Dibromoethane	106-93-4	µg/L	1	u q	uj	n	1	0.4	0.18	VOCs	S
280-90534-1	L10mw-001-110316-GW	280-90534-3	Water	1,2-Dichloroethane	107-06-2	µg/L	1	u q	uj	n	1	0.4	0.13	VOCs	S
280-90534-1	L10mw-001-110316-GW	280-90534-3	Water	2-Hexanone	591-78-6	µg/L	5	u q	uj	n	5	4	1.4	VOCs	S
280-90534-1	L10mw-001-110316-GW	280-90534-3	Water	Bromoform	75-25-2	µg/L	1	u q	uj	n	1	0.4	0.19	VOCs	S
280-90534-1	L10mw-001-110316-GW	280-90534-3	Water	Chlorobenzene	108-90-7	µg/L	1	u q	uj	n	1	0.4	0.17	VOCs	S
280-90534-1	L10mw-001-110316-GW	280-90534-3	Water	Chlorobromomethane	74-97-5	µg/L	1	u q	uj	n	1	0.2	0.1	VOCs	S
280-90534-1	L10mw-001-110316-GW	280-90534-3	Water	Dibromochloromethane	124-48-1	µg/L	1	u q	uj	n	1	0.4	0.17	VOCs	S
280-90534-1	L10mw-001-110316-GW	280-90534-3	Water	Ethylbenzene	100-41-4	µg/L	1	u q	uj	n	1	0.4	0.16	VOCs	S
280-90534-1	L10mw-001-110316-GW	280-90534-3	Water	Methylene chloride	75-09-2	µg/L	5	j	u	n	5	0.8	0.32	VOCs	B
280-90534-1	L10mw-001-110316-GW	280-90534-3	Water	Styrene	100-42-5	µg/L	1	u q	uj	n	1	0.4	0.17	VOCs	S
280-90534-1	L10mw-001-110316-GW	280-90534-3	Water	Tetrachloroethene	127-18-4	µg/L	1	u q	uj	n	1	0.4	0.2	VOCs	S
280-90534-1	L10mw-001-110316-GW	280-90534-3	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.42	u q	uj	n	0.42	4.4	0.088	Explosives and Propellants	L
280-90534-1	L10mw-001-110316-GW	280-90534-3	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u q	uj	n	0.21	4.4	0.068	Explosives and Propellants	L
280-90534-1	L10mw-001-110316-GW	280-90534-3	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.21	u q	uj	n	0.21	0.12	0.054	Explosives and Propellants	L
280-90534-1	L10mw-001-110316-GW	280-90534-3	Water	2-Nitrotoluene	88-72-2	µg/L	0.42	u q	uj	n	0.42	0.2	0.09	Explosives and Propellants	L
280-90534-1	L10mw-001-110316-GW	280-90534-3	Water	3-Nitrotoluene	99-08-1	µg/L	0.42	u q	uj	n	0.42	0.2	0.088	Explosives and Propellants	L
280-90534-1	L10mw-001-110316-GW	280-90534-3	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.21	u q	uj	n	0.21	0.12	0.061	Explosives and Propellants	L
280-90534-1	L10mw-001-110316-GW	280-90534-3	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	uj	n	1.1	0.4	0.21	Explosives and Propellants	L
280-90534-1	L10mw-003-110316-GW	280-90534-4	Water	Methylene chloride	75-09-2	µg/L	5	j	u	n	5	0.8	0.32	Explosives and Propellants	B
280-90534-1	L10mw-003-110316-GW	280-90534-4	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.42	u q	uj	n	0.42	4.4	0.088	Explosives and Propellants	L
280-90534-1	L10mw-003-110316-GW	280-90534-4	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u q	uj	n	0.21	4.4	0.068	Explosives and Propellants	L
280-90534-1	L10mw-003-110316-GW	280-90534-4	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.21	u q	uj	n	0.21	0.12	0.053	Explosives and Propellants	L
280-90534-1	L10mw-003-110316-GW	280-90534-4	Water	2-Nitrotoluene	88-72-2	µg/L	0.42	u q	uj	n	0.42	0.2	0.09	Explosives and Propellants	L
280-90534-1	L10mw-003-110316-GW	280-90534-4	Water	3-Nitrotoluene	99-08-1	µg/L	0.42	u q	uj	n	0.42	0.2	0.088	Explosives and Propellants	L
280-90534-1	L10mw-003-110316-GW	280-90534-4	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.21	u q	uj	n	0.21	0.12	0.061	Explosives and Propellants	L
280-90534-1	L10mw-003-110316-GW	280-90534-4	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	uj	n	1.1	0.4	0.21	Explosives and Propellants	L

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90589-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by the Project Chemist. Signatures indicate the report is approved for release.



Travis Withers

2017.01.19 11:55:04 -07'00'

Travis Withers, Validation Chemist, TEC-WESTON JV

Date



Heather A. Miner

2017.01.19 12:19:22 -07'00'

Heather Miner, Project Chemist, TEC-WESTON JV

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90589-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polychlorinated Biphenyls (PCBs)	8082A	Denver, CO
Polycyclic Aromatic Hydrocarbons	8270D SIM	Denver, CO
Organochlorine Pesticides	8081B	Denver, CO
Explosives	8330B	Denver, CO
Metals	6010C/6020A/7470A	Denver, CO
Total Cyanide	9012B	Denver, CO
Nitrate	9056A	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	SVOCs (phthalates)	PAHs	PCBs	Pesticides	Explosives	Metals	Cyanide
L12mw-244-110416-GW	280-90589-1	11/04/16	Groundwater	MS/MSD	✓				✓			
L12mw-501-110416-GW	280-90589-2	11/04/16	Groundwater	Field Duplicate ¹	✓				✓			
L12mw-245-110416-GW	280-90589-3	11/04/16	Groundwater		✓	✓		✓	✓	✓	✓	✓
L12mw-242-110416-GW	280-90589-4	11/04/16	Groundwater		✓	✓		✓		✓	✓	✓
L12mw-153-110416-GW	280-90589-5	11/04/16	Groundwater				✓	✓		✓		
L12mw-188-110416-GW	280-90589-6	11/04/16	Groundwater						✓	✓		
L12mw-107-110416-GW	280-90589-7	11/04/16	Groundwater		✓		✓	✓		✓		✓
L12mw-500-110416-GW	280-90589-8	11/04/16	Groundwater	Field Duplicate ²	✓		✓	✓		✓		✓
L12mw-183-110416-GW	280-90589-9	11/04/16	Groundwater				✓		✓		✓	✓
L12mw-182-110416-GW	280-90589-10	11/04/16	Groundwater		✓		✓	✓		✓	✓	✓
TRIP BLANK	280-90589-11	11/04/16	Water	Trip Blank	✓							

1. Sample L12mw-501-110416-GW is the field duplicate of parent sample L12mw-244-110416-GW

2. Sample L12mw-500-110416-GW is the field duplicate of parent sample L12mw-107-110416-GW

Note: Samples were also analyzed for natural attenuation parameters; these parameters were not validated.

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
J	CC	Estimated detection; continuing calibration verification did not meet acceptance criteria.
J	S	Estimated detection; surrogate outlier.
UJ	CC	Estimated non-detection; continuing calibration verification did not meet acceptance criteria.
UJ	S	Estimated non-detection; surrogate outlier.
UJ	L	Estimated non-detection; LCS/LCSD percent recovery or RPD exceedance.
UJ	M	Estimated non-detection; MS/MSD percent recovery or RPD exceedance.
U	B	Not detected; target analyte was detected in the method or calibration blank.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 5, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

The following samples submitted for VOC analysis had one or more VOA vials that contained a headspace bubble greater than 6 mm in diameter. It is noted that loss of volatiles may have occurred in these vials: two of three vials for L12mw-244-110416-GW, two of three vials for L12mw-244MS-110416-GW, three of three vials for L12mw-244MSD-110416-GW, and two of three vials for L12mw-501-110416-GW. The laboratory used the one vial without bubbles for analysis for samples L12mw-244-110416-GW and L12mw-501-110416-GW; therefore, no qualification was necessary.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LCS recoveries
- MS/MSD recoveries and RPDs
- LODs and LOQs
- Instrument tuning
- Internal standard area counts
- Initial calibration
- Initial calibration verification
- Closing calibration verification
- Trip blank

All analytical or quality issues for Method 8260B are described in the sections below.

1.4.1.1 Method Blanks

Methylene chloride was detected in method blanks MB 280-352050/6 (0.324 µg/L) and MB 280-352095/6 (0.377 µg/L) at a concentration below the LOQ (5.0 µg/L). All associated sample results were non-detect for methylene chloride; therefore, no qualification was necessary.

Acetone was detected in method blank MB 280-352050/6 (3.40 µg/L) at a concentration below the LOQ (10 µg/L). All associated sample results were non-detect for acetone; therefore, no qualification was necessary.

1.4.1.2 Continuing Calibration Verification

Several analytes were detected in the calibration verifications bracketing the samples. The following table presents the initial and continuing calibration verification detections:

Calibration Verification	Associated Samples	Analyte	%D	%D Limit	Assigned Flags	Samples Qualified
CCV 280-352095/2	L12mw-244-110416-GW L12mw-501-110416-GW L12mw-245-110416-GW	Acetone	25.9	±20	J CC	L12mw-245-110416-GW
	L12mw-242-110416-GW L12mw-107-110416-GW L12mw-500-110416-GW L12mw-182-110416-GW	4-Methyl-2-pentanone	27.3	±20	N/A	None
CCV 280-352095/10	L12mw-244-110416-GW L12mw-501-110416-GW	1,1,1-Trichloroethane	24.6	±20	N/A	None
	L12mw-245-110416-GW L12mw-242-110416-GW	Carbon tetrachloride	29	±20	N/A	None
	L12mw-107-110416-GW L12mw-500-110416-GW	1,2-Dichloroethane	20.4	±20	N/A	None
	L12mw-182-110416-GW	trans-1,3-Dichloropropene	26.3	±20	N/A	None
CCV 280-352050/2	TB-110416-GW	Bromoform	20.3	±20	UJ CC	TB-110416-GW

CCV = continuing calibration verification

%D = percent difference

Acetone was detected in sample L12mw-245-110416-GW (1.9 µg/L); this sample result was qualified as estimated (J CC).

Bromoform was non-detect in sample TB-110416-GW; this sample result was qualified as estimated (UJ CC).

1.4.1.3 Field Duplicates

Two field duplicates (L12mw-500-110416-GW, L12mw-501-110416-GW) were collected and analyzed for VOCs. No detections were reported in either the parent or duplicate sample.

1.4.2 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blank
- LCS recoveries
- Instrument tuning
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Internal standard area counts
- Equipment blank

All analytical or quality parameters requiring further discussion for Method 8270D are described in the sections below.

1.4.2.1 Surrogate Recoveries

Surrogate terphenyl-d14 (45%) recovered below the acceptance limits (50-134%) in sample L12mw-245-110416-GW. No sample results were associated with the terphenyl-d14 surrogate; therefore, no qualification was necessary.

1.4.3 Polycyclic Aromatic Hydrocarbons by Method 8270D SIM

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blank
- LCS recoveries
- Instrument tuning
- Internal standards
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification

All analytical or quality issues for Method 8270D SIM are described in the sections below.

1.4.3.1 Surrogate Recoveries

Surrogate 2-fluorobiphenyl recovered below the acceptance limits (53-106%) in samples L12mw-153-110416-GW (36%) and L12mw-183-110416-GW (47%). All associated sample results were qualified as estimated (UJ S).

Surrogate terphenyl-d14 recovered above the acceptance limits (58-132%) in sample L12mw-500-110416-GW (250%). All associated sample results were non-detect; therefore, no qualification was necessary.

Surrogate nitrobenzene-d5 recovered below the acceptance limits (55-111%) in samples L12mw-153-110416-GW (44%), L12mw-500-110416-GW (54%), and L12mw-183-110416-GW (47%). All associated sample results were qualified as estimated (J/UJ S).

1.4.3.2 Field Duplicates

One field duplicate (L12mw-500-110416-GW) was collected and analyzed for PAHs. No detections were reported in either the parent or duplicate sample.

1.4.4 Organochlorine Pesticides by Method 8081B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Method blank
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Internal standards
- Endrin/DDT breakdown check
- Second column confirmation

All analytical or quality issues for Method 8081B are described in the sections below.

1.4.4.1 Laboratory Control Sample

Aldrin (11%), gamma-chlordane (53%), and heptachlor (19%) recovered below their respective acceptance limits (45-134%, 56-136%, 54-130%) in the LCS. All associated sample results were qualified as estimated (UJ L).

1.4.4.2 Matrix Spike/Matrix Spike Duplicates

An MS/MSD was performed on sample L12mw-244-110416-GW. All MS/MSD recoveries and RPDs were within control limits with the exception of the exceedances presented in the following table:

Parent Sample	Analyte	MS %R	MSD %R	%R Limits	RPD	RPD Limits	Assigned Flags
L12mw-244-110416-GW	Aldrin	35	31	45-134	11	20	UJ M
	Heptachlor	46	42	54-130	7	20	UJ M

%R = percent recovery

Bolded values are outside control limits.

The MS and MSD recoveries were below the QC limits for aldrin and heptachlor. These analytes in the associated parent sample were qualified as estimated (UJ M).

1.4.4.3 Field Duplicates

One field duplicate (L12mw-501-110416-GW) was collected and analyzed for pesticides. No detections were reported in either the parent or duplicate sample.

1.4.5 Polychlorinated Biphenyls by Method 8082A

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Method blank
- LCS/LCSD recoveries & RPDs
- Field duplicate
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Second column confirmation

All analytical or quality issues for Method 8082A are described in the sections below.

1.4.5.1 Sample Preparation

The following samples underwent a sulfuric acid clean-up (EPA 3665A) to reduce matrix interferences: L12mw-245-110416-GW, L12mw-242-110416-GW, L12mw-153-110416-GW, L12mw-188-110416-GW, L12mw-242-110416-GW, L12mw-153-110416-GW, L12mw-500-110416-GW, and L12mw-182-110416-GW.

1.4.5.2 Field Duplicates

One field duplicate (L12mw-500-110416-GW) was collected and analyzed for PCBs. No detections were reported in either the parent or duplicate sample.

1.4.6 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Second column confirmation

All analytical or quality issues for Method 8330B are described in the sections below.

1.4.6.1 Method Blank

RDX (0.0599 µg/L) was detected in the method blank at a concentration below the LOQ (0.20 µg/L). All associated sample results were non-detect for RDX; therefore, no qualification was necessary.

1.4.6.2 Laboratory Control Sample

Several analytes were recovered below the acceptance limits in the LCS. These exceedances are outlined in the table below:

Analyte	LCS %R	%R Limits	Assigned Flags
1,3,5-Trinitrobenzene	66	73-125	UJ L
1,3-Dinitrobenzene	72	78-120	UJ L
2,4-Dinitrotoluene	62	78-120	UJ L
2,6-Dinitrotoluene	62	77-127	UJ L
2-Amino-4,6-dinitrotoluene	59	79-120	UJ L
2-Nitrotoluene	53	70-127	UJ L
3-Nitrotoluene	54	73-125	UJ L
4-Amino-2,6-dinitrotoluene	60	76-125	UJ L
4-Nitrotoluene	59	71-127	UJ L

%R = percent recovery

All sample results associated with the exceedances in the table above were qualified as estimated (UJ L).

1.4.6.3 Field Duplicates

Two field duplicates (L12mw-500-110416-GW, L12mw-501-110416-GW) were collected and analyzed for explosives. No detections were reported in either the parent or duplicate sample.

1.4.7 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Lower control interference check standard
- Contract required detection limit standard
- Instrument tuning

All analytical or quality issues for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.7.1 Method Blanks

Iron (22.6 µg/L) and sodium (223 µg/L) were detected in the method blank at concentrations below their respective LOQs (100 µg/L, 5000 µg/L). All associated sample results had iron and sodium detections at concentrations above the LOQ; therefore, no qualification was necessary.

1.4.7.2 Calibration Blanks

Several analytes were detected in the calibration blanks bracketing the samples. The following table presents the initial and continuing calibration blank detections:

Calibration Blank	Associated Samples	Analyte	Blank Detection (µg/L)	LOQ (µg/L)	Assigned Flags	Samples Qualified
CCB 280-352990/98	L12mw-245-110416-GW L12mw-242-110416-GW L12mw-183-110416-GW L12mw-182-110416-GW	Sodium	141	5000	N/A	None
CCB 280-352990/110	L12mw-245-110416-GW L12mw-242-110416-GW	Sodium	130	5000	N/A	None

	L12mw-183-110416-GW L12mw-182-110416-GW					
ICB 280-352617/7	L12mw-245-110416-GW L12mw-242-110416-GW	Antimony	0.85	2	N/A	None
	L12mw-183-110416-GW L12mw-182-110416-GW	Thallium	0.053	1	N/A	None
CCB 280-352617/46	L12mw-245-110416-GW	Antimony	0.501	2	N/A	None
	L12mw-242-110416-GW	Beryllium	0.089	1	N/A	None
	L12mw-183-110416-GW	Silver	0.049	5	N/A	None
	L12mw-182-110416-GW	Thallium	0.125	1	N/A	None
		Zinc	3.49	10	U B	L12mw-245-110416-GW L12mw-242-110416-GW L12mw-182-110416-GW
CCB 280-352617/57	L12mw-245-110416-GW L12mw-242-110416-GW L12mw-183-110416-GW L12mw-182-110416-GW	Zinc	3.64	10	U B	L12mw-245-110416-GW L12mw-242-110416-GW L12mw-182-110416-GW

CCB = continuing calibration blank

ICB = initial calibration blank

Detections less than the LOQ in associated samples are qualified as not detected at the LOQ (U B).

1.4.7.3 Initial/Continuing Calibration Verification

Antimony (125 %) recovered above the acceptance limits (80-120%) in the low-level initial calibration verification ICVL 280-352617/8. All associated sample results were non-detect for antimony; therefore, no qualification was necessary.

Manganese (122 %) recovered above the acceptance limits (80-120%) in the low-level continuing calibration verification CCVL 280-352617/47. All associated sample results were qualified as estimated (J CC).

1.4.7.4 Interference Check Solutions

Manganese (1.51 µg/L) was detected in the interference check standard A (ISC-A) at a concentration greater than the LOD (1 µg/L). The lab confirmed this element is a trace impurity and is consistent with concentrations found by the manufacturer of the ICS-A solution. Based on reviewer's professional judgment, no qualification was necessary.

1.4.8 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

All analytical or quality issues for Method 9012B are described in the sections below.

1.4.8.1 Field Duplicate

One field duplicate (L12mw-500-110416-GW) was collected and analyzed for total cyanide. For detections greater than 5x the LOQ in both samples, an RPD was calculated. For detections less than 5x the LOQ, the difference in values was compared to ± the LOQ. The following table shows the detections in parent and field duplicate samples:

Primary/Duplicate Sample ID	Analyte	Primary Sample Result (µg/L)	Field Duplicate Result (µg/L)	LOQ (µg/L)	RPD (%)	RPD Limit (%) ¹
L12mw-107-110416-GW /L12mw-500-110416-GW	Total cyanide	2.9 J	7.7 J	10	N/A	±LOQ

¹ The RPD limit is 20% for detections greater than 5x the LOQ; ± the LOQ for detections less than 5x the LOQ.

J Laboratory flag indicating the result is less than the LOQ and is estimated.

U Laboratory flag indicating the result is not detected.

N/A Not applicable

All calculated RPDs and difference in detections met criteria. No validation flags were assigned.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90589-1	L12mw-244-110416-GW	280-90589-1	Water	Aldrin	309-00-2	µg/L	0.052	u q j	uj	n	0.052	0.021	0.0025	Pesticides	L M
280-90589-1	L12mw-244-110416-GW	280-90589-1	Water	Gamma-Chlordane	5103-74-2	µg/L	0.052	u q	uj	n	0.052	0.03	0.0024	Pesticides	L
280-90589-1	L12mw-244-110416-GW	280-90589-1	Water	Heptachlor	76-44-8	µg/L	0.052	u q j	uj	n	0.052	0.05	0.01	Pesticides	L M
280-90589-1	L12mw-501-110416-GW	280-90589-2	Water	Aldrin	309-00-2	µg/L	0.051	u q	uj	n	0.051	0.021	0.0025	Pesticides	L
280-90589-1	L12mw-501-110416-GW	280-90589-2	Water	Gamma-Chlordane	5103-74-2	µg/L	0.051	u q	uj	n	0.051	0.03	0.0024	Pesticides	L
280-90589-1	L12mw-501-110416-GW	280-90589-2	Water	Heptachlor	76-44-8	µg/L	0.051	u q	uj	n	0.051	0.05	0.01	Pesticides	L
280-90589-1	L12mw-245-110416-GW	280-90589-3	Water	1,3,5-Trinitrobenzene	99-35-4	µg/L	1.1	u q	uj	n	1.1	0.4	0.21	Explosives and Propellants	L
280-90589-1	L12mw-245-110416-GW	280-90589-3	Water	1,3-Dinitrobenzene	99-65-0	µg/L	0.43	u q	uj	n	0.43	0.2	0.095	Explosives and Propellants	L
280-90589-1	L12mw-245-110416-GW	280-90589-3	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.43	u q	uj	n	0.43	4.4	0.089	Explosives and Propellants	L
280-90589-1	L12mw-245-110416-GW	280-90589-3	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u q	uj	n	0.21	4.4	0.069	Explosives and Propellants	L
280-90589-1	L12mw-245-110416-GW	280-90589-3	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.21	u q	uj	n	0.21	0.12	0.054	Explosives and Propellants	L
280-90589-1	L12mw-245-110416-GW	280-90589-3	Water	2-Nitrotoluene	88-72-2	µg/L	0.43	u q	uj	n	0.43	0.2	0.091	Explosives and Propellants	L
280-90589-1	L12mw-245-110416-GW	280-90589-3	Water	3-Nitrotoluene	99-08-1	µg/L	0.43	u q	uj	n	0.43	0.2	0.089	Explosives and Propellants	L
280-90589-1	L12mw-245-110416-GW	280-90589-3	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.21	u q	uj	n	0.21	0.12	0.061	Explosives and Propellants	L
280-90589-1	L12mw-245-110416-GW	280-90589-3	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	uj	n	1.1	0.4	0.21	Explosives and Propellants	L
280-90589-1	L12mw-245-110416-GW	280-90589-3	Water	Manganese	7439-96-5	µg/L	140	q	j	y	3.5	0.095	0.31	Metals	CC
280-90589-1	L12mw-245-110416-GW	280-90589-3	Water	Zinc	7440-66-6	µg/L	20	j	u	n	20	8	2	Metals	B
280-90589-1	L12mw-245-110416-GW	280-90589-3	Water	Aldrin	309-00-2	µg/L	0.051	u q	uj	n	0.051	0.021	0.0024	Pesticides	L
280-90589-1	L12mw-245-110416-GW	280-90589-3	Water	Gamma-Chlordane	5103-74-2	µg/L	0.051	u q	uj	n	0.051	0.03	0.0023	Pesticides	L
280-90589-1	L12mw-245-110416-GW	280-90589-3	Water	Heptachlor	76-44-8	µg/L	0.051	u q	uj	n	0.051	0.05	0.01	Pesticides	L
280-90589-1	L12mw-245-110416-GW	280-90589-3	Water	Acetone	67-64-1	µg/L	1.9	j q	J	y	10	6.4	1.9	VOCs	CC
280-90589-1	L12mw-242-110416-GW	280-90589-4	Water	1,3,5-Trinitrobenzene	99-35-4	µg/L	1.1	u q	uj	n	1.1	0.4	0.21	Explosives and Propellants	L
280-90589-1	L12mw-242-110416-GW	280-90589-4	Water	1,3-Dinitrobenzene	99-65-0	µg/L	0.42	u q	uj	n	0.42	0.2	0.094	Explosives and Propellants	L
280-90589-1	L12mw-242-110416-GW	280-90589-4	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.42	u q	uj	n	0.42	4.4	0.089	Explosives and Propellants	L
280-90589-1	L12mw-242-110416-GW	280-90589-4	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u q	uj	n	0.21	4.4	0.068	Explosives and Propellants	L
280-90589-1	L12mw-242-110416-GW	280-90589-4	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.21	u q	uj	n	0.21	0.12	0.054	Explosives and Propellants	L
280-90589-1	L12mw-242-110416-GW	280-90589-4	Water	2-Nitrotoluene	88-72-2	µg/L	0.42	u q	uj	n	0.42	0.2	0.09	Explosives and Propellants	L
280-90589-1	L12mw-242-110416-GW	280-90589-4	Water	3-Nitrotoluene	99-08-1	µg/L	0.42	u q	uj	n	0.42	0.2	0.088	Explosives and Propellants	L
280-90589-1	L12mw-242-110416-GW	280-90589-4	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.21	u q	uj	n	0.21	0.12	0.061	Explosives and Propellants	L
280-90589-1	L12mw-242-110416-GW	280-90589-4	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	uj	n	1.1	0.4	0.21	Explosives and Propellants	L
280-90589-1	L12mw-242-110416-GW	280-90589-4	Water	Manganese	7439-96-5	µg/L	88	q	j	y	3.5	0.095	0.31	Metals	CC
280-90589-1	L12mw-242-110416-GW	280-90589-4	Water	Zinc	7440-66-6	µg/L	20	j	u	n	20	8	2	Metals	B
280-90589-1	L12mw-153-110416-GW	280-90589-5	Water	1,3,5-Trinitrobenzene	99-35-4	µg/L	1.1	u q	uj	n	1.1	0.4	0.22	Explosives and Propellants	L
280-90589-1	L12mw-153-110416-GW	280-90589-5	Water	1,3-Dinitrobenzene	99-65-0	µg/L	0.43	u q	uj	n	0.43	0.2	0.096	Explosives and Propellants	L
280-90589-1	L12mw-153-110416-GW	280-90589-5	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.43	u q	uj	n	0.43	4.4	0.091	Explosives and Propellants	L
280-90589-1	L12mw-153-110416-GW	280-90589-5	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.22	u q	uj	n	0.22	4.4	0.07	Explosives and Propellants	L
280-90589-1	L12mw-153-110416-GW	280-90589-5	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.22	u q	uj	n	0.22	0.12	0.055	Explosives and Propellants	L
280-90589-1	L12mw-153-110416-GW	280-90589-5	Water	2-Nitrotoluene	88-72-2	µg/L	0.43	u q	uj	n	0.43	0.2	0.092	Explosives and Propellants	L

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90589-1	L12mw-153-110416-GW	280-90589-5	Water	3-Nitrotoluene	99-08-1	µg/L	0.43	u q	uj	n	0.43	0.2	0.09	Explosives and Propellants	L
280-90589-1	L12mw-153-110416-GW	280-90589-5	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.22	u q	uj	n	0.22	0.12	0.062	Explosives and Propellants	L
280-90589-1	L12mw-153-110416-GW	280-90589-5	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	uj	n	1.1	0.4	0.22	Explosives and Propellants	L
280-90589-1	L12mw-153-110416-GW	280-90589-5	Water	Acenaphthene	83-32-9	µg/L	0.1	u q	uj	n	0.1	1	0.0043	PAHs	S
280-90589-1	L12mw-153-110416-GW	280-90589-5	Water	Acenaphthylene	208-96-8	µg/L	0.1	u q	uj	n	0.1	1	0.0052	PAHs	S
280-90589-1	L12mw-153-110416-GW	280-90589-5	Water	Anthracene	120-12-7	µg/L	0.1	u q	uj	n	0.1	1	0.0057	PAHs	S
280-90589-1	L12mw-153-110416-GW	280-90589-5	Water	Fluoranthene	206-44-0	µg/L	0.1	u q	uj	n	0.1	0.5	0.0049	PAHs	S
280-90589-1	L12mw-153-110416-GW	280-90589-5	Water	Fluorene	86-73-7	µg/L	0.1	u q	uj	n	0.1	1	0.0056	PAHs	S
280-90589-1	L12mw-153-110416-GW	280-90589-5	Water	Naphthalene	91-20-3	µg/L	0.08	j q	j	y	0.1	1	0.0081	PAHs	S
280-90589-1	L12mw-153-110416-GW	280-90589-5	Water	Phenanthrene	85-01-8	µg/L	0.1	u q	uj	n	0.1	1	0.0094	PAHs	S
280-90589-1	L12mw-153-110416-GW	280-90589-5	Water	Pyrene	129-00-0	µg/L	0.1	u q	uj	n	0.1	1	0.0062	PAHs	S
280-90589-1	L12mw-188-110416-GW	280-90589-6	Water	1,3,5-Trinitrobenzene	99-35-4	µg/L	1.1	u q	uj	n	1.1	0.4	0.21	Explosives and Propellants	L
280-90589-1	L12mw-188-110416-GW	280-90589-6	Water	1,3-Dinitrobenzene	99-65-0	µg/L	0.43	u q	uj	n	0.43	0.2	0.094	Explosives and Propellants	L
280-90589-1	L12mw-188-110416-GW	280-90589-6	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.43	u q	uj	n	0.43	4.4	0.089	Explosives and Propellants	L
280-90589-1	L12mw-188-110416-GW	280-90589-6	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u q	uj	n	0.21	4.4	0.069	Explosives and Propellants	L
280-90589-1	L12mw-188-110416-GW	280-90589-6	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.21	u q	uj	n	0.21	0.12	0.054	Explosives and Propellants	L
280-90589-1	L12mw-188-110416-GW	280-90589-6	Water	2-Nitrotoluene	88-72-2	µg/L	0.43	u q	uj	n	0.43	0.2	0.091	Explosives and Propellants	L
280-90589-1	L12mw-188-110416-GW	280-90589-6	Water	3-Nitrotoluene	99-08-1	µg/L	0.43	u q	uj	n	0.43	0.2	0.089	Explosives and Propellants	L
280-90589-1	L12mw-188-110416-GW	280-90589-6	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.21	u q	uj	n	0.21	0.12	0.061	Explosives and Propellants	L
280-90589-1	L12mw-188-110416-GW	280-90589-6	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	uj	n	1.1	0.4	0.21	Explosives and Propellants	L
280-90589-1	L12mw-188-110416-GW	280-90589-6	Water	Aldrin	309-00-2	µg/L	0.052	u q	uj	n	0.052	0.021	0.0025	Pesticides	L
280-90589-1	L12mw-188-110416-GW	280-90589-6	Water	Gamma-Chlordane	5103-74-2	µg/L	0.052	u q	uj	n	0.052	0.03	0.0024	Pesticides	L
280-90589-1	L12mw-188-110416-GW	280-90589-6	Water	Heptachlor Epoxide	1024-57-3	µg/L	0.052	u	uj	n	0.052	0.036	0.0033	Pesticides	L
280-90589-1	L12mw-107-110416-GW	280-90589-7	Water	1,3,5-Trinitrobenzene	99-35-4	µg/L	1.1	u q	uj	n	1.1	0.4	0.21	Explosives and Propellants	L
280-90589-1	L12mw-107-110416-GW	280-90589-7	Water	1,3-Dinitrobenzene	99-65-0	µg/L	0.43	u q	uj	n	0.43	0.2	0.095	Explosives and Propellants	L
280-90589-1	L12mw-107-110416-GW	280-90589-7	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.43	u q	uj	n	0.43	4.4	0.09	Explosives and Propellants	L
280-90589-1	L12mw-107-110416-GW	280-90589-7	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u q	uj	n	0.21	4.4	0.069	Explosives and Propellants	L
280-90589-1	L12mw-107-110416-GW	280-90589-7	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.21	u q	uj	n	0.21	0.12	0.054	Explosives and Propellants	L
280-90589-1	L12mw-107-110416-GW	280-90589-7	Water	2-Nitrotoluene	88-72-2	µg/L	0.43	u q	uj	n	0.43	0.2	0.092	Explosives and Propellants	L
280-90589-1	L12mw-107-110416-GW	280-90589-7	Water	3-Nitrotoluene	99-08-1	µg/L	0.43	u q	uj	n	0.43	0.2	0.089	Explosives and Propellants	L
280-90589-1	L12mw-107-110416-GW	280-90589-7	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.21	u q	uj	n	0.21	0.12	0.062	Explosives and Propellants	L
280-90589-1	L12mw-107-110416-GW	280-90589-7	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	uj	n	1.1	0.4	0.21	Explosives and Propellants	L
280-90589-1	L12mw-500-110416-GW	280-90589-8	Water	1,3,5-Trinitrobenzene	99-35-4	µg/L	1.1	u q	uj	n	1.1	0.4	0.21	Explosives and Propellants	L
280-90589-1	L12mw-500-110416-GW	280-90589-8	Water	1,3-Dinitrobenzene	99-65-0	µg/L	0.42	u q	uj	n	0.42	0.2	0.094	Explosives and Propellants	L
280-90589-1	L12mw-500-110416-GW	280-90589-8	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.42	u q	uj	n	0.42	4.4	0.089	Explosives and Propellants	L
280-90589-1	L12mw-500-110416-GW	280-90589-8	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u q	uj	n	0.21	4.4	0.069	Explosives and Propellants	L
280-90589-1	L12mw-500-110416-GW	280-90589-8	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.21	u q	uj	n	0.21	0.12	0.054	Explosives and Propellants	L
280-90589-1	L12mw-500-110416-GW	280-90589-8	Water	2-Nitrotoluene	88-72-2	µg/L	0.42	u q	uj	n	0.42	0.2	0.091	Explosives and Propellants	L
280-90589-1	L12mw-500-110416-GW	280-90589-8	Water	3-Nitrotoluene	99-08-1	µg/L	0.42	u q	uj	n	0.42	0.2	0.089	Explosives and Propellants	L
280-90589-1	L12mw-500-110416-GW	280-90589-8	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.21	u q	uj	n	0.21	0.12	0.061	Explosives and Propellants	L

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90589-1	L12mw-500-110416-GW	280-90589-8	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	uj	n	1.1	0.4	0.21	Explosives and Propellants	L
280-90589-1	L12mw-500-110416-GW	280-90589-8	Water	Naphthalene	91-20-3	µg/L	0.11	u q	uj	n	0.11	1	0.0085	PAHs	S
280-90589-1	L12mw-183-110416-GW	280-90589-9	Water	Manganese	7439-96-5	µg/L	70	q	J	y	3.5	0.095	0.31	Metals	CC
280-90589-1	L12mw-183-110416-GW	280-90589-9	Water	Acenaphthene	83-32-9	µg/L	0.11	u q	uj	n	0.11	1	0.0044	PAHs	S
280-90589-1	L12mw-183-110416-GW	280-90589-9	Water	Acenaphthylene	208-96-8	µg/L	0.11	u q	uj	n	0.11	1	0.0054	PAHs	S
280-90589-1	L12mw-183-110416-GW	280-90589-9	Water	Anthracene	120-12-7	µg/L	0.11	u q	uj	n	0.11	1	0.0059	PAHs	S
280-90589-1	L12mw-183-110416-GW	280-90589-9	Water	Fluoranthene	206-44-0	µg/L	0.11	u q	uj	n	0.11	0.5	0.0051	PAHs	S
280-90589-1	L12mw-183-110416-GW	280-90589-9	Water	Fluorene	86-73-7	µg/L	0.11	u q	uj	n	0.11	1	0.0058	PAHs	S
280-90589-1	L12mw-183-110416-GW	280-90589-9	Water	Naphthalene	91-20-3	µg/L	0.11	u q	uj	n	0.11	1	0.0084	PAHs	S
280-90589-1	L12mw-183-110416-GW	280-90589-9	Water	Phenanthrene	85-01-8	µg/L	0.11	u q	uj	n	0.11	1	0.0098	PAHs	S
280-90589-1	L12mw-183-110416-GW	280-90589-9	Water	Pyrene	129-00-0	µg/L	0.11	u q	uj	n	0.11	1	0.0064	PAHs	S
280-90589-1	L12mw-183-110416-GW	280-90589-9	Water	Aldrin	309-00-2	µg/L	0.05	u q	uj	n	0.05	0.021	0.0024	Pesticides	L
280-90589-1	L12mw-183-110416-GW	280-90589-9	Water	Gamma-Chlordane	5103-74-2	µg/L	0.05	u q	uj	n	0.05	0.03	0.0023	Pesticides	L
280-90589-1	L12mw-183-110416-GW	280-90589-9	Water	Heptachlor	76-44-8	µg/L	0.05	u q	uj	n	0.05	0.05	0.01	Pesticides	L
280-90589-1	L12mw-182-110416-GW	280-90589-10	Water	1,3,5-Trinitrobenzene	99-35-4	µg/L	1.1	u q	uj	n	1.1	0.4	0.21	Explosives and Propellants	L
280-90589-1	L12mw-182-110416-GW	280-90589-10	Water	1,3-Dinitrobenzene	99-65-0	µg/L	0.42	u q	uj	n	0.42	0.2	0.094	Explosives and Propellants	L
280-90589-1	L12mw-182-110416-GW	280-90589-10	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.42	u q	uj	n	0.42	4.4	0.088	Explosives and Propellants	L
280-90589-1	L12mw-182-110416-GW	280-90589-10	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u q	uj	n	0.21	4.4	0.068	Explosives and Propellants	L
280-90589-1	L12mw-182-110416-GW	280-90589-10	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.21	u q	uj	n	0.21	0.12	0.054	Explosives and Propellants	L
280-90589-1	L12mw-182-110416-GW	280-90589-10	Water	2-Nitrotoluene	88-72-2	µg/L	0.42	u q	uj	n	0.42	0.2	0.09	Explosives and Propellants	L
280-90589-1	L12mw-182-110416-GW	280-90589-10	Water	3-Nitrotoluene	99-08-1	µg/L	0.42	u q	uj	n	0.42	0.2	0.088	Explosives and Propellants	L
280-90589-1	L12mw-182-110416-GW	280-90589-10	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.21	u q	uj	n	0.21	0.12	0.061	Explosives and Propellants	L
280-90589-1	L12mw-182-110416-GW	280-90589-10	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	uj	n	1.1	0.4	0.21	Explosives and Propellants	L
280-90589-1	L12mw-182-110416-GW	280-90589-10	Water	Manganese	7439-96-5	µg/L	35	q	J	y	3.5	0.095	0.31	Metals	CC
280-90589-1	L12mw-182-110416-GW	280-90589-10	Water	Zinc	7440-66-6	µg/L	20	j	U	n	20	8	2	Metals	B
280-90589-1	TB-110416-GW	280-90589-11	Water	Bromofom	75-25-2	µg/L	1	u q	u j	n	1	0.4	0.19	VOCs	CC

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90597-1

Prepared For:



National Guard Bureau
NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture
2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by the Project Chemist. Signatures indicate the report is approved for release.



Erica Fisher, Validator, TEC-WESTON JV

02/09/2017

Date



Peter Chapman, Validation Chemist, TEC-WESTON JV

2/9/17

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90597-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polycyclic Aromatic Hydrocarbons	8270D SIM	Denver, CO
Explosives	8330B	Denver, CO
Total Cyanide	9012B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data*

Review (EPA 2014) and USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014). Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	SVOCs (phthalates)	PAHs	Explosives	Cyanide
LL11mw-006-110416-GW	280-90597-1	11/04/16	Groundwater		✓	✓	✓	✓	✓

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
UJ	L	Estimated non-detection; LCS/LCSD percent recovery or RPD exceedance.
U	B	Not detected; target analyte was detected in the method or calibration blank.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 5, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- LCS recoveries
- Instrument tuning
- Internal standard area counts
- Initial calibration
- Initial calibration verification
- Closing calibration verification

All analytical or quality issues for Method 8260B are described in the sections below.

1.4.1.1 Method Blank

Methylene chloride was detected in method blank MB 280-352111/8 (1.00 µg/L) at a concentration below the LOQ (5.0 µg/L). Methylene chloride was detected in associated sample LL11mw-006-110416-GW (1.9 µg/L) less than the LOQ. The sample result is qualified as a non-detection at the LOQ (U B).

1.4.1.2 Matrix Spike/Matrix Spike Duplicates

No MS/MSDs were reported in this SDG.

1.4.1.3 Field Duplicates

No field duplicates were reported in this SDG.

1.4.2 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Method blank
- Instrument tuning
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Internal standard area counts

All analytical or quality parameters requiring further discussion for Method 8270D are described in the sections below.

1.4.2.1 Laboratory Control Samples

Hexachlorocyclopentadiene (45%) exceeded the RPD limit (20%) in the LCS/LCSD pair. As the recoveries for the LCS and LCSD samples were within QC limits, no qualification is considered necessary.

1.4.2.2 Matrix Spike/Matrix Spike Duplicates

No MS/MSDs were reported in this SDG.

1.4.2.3 Field Duplicates

No field duplicates were reported in this SDG.

1.4.3 Polycyclic Aromatic Hydrocarbons by Method 8270D SIM

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Method blank
- LCS recoveries
- Instrument tuning
- Internal standards
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification

No analytical or quality issues for Method 8270D SIM were found.

1.4.3.1 Matrix Spike/Matrix Spike Duplicates

No MS/MSDs were reported in this SDG.

1.4.3.2 Field Duplicates

No field duplicates were reported in this SDG.

1.4.4 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Initial calibration
- Initial calibration verification
- Continuing calibration verification

- Second column confirmation

All analytical or quality issues for Method 8330B are described in the sections below.

1.4.4.1 Method Blank

RDX (0.0599 µg/L) was detected in the method blank at a concentration below the LOQ (0.20 µg/L). The associated sample result was non-detect for RDX; therefore, no qualification was necessary.

1.4.4.2 Laboratory Control Sample

Several analytes were recovered below the acceptance limits in laboratory control sample LCS 280-350991/2-A. These exceedances are outlined in the table below:

Analyte	LCS %R	%R Limits	Assigned Flags
1,3,5-Trinitrobenzene	66	73-125	UJ L
1,3-Dinitrobenzene	72	78-120	UJ L
2,4-Dinitrotoluene	62	78-120	UJ L
2,6-Dinitrotoluene	62	77-127	UJ L
2-Amino-4,6-dinitrotoluene	59	79-120	UJ L
2-Nitrotoluene	53	70-127	UJ L
3-Nitrotoluene	54	73-125	UJ L
4-Amino-2,6-dinitrotoluene	60	76-125	UJ L
4-Nitrotoluene	59	71-127	UJ L

%R = percent recovery

The sample results in associated sample LL11mw-006-110416-GW were all non-detect for these analytes and therefore qualified as estimated (UJ L).

1.4.4.3 Matrix Spike/Matrix Spike Duplicates

No MS/MSDs were reported in this SDG.

1.4.4.4 Field Duplicates

No field duplicates were reported in this SDG.

1.4.5 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blank
- MS/MSD recoveries and RPDs
- LCS recoveries
- Low and high level control sample recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

No analytical or quality issues for Method 9012B were observed.

1.4.5.1 Field Duplicates

No field duplicates were reported in this SDG.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90597-1	LL11mw-006-110416-GW	280-90597-1	Water	1,3,5-Trinitrobenzene	99-35-4	µg/L	1.1	u q	uj	n	1.1	0.4	0.21	Explosives and Propellants	L
280-90597-1	LL11mw-006-110416-GW	280-90597-1	Water	1,3-Dinitrobenzene	99-65-0	µg/L	0.43	u q	uj	n	0.43	0.2	0.095	Explosives and Propellants	L
280-90597-1	LL11mw-006-110416-GW	280-90597-1	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.43	u q	uj	n	0.43	4.4	0.09	Explosives and Propellants	L
280-90597-1	LL11mw-006-110416-GW	280-90597-1	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u q	uj	n	0.21	4.4	0.069	Explosives and Propellants	L
280-90597-1	LL11mw-006-110416-GW	280-90597-1	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.21	u q	uj	n	0.21	0.12	0.054	Explosives and Propellants	L
280-90597-1	LL11mw-006-110416-GW	280-90597-1	Water	2-Nitrotoluene	88-72-2	µg/L	0.43	u q	uj	n	0.43	0.2	0.092	Explosives and Propellants	L
280-90597-1	LL11mw-006-110416-GW	280-90597-1	Water	3-Nitrotoluene	99-08-1	µg/L	0.43	u q	uj	n	0.43	0.2	0.089	Explosives and Propellants	L
280-90597-1	LL11mw-006-110416-GW	280-90597-1	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.21	u q	uj	n	0.21	0.12	0.062	Explosives and Propellants	L
280-90597-1	LL11mw-006-110416-GW	280-90597-1	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	uj	n	1.1	0.4	0.21	Explosives and Propellants	L
280-90597-1	LL11mw-006-110416-GW	280-90597-1	Water	Methylene chloride	75-09-2	µg/L	5	j	u	n	5	0.8	0.32	VOCs	B

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90632-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Project Chemist and Secondary QC Review was performed by the Validation Chemist. Signatures indicate the report is approved for release.



Heather A. Miner

2017.01.19 11:30:13 -07'00'

Heather Miner, Project Chemist, TEC-WESTON JV

Date



Travis Withers

2017.01.19 11:55:53 -07'00'

Travis Withers, Validation Chemist, TEC-WESTON JV

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90632-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polychlorinated Biphenyls (PCBs)	8082A	Denver, CO
Polycyclic Aromatic Hydrocarbons	8270D SIM	Denver, CO
Organochlorine Pesticides	8081B	Denver, CO
Explosives	8330B	Denver, CO
Metals	6010C/6020A/7470A	Denver, CO
Hexavalent Chromium	353.2	Denver, CO
Total Cyanide	9012B	Denver, CO
Alkalinity	2320B	Denver, CO
Sulfide	9034	Denver, CO
Anions	9056A	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be

taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	SVOCs (phthalates, nitroaromatics, phenols)	PAHs	Pesticides	PCBs	Explosives	Metals	Cr(VI)	Cyanide	Alkalinity
RQLmw-013-110716-GW	280-90632-1	10/26/16	Groundwater	MS/MSD	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
RQLmw-502-110716-GW	280-90632-3	10/27/16	Groundwater	Duplicate	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Note: RQLmw-502-110716-GW is a field duplicate of parent sample RQLmw-013-110716-GW.

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
J	M	Estimated detection; The associated MS/MSD recoveries and/or RPD were outside QC limits.
UJ	L	Estimated non-detection; the associated LCS/LCSD recovery and/or RPD were outside QC limits.
UJ	S	Estimated non-detection; the surrogate recovery was outside QC limits.
U	B	Not detected; target analyte was detected in the method or calibration blank.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 8, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- LCS recoveries
- MS/MSD recoveries and RPDs
- Instrument tuning
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Internal standard area counts

All analytical or quality parameters requiring further discussion for Method 8260B are described in the sections below.

1.4.1.1 Method Blanks

Methylene chloride (0.675 µg/L) was detected in the method blank at a concentration below the LOQ (5.0 µg/L). Methylene chloride was also detected at concentrations below the LOQ in samples RQLmw-013-110716-GW (0.72 µg/L) and RQLmw-502-110716-GW (0.8 µg/L). These samples results were qualified as non-detect at the LOQ (U B).

1.4.1.2 Trip Blanks

The trip blank associated with samples reported in this SDG is reported in SDG 280-90637-1. No detections were reported in the trip blank sample.

1.4.1.3 Field Duplicates

One field duplicate (RQLmw-502-110716-GW), associated with parent sample RQLmw-013-110716-GW, was analyzed for VOCs. No detections were reported in either the parent or duplicate sample.

1.4.2 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- LCS recoveries
- Instrument tuning
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Internal standard area counts

All analytical or quality parameters requiring further discussion for Method 8270D are described in the sections below.

1.4.2.1 Matrix Spike/Matrix Spike Duplicates

An MS/MSD was performed on sample RQLmw-013-110716-GW. The RPD for hexachlorocyclopentadiene (34%) was recovered above the RPD limit (20%). Hexachlorocyclopentadiene was not detected in the parent sample; therefore, no qualifications were required.

1.4.2.2 Field Duplicates

One field duplicate (RQLmw-502-110716-GW), associated with parent sample RQLmw-013-110716-GW, was analyzed for SVOCs. No detections were reported in either the parent or duplicate sample.

1.4.3 Polycyclic Aromatic Hydrocarbons (PAHs) by Method 8270D SIM

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blank
- LCS recoveries
- Instrument tuning
- Internal standards
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification

All analytical or quality issues for Method 8270D SIM are described in the sections below.

1.4.3.1 Surrogates

Surrogate 2-fluorobiphenyl (52%) and nitrobenzene-d5 (51%) were recovered below QC limits (53-106% and 55-111%, respectively) in sample RQLmw-502-110716-GW. All associated analytes in sample RQLmw-502-110716-GW were qualified as estimated (UJ S). It should be noted that surrogates were recovered within QC limits in parent sample RQLmw-013-110716-GW.

1.4.3.2 Matrix Spike/Matrix Spike Duplicates

An MS/MSD was performed on sample RQLmw-013-110716-GW. The RPDs for benzo(a)anthracene (26%), benzo(b)fluoranthene (35%), benzo(k)fluoroanthene (39%), benzo(a)pyrene (24%), fluoranthene (27%), and pyrene (37%) exceeded the RPD limit (20%). With the exception of benzo(b)fluoranthene, none of these analytes were detected in their associated parent sample; therefore, no qualifications were required. Benzo(b)fluoranthene was qualified as estimated (J M).

1.4.1 Organochlorine Pesticides by Method 8081B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- MS/MSD recoveries and RPDs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Endrin/DDT breakdown

All analytical or quality parameters requiring further discussion for Method 8081B are described in the sections below.

1.4.1.1 Laboratory Control Sample

Several analytes were recovered below QC limits in the LCS. The table below presents the LCS exceedances:

LCS/LCSD	Analyte	LCS %R	%R QC Limits	Assigned Flags
280-351386/2-A	Aldrin	38	45-134	J/UJ L
	Heptachlor	49	54-130	J/UJ L

%R = percent recovery
Bolded values are outside control limits.

Aldrin and heptachlor were qualified as estimated (UJ L) in the associated samples.

1.4.1.2 Field Duplicates

One field duplicate (RQLmw-502-110716-GW), associated with parent sample RQLmw-013-110716-GW, was analyzed for pesticides. No detections were reported in either the parent or duplicate sample.

1.4.2 Polychlorinated Biphenyls by Method 8082A

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- LCS recoveries
- MS/MSD recoveries and RPDs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification

All analytical or quality parameters requiring further discussion for Method 8082A are described in the sections below.

1.4.2.1 Field Duplicates

One field duplicate (RQLmw-502-110716-GW), associated with parent sample RQLmw-013-110716-GW, was analyzed for PCBs. No detections were reported in either the parent or duplicate sample.

1.4.3 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- LCS recoveries
- Initial calibration
- Initial calibration verification
- Continuing calibration verification

All analytical or quality parameters requiring further discussion for Method 8330B are described in the sections below.

1.4.3.1 Method Blank

RDX (0.132 µg/L) was detected in the method blank at a concentration below the LOQ (0.4 µg/L). RDX was not detected in the associated samples. No qualification was necessary.

1.4.3.2 Matrix Spike/Matrix Spike Duplicates

An MS/MSD was performed on sample RQLmw-013-110716-GW. 4-Amino-2,6-dinitrotoluene was recovered below control limits (76-125%) in the MS (74%). Because the MSD recovery and the RPD were within control limits, no qualifications were deemed necessary.

1.4.3.3 Field Duplicates

One field duplicate (RQLmw-502-110716-GW), associated with parent sample RQLmw-013-110716-GW, was analyzed for explosives. No detections were reported in either the parent or duplicate sample.

1.4.4 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Low level calibration check standard
- Interference check solutions
- Instrument tuning

All analytical or quality parameters requiring further discussion for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.4.1 Calibration Blanks

Several analytes were detected in the calibration blanks bracketing sample LL1mw-084-110716-GW. The following table presents the initial and continuing calibration blank detections:

Calibration Blank	Analyte	Blank Detection (µg/L)	LOQ (µg/L)	Assigned Flags	Samples Qualified
ICB 280-352414/11	Antimony	0.871	6	U B	RQLmw-013-110706-GW RQLmw-502-110716-GW

Calibration Blank	Analyte	Blank Detection (µg/L)	LOQ (µg/L)	Assigned Flags	Samples Qualified
CCB 280-352414/106	Beryllium	0.092 J	1	U B	RQLmw-013-110706-GW RQLmw-502-110716-GW
	Thallium	0.072 J	1	None	None
CCB 280-352414/119	Beryllium	0.092 J	1	U B	RQLmw-013-110706-GW RQLmw-502-110716-GW
	Silver	0.038 J	5	U B	RQLmw-013-110706-GW RQLmw-502-110716-GW
	Thallium	0.075 J	1	None	None

CCB = continuing calibration blank

ICB = initial calibration blank

Detections less than the LOQ in associated samples are qualified as not detected at the LOQ (U B). Thallium was detected at concentrations greater than the LOQ in both samples; therefore, no qualifications were applied to thallium results.

1.4.4.2 Matrix Spike/Matrix Spike Duplicates

An MS/MSD was performed on sample RQLmw-013-110716-GW. Aluminum was recovered above control limits (86-115%) in the MS (121%) and MSD (119%). Aluminum was detected in the parent sample; these results were qualified as estimated (J M). It should be noted that manganese was detected in the parent sample at a concentration greater than four times the spike concentration; the MS/MSD recoveries could not be evaluated for manganese.

1.4.4.3 Field Duplicates

One field duplicate was collected (RQLmw-502-110716-GW), associated with parent sample RQLmw-013-110716-GW, and analyzed for metals. For detections greater than 5x the LOQ in both samples, an RPD was calculated. For detections less than 5x the LOQ, the difference in values was compared to \pm the LOQ. The following table shows the detections in parent and field duplicate samples:

Primary/Duplicate Sample ID	Analyte	Primary Sample Result (µg/L)	Field Duplicate Result (µg/L)	LOQ (µg/L)	RPD (%)	RPD Limit (%) ¹
RQLmw-013-110716-GW/ RQLmw-502-110716-GW	Aluminum	3000	3100	300	3	20
	Calcium	37000	39000	1000	5	20
	Iron	59 J	59 J	100	N/A	± LOQ
	Magnesium	17000	17000	500	0	20
	Potassium	2300 J	2400 J	3000	N/A	± LOQ
	Sodium	5500	6100	5000	10	20
	Arsenic	0.54 J	0.54 J	5	N/A	± LOQ
	Barium	17	17	3	0	20
	Chromium	1.8 U	0.51 J	10	N/A	± LOQ
	Cobalt	17	16	1	6	20
	Lead	0.35 J	0.54 J	3	N/A	± LOQ
	Manganese	2000	2100	3.5	5	20
	Nickel	36	35	3	3	20
	Thallium	1.4	1.5	1	N/A	± LOQ
Zinc	130	130	20	0	20	

¹ The RPD limit is 20% for detections greater than 5x the LOQ; ± the LOQ for detections less than 5x the LOQ.

J Laboratory flag indicating the result is less than the LOQ and is estimated.

U Laboratory flag indicating the result is not detected.

N/A Not applicable

All calculated RPDs and difference in detections met criteria. No validation flags were assigned.

1.4.5 Hexavalent Chromium by Method 7196A

The following parameters were evaluated and met the required criteria:

- Holding time
- LODs and LOQs
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

All analytical or quality parameters requiring further discussion for Method 7196A are described in the sections below.

1.4.5.1 Field Duplicates

One field duplicate (RQLmw-502-110716-GW), associated with parent sample RQLmw-013-110716-GW, was analyzed for hexavalent chromium. No detections were reported in either the parent or duplicate sample.

1.4.6 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blank
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

All analytical or quality parameters requiring further discussion for Method 9012B are described in the sections below.

1.4.6.1 Matrix Spike/Matrix Spike Duplicates

An MS/MSD was performed on sample RQLmw-013-110716-GW. Cyanide was recovered above control limits (83-116%) in the MS (125%) and MSD (130%). Cyanide was not detected in the parent sample; no qualifications were necessary.

1.4.6.2 Field Duplicates

One field duplicate (RQLmw-502-110716-GW), associated with parent sample RQLmw-013-110716-GW, was analyzed for cyanide. No detections were reported in either the parent or duplicate sample.

1.4.7 Alkalinity by Method SM 2320B

The following parameters were evaluated and met the required criteria:

- Holding time
- LODs and LOQs
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification

All analytical or quality parameters requiring further discussion for Method SM 2320B are described in the sections below.

1.4.7.1 Method Blanks

Alkalinity (1.12 µg/L) was detected in the method blank at a concentration below the LOQ (5.0 µg/L). Because alkalinity was detected in the associated samples at concentrations above the LOQ, no qualifiers were assigned.

1.4.7.2 Calibration Blanks

Alkalinity (1.70 µg/L) was detected in the ending continuing calibration blank at a concentration below the LOQ (5.0 µg/L). Because alkalinity was detected in the associated samples at concentrations above the LOQ, no qualifiers were assigned.

1.4.7.3 Field Duplicates

One field duplicate was collected (RQLmw-502-110716-GW) and analyzed for alkalinity. For detections greater than 5x the LOQ in both samples, an RPD was calculated. For detections less than 5x the LOQ, the difference in values was compared to ± the LOQ. The following table shows the detections in parent and field duplicate samples:

Primary/Duplicate Sample ID	Analyte	Primary Sample Result (µg/L)	Field Duplicate Result (µg/L)	LOQ (µg/L)	RPD (%)	RPD Limit (%) ¹
RQLmw-013-110716-GW/ RQLmw-502-110716-GW	Alkalinity	1.2 J	1.2 J	2.1	N/A	± LOQ

¹ The RPD limit is 20% for detections greater than 5x the LOQ; ± the LOQ for detections less than 5x the LOQ.

J Laboratory flag indicating the result is less than the LOQ and is estimated.

N/A Not applicable

All calculated RPDs and difference in detections met criteria. No validation flags were assigned.

DATA VALIDATION TABLE

SDG	Field Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytic/Method	Reason Code
280-90632-1	RQLmw-013-110716-GW	Water	Aluminum	7429-90-5	µg/L	3000	v	j	y	300	70	18	Metals	M
280-90632-1	RQLmw-013-110716-GW	Water	Antimony	7440-36-0	µg/L	6	j	u	n	6	1	0.4	Metals	B
280-90632-1	RQLmw-013-110716-GW	Water	Beryllium	7440-41-7	µg/L	1	j	u	n	1	0.3	0.08	Metals	B
280-90632-1	RQLmw-013-110716-GW	Water	Silver	7440-22-4	µg/L	5	j	u	n	5	0.1	0.033	Metals	B
280-90632-1	RQLmw-013-110716-GW	Water	Aldrin	309-00-2	µg/L	0.05	uq	uj	n	0.05	0.021	0.0024	Pesticides	L
280-90632-1	RQLmw-013-110716-GW	Water	Heptachlor	76-44-8	µg/L	0.05	uq	uj	n	0.05	0.05	0.01	Pesticides	L
280-90632-1	RQLmw-013-110716-GW	Water	Methylene chloride	75-09-2	µg/L	5	j	u	n	5	0.8	0.32	VOC's	B
280-90632-1	RQLmw-013-110716-GW	Water	Benz(o)b/fluoranthene	205-99-2	µg/L	0.019	j	i	y	0.1	2	0.0031	PAHs	M
280-90632-1	RQLmw-502-110716-GW	Water	Antimony	7440-36-0	µg/L	6	j	u	n	6	1	0.4	Metals	B
280-90632-1	RQLmw-502-110716-GW	Water	Beryllium	7440-41-7	µg/L	1	j	u	n	1	0.3	0.08	Metals	B
280-90632-1	RQLmw-502-110716-GW	Water	Silver	7440-22-4	µg/L	5	j	u	n	5	0.1	0.033	Metals	B
280-90632-1	RQLmw-502-110716-GW	Water	Aldrin	309-00-2	µg/L	0.052	uq	uj	n	0.052	0.021	0.0025	Pesticides	L
280-90632-1	RQLmw-502-110716-GW	Water	Heptachlor	76-44-8	µg/L	0.052	uq	uj	n	0.052	0.05	0.01	Pesticides	L
280-90632-1	RQLmw-502-110716-GW	Water	Methylene chloride	75-09-2	µg/L	5	j	u	n	5	0.8	0.32	VOC's	B
280-90632-1	RQLmw-502-110716-GW	Water	Acenaphthene	83-32-9	µg/L	0.11	uq	uj	n	0.11	1	0.0044	PAHs	S
280-90632-1	RQLmw-502-110716-GW	Water	Acenaphthylene	208-96-8	µg/L	0.11	uq	uj	n	0.11	1	0.0054	PAHs	S
280-90632-1	RQLmw-502-110716-GW	Water	Anthracene	120-12-7	µg/L	0.11	uq	uj	n	0.11	1	0.0059	PAHs	S
280-90632-1	RQLmw-502-110716-GW	Water	Fluoranthene	206-44-0	µg/L	0.11	uq	uj	n	0.11	0.5	0.0051	PAHs	S
280-90632-1	RQLmw-502-110716-GW	Water	Fluorene	86-73-7	µg/L	0.11	uq	uj	n	0.11	1	0.0058	PAHs	S
280-90632-1	RQLmw-502-110716-GW	Water	Naphthalene	91-20-3	µg/L	0.11	uq	uj	n	0.11	1	0.0085	PAHs	S
280-90632-1	RQLmw-502-110716-GW	Water	Phenanthrene	85-01-8	µg/L	0.11	uq	uj	n	0.11	1	0.0098	PAHs	S
280-90632-1	RQLmw-502-110716-GW	Water	Pyrene	129-00-0	µg/L	0.046	j q	j	y	0.11	1	0.0064	PAHs	S

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90635-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Project Chemist and Secondary QC Review was performed by the Validation Chemist. Signatures indicate the report is approved for release.



Heather A. Miner

2017.01.19 11:29:38 -07'00'

Heather Miner, Project Chemist, TEC-WESTON JV

Date



Travis Withers

2017.01.19 11:56:41 -07'00'

Travis Withers, Validation Chemist, TEC-WESTON JV

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90635-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polychlorinated Biphenyls (PCBs)	8082A	Denver, CO
Organochlorine Pesticides	8081B	Denver, CO
Explosives	8330B	Denver, CO
Metals	6010C/6020A/7470A	Denver, CO
Alkalinity	2320B	Denver, CO
Hexavalent Chromium	7196A	Denver, CO
Total Cyanide	9012B	Denver, CO
Sulfide	9034	Denver, CO
Anions	9056A	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R)

should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	SVOCs (phthalates)	Pesticides	PCBs	Explosives	Metals	Cr(VI)	Cyanide	Alkalinity
FWGmw-013-110716-GW	280-90635-1	11/07/16	Groundwater								✓	
LL1mw-084-110716-GW	280-90635-2	11/07/16	Groundwater		✓	✓	✓	✓	✓	✓	✓	✓
LL1mw-081-110716-GW	280-90635-3	11/07/16	Groundwater					✓			✓	

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
J	P	Estimated detection; the RPD between the primary and confirmation column was outside QC limits.
J	S	Estimated detection; the surrogate recovery was outside QC limits.
UJ	L	Estimated non-detection; the associated LCS/LCSD recovery and/or RPD were outside QC limits.
UJ	S	Estimated non-detection; the surrogate recovery was outside QC limits.
U	B	Not detected; target analyte was detected in the method or calibration blank.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 8, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

“-GW” was added to the end of all sample IDs to comply with the RIWP. Zeros were added to samples LL1mw-084-110716-GW and LL1mw-081-110716-GW to comply with the RIWP.

Method 8270D SVOCs are requested on the chain-of-custody for LL1mw-084-110716-GW; however, this analysis was not required and was cancelled.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- LCS recoveries
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Internal standard area counts

No analytical or quality parameters required further discussion for Method 8270D.

1.4.1 Organochlorine Pesticides by Method 8081B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Endrin/DDT breakdown

All analytical or quality parameters requiring further discussion for Method 8081B are described in the sections below.

1.4.1.1 Laboratory Control Sample

Several analytes were recovered below QC limits in the LCS. The table below presents the LCS exceedances:

LCS/LCSD	Analyte	LCS %R	%R QC Limits	Assigned Flags
280-351386/2-A	Aldrin	38	45-134	J/UJ L
	Heptachlor	49	54-130	J/UJ L

%R = percent recovery

Bolded values are outside control limits.

Aldrin and heptachlor were qualified as estimated (UJ L) in the associated sample.

1.4.2 Polychlorinated Biphenyls by Method 8082A

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- LCS recoveries
- Initial calibration
- Initial calibration verification
- Continuing calibration verification

No analytical or quality parameters required further discussion for Method 8082A.

1.4.3 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- LCS recoveries
- Initial calibration
- Initial calibration verification
- Continuing calibration verification

All analytical or quality parameters requiring further discussion for Method 8330B are described in the sections below.

1.4.3.1 Surrogates

Surrogate 1,2-dinitrobenzene (77%) was recovered below QC limits (83-119%) in sample LL1mw-084-110716-GW on the second column. All analytes reported on the second column in

sample LL1mw-084-110716-GW were qualified as estimated (J/UJ S). The laboratory noted the evidence of matrix interference was present.

1.4.3.2 Second Column Confirmation

Several analytes were detected on both the primary and secondary column; however, the RPDs exceeded the 40% QC limit. The following table presents the RPD exceedances:

Sample ID	Analyte	Primary Column Result (µg/L)	Secondary Column Result (µg/L)	RPD (%)	RPD Limit (%)
LL1mw-084-110716-GW	HMX	2.7	0.22 J	170	40
	RDX	1.2	0.5	86	40
	1,3-Dinitrobenzene	1.1	0.71	44	40

J Laboratory flag indicating the result is less than the LOQ and is estimated.

These results are qualified as estimated (J P).

1.4.3.3 Method Blank

RDX (0.132 µg/L) was detected in the method blank at a concentration below the LOQ (0.4 µg/L). RDX was not detected in the associated sample. No qualification was necessary.

1.4.4 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- LCS recoveries
- Low level calibration check standard
- Initial calibration verification
- Interference check solutions
- Instrument tuning

All analytical or quality parameters requiring further discussion for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.4.1 Method Blanks

Iron (22.6 µg/L) and sodium (223 µg/L) were detected in the method blank at concentrations below their respective LOQs (100 µg/L and 5000 µg/L). Iron was not detected in the associated sample.

Sodium was detected at a concentration below the LOQ in samples LL1mw-084-110716-GW (4600 µg/L); this result was qualified as not detected at the LOQ (U B).

1.4.4.2 Calibration Blanks

Several analytes were detected in the calibration blanks bracketing sample LL1mw-084-110716-GW. The following table presents the initial and continuing calibration blank detections:

Calibration Blank	Analyte	Blank Detection (µg/L)	LOQ (µg/L)	Assigned Flags	Samples Qualified
CCB 280-352990/75	Sodium	243 J	5000	U B	LL1mw-084-110716-GW
CCB 280-352990/89	Sodium	132 J	5000	U B	LL1mw-084-110716-GW
ICB 280-352414/11	Antimony	0.871	6	None	None
CCB 280-352414/106	Beryllium	0.092 J	1	U B	LL1mw-084-110716-GW
	Thallium	0.072 J	1	U B	LL1mw-084-110716-GW
CCB 280-352414/119	Beryllium	0.092 J	1	U B	LL1mw-084-110716-GW
	Silver	0.038 J	5	None	None
	Thallium	0.075 J	1	U B	LL1mw-084-110716-GW

CCB = continuing calibration blank

ICB = initial calibration blank

Detections less than the LOQ in associated samples are qualified as not detected at the LOQ (U B).

1.4.4.3 Continuing Calibration Verification

Sodium (123%) recovered above the QC limits (80-120%) in the low level CCV 280-352990/90. Sodium was previously qualified as not detected based on method and calibration blank contamination. No qualification was required.

1.4.5 Hexavalent Chromium by Method 7196A

The following parameters were evaluated and met the required criteria:

- Holding time
- LODs and LOQs
- Method blanks
- LCS recoveries

- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

No analytical or quality parameters required further discussion for Method 7196A.

1.4.6 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blank
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

No analytical or quality parameters required further discussion for Method 9012B.

1.4.7 Alkalinity by Method SM 2320B

The following parameters were evaluated and met the required criteria:

- Holding time
- LODs and LOQs
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification

All analytical or quality parameters requiring further discussion for Method 9012B are described in the sections below.

1.4.7.1 Method Blanks

Alkalinity (1.12 µg/L) was detected in the method blank at a concentration below the LOQ (5.0 µg/L). Because alkalinity was detected in the associated samples at concentrations above the LOQ, no qualifiers were assigned.

1.4.7.2 Calibration Blanks

Alkalinity (1.70 µg/L) was detected in the ending continuing calibration blank at a concentration below the LOQ (5.0 µg/L). Because alkalinity was detected in the associated samples at concentrations above the LOQ, no qualifiers were assigned.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	AnalyticMethod	Reason Code
280-90635-1	LL1mw-084-110716-GW	280-90635-2	Water	Sodium	7440-23-5	µg/L	5000	j	u	n	5000	350	92	Metals	B
280-90635-1	LL1mw-084-110716-GW	280-90635-2	Water	Beryllium	7440-41-7	µg/L	1	j	u	n	1	0.3	0.08	Metals	B
280-90635-1	LL1mw-084-110716-GW	280-90635-2	Water	Thallium	7440-28-0	µg/L	1	j	u	n	1	0.2	0.05	Metals	B
280-90635-1	LL1mw-084-110716-GW	280-90635-2	Water	Aldrin	309-00-2	µg/L	0.054	u q	uj	n	0.054	0.021	0.0026	Pesticides	L
280-90635-1	LL1mw-084-110716-GW	280-90635-2	Water	Heptachlor	76-44-8	µg/L	0.054	u q	uj	n	0.054	0.05	0.011	Pesticides	L
280-90635-1	LL1mw-084-110716-GW	280-90635-2	Water	1,3-Dinitrobenzene	99-65-0	µg/L	0.71	q j	j	y	0.43	0.2	0.095	Explosives	S P
280-90635-1	LL1mw-084-110716-GW	280-90635-2	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	uj	n	1.1	0.4	0.21	Explosives	S
280-90635-1	LL1mw-084-110716-GW	280-90635-2	Water	HMX	2691-41-0	µg/L	0.22	q j m	j	y	0.43	0.2	0.094	Explosives	S P
280-90635-1	LL1mw-084-110716-GW	280-90635-2	Water	RDX	121-82-4	µg/L	0.5	q j	j	y	0.21	0.12	0.056	Explosives	S P
280-90635-1	LL1mw-084-110716-GW	280-90635-2	Water	Tetryl	479-45-8	µg/L	0.26	u q	uj	n	0.26	0.2	0.085	Explosives	S

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90637-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by the Project Chemist. Signatures indicate the report is approved for release.



Travis Withers

2017.01.19 11:57:26 -07'00'

Travis Withers, Validation Chemist, TEC-WESTON JV

Date



Heather A. Miner

**2017.01.19 12:18:46
-07'00'**

Heather Miner, Project Chemist, TEC-WESTON JV

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90637-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polycyclic Aromatic Hydrocarbons	8270D SIM	Denver, CO
Polychlorinated Biphenyls (PCBs)	8082A	Denver, CO
Organochlorine Pesticides	8081B	Denver, CO
Explosives	8330B	Denver, CO
Metals	6010C/6020A/7470A	Denver, CO
Total Cyanide	9012B	Denver, CO
Anions	9056A	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	SVOCs (phthalates)	SVOCs (full list)	PAHs	PCBs	Pesticides	Explosives	Metals	Cyanide
LL7mw-006-110716-GW	280-90637-1	11/07/16	Groundwater		✓					✓	✓		✓
LL7mw-005-110716-GW	280-90637-2	11/07/16	Groundwater								✓		✓
LL7mw-001-110716-GW	280-90637-3	11/07/16	Groundwater		✓	✓					✓	✓	✓
L12mw-243-110716-GW	280-90637-4	11/07/16	Groundwater		✓		✓	✓	✓		✓		✓
L12mw-187-110716-GW	280-90637-5	11/07/16	Groundwater		✓		✓	✓	✓			✓	✓
L12mw-154-110716-GW	280-90637-6	11/07/16	Groundwater		✓			✓	✓		✓	✓	✓
LL8mw-500-110716-GW	280-90637-7	11/07/16	Groundwater	Field Duplicate								✓	
LL8mw-001-110716-GW	280-90637-8	11/07/16	Groundwater									✓	✓
TRIP BLANK	280-90637-9	11/07/16	Water	Trip Blank	✓								
L12mw-186-110716-GW	280-90637-10	11/07/16	Groundwater		✓			✓	✓	✓	✓		✓

Note: LL8mw-500-110716-GW is a field duplicate of parent sample LL8mw-001-110716-GW.

Samples were also analyzed for natural attenuation parameters; these parameters were not validated.

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
J	CC	Estimated detection; continuing calibration verification did not meet acceptance criteria.
UJ	CC	Estimated non-detection; continuing calibration verification did not meet acceptance criteria.
UJ	L	Estimated non-detection; LCS/LCSD percent recovery or RPD exceedance.
UJ	S	Estimated non-detection; surrogate outlier.
U	B	Not detected; target analyte was detected in the method or calibration blank.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 8, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

Sample volume was submitted for samples TRIP BLANK and L12mw-186-110716-GW, but were not listed on the COC. The samples were logged per the volume received by the laboratory.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- Method blank
- LCS recoveries
- LODs and LOQs
- Instrument tuning
- Internal standard area counts
- Initial calibration
- Initial calibration verification
- Closing calibration verification
- Trip blank

All analytical or quality issues for Method 8260B are described in the sections below.

1.4.1.1 Continuing Calibration Verification

Chloroethane (-21.2%D) was recovered outside of the acceptance criteria ($\pm 20\%$ D) in CCV 280-352221/0. All associated sample results were qualified estimated (UJ CC).

1.4.2 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- LCS recoveries
- Instrument tuning
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Internal standard area counts

No analytical or quality parameters required further discussion for Method 8270D.

1.4.3 Polycyclic Aromatic Hydrocarbons by Method 8270D SIM

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blank
- LCS recoveries
- Instrument tuning
- Internal standards
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification

All analytical or quality issues for Method 8270D SIM are described in the sections below.

1.4.3.1 Surrogate Recoveries

Surrogate 2-fluorobiphenyl recovered below the acceptance limits (53-106%) in sample L12mw-187-110716-GW (52%) All associated sample results were qualified as estimated (UJ S).

Surrogate nitrobenzene-d5 recovered below the acceptance limits (55-111%) in sample L12mw-154-110716-GW (53%). All associated sample results were qualified as estimated (UJ S).

1.4.4 Organochlorine Pesticides by Method 8081B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Internal standards
- Endrin/DDT breakdown check
- Second column confirmation

All analytical or quality issues for Method 8081B are described in the sections below.

1.4.4.1 Laboratory Control Sample

Aldrin (38%) and heptachlor (49%) recovered below their respective acceptance limits (45-134%, 54-130%) in the LCS. All associated sample results were qualified as estimated (UJ L).

1.4.5 Polychlorinated Biphenyls by Method 8082A

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Method blank
- LCS/LCSD recoveries & RPDs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Second column confirmation

All analytical or quality issues for Method 8082A are described in the sections below.

1.4.5.1 Sample Preparation

The following samples underwent sulfuric acid clean-up (EPA 3665A) prior to analysis to reduce matrix interferences: L12mw-243-110716-GW, L12mw-187-110716-GW, L12mw-154-110716-GW, and L12mw-186-110716-GW.

1.4.6 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS recoveries
- Equipment blanks
- Initial calibration verification
- Continuing calibration verification
- 2nd column confirmation

All analytical or quality issues for Method 8330B are described in the sections below.

1.4.6.1 Method Blanks

RDX (0.132 µg/L) was detected in the method blank at a concentration below the LOQ (0.20 µg/L). All associated sample results were either non-detect or greater than the LOQ; therefore, no qualification was necessary.

Nitrobenzene (0.572 µg/L) was detected in the method blank at a concentration above the LOQ (0.40 µg/L). All associated sample results were non-detect for nitrobenzene; therefore, no qualification was necessary.

1.4.6.2 Surrogate Recoveries

Surrogate 1,2-dinitrobenzene (75%) recovered below the acceptance limits (83-119%) in sample L12mw-186-110716-GW. All associated sample results were qualified as estimated (UJ S).

1.4.7 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- LCS recoveries
- Field duplicate
- Initial calibration verification
- Lower control interference check standard
- Contract required detection limit standard
- Instrument tuning
- Interference check standards

All analytical or quality issues for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.7.1 Dilutions

Due to a high concentration of calcium, the calcium result in sample L12mw-187-110716-GW was reported at a 5x dilution. The reporting limits were adjusted accordingly.

1.4.7.2 Method Blanks

Iron (22.6 µg/L) and sodium (223 µg/L) were detected in the method blank at concentrations below their respective LOQs (100 µg/L, 5000 µg/L). Iron was detected at a concentration below the LOQ in sample L12mw-187-110716-GW (38 µg/L); this result was qualified as non-detect at the LOQ (U B).

All other associated sample results were either non-detect or above the LOQ; therefore, no qualification was necessary.

1.4.7.3 Calibration Blanks

Several analytes were detected in the calibration blanks bracketing the samples. The following table presents the initial and continuing calibration blank detections:

Calibration Blank	Associated Samples	Analyte	Blank Detection (µg/L)	LOQ (µg/L)	Assigned Flags	Samples Qualified
CCB 280-352990/75	LL7mw-001-110716-GW L12mw-187-110716-GW	Sodium	243	5000	N/A	None

	LL12mw-154-110716-GW LL8mw-500-110716-GW LL8mw-001-110716-GW					
CCB 280-352990/89	LL7mw-001-110716-GW LL12mw-187-110716-GW LL12mw-154-110716-GW LL8mw-500-110716-GW LL8mw-001-110716-GW	Sodium	132	5000	N/A	None
ICB 280-352414/11	LL7mw-001-110716-GW LL12mw-187-110716-GW LL12mw-154-110716-GW LL8mw-500-110716-GW LL8mw-001-110716-GW	Antimony	0.871	2	N/A	None
CCB 280-352414/106	LL7mw-001-110716-GW	Beryllium	0.092	1	U B	LL7mw-001-110716-GW
		Thallium	0.072	1	U B	LL7mw-001-110716-GW
CCB 280-352414/119	LL12mw-187-110716-GW LL12mw-154-110716-GW LL8mw-500-110716-GW LL8mw-001-110716-GW	Beryllium	0.092	1	U B	LL12mw-187-110716-GW
		Silver	0.038	5	U B	LL12mw-187-110716-GW
		Thallium	0.075	1	N/A	None
CCB 280-352414/131	LL12mw-187-110716-GW LL12mw-154-110716-GW LL8mw-500-110716-GW LL8mw-001-110716-GW	Beryllium	0.097	1	U B	LL12mw-187-110716-GW
		Thallium	0.056	1	N/A	None

CCB = continuing calibration blank

ICB = initial calibration blank

Detections less than the LOQ in associated samples are qualified as not detected at the LOQ (U B).

1.4.7.4 Continuing Calibration Verification

Sodium recovered above the acceptance limits (80-120%) in low level continuing calibration verifications CCVL 280-352990/76 (124%) and CCVL 280-352990/90 (123%). All associated sample results were qualified as estimated (J CC).

1.4.7.5 Field Duplicates

One field duplicate (LL8mw-500-110716-GW) was collected and analyzed for metals. For detections greater than 5x the LOQ in both samples, an RPD was calculated. For detections less than 5x the LOQ, the difference in values was compared to \pm the LOQ. The following table shows the detections in parent and field duplicate samples:

Primary/Duplicate Sample ID	Analyte	Primary Sample Result ($\mu\text{g/L}$)	Field Duplicate Result ($\mu\text{g/L}$)	LOQ ($\mu\text{g/L}$)	RPD (%)	RPD Limit (%) ¹
LL8mw-001-110716-GW /LL8-500-110716-GW	Aluminum	220 J	120 J	300	N/A	\pm LOQ
	Calcium	83000	82000	1000	1.2	20
	Iron	1600	1200	100	28.6	20
	Magnesium	43000	43000	500	0.0	20
	Potassium	2000 J	2000 J	3000	N/A	\pm LOQ
	Sodium	21000	20000	5000	N/A	\pm LOQ
	Arsenic	3.2 J	2.9 J	5	N/A	\pm LOQ
	Barium	31	31	3	0	20
	Chromium	0.74 J	10 U	10	N/A	\pm LOQ
	Cobalt	0.39 J	0.33 J	1	N/A	\pm LOQ
	Copper	0.66 J	0.89 J	2	N/A	\pm LOQ
	Lead	0.33 J	0.39 J	3	N/A	\pm LOQ
	Manganese	150	140	3.5	6.9	20
	Nickel	0.8 J	0.54 J	3	N/A	\pm LOQ
	Vanadium	0.66 J	6 U	6	N/A	\pm LOQ
	Zinc	2.6 J	2.5 J	20	N/A	\pm LOQ

¹ The RPD limit is 20% for detections greater than 5x the LOQ; \pm the LOQ for detections less than 5x the LOQ.

J Laboratory flag indicating the result is less than the LOQ and is estimated.

U Laboratory flag indicating the result is not detected.

N/A Not applicable

All calculated RPDs and difference in detections met criteria. No validation flags were assigned.

1.4.8 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

All analytical or quality parameters requiring further discussion for Method 9012B are described in the sections below.

1.4.8.1 Matrix Spike/Matrix Spike Duplicates

An MS/MSD was performed on sample LL8mw-001-110716-GW. Total cyanide was recovered above acceptance limits (83-116%) in the MS (132%) and the MSD (137%). The associated parent sample was non-detect for total cyanide; therefore, no qualification was necessary.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90637-1	LL7mw-006-110716-GW	280-90637-1	Water	Aldrin	309-00-2	µg/L	0.051	u q	uj	n	0.051	0.02	0.0024	Pesticides	L
280-90637-1	LL7mw-006-110716-GW	280-90637-1	Water	Heptachlor	76-44-8	µg/L	0.051	u q	uj	n	0.051	0.05	0.01	Pesticides	L
280-90637-1	LL7mw-006-110716-GW	280-90637-1	Water	Chloroethane	75-00-3	µg/L	2	u q	uj	n	2	1.6	0.41	VOCs	CC
280-90637-1	LL7mw-001-110716-GW	280-90637-3	Water	Beryllium	7440-41-7	µg/L	1	j	u	n	1	0.3	0.08	Metals	B
280-90637-1	LL7mw-001-110716-GW	280-90637-3	Water	Thallium	7440-28-0	µg/L	1	j	u	n	1	0.2	0.05	Metals	B
280-90637-1	LL7mw-001-110716-GW	280-90637-3	Water	Chloroethane	75-00-3	µg/L	2	u	uj	n	2	1.6	0.41	VOCs	CC
280-90637-1	L12mw-243-110716-GW	280-90637-4	Water	Chloroethane	75-00-3	µg/L	2	u q	uj	n	2	1.6	0.41	VOCs	CC
280-90637-1	L12mw-187-110716-GW	280-90637-5	Water	Beryllium	7440-41-7	µg/L	1	u	u	n	1	0.3	0.08	Metals	B
280-90637-1	L12mw-187-110716-GW	280-90637-5	Water	Iron	7439-89-6	µg/L	100	j	u	n	100	85	22	Metals	B
280-90637-1	L12mw-187-110716-GW	280-90637-5	Water	Silver	7440-22-4	µg/L	5	j	u	n	5	0.1	0.033	Metals	B
280-90637-1	L12mw-187-110716-GW	280-90637-5	Water	Sodium	7440-23-5	µg/L	40000	v	j	y	5000	350	92	Metals	CC
280-90637-1	L12mw-187-110716-GW	280-90637-5	Water	Acenaphthene	83-32-9	µg/L	0.1	u q	uj	n	0.1	1	0.0043	PAHs	S
280-90637-1	L12mw-187-110716-GW	280-90637-5	Water	Acenaphthylene	208-96-8	µg/L	0.1	u q	uj	n	0.1	1	0.0052	PAHs	S
280-90637-1	L12mw-187-110716-GW	280-90637-5	Water	Anthracene	120-12-7	µg/L	0.1	u q	uj	n	0.1	1	0.0057	PAHs	S
280-90637-1	L12mw-187-110716-GW	280-90637-5	Water	Fluoranthene	206-44-0	µg/L	0.1	u q	uj	n	0.1	0.5	0.0049	PAHs	S
280-90637-1	L12mw-187-110716-GW	280-90637-5	Water	Fluorene	86-73-7	µg/L	0.1	u q	uj	n	0.1	1	0.0056	PAHs	S
280-90637-1	L12mw-187-110716-GW	280-90637-5	Water	Phenanthrene	85-01-8	µg/L	0.1	u q	uj	n	0.1	1	0.0095	PAHs	S
280-90637-1	L12mw-187-110716-GW	280-90637-5	Water	Pyrene	129-00-0	µg/L	0.1	u q	uj	n	0.1	1	0.0062	PAHs	S
280-90637-1	L12mw-187-110716-GW	280-90637-5	Water	Chloroethane	75-00-3	µg/L	2	u q	uj	n	2	1.6	0.41	VOCs	CC
280-90637-1	L12mw-154-110716-GW	280-90637-6	Water	Sodium	7440-23-5	µg/L	28000	v	j	y	5000	350	92	Metals	CC
280-90637-1	L12mw-154-110716-GW	280-90637-6	Water	Naphthalene	91-20-3	µg/L	0.1	u q	uj	n	0.1	1	0.0083	PAHs	S
280-90637-1	L12mw-154-110716-GW	280-90637-6	Water	Chloroethane	75-00-3	µg/L	2	u q	uj	n	2	1.6	0.41	VOCs	CC
280-90637-1	LL8mw-500-110716-GW	280-90637-7	Water	Sodium	7440-23-5	µg/L	20000	v	j	y	5000	350	92	Metals	CC
280-90637-1	LL8mw-001-110716-GW	280-90637-8	Water	Sodium	7440-23-5	µg/L	21000	v	j	y	5000	350	92	Metals	CC
280-90637-1	TRIP BLANK	280-90637-9	Water	Chloroethane	75-00-3	µg/L	2	u q	uj	n	2	1.6	0.41	VOCs	CC
280-90637-1	L12mw-186-110716-GW	280-90637-10	Water	1,3,5-Trinitrobenzene	99-35-4	µg/L	1.1	u q	uj	n	1.1	0.4	0.22	Explosives and Propellants	S
280-90637-1	L12mw-186-110716-GW	280-90637-10	Water	1,3-Dinitrobenzene	99-65-0	µg/L	0.44	u q	uj	n	0.44	0.2	0.098	Explosives and Propellants	S
280-90637-1	L12mw-186-110716-GW	280-90637-10	Water	2,4,6-Trinitrotoluene	118-96-7	µg/L	0.44	u q	uj	n	0.44	0.2	0.08	Explosives and Propellants	S
280-90637-1	L12mw-186-110716-GW	280-90637-10	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.44	u q	uj	n	0.44	4.4	0.092	Explosives and Propellants	S
280-90637-1	L12mw-186-110716-GW	280-90637-10	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.22	u q	uj	n	0.22	4.4	0.071	Explosives and Propellants	S
280-90637-1	L12mw-186-110716-GW	280-90637-10	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.22	u q	uj	n	0.22	0.12	0.056	Explosives and Propellants	S
280-90637-1	L12mw-186-110716-GW	280-90637-10	Water	2-Nitrotoluene	88-72-2	µg/L	0.44	u q	uj	n	0.44	0.2	0.094	Explosives and Propellants	S
280-90637-1	L12mw-186-110716-GW	280-90637-10	Water	3-Nitrotoluene	99-08-1	µg/L	0.44	u q	uj	n	0.44	0.2	0.092	Explosives and Propellants	S
280-90637-1	L12mw-186-110716-GW	280-90637-10	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.22	u q	uj	n	0.22	0.12	0.064	Explosives and Propellants	S
280-90637-1	L12mw-186-110716-GW	280-90637-10	Water	4-Nitrotoluene	99-99-0	µg/L	1.1	u q	uj	n	1.1	0.4	0.22	Explosives and Propellants	S
280-90637-1	L12mw-186-110716-GW	280-90637-10	Water	HMX	2691-41-0	µg/L	0.44	u q	uj	n	0.44	0.2	0.097	Explosives and Propellants	S
280-90637-1	L12mw-186-110716-GW	280-90637-10	Water	Nitrobenzene	98-95-3	µg/L	0.44	u q	uj	n	0.44	2	0.1	Explosives and Propellants	S
280-90637-1	L12mw-186-110716-GW	280-90637-10	Water	Nitroglycerin	55-63-0	µg/L	3.3	u q	uj	n	3.3	2	1	Explosives and Propellants	S

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90637-1	L12mw-186-110716-GW	280-90637-10	Water	PETN	78-11-5	µg/L	2.2	u q	uj	n	2.2	1.2	0.46	Explosives and Propellants	S
280-90637-1	L12mw-186-110716-GW	280-90637-10	Water	RDX	121-82-4	µg/L	0.22	u q	uj	n	0.22	0.12	0.058	Explosives and Propellants	S
280-90637-1	L12mw-186-110716-GW	280-90637-10	Water	Tetryl	479-45-8	µg/L	0.26	u q	uj	n	0.26	0.2	0.087	Explosives and Propellants	S
280-90637-1	L12mw-186-110716-GW	280-90637-10	Water	Aldrin	309-00-2	µg/L	0.054	u q	uj	n	0.054	0.02	0.0026	Pesticides	L
280-90637-1	L12mw-186-110716-GW	280-90637-10	Water	Heptachlor	76-44-8	µg/L	0.054	u q	uj	n	0.054	0.05	0.011	Pesticides	L
280-90637-1	L12mw-186-110716-GW	280-90637-10	Water	Chloroethane	75-00-3	µg/L	2	u q	uj	n	2	1.6	0.41	VOCs	CC

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90705-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Project Chemist and Secondary QC Review was performed by the Validation Chemist. Signatures indicate the report is approved for release.



Heather A. Miner

2017.01.19 11:28:41 -07'00'

Heather Miner, Project Chemist, TEC-WESTON JV

Date



Travis Withers

2017.01.19 11:58:20 -07'00'

Travis Withers, Validation Chemist, TEC-WESTON JV

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90705-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polychlorinated Biphenyls (PCBs)	8082A	Denver, CO
Polycyclic Aromatic Hydrocarbons (PAHs)	8270D SIM	Denver, CO
Organochlorine Pesticides	8081B	Denver, CO
Explosives	8330B	Denver, CO
Metals	6010C/6020A/7470A	Denver, CO
Hexavalent Chromium	353.2	Denver, CO
Total Cyanide	9012B	Denver, CO
Anions	9056A	Denver, CO
Arsenic	6020A	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R)

should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	SVOCs (phthalates)	PAHs	Pesticides	PCBs	Explosives	Metals	Arsenic	Cr(VI)	Cyanide
L12mw-185-110816-GW	280-90705-1	11/07/16	Groundwater	MS/MSD	✓		✓		✓	✓		✓		✓
L12mw-500-110816-GW	280-90705-2	11/07/16	Groundwater	Field Duplicate	✓		✓		✓	✓		✓		✓
L12mw-247-110816-GW	280-90705-3	11/08/16	Groundwater			✓		✓	✓	✓	✓		✓	✓
TRIP BLANK	280-90705-4	10/07/16	Water	Trip Blank	✓									

Notes: Sample L12mw-500-110816-GW is a field duplicate of parent sample L12mw-185-110816-GW.

Samples were also analyzed for natural attenuation parameters; these parameters were not validated.

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
J	CC	Estimated detection; continuing calibration verification did not meet acceptance criteria.
UJ	L	Estimated non-detection; the associated LCS/LCSD recovery and/or RPD were outside QC limits.
UJ	M	Estimated non-detection; The associated MS/MSD recoveries and/or RPD were outside QC limits.
UJ	S	Estimated non-detection; the surrogate recovery was outside QC limits.
U	B	Not detected; target analyte was detected in the method or calibration blank.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 9, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

A trip blank was received; however, it was not listed on the chain-of-custody. The trip blank was logged in per the information on the sample labels and analyzed for VOCs.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- Instrument tuning
- Initial calibration
- Initial calibration verification
- Internal standard area counts
- Closing calibration verification
- Trip blank

All analytical or quality parameters requiring further discussion for Method 8260B are described in the sections below.

1.4.1.1 Continuing Calibration Verification

Chloroethane (21.2%D) was recovered outside of the acceptance criteria ($\pm 20\%$ D) in CCV 280-352221/2. All associated sample results were qualified as non-detect; therefore, no qualification was necessary.

1.4.1.2 Matrix Spike/Matrix Spike Duplicates

An MS/MSD was performed on sample L12mw-185-110816-GW. All MS/MSD recoveries and RPDs were within control limits with the exception of the exceedances presented in the following table:

Parent Sample	Analyte	MS %R	MSD %R	%R QC Limits	RPD	RPD Limits	Assigned Flags
	1,1,1-Trichloroethane	120	133	74-131	10	20	None

L12mw- 185-110816- GW	1,1,2-Trichloroethane	116	121	80-119	2	20	None
	1,1-Dichloroethane	135	141	77-125	4	20	Detections only
	1,2-Dichloroethane	135	137	73-128	2	20	Detections only
	1,2-Dichloroethene, total	124	131	79-121	5	20	Detections only
	1,2-Dichloropropane	131	134	78-122	3	20	Detections only
	Benzene	129	135	79-120	4	20	Detections only
	Bromochloromethane	123	124	78-123	1	20	None
	Bromomethane	58	74	53-141	24	20	Detections only
	Chlorobenzene	128	132	82-118	3	20	Detections only
	Chloroethane	60	81	60-138	30	20	Detections only
	Chloroform	130	133	79-124	2	20	Detections only
	Ethylbenzene	124	131	79-121	6	20	Detections only
	Methylene chloride	120	125	74-124	4	20	None
	Styrene	121	125	78-123	3	20	None
	Tetrachloroethene	118	131	74-129	11	20	None
	Toluene	126	134	80-121	6	20	Detections only
	Trichloroethene	121	131	79-123	8	20	None
	Vinyl chloride	58	80	58-137	32	20	Detections only
Total xylenes	124	132	79-121	7	20	Detections only	

%R = percent recovery

Bolded values are outside control limits.

The MSD recoveries were outside QC limits for 1,1,1-trichloroethane, 1,1,2-trichloroethane, bromochloromethane, methylene chloride, styrene, tetrachloroethene, and trichloroethene. Because the MS recoveries and RPDs were within acceptance criteria, no qualifiers were assigned.

The MS/MSD recoveries were above QC limits for 1,1-dichloroethane, 1,2-dichloroethane, total-1,2-dichloroethane, 1,2-dichloropropane, benzene, chlorobenzene, chloroform, ethylbenzene, toluene, and total xylenes. None of these analytes were detected in their associated parent sample; therefore, no qualifications were required.

The RPDs for bromomethane, chloroethane, and vinyl chloride exceeded the RPD limit. None of these analytes were detected in their associated parent sample; therefore, no qualifications were required.

1.4.1.3 Field Duplicates

One field duplicate (L12mw-500-110816-GW), associated with parent sample L12mw-185-110816-GW, was analyzed for VOCs. No detections were reported in either the parent or duplicate sample.

1.4.2 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS recoveries
- Instrument tuning
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Internal standard area counts

No analytical or quality parameters required further discussion for Method 8270D.

1.4.1 Polycyclic Aromatic Compounds by Method 8270D SIM

The following parameters were evaluated and met the required criteria:

- Holding time
- LODs and LOQs
- Method blank
- LCS recoveries
- Instrument tuning
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Internal standard area counts

All analytical or quality parameters requiring further discussion for Method 8270D SIM are described in the sections below.

1.4.1.1 Surrogates

Surrogates 2-fluorobiphenyl (46%) and nitrobenzene-d5 (42%) were recovered below QC limits (53-106% and 55-111%, respectively) in sample L12mw-185-110816-GW. The sample was re-

extracted and reanalyzed outside of holding time with similar results. Both sets of data were reported. Whenever two sets of data are reported for the same sample and analytes, the reviewer selects the most technically defensible results to retain in the final data set. The other results are considered as not preferred and are not included in the final data set. In this case, the original sample results will be retained and the re-extracted sample results will be not included in the final data set. All analytes associated with the surrogate outliers are qualified as estimated (UJ S) in the original data set. It should be noted that all surrogate recoveries were within QC limits in the field duplicate performed on this sample.

1.4.1.2 Matrix Spike/Matrix Spike Duplicate

An MS/MSD was performed on sample L12mw-185-110816-GW. The MS/MSD was inadvertently not spiked during the extraction process. As a result, the parent samples and the MS/MSD were re-extracted outside of holding time. All MS/MSD recoveries and RPDs were within control limits. Based on reviewer's professional judgment, no qualifiers were assigned.

1.4.1.3 Field Duplicates

One field duplicate (L12mw-500-110816-GW), associated with parent sample L12mw-185-110816-GW, was analyzed for PAHs. No detections were reported in either the parent or duplicate sample.

1.4.2 Organochlorine Pesticides by Method 8081B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Endrin/DDT breakdown

All analytical or quality parameters requiring further discussion for Method 8081B are described in the sections below.

1.4.2.1 Laboratory Control Sample

Several analytes were recovered below QC limits in the LCS. The table below presents the LCS exceedances:

LCS/LCSD	Analyte	LCS %R	%R QC Limits	Assigned Flags
280-351386/2-A	Aldrin	38	45-134	J/UJ L
	Heptachlor	49	54-130	J/UJ L

%R = percent recovery

Bolded values are outside control limits.

Aldrin and heptachlor were qualified as estimated (UJ L) in the associated sample.

1.4.3 Polychlorinated Biphenyls by Method 8082A

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- LCS recoveries
- MS/MSD recoveries and RPDs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification

All analytical or quality parameters requiring further discussion for Method 8082A are described in the sections below.

1.4.3.1 Field Duplicates

One field duplicate (L12mw-500-110816-GW), associated with parent sample L12mw-185-110816-GW, was analyzed for PCBs. No detections were reported in either the parent or duplicate sample.

1.4.4 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification

All analytical or quality parameters requiring further discussion for Method 8330B are described in the sections below.

1.4.4.1 Method Blank

RDX (0.132 µg/L) was detected in the method blank at a concentration below the LOQ (0.4 µg/L). RDX was not detected in any associated sample. No qualification was necessary.

1.4.4.2 Laboratory Control Samples

Two LCSs were performed. 2-Nitrotoluene (69%) was recovered below the QC limits (70-127%) in the LCS associated with sample L12mw-247-110816-GW. The associated 2-nitrotoluene result was qualified as estimated (UJ L).

1.4.4.3 Matrix Spike/Matrix Spike Duplicates

An MS/MSD was performed on sample L12mw-185-110816-GW. All MS/MSD recoveries and RPDs were within control limits with the exception of the exceedances presented in the following table:

Parent Sample	Analyte	MS %R	MSD %R	%R QC Limits	RPD	RPD Limits	Assigned Flags
L12mw-185-110816-GW	2-Amino-4,6-dinitrotoluene	72	80	79-120	4	20	None
	4-Amino-2,6-dinitrotoluene	67	74	76-125	4	20	UJ M
	2,4-Dinitrotoluene	76	85	78-120	5	20	None
	2,6-Dinitrotoluene	75	84	77-127	5	20	None
	2-Nitrotoluene	63	75	70-127	11	20	None
	3-Nitrotoluene	63	79	73-125	17	20	None
	4-Nitrotoluene	65	77	71-127	10	20	None

%R = percent recovery

Bolded values are outside control limits.

The MS recoveries were outside QC limits for 2-amino-4,6-dinitrotoluene, 2,4-dinitrotoluene, 2,6-dinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, and 4-nitrotoluene. Because the MSD and RPD were within QC limits, no qualifications were deemed necessary.

The MS/MSD recoveries were outside QC limits for 4-amino-2,6-dinitrotoluene; this analyte in the associated parent sample is qualified as estimated (UJ M).

1.4.4.4 Field Duplicates

One field duplicate (L12mw-500-110816-GW), associated with parent sample L12mw-185-110816-GW, was analyzed for explosives. No detections were reported in either the parent or duplicate sample.

1.4.5 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- LCS recoveries
- MS/MSD recoveries and RPDs
- Interference check solutions
- Instrument tuning

All analytical or quality parameters requiring further discussion for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.5.1 Method Blanks

Iron (22.6 µg/L) and sodium (223 µg/L) were detected in the method blank at concentrations below their respective LOQs (100 µg/L and 5000 µg/L). Iron and sodium detected at concentrations greater than the LOQ; therefore, no qualification was necessary.

1.4.5.2 Calibration Blanks

Several analytes were detected in the calibration blanks bracketing sample L12mw-247-110816-GW. The following table presents the initial and continuing calibration blank detections:

Calibration Blank	Analyte	Blank Detection (µg/L)	LOQ (µg/L)	Assigned Flags	Samples Qualified
CCB 280-352990/75	Sodium	243 J	5000	None	None
CCB 280-352990/89	Sodium	132 J	5000	None	None
ICB 280-352414/11	Antimony	0.871	6	None	None
CCB 280-352414/119	Beryllium	0.092 J	1	U B	L12mw-247-110816-GW

Calibration Blank	Analyte	Blank Detection (µg/L)	LOQ (µg/L)	Assigned Flags	Samples Qualified
	Silver	0.038 J	5	None	None
	Thallium	0.075 J	1	U B	L12mw-247-110816-GW
CCB 280-352414/131	Beryllium	0.097 J	1	U B	L12mw-247-110816-GW
	Thallium	0.056 J	1	U B	L12mw-247-110816-GW

CCB = continuing calibration blank

ICB = initial calibration blank

Detections less than the LOQ in associated samples are qualified as not detected at the LOQ (U B).

1.4.5.3 Initial/Continuing Calibration Verification

Sodium (124% and 123%) was recovered above the QC limits (80-120%) in the low level CCVs 280-352990/76 and 280-352990/90 associated with sample L12mw-247-110816-GW. Sodium was detected in the associated sample and was qualified as estimated (J CC).

1.4.5.4 Field Duplicates

One field duplicate (L12mw-500-110816-GW), associated with parent sample L12mw-185-110816-GW, was collected and analyzed for total arsenic. For detections greater than 5x the LOQ in both samples, an RPD was calculated. For detections less than 5x the LOQ, the difference in values was compared to ± the LOQ. The following table shows the detections in the parent and field duplicate sample:

Primary/Duplicate Sample ID	Analyte	Primary Sample Result (µg/L)	Field Duplicate Result (µg/L)	LOQ (µg/L)	RPD (%)	RPD Limit (%) ¹
L12mw-185-110816-GW/ L12mw-500-110816-GW	Arsenic	0.51 J	0.71 J	5	N/A	± LOQ

¹ The RPD limit is 20% for detections greater than 5x the LOQ; ± the LOQ for detections less than 5x the LOQ.

J Laboratory flag indicating the result is less than the LOQ and is estimated.

N/A Not applicable

All calculated RPDs and difference in detections met criteria. No validation flags were assigned.

1.4.6 Hexavalent Chromium by Method 7196A

The following parameters were evaluated and met the required criteria:

- Holding time
- LODs and LOQs
- Method blank
- LCS/LCSD recoveries and RPD
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

All analytical or quality parameters requiring further discussion for Method 7196A are described in the sections below.

1.4.6.1 Matrix Spike/Matrix Spike Duplicates

An MS/MSD was performed on sample L12mw-247-110819-GW. The following table presents the MS/MSD recoveries outside control limits:

Parent Sample	Analyte	MS %R	MSD %R	%R QC Limits	RPD	RPD Limits	Assigned Flags
L12mw-247-110816-GW	Hexavalent chromium	86	81	90-110	6	20	UJ M

%R = percent recovery

Bolded values are outside control limits.

The MS/MSD recoveries were outside QC limits for hexavalent chromium; this analyte in the associated parent sample is qualified as estimated (UJ M).

1.4.7 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria:

- Holding times
- Method blank
- LCS recoveries
- MS/MSD recoveries and RPD
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

All analytical or quality parameters requiring further discussion for Method 9012B are described in the sections below.

1.4.7.1 Dilutions

Samples LL12mw-185-110816-GW, L12mw-500-110816-GW, and L12mw-247-110816-GW were analyzed at 10x, 10, and 4x dilutions, respectively, due to matrix interference. LODs and LOQs were elevated. There is no impact to the usability of the data because cyanide was detected in all samples.

1.4.7.2 Field Duplicates

One field duplicate (L12mw-500-110816-GW), associated with parent sample L12mw-185-110816-GW, was collected and analyzed for total cyanide. For detections greater than 5x the LOQ in both samples, an RPD was calculated. For detections less than 5x the LOQ, the difference in values was compared to ± the LOQ. The following table shows the detections in the parent and field duplicate sample:

Primary/Duplicate Sample ID	Analyte	Primary Sample Result (µg/L)	Field Duplicate Result (µg/L)	LOQ (µg/L)	RPD (%)	RPD Limit (%)¹
L12mw-185-110816-GW/ L12mw-500-110816-GW	Cyanide	16	11	50	N/A	± LOQ

¹ The RPD limit is 20% for detections greater than 5x the LOQ; ± the LOQ for detections less than 5x the LOQ.

J Laboratory flag indicating the result is less than the LOQ and is estimated.

N/A Not applicable

All calculated RPDs and difference in detections met criteria. No validation flags were assigned.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	Result	Units	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Group	Reason Code
280-90705-1	L12mw-185-110816-GW	280-90705-1	Water	Acenaphthene	0.11	µg/L	u q	uj	n	0.11	0.041	0.0048	PAHs	S
280-90705-1	L12mw-185-110816-GW	280-90705-1	Water	Acenaphthylene	0.11	µg/L	u q	uj	n	0.11	0.041	0.0059	PAHs	S
280-90705-1	L12mw-185-110816-GW	280-90705-1	Water	Anthracene	0.11	µg/L	u q	uj	n	0.11	0.041	0.0064	PAHs	S
280-90705-1	L12mw-185-110816-GW	280-90705-1	Water	Benzof(g,h,i)perylene	0.11	µg/L	u q	uj	n	0.11	0.012	0.0071	PAHs	S
280-90705-1	L12mw-185-110816-GW	280-90705-1	Water	Fluoranthene	0.11	µg/L	u q	uj	n	0.11	0.012	0.0055	PAHs	S
280-90705-1	L12mw-185-110816-GW	280-90705-1	Water	Fluorene	0.11	µg/L	u q	uj	n	0.11	0.041	0.0063	PAHs	S
280-90705-1	L12mw-185-110816-GW	280-90705-1	Water	Naphthalene	0.11	µg/L	u q	uj	n	0.11	0.012	0.0092	PAHs	S
280-90705-1	L12mw-185-110816-GW	280-90705-1	Water	Phenanthrene	0.11	µg/L	u q	uj	n	0.11	0.02	0.011	PAHs	S
280-90705-1	L12mw-185-110816-GW	280-90705-1	Water	Pyrene	0.11	µg/L	u q	uj	n	0.11	0.02	0.007	PAHs	S
280-90705-1	L12mw-185-110816-GW	280-90705-1	Water	4-Amino-2,6-dinitrotoluene	0.21	µg/L	u j	uj	n	0.21	0.66	0.061	Explosives and Propellants	M
280-90705-1	L12mw-247-110816-GW	280-90705-3	Water	Sodium	23000	µg/L	v	j	y	5000	350	92	Metals	CC
280-90705-1	L12mw-247-110816-GW	280-90705-3	Water	Beryllium	1	µg/L	j	u	n	1	0.30	0.08	Metals	B
280-90705-1	L12mw-247-110816-GW	280-90705-3	Water	Thallium	1	µg/L	j	u	n	1	0.20	0.05	Metals	B
280-90705-1	L12mw-247-110816-GW	280-90705-3	Water	Chromium, hexavalent	20	µg/L	u j	uj	n	20	0.000004	4	Hexavalent Chromium	M
280-90705-1	L12mw-247-110816-GW	280-90705-3	Water	Aldrin	0.051	µg/L	u q	uj	n	0.051	0.021	0.0024	Pesticides	L
280-90705-1	L12mw-247-110816-GW	280-90705-3	Water	Heptachlor	0.051	µg/L	u q	uj	n	0.051	0.051	0.01	Pesticides	L
280-90705-1	L12mw-247-110816-GW	280-90705-3	Water	2-Nitrotoluene	0.4	µg/L	u q	uj	n	0.4	1.1	0.086	Explosives and Propellants	L

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90731-1

Prepared For:



National Guard Bureau
NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture
2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by the Project Chemist. Signatures indicate the report is approved for release.



Erica Fisher, Validator, TEC-WESTON JV

02/09/2017

Date



Pete Chapman, Project Chemist, TEC-WESTON JV

2/7/17

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90731-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Polycyclic Aromatic Hydrocarbons (PAHs)	8270D SIM	Denver, CO
Polychlorinated Biphenyls (PCBs)	8082A	Denver, CO
Explosives	8330B	Denver, CO
Metals	6010C/6020A/7470A	Denver, CO
Alkalinity	2320B	Denver, CO
Total Cyanide	9012B	Denver, CO
Sulfide	9034	Denver, CO
Anions	9056A	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	PAHs	PCBs	Explosives	Metals	Alkalinity	Cyanide
BKGmw-004-110816-GW	280-90731-1	11/08/16	Groundwater		✓	✓	✓	✓	✓		✓
BKGmw-008-110816-GW	280-90731-2	11/08/16	Groundwater	MS/MSD	✓	✓	✓	✓	✓	✓	✓
BKGmw-500-110816-GW	280-90731-3	11/08/16	Groundwater	Field Duplicate ¹	✓	✓	✓	✓	✓	✓	✓
BKGmw-018-110816-GW	280-90731-4	11/08/16	Groundwater						✓	✓	
BKGmw-006-110816-GW	280-90731-5	11/08/16	Groundwater						✓	✓	
TRIP BLANK	280-90731-6	11/08/16	Groundwater		✓						

1. Sample BKGmw-500-110816-GW is the field duplicate of parent sample BKGmw-008-110816-GW

Note: Samples were also analyzed for natural attenuation parameters; these parameters were not validated.

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
J	CC	Estimated detection; the continuing calibration verification did not meet QC criteria.
UJ	L	Estimated non-detection; the associated LCS/LCSD recovery and/or RPD were outside QC limits.
U	B	Not detected; target analyte was detected in the method or calibration blank.
J	D	Estimated detection; RPD or difference in values between the parent and duplicate sample exceeds the QC criteria.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 9, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

The laboratory noted a sample time discrepancy for sample BKGmw-008-110816 between the COC and the sample containers. The sample time on the COC was listed as 1140, whilst the sample containers listed 1120. The laboratory logged the samples as per the COC.

A trip blank was submitted for analysis with the samples and was not listed on the COC. The laboratory submitted the samples for VOC analysis.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- MS/MSD recoveries and RPDs
- LODs and LOQs
- Instrument tuning
- Internal standard area counts
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Trip blank

All analytical or quality issues for Method 8260B are described in the sections below.

1.4.1.1 Method Blanks

Methylene chloride was detected in method blank MB 280-352586/6 (0.999 µg/L) associated with samples BKGmw-004-110816, BKGmw-008-110816 and BKGmw-500-110816 at a concentration below the LOQ (5.0 µg/L). All associated sample results were non-detect for methylene chloride; therefore, no qualification was necessary.

1.4.1.2 Laboratory Control Samples

Methylene chloride recovered above the control limits (74-124%) in laboratory control sample LCS 280-352586/4 (136%) associated with samples BKGmw-004-110816, BKGmw-008-110816

and BKGmw-500-110816. All associated sample results were non-detect for methylene chloride; therefore, no qualification was necessary.

1.4.2 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Method blank
- MS/MSD recoveries and RPDs
- LCS recoveries
- Field duplicate
- Instrument tuning
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Internal standard area counts
- Equipment blank

No analytical or quality parameters were found for Method 8270D.

1.4.3 Polycyclic Aromatic Hydrocarbons by Method 8270D SIM

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Method blank
- MS/MSD recoveries and RPDs
- LCS recoveries
- Instrument tuning
- Internal standards
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification

No analytical or quality issues were found for Method 8270D SIM.

1.4.4 Polychlorinated Biphenyls by Method 8082A

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Method blank
- MS/MSD recoveries and RPDs
- LCS recoveries
- Field duplicate
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Second column confirmation

All analytical or quality issues requiring further discussion for Method 8082A are described in the sections below.

1.4.4.1 Sample Preparation

The following samples underwent a sulfuric acid clean-up (EPA 3665A) to reduce matrix interferences: BKGmw-004-110816-GW, BKGmw-008-110816-GW, BKGmw-500-110816-GW.

1.4.5 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Method blank
- MS/MSD recoveries and RPDs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Second column confirmation
- Field duplicate

All analytical or quality issues for Method 8330B are described in the sections below.

1.4.5.1 Laboratory Control Sample

2-Nitrotoluene (69%) recovered below the acceptance limits (70-127%) in the LCS. All sample results associated with the exceedance were qualified as estimated (UJ L).

1.4.6 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- LCS recoveries
- MS/MSD recoveries and RPDs
- Lower control interference check standard
- Contract required detection limit standard
- Instrument tuning
- Field duplicate

All analytical or quality issues for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.6.1 Method Blanks

Iron (22.6 µg/L) and sodium (223 µg/L) were detected in method blank MB 280-351982/1-A at concentrations below their respective LOQs (100 µg/L, 5000 µg/L). The following table shows the sample concentrations and assigned validation flags.

Sample ID	Iron Concentration (µg/L)	Assigned Flags	Sodium Concentration (µg/L)	Assigned Flags
BKGmw-004-110816-GW	33 (J)	U B	7700	None
BKGmw-008-110816-GW	42 (J)	U B	6200	None
BKGmw-500-110816-GW	85 (U)	None	6300	None
BKGmw-018-110816-GW	68 (J)	U B	2200	U B
BKGmw-006-110816-GW	870	None	57000	None

J Laboratory flag indicating the result is less than the LOQ and is estimated.

U Laboratory flag indicating the result is not detected

Detections less than the LOQ in associated samples are qualified as not detected at the LOQ (U B). Non-detections and detections greater than the LOQ in associated samples are not qualified.

1.4.6.2 Calibration Blanks

Several analytes were detected in the calibration blanks bracketing the samples. The following table presents the initial and continuing calibration blank detections:

Calibration Blank	Associated Samples	Analyte	Blank Detection (µg/L)	LOQ (µg/L)	Assigned Flags	Samples Qualified
CCB 280-352990/75	BKGmw-004-110816-GW	Sodium	243	5000	N/A	None
CCB 280-352990/89	BKGmw-004-110816-GW BKGmw-008-110816-GW	Sodium	132	5000	N/A	None
CCB 280-352990/98	BKGmw-008-110816-GW BKGmw-500-110816-GW BKGmw-018-110816-GW BKGmw-006-110816-GW	Sodium	141	5000	U B	BKGmw-018-110816-GW
CCB 280-352990/110	BKGmw-500-110816-GW BKGmw-018-110816-GW BKGmw-006-110816-GW	Sodium	130	5000	U B	BKGmw-018-110816-GW

ICB 280-352617/7	BKGmw-004-110816-GW BKGmw-008-110816-GW BKGmw-500-110816-GW BKGmw-018-110816-GW BKGmw-006-110816-GW	Antimony	0.85	2	U B	BKGmw-004-110816-GW
		Thallium	0.053	1	U B	BKGmw-004-110816-GW
CCB 280-352617/35	BKGmw-004-110816-GW BKGmw-008-110816-GW	Manganese	0.337	3.5	U B	BKGmw-004-110816-GW BKGmw-008-110816-GW
		Silver	0.04	5	N/A	None
		Thallium	0.065	1	U B	BKGmw-004-110816-GW
		Zinc	3.45	8	U B	BKGmw-004-110816-GW BKGmw-008-110816-GW
CCB 280-352617/46	BKGmw-004-110816-GW BKGmw-008-110816-GW BKGmw-500-110816-GW BKGmw-018-110816-GW BKGmw-006-110816-GW	Antimony	0.501	2	U B	BKGmw-004-110816-GW
		Beryllium	0.089	1	N/A	None
		Silver	0.049	5	N/A	None
		Thallium	0.125	1	U B	BKGmw-004-110816-GW
		Zinc	3.49	10	U B	BKGmw-004-110816-GW BKGmw-008-110816-GW BKGmw-500-110816-GW BKGmw-018-110816-GW
CCB 280-352617/57	BKGmw-500-110816-GW BKGmw-018-110816-GW BKGmw-006-110816-GW	Zinc	3.64	10	U B	BKGmw-500-110816-GW

CCB = continuing calibration blank

ICB = initial calibration blank

Detections less than the LOQ in associated samples are qualified as not detected at the LOQ (U B).

1.4.6.3 Initial/Continuing Calibration Verification

Several calibration verification samples had analyte recoveries above the control limits. The following table presents the calibration samples and analytes that recovered above the acceptance limits:

Calibration Sample	Associated Samples	Analyte	%R	QC Limits (%R)	Assigned Flags	Samples Qualified
ICVL 280-352617/8	BKGmw-004-110816-GW BKGmw-008-110816-GW BKGmw-500-110816-GW BKGmw-018-110816-GW BKGmw-006-110816-GW	Antimony	125	80-120	None	None
CCVL 280-352617/47	BKGmw-004-110816-GW BKGmw-008-110816-GW BKGmw-500-110816-GW BKGmw-018-110816-GW BKGmw-006-110816-GW	Manganese	122	80-120	J CC	BKGmw-500-110816-GW BKGmw-018-110816-GW BKGmw-006-110816-GW
CCVL 280-352990/90	BKGmw-004-110816-GW BKGmw-008-110816-GW	Sodium	123	80-120	J CC	BKGmw-004-110816-GW BKGmw-008-110816-GW
CCVL 280-352990/76	BKGmw-004-110816-GW	Sodium	124	80-120	J CC	BKGmw-004-110816-GW

ICVL = low-level initial calibration verification

CCVL = low level continuing calibration verification

No further qualification was applied to samples previously qualified as non-detect at the LOQ due to blank contamination (U B), or to samples with undetected analytes. The associated samples where analytes were detected have been qualified as estimated (J IC/CC).

1.4.6.4 Interference Check Solutions

Manganese (1.51 µg/L) was detected in the interference check standard A (ISC-A) at a concentration greater than the LOD (0.95 µg/L). The lab confirmed this element is a trace impurity and is consistent with concentrations found by the manufacturer of the ICS-A solution. Based on reviewer's professional judgment, no qualification was necessary.

1.4.7 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- LCS recoveries
- MS/MSD recoveries and RPDs
- Method blank
- Low and high level control samples
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank

All analytical or quality parameters requiring further discussion for Method 9012B are described in the sections below.

1.4.7.1 Field Duplicate

One field duplicate (BKGMw-500-110816-GW) was collected and analyzed for total cyanide. For detections greater than 5x the LOQ in both samples, an RPD was calculated. For detections less than 5x the LOQ, the difference in values was compared to \pm the LOQ. The following table shows the detections in parent and field duplicate samples:

Primary/Duplicate Sample ID	Analyte	Primary Sample Result ($\mu\text{g/L}$)	Field Duplicate Result ($\mu\text{g/L}$)	LOQ ($\mu\text{g/L}$)	Absolute Difference	QC Criteria ¹
BKGMw-008-110816-GW / BKGMw-500-110816-GW	Total cyanide	5.0 (U)	19	10	14.0	\pm LOQ

¹ The RPD limit is 20% for detections greater than 5x the LOQ; \pm the LOQ for detections less than 5x the LOQ.

J Laboratory flag indicating the result is less than the LOQ and is estimated.

U Laboratory flag indicating the result is not detected.

N/A Not applicable.

Bold font indicates an exceedance of the quality control criteria.

The difference in detections between the primary and duplicate sample exceeded the total cyanide LOQ. The associated samples have been qualified as estimated (J D).

1.4.1 Alkalinity by Method SM 2320B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs

- LCS recoveries
- Low and high level control samples
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank
- Duplicate sample

All analytical or quality parameters requiring further discussion for Method 9012B are described in the sections below.

1.4.1.1 Method Blanks

Alkalinity (2.13 mg/L) was detected in method blank sample MB 280-351192/31 at a concentration below the LOQ (5.0 mg/L). Alkalinity was also detected in the associated samples BKGmw-008-110816-GW, BKGmw-500-110816-GW, BKGmw-018-110816-GW and BKGmw-006-110816-GW above the LOQ. As the sample result was greater than 2x the blank detection, no qualification is necessary.

1.4.1.2 Calibration Blanks

Alkalinity was detected in calibration blanks CCB 280-351192/43 (2.23 mg/L) and CCB 280-351192/54 (2.07 mg/L) at concentrations below the LOQ (5.0 mg/L). Alkalinity was detected in associated samples BKGmw-008-110816-GW (68 mg/L), BKGmw-500-110816-GW (67 mg/L), BKGmw-018-110816-GW (110 mg/L) and BKGmw-006-110816-GW (190 mg/L) above the LOQ. As the sample results were greater than 2x the blank detection, no qualification is necessary.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90731-1	BKGMw-004-110816-GW	280-90731-1	Water	Iron	7439-89-6	µg/L	100	j	u	n	100	85	22	Metals	B
280-90731-1	BKGMw-004-110816-GW	280-90731-1	Water	Sodium	7440-23-5	µg/L	7700	v	j	y	5000	350	92	Metals	CC
280-90731-1	BKGMw-004-110816-GW	280-90731-1	Water	Antimony	7440-36-0	µg/L	6	j	u	n	6	1	0.4	Metals	B
280-90731-1	BKGMw-004-110816-GW	280-90731-1	Water	Manganese	7439-96-5	µg/L	3.5	j q	u	n	3.5	0.95	0.31	Metals	B
280-90731-1	BKGMw-004-110816-GW	280-90731-1	Water	Thallium	7440-28-0	µg/L	1	j	u	n	1	0.2	0.05	Metals	B
280-90731-1	BKGMw-004-110816-GW	280-90731-1	Water	Zinc	7440-66-6	µg/L	20	j	u	n	20	8	2	Metals	B
280-90731-1	BKGMw-004-110816-GW	280-90731-1	Water	2-Nitrotoluene	88-72-2	µg/L	0.21	u q	uj	n	0.42	0.21	0.089	Explosives and Propellants	L
280-90731-1	BKGMw-008-110816-GW	280-90731-2	Water	Iron	7439-89-6	µg/L	100	j	u	n	100	85	22	Metals	B
280-90731-1	BKGMw-008-110816-GW	280-90731-2	Water	Sodium	7440-23-5	µg/L	6200	v	j	y	5000	350	92	Metals	CC
280-90731-1	BKGMw-008-110816-GW	280-90731-2	Water	Manganese	7439-96-5	µg/L	3.5	j q	u	n	3.5	0.95	0.31	Metals	B
280-90731-1	BKGMw-008-110816-GW	280-90731-2	Water	Zinc	7440-66-6	µg/L	20	j	u	n	20	8	2	Metals	B
280-90731-1	BKGMw-008-110816-GW	280-90731-2	Water	2-Nitrotoluene	88-72-2	µg/L	0.21	u q	uj	n	0.41	0.21	0.088	Explosives and Propellants	L
280-90731-1	BKGMw-008-110816-GW	280-90731-2	Water	Total Cyanide	57-12-5	µg/L	5	u	j	n	10	5	2	Cyanide	D
280-90731-1	BKGMw-500-110816-GW	280-90731-3	Water	Manganese	7439-96-5	µg/L	1.2	j q	j	y	3.5	0.95	0.31	Metals	CC
280-90731-1	BKGMw-500-110816-GW	280-90731-3	Water	Zinc	7440-66-6	µg/L	20	j	u	n	20	8	2	Metals	B
280-90731-1	BKGMw-500-110816-GW	280-90731-3	Water	2-Nitrotoluene	88-72-2	µg/L	0.21	u q	uj	n	0.42	0.21	0.09	Explosives and Propellants	L
280-90731-1	BKGMw-500-110816-GW	280-90731-3	Water	Total Cyanide	57-12-5	µg/L	19	v	j	y	10	5	2	Cyanide	D
280-90731-1	BKGMw-018-110816-GW	280-90731-4	Water	Iron	7439-89-6	µg/L	100	j	u	n	100	85	22	Metals	B
280-90731-1	BKGMw-018-110816-GW	280-90731-4	Water	Sodium	7440-23-5	µg/L	5000	j	u	n	5000	350	92	Metals	B
280-90731-1	BKGMw-018-110816-GW	280-90731-4	Water	Manganese	7439-96-5	µg/L	22	q	j	y	3.5	0.95	0.31	Metals	CC
280-90731-1	BKGMw-006-110816-GW	280-90731-5	Water	Manganese	7439-96-5	µg/L	80	q	j	y	3.5	0.95	0.31	Metals	CC

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90735-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by the Project Chemist. Signatures indicate the report is approved for release.



Erica Fisher, Validator, TEC-WESTON JV

02/06/2017

Date



Pete Chapman, Project Chemist, TEC-WESTON JV

2/6/17

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90735-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polycyclic Aromatic Hydrocarbons (PAHs)	8270D SIM	Denver, CO
Organochlorine Pesticides	8081B	Denver, CO
Polychlorinated Biphenyls (PCBs)	8082A	Denver, CO
Explosives	8330B	Denver, CO
Total Cyanide	9012B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data*

Review (EPA 2014) and USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014). Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	SVOCs (phthalates, phenols, nitroaromatics)	PAHs	Pesticides	PCBs	Explosives	Cyanide
CBPmw-009-110816-GW	280-90735-1	11/08/16	Groundwater		✓	✓		✓	✓	✓
CBPmw-004-110816-GW	280-90735-2	11/08/16	Groundwater					✓	✓	✓
CBPmw-006-110816-GW	280-90735-3	11/08/16	Groundwater		✓	✓				✓
CBPmw-008-110816-GW	280-90735-4	11/08/16	Groundwater		✓	✓	✓	✓	✓	✓
CBPmw-002-110816-GW	280-90735-4	11/08/16	Groundwater					✓	✓	✓

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
R	H	Rejected result, result is not usable; the holding time was exceeded.
UJ	S	Estimated non-detection; surrogate outlier.
UJ	L	Estimated non-detection; LCS/LCSD percent recovery or RPD exceedance.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 9, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Method blank
- LCS recoveries
- Instrument tuning
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Internal standard area counts
- Equipment blank

No analytical or quality parameters requiring further discussion were identified for Method 8270D.

1.4.2 Polycyclic Aromatic Hydrocarbons by Method 8270D SIM

The following parameters were evaluated and met the required criteria:

- LODs and LOQs
- Method blank
- LCS/LCSD recoveries and RPDs
- Instrument tuning
- Internal standards
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification

All analytical or quality issues for Method 8270D SIM are described in the sections below.

1.4.2.1 Sample Preparation and Holding Time

Sample CBPmw-009-110816-GW was extracted 22 days past its 7 day extraction holding time. The laboratory noted that this was a result of laboratory oversight. All analytes in this sample were non-detect and therefore, due to the significant exceedance (>2x) of the extraction holding time, the results are rejected (R H).

The laboratory also advised that the sample container for CBPmw-009-110816-GW was not the appropriate size for analysis. Therefore a sub-sample was analyzed and the container did not undergo the required solvent rinse. However, no further qualifications are applied as the analytical data set for this sample are rejected as a result of the holding time exceedance.

1.4.2.2 Surrogate Recoveries

Surrogates nitrobenzene-d5 (37%) and 2-fluorobiphenyl (37%) recovered below the acceptance limits (53-111% and 53-106%, respectively) in sample CBPmw-008-110816-GW. All associated sample results were qualified as estimated (UJ S).

1.4.3 Organochlorine Pesticides by Method 8081B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Method blank
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Internal standards
- Endrin/DDT breakdown check
- Second column confirmation

All analytical or quality issues for Method 8081B are described in the sections below.

1.4.3.1 Laboratory Control Sample

Aldrin (38%) and heptachlor (49%) recovered below their respective acceptance limits (45-134%, and 54-130%) in LCS 280-351386/2-A. All associated sample results were qualified as estimated (UJ L).

1.4.4 Polychlorinated Biphenyls by Method 8082A

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Method blank
- LCS recoverie
- Field duplicate
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Second column confirmation

All analytical or quality issues for Method 8082A are described in the sections below.

1.4.4.1 Sample Preparation

The following samples underwent a sulfuric acid clean-up (EPA 3665A) to reduce matrix interferences: CBPmw-009-110816, CBPmw-004-110816, CBPmw-008-110816 and CBPmw-002-110816.

1.4.5 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blank
- Surrogate recoveries
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Second column confirmation

All analytical or quality issues for Method 8330B are described in the sections below.

1.4.5.1 Laboratory Control Sample

2-Nitrotoluene recovered below (69%) the acceptance limits (70-127%) in the LCS. The associated sample results were qualified as estimated (UJ L).

1.4.6 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blanks
- LCS recoveries
- Low and high level control samples
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

All analytical or quality issues for Method 9012B are described in the sections below.

1.4.6.1 Sample Preparation

Sample CBPmw-00816-GW was analyzed at a 2x dilution. Reporting limits were adjusted appropriately.

1.4.6.2 LODs and LOQs

The LOD (5 µg/L) and LOQ (10 µg/L) for sample CBPmw-00816-GW were adjusted (10 µg/L and 20 µg/L, respectively) to account for a 2x sample dilution. No qualification was necessary.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90735-1	CBPmw-009-110816-GW	280-90735-1	Water	2-Nitrotoluene	88-72-2	µg/L	0.21	u q	uj	n	0.41	0.21	0.089	Explosives and Propellants	L
280-90735-1	CBPmw-009-110816-GW	280-90735-1	Water	Acenaphthene	83-32-9	µg/L	0.04	u h	r	n	0.1	0.04	0.0042	PAHs	H
280-90735-1	CBPmw-009-110816-GW	280-90735-1	Water	Acenaphthylene	208-96-8	µg/L	0.04	u h	r	n	0.1	0.04	0.0051	PAHs	H
280-90735-1	CBPmw-009-110816-GW	280-90735-1	Water	Anthracene	120-12-7	µg/L	0.04	u h	r	n	0.1	0.04	0.0056	PAHs	H
280-90735-1	CBPmw-009-110816-GW	280-90735-1	Water	Benz(a)anthracene	56-55-3	µg/L	0.012	u h	r	n	0.1	0.012	0.0042	PAHs	H
280-90735-1	CBPmw-009-110816-GW	280-90735-1	Water	Benzo(a)pyrene	50-32-8	µg/L	0.012	u h	r	n	0.1	0.012	0.0069	PAHs	H
280-90735-1	CBPmw-009-110816-GW	280-90735-1	Water	Benzo(b)fluoranthene	205-99-2	µg/L	0.012	u h	r	n	0.1	0.012	0.0031	PAHs	H
280-90735-1	CBPmw-009-110816-GW	280-90735-1	Water	Benzo(g,h,i)perylene	191-24-2	µg/L	0.012	u h	r	n	0.1	0.012	0.0062	PAHs	H
280-90735-1	CBPmw-009-110816-GW	280-90735-1	Water	Benzo(k)fluoranthene	207-08-9	µg/L	0.012	u h	r	n	0.1	0.012	0.0063	PAHs	H
280-90735-1	CBPmw-009-110816-GW	280-90735-1	Water	Chrysene	218-01-9	µg/L	0.012	u h	r	n	0.1	0.012	0.0033	PAHs	H
280-90735-1	CBPmw-009-110816-GW	280-90735-1	Water	Dibenz(a,h)anthracene	53-70-3	µg/L	0.012	u h	r	n	0.1	0.012	0.0041	PAHs	H
280-90735-1	CBPmw-009-110816-GW	280-90735-1	Water	Fluoranthene	206-44-0	µg/L	0.012	u h	r	n	0.1	0.012	0.0048	PAHs	H
280-90735-1	CBPmw-009-110816-GW	280-90735-1	Water	Fluorene	86-73-7	µg/L	0.04	u h	r	n	0.1	0.04	0.0055	PAHs	H
280-90735-1	CBPmw-009-110816-GW	280-90735-1	Water	Indeno(1,2,3-cd)pyrene	193-39-5	µg/L	0.04	u h	r	n	0.1	0.04	0.0045	PAHs	H
280-90735-1	CBPmw-009-110816-GW	280-90735-1	Water	Naphthalene	91-20-3	µg/L	0.012	u h	r	n	0.1	0.012	0.008	PAHs	H
280-90735-1	CBPmw-009-110816-GW	280-90735-1	Water	Phenanthrene	85-01-8	µg/L	0.02	u h	r	n	0.1	0.02	0.0093	PAHs	H
280-90735-1	CBPmw-009-110816-GW	280-90735-1	Water	Pyrene	129-00-0	µg/L	0.02	u h	r	n	0.1	0.02	0.0061	PAHs	H
280-90735-1	CBPmw-004-110816-GW	280-90735-2	Water	2-Nitrotoluene	88-72-2	µg/L	0.22	u q	uj	n	0.44	0.22	0.095	Explosives and Propellants	L
280-90735-1	CBPmw-008-110816-GW	280-90735-4	Water	2-Nitrotoluene	88-72-2	µg/L	0.21	u q	uj	n	0.42	0.21	0.089	Explosives and Propellants	L
280-90735-1	CBPmw-008-110816-GW	280-90735-4	Water	Acenaphthene	83-32-9	µg/L	0.041	u q	uj	n	0.1	0.041	0.0043	PAHs	S
280-90735-1	CBPmw-008-110816-GW	280-90735-4	Water	Acenaphthylene	208-96-8	µg/L	0.041	u q	uj	n	0.1	0.041	0.0053	PAHs	S
280-90735-1	CBPmw-008-110816-GW	280-90735-4	Water	Anthracene	120-12-7	µg/L	0.041	u q	uj	n	0.1	0.041	0.0058	PAHs	S
280-90735-1	CBPmw-008-110816-GW	280-90735-4	Water	Fluoranthene	206-44-0	µg/L	0.012	u q	uj	n	0.1	0.012	0.005	PAHs	S
280-90735-1	CBPmw-008-110816-GW	280-90735-4	Water	Fluorene	86-73-7	µg/L	0.041	u q	uj	n	0.1	0.041	0.0057	PAHs	S
280-90735-1	CBPmw-008-110816-GW	280-90735-4	Water	Naphthalene	91-20-3	µg/L	0.012	u q	uj	n	0.1	0.012	0.0083	PAHs	S
280-90735-1	CBPmw-008-110816-GW	280-90735-4	Water	Phenanthrene	85-01-8	µg/L	0.021	u q	uj	n	0.1	0.021	0.0096	PAHs	S
280-90735-1	CBPmw-008-110816-GW	280-90735-4	Water	Pyrene	129-00-0	µg/L	0.021	u q	uj	n	0.1	0.021	0.0063	PAHs	S
280-90735-1	CBPmw-008-110816-GW	280-90735-4	Water	Aldrin	309-00-2	µg/L	0.021	u q	uj	n	0.05	0.021	0.0024	Pesticides	L
280-90735-1	CBPmw-008-110816-GW	280-90735-4	Water	Heptachlor	76-44-8	µg/L	0.05	u q	uj	n	0.05	0.05	0.01	Pesticides	L
280-90735-1	CBPmw-002-110816-GW	280-90735-5	Water	2-Nitrotoluene	88-72-2	µg/L	0.21	u q	uj	n	0.43	0.21	0.092	Explosives and Propellants	L

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90737-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Project Chemist and Secondary QC Review was performed by the Validation Chemist. Signatures indicate the report is approved for release.



Heather A. Miner

2017.01.19 11:28:02 -07'00'

Heather Miner, Project Chemist, TEC-WESTON JV

Date



Travis Withers

2017.01.19 11:59:02 -07'00'

Travis Withers, Validation Chemist, TEC-WESTON JV

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90737-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polycyclic Aromatic Hydrocarbons (PAHs)	8270D SIM	Denver, CO
Polychlorinated Biphenyls (PCBs)	8082A	Denver, CO
Explosives	8330B	Denver, CO
Alkalinity	2320B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA*

2014). Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	SVOCs (full list)	PAHs	PCBs	Explosives	Alkalinity
FWGmw-002-110816-GW	280-90737-1	11/08/16	Groundwater		✓	✓	✓	✓	✓
FWGmw-501-110816-GW	280-90737-2	11/08/16	Groundwater	Field Duplicate	✓	✓	✓	✓	✓

Notes: Sample FWGmw-501-110816-GW is a field duplicate of parent sample FWGmw-002-110816-GW.

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
UJ	L	Estimated non-detection; the associated LCS/LCSD recovery and/or RPD were outside QC limits.
UJ	S	Estimated non-detection; the surrogate recovery was outside QC limits.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 9, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- LCS recoveries
- Instrument tuning
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Internal standard recoveries

All analytical or quality parameters requiring further discussion for Method 8270D are described in the sections below.

1.4.1.1 Field Duplicates

One field duplicate (FWGmw-501-110816-GW), associated with parent sample FWGmw-002-110816-GW, was analyzed for SVOCs. No detections were reported in either the parent or duplicate sample.

1.4.1 Polycyclic Aromatic Compounds by Method 8270D SIM

The following parameters were evaluated and met the required criteria:

- Holding time
- LODs and LOQs
- Method blank
- LCS recoveries
- Instrument tuning
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Internal standard area counts

All analytical or quality parameters requiring further discussion for Method 8270D SIM are described in the sections below.

1.4.1.1 Surrogates

Surrogates 2-fluorobiphenyl (50%) and nitrobenzene-d5 (46%) were recovered below QC limits (53-106% and 55-111%, respectively) in sample FWGmw-002-110816-GW. All associated analytes in sample FWGmw-002-110816-GW were qualified as estimated (UJ S). It should be

noted that all surrogate recoveries were within QC limits in the field duplicate performed on this sample.

1.4.1.1 Field Duplicates

One field duplicate (FWGmw-501-110816-GW), associated with parent sample FWGmw-002-110816-GW, was analyzed for PAHs. No detections were reported in either the parent or duplicate sample.

1.4.2 Polychlorinated Biphenyls by Method 8082A

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- LCS recoveries
- Initial calibration
- Initial calibration verification
- Continuing calibration verification

All analytical or quality parameters requiring further discussion for Method 8082A are described in the sections below.

1.4.2.1 Field Duplicates

One field duplicate (FWGmw-501-110816-GW), associated with parent sample FWGmw-002-110816-GW, was analyzed for PCBs. No detections were reported in either the parent or duplicate sample.

1.4.3 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- Initial calibration
- Initial calibration verification
- Continuing calibration verification

All analytical or quality parameters requiring further discussion for Method 8330B are described in the sections below.

1.4.3.1 Laboratory Control Samples

2-Nitrotoluene (69%) was recovered below the QC limits (70-127%) in the LCS. The associated 2-nitrotoluene results were qualified as estimated (UJ L).

1.4.3.2 Field Duplicates

One field duplicate (FWGmw-501-110816-GW), associated with parent sample FWGmw-002-110816-GW, was analyzed for explosives. No detections were reported in either the parent or duplicate sample.

1.4.4 Alkalinity by Method SM 2320B

The following parameters were evaluated and met the required criteria:

- Holding time
- LODs and LOQs
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification

All analytical or quality parameters requiring further discussion for Method 9012B are described in the sections below.

1.4.4.1 Method Blanks

Alkalinity (2.13 µg/L) was detected in the method blank at a concentration below the LOQ (5.0 µg/L). Because alkalinity was detected in the associated samples at concentrations above the LOQ, no qualifiers were assigned.

1.4.4.2 Calibration Blanks

Alkalinity (ranging from 2.07 µg/L to 2.23 µg/L) was detected in the initial and continuing calibration blanks at concentrations below the LOQ (5.0 µg/L). Because alkalinity was detected in the associated samples at concentrations above the LOQ, no qualifiers were assigned.

1.4.4.3 Field Duplicates

One field duplicate (FWGmw-501-110816-GW), associated with parent sample FWGmw-002-110816-GW, was analyzed for alkalinity. For detections greater than 5x the LOQ in both samples,

an RPD was calculated. For detections less than 5x the LOQ, the difference in values was compared to \pm the LOQ. The following table shows the detections in parent and field duplicate samples:

Primary/Duplicate Sample ID	Analyte	Primary Sample Result (mg/L)	Field Duplicate Result (mg/L)	LOQ (mg/L)	RPD (%)	RPD Limit (%)¹
FWGmw-002-110816-GW / FWGmw-501-110816-GW	Alkalinity	220	220	5	0	20

¹ The RPD limit is 20% for detections greater than 5x the LOQ; \pm the LOQ for detections less than 5x the LOQ.

All calculated RPDs and difference in detections met criteria. No validation flags were assigned.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	Result	Units	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Group	Reason Code
280-90737-1	FWGmw-002-110816-GW	280-90737-1	Water	Acenaphthene	0.1	µg/L	u q	uj	n	0.1	0.041	0.0042	PAHs	S
280-90737-1	FWGmw-002-110816-GW	280-90737-1	Water	Acenaphthylene	0.1	µg/L	u q	uj	n	0.1	0.041	0.0051	PAHs	S
280-90737-1	FWGmw-002-110816-GW	280-90737-1	Water	Anthracene	0.1	µg/L	u q	uj	n	0.1	0.041	0.0056	PAHs	S
280-90737-1	FWGmw-002-110816-GW	280-90737-1	Water	Fluoranthene	0.1	µg/L	u q	uj	n	0.1	0.012	0.0048	PAHs	S
280-90737-1	FWGmw-002-110816-GW	280-90737-1	Water	Fluorene	0.1	µg/L	u q	uj	n	0.1	0.041	0.0055	PAHs	S
280-90737-1	FWGmw-002-110816-GW	280-90737-1	Water	Naphthalene	0.1	µg/L	u q	uj	n	0.1	0.012	0.008	PAHs	S
280-90737-1	FWGmw-002-110816-GW	280-90737-1	Water	Phenanthrene	0.1	µg/L	u q	uj	n	0.1	0.020	0.0093	PAHs	S
280-90737-1	FWGmw-002-110816-GW	280-90737-1	Water	Pyrene	0.1	µg/L	u q	uj	n	0.1	0.020	0.0061	PAHs	S
280-90737-1	FWGmw-002-110816-GW	280-90737-1	Water	2-Nitrotoluene	0.42	µg/L	u q	uj	n	0.42	0.22	0.089	Explosives and Propellants	L
280-90737-1	FWGmw-501-110816-GW	280-90737-2	Water	2-Nitrotoluene	0.42	µg/L	u q	uj	n	0.42	0.22	0.089	Explosives and Propellants	L

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90772-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Project Chemist and Secondary QC Review was performed by the Validation Chemist. Signatures indicate the report is approved for release.



Erica Fisher, Validator, TEC-WESTON JV

02/08/2017

Date



Pete Chapman, Validation Chemist, TEC-WESTON JV

2/8/17

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90772-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Metals	6010C/6020A/7470A	Denver, CO
Alkalinity	2320B	Denver, CO
Sulfide	9034	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend

using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	Metals	Alkalinity
BKGmw-005-110916-GW	280-90772-1	11/09/16	Groundwater		✓	✓
BKGmw-017-110916-GW	280-90772-2	11/09/16	Groundwater		✓	✓
BKGmw-016-110916-GW	280-90772-3	11/09/16	Groundwater		✓	✓

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
J	CC	Estimated detection; continuing calibration verification did not meet acceptance criteria.
U	B	Not detected; target analyte was detected in the method or calibration blank.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 10, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blanks
- LCS recoveries
- MS/MSD recoveries and RPDs
- Post digestion spike recoveries
- Instrument tuning
- Serial dilutions

All analytical or quality parameters requiring further discussion for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.1.1 Calibration Blanks

Several analytes were detected in the calibration blanks bracketing the samples. The following table presents the initial and continuing calibration blank detections:

Calibration Blank	Associated Samples	Analyte	Blank Detection (µg/L)	LOQ (µg/L)	Assigned Flags	Samples Qualified
ICB 280-352617/7	BKGmw-005-110916-GW BKGmw-017-110916-GW BKGmw-016-110916-GW	Antimony	0.85	6	N/A	None
		Thallium	0.053	1	N/A	N/A
CCB 280-352617/46	BKGmw-005-110916-GW	Antimony	0.501	6	N/A	None
		Beryllium	0.089	1	N/A	None
		Silver	0.049	5	N/A	None
		Thallium	0.125	1	N/A	None
		Zinc	3.49	20	U B	BKGmw-005-110916-GW
CCB 280-352617/57	BKGmw-005-110916-GW BKGmw-017-110916-GW BKGmw-016-110916-GW	Zinc	3.64	20	U B	BKGmw-005-110916-GW BKGmw-017-110916-GW BKGmw-016-110916-GW
CCB 280-352617/68	BKGmw-017-110916-GW BKGmw-016-110916-GW	Manganese	0.784	3.5	N/A	None
		Thallium	0.059	1	N/A	None
		Zinc	4.09	20	U B	BKGmw-017-110916-GW

						BKGmw-016-110916-GW
	BKGmw-018-110816-GW BKGmw-006-110816-GW					

CCB = continuing calibration blank
ICB = initial calibration blank

Detections less than the LOQ in associated samples are qualified as not detected at the LOQ (U B).

1.4.1.2 Calibration Verification

Antimony (125%) recovered above the QC limits (80-120%) in the low level initial calibration verification 280-352617/8. Antimony was not detected in the associated samples, therefore no qualification was necessary.

Manganese (122%) recovered above the QC limits (80-120%) in the low level CCV 280-352617/47. Manganese was detected in the associated sample BKGmw-005-110916-GW. The sample result was qualified as estimated (J CC).

1.4.1.1 Interference Check Standards

Manganese was detected in the interference check standard A (ISC-A) at a concentration (1.51 µg/L) greater than the LOD (0.95 µg/L). The laboratory noted manganese is a verified trace impurity and is not indicative of matrix interference. Based on reviewer’s professional judgment, no qualification was necessary.

1.4.2 Alkalinity by Method SM 2320B

The following parameters were evaluated and met the required criteria:

- Holding time
- LODs and LOQs
- LCS/LCSD recoveries and RPDs
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank

All analytical or quality parameters requiring further discussion for Method SM 2320 are described in the sections below.

1.4.2.1 Instrument Blank

The laboratory report that alkalinity was detected in the instrument blank at levels above one half the reporting limit. Because alkalinity was detected in the associated samples, BKGmw-005-110916-GW, BKGmw-017-110916-GW and BKGmw-016-110916-GW, at concentrations above the LOQ, no qualifiers were assigned.

1.4.2.2 Method Blanks

Alkalinity (2.87 µg/L) was detected in the method blank at a concentration below the LOQ (5.0 µg/L). Because alkalinity was detected in the associated samples, BKGmw-005-110916-GW, BKGmw-017-110916-GW and BKGmw-016-110916-GW, at concentrations above the LOQ, no qualifiers were assigned.

1.4.2.3 Calibration Blanks

Alkalinity (1.68 µg/L) was detected in the continuing calibration blanks CCB 280-350760/18 (2.59 µg/L) and 280-350760/30 (2.37 µg/L) at concentrations below the LOQ (5.0 µg/L). Because alkalinity was detected in the associated samples, BKGmw-005-110916-GW, BKGmw-017-110916-GW and BKGmw-016-110916-GW, at concentrations above the LOQ, no qualifiers were assigned.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90772-1	BKGmw-005-110916-GW	280-90772-1	Water	Manganese	7439-96-5	µg/L	15	q	j	y	3.5	0.95	0.31	Metals	CC
280-90772-1	BKGmw-005-110916-GW	280-90772-1	Water	Zinc	7440-66-6	µg/L	20	j	u	n	20	8	2	Metals	B
280-90772-1	BKGmw-017-110916-GW	280-90772-2	Water	Zinc	7440-66-6	µg/L	20	j	u	n	20	8	2	Metals	B
280-90772-1	BKGmw-016-110916-GW	280-90772-3	Water	Zinc	7440-66-6	µg/L	20	j	u	n	20	8	2	Metals	B

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90775-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Project Chemist and Secondary QC Review was performed by the Validation Chemist. Signatures indicate the report is approved for release.



Erica Fisher, Validator, TEC-WESTON JV

02/08/2017

Date



Pete Chapman, Validation Chemist, TEC-WESTON JV

2/8/17

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90775-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Polycyclic Aromatic Hydrocarbons (PAHs)	8270D SIM	Denver, CO
Polychlorinated Biphenyls (PCBs)	8082A	Denver, CO
Total Cyanide	9012B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above

referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	PAHs	PCBs	Cyanide
CBLmw-001-110916	280-90465-1	11/09/16	Groundwater		✓	✓	✓
CBLmw-002-110916	280-90465-2	11/09/16	Groundwater		✓	✓	✓
CBLmw-003-110916	280-90465-3	11/09/16	Groundwater		✓	✓	✓
CBLmw-004-110916	280-90465-4	11/09/16	Groundwater		✓	✓	✓

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
UJ	S	Estimated non-detection; the surrogate recovery was outside QC limits.

Validation Flag	Reason Code	Description
U	B	Not detected; target analyte was detected in the method or calibration blank.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 10, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Polycyclic Aromatic Hydrocarbons (PAHs) by Method 8270D SIM

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blank
- LCS recoveries
- MS/MSD recoveries and RPDs
- Instrument tuning
- Internal standards
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification

All analytical or quality parameters requiring further discussion for Method 8270D SIM are described in the sections below.

1.4.1.1 Surrogates

Surrogates nitrobenzene-d5 (51%) and 2-fluorobiphenyl (52%) recovered below their respective QC limits (55-111% and 53-106%) in sample CBLmw-001-110916-GW. None of the analytes associated with these surrogates were detected in the associated sample. Therefore the results associated with the surrogate outliers are qualified as estimated (UJ S).

1.4.2 Polychlorinated Biphenyls by Method 8082A

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks

- LCS/LCSD recoveries and RPDs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification

All analytical or quality parameters requiring further discussion for Method 8082A are described in the sections below.

1.4.2.1 Sample Preparation

The following samples underwent a sulfuric acid clean-up (EPA 3665A) to reduce matrix interferences: CBLmw-001-110916-GW, CBLmw-002-110916-GW, CBLmw-003-110916-GW and CBLmw-004-110916-GW.

1.4.2.2 Laboratory Control Samples

The laboratory reported PCB-1016 results from the primary column as the LCS/LCSD %RPD was outside control limits (30%) on the confirmation column. The laboratory report that the primary column was in control. No qualification are considered to be necessary.

1.4.3 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- LCS recoveries
- MS/MSD recoveries and RPDs
- Low and high level control samples
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

All analytical or quality parameters requiring further discussion for Method 9012B are described in the sections below.

1.4.3.1 Method Blank

Cyanide (4.42 µg/L) was detected in method blank sample MB 280-352264/4-A below the LOQ (10 µg/L).

Cyanide was detected in associated samples CBLmw-002-110916-GW, CBLmw-003-110916-GW and CBLmw-004-110916-GW. These results are qualified as not detected at the LOQ (U B).

Cyanide was not detected in sample CBLmw-001-110916-GW, therefore, no qualification is necessary.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90775-1	CBLmw-001-110916-GW	280-90775-1	Water	Acenaphthene	83-32-9	µg/L	0.041	u q	uj	n	0.1	0.041	0.0043	SVOCs	S
280-90775-1	CBLmw-001-110916-GW	280-90775-1	Water	Acenaphthylene	208-96-8	µg/L	0.041	u q	uj	n	0.1	0.041	0.0052	SVOCs	S
280-90775-1	CBLmw-001-110916-GW	280-90775-1	Water	Anthracene	120-12-7	µg/L	0.041	u q	uj	n	0.1	0.041	0.0057	SVOCs	S
280-90775-1	CBLmw-001-110916-GW	280-90775-1	Water	Fluoranthene	206-44-0	µg/L	0.012	u q	uj	n	0.1	0.012	0.0049	SVOCs	S
280-90775-1	CBLmw-001-110916-GW	280-90775-1	Water	Fluorene	86-73-7	µg/L	0.041	u q	uj	n	0.1	0.041	0.0056	SVOCs	S
280-90775-1	CBLmw-001-110916-GW	280-90775-1	Water	Naphthalene	91-20-3	µg/L	0.012	u q	uj	n	0.1	0.012	0.0082	SVOCs	S
280-90775-1	CBLmw-001-110916-GW	280-90775-1	Water	Phenanthrene	85-01-8	µg/L	0.02	u q	uj	n	0.1	0.02	0.0095	SVOCs	S
280-90775-1	CBLmw-001-110916-GW	280-90775-1	Water	Pyrene	129-00-0	µg/L	0.02	u q	uj	n	0.1	0.02	0.0062	SVOCs	S
280-90775-1	CBLmw-002-110916-GW	280-90775-2	Water	Total Cyanide	57-12-5	µg/L	10	j	u	n	10	5	2	Cyanide	B
280-90775-1	CBLmw-003-110916-GW	280-90775-3	Water	Total Cyanide	57-12-5	µg/L	10	j	u	n	10	5	2	Cyanide	B
280-90775-1	CBLmw-004-110916-GW	280-90775-4	Water	Total Cyanide	57-12-5	µg/L	10	j	u	n	10	5	2	Cyanide	B

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90779-1

Prepared For:



National Guard Bureau
NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture
2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Project Chemist and Secondary QC Review was performed by the Validation Chemist. Signatures indicate the report is approved for release.



Heather A. Miner

2017.01.19 11:26:08 -07'00'

Heather Miner, Project Chemist, TEC-WESTON JV

Date



Travis Withers

2017.01.19 11:59:42 -07'00'

Travis Withers, Validation Chemist, TEC-WESTON JV

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90779-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polychlorinated Biphenyls (PCBs)	8082A	Denver, CO
Organochlorine Pesticides	8081B	Denver, CO
Explosives	8330B	Denver, CO
Metals	6010C/6020A/7470A	Denver, CO
Total Cyanide	9012B	Denver, CO
Alkalinity	2320B	Denver, CO
Sulfide	9034	Denver, CO
Anions	9056A	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R)

should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	SVOCs (phthalates)	Pesticides	PCBs	Explosives	Metals	Cyanide	Alkalinity
FWGmw-015-110916-GW	280-90779-1	11/09/16	Groundwater		✓	✓		✓	✓	✓	✓	
FWGmw-016-110916-GW	280-90779-2	11/09/16	Groundwater			✓		✓	✓	✓		
SCFmw-004-110916-GW	280-90779-3	11/09/16	Groundwater		✓	✓	✓	✓	✓	✓	✓	
FWGmw-005-110916-GW	280-90779-4	11/09/16	Groundwater							✓		✓
TRIP BLANK	280-90779-5	11/09/16	Water	Trip Blank	✓							

Notes: Samples were also analyzed for natural attenuation parameters; these parameters were not validated.

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
J	CC	Estimated detection; continuing calibration verification did not meet acceptance criteria.
UJ	CC	Estimated non-detection; continuing calibration verification did not meet acceptance criteria.
UJ	H	Estimated non-detection; holding time exceeded.
UJ	L	Estimated non-detection; the associated LCS/LCSD recovery and/or RPD were outside QC limits.
U	B	Not detected; target analyte was detected in the method or calibration blank.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 10, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

“-GW” was added to the end of all sample IDs to comply with the RIWP.

A trip blank was received; however, it was not listed on the chain-of-custody. The trip blank was logged in per the information on the sample labels and analyzed for VOCs.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria:

- Surrogate recoveries
- LODs and LOQs
- Instrument tuning
- Initial calibration
- Initial calibration verification
- Closing calibration verification
- Internal standard area counts
- Trip blank

All analytical or quality parameters requiring further discussion for Method 8260B are described in the sections below.

1.4.1.1 Holding Time

Sample FWGmw-015-111916-GW was extracted 4 days past its 14-day holding time. The laboratory noted this holding time exceedance occurred because the sample volume received was in excess of their analytical capacity. All results were qualified as estimated (J/UJ H).

1.4.1.2 Method Blanks

Acetone (1.93 µg/L) was detected in the method blank at a concentration below the LOQ (10 µg/L). Acetone was also detected at a concentration below the LOQ in associated sample FWGmw-015-110916-GW (1.9 µg/L). Acetone was qualified as non-detect at the LOQ (U B).

1.4.1.3 Laboratory Control Sample

4-Methyl-2-pentanone (66%) and methylene chloride (72%) were recovered in the LCS below the control limits (67-130% and 74-124%, respectively). This LSC is associated with samples SCFmw-004-110916-GW and TRIP BLANK. 4-Methyl-2-pentanone and methylene chloride were qualified as estimated (J/UJ L) in the associated samples.

1.4.1.4 Continuing Calibration Verification

Methylene chloride (-24.2%D) and bromoform (-30.4%D) were recovered outside of the acceptance criteria ($\pm 20\%$ D) in CCV 280-352766/2. This CCV is associated with samples SCFmw-004-110916-GW and TRIP BLANK. Methylene chloride and bromoform were qualified as estimated (J/UJ CC) in the associated samples.

1.4.2 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS recoveries
- Instrument tuning
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Internal standard recoveries

No analytical or quality parameters required further discussion for Method 8270D.

1.4.1 Organochlorine Pesticides by Method 8081B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Endrin/DDT breakdown

All analytical or quality parameters requiring further discussion for Method 8081B are described in the sections below.

1.4.1.1 Laboratory Control Sample

Several analytes were recovered below QC limits in the LCS. The table below presents the LCS exceedances:

LCS/LCSD	Analyte	LCS %R	%R QC Limits	Assigned Flags
280-351608/2-A	Aldrin	32	45-134	J/UJ L
	Heptachlor	41	54-130	J/UJ L

%R = percent recovery

Bolded values are outside control limits.

Aldrin and heptachlor were qualified as estimated (UJ L) in the associated sample.

1.4.2 Polychlorinated Biphenyls by Method 8082A

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- LCS recoveries
- Initial calibration
- Initial calibration verification
- Continuing calibration verification

No analytical or quality parameters required further discussion for Method 8082A.

1.4.3 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- LCS recoveries
- Initial calibration
- Initial calibration verification
- Continuing calibration verification

No analytical or quality parameters required further discussion for Method 8330B.

1.4.4 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blanks
- LCS recoveries

- Low level calibration check standard
- Instrument tuning

All analytical or quality parameters requiring further discussion for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.4.1 Calibration Blanks

Antimony and thallium were detected in ICB 280-352617/7 (0.850 µg/L and 0.053 µg/L) at concentrations below their respective LOQs (2 µg/L and 1 µg/L). Antimony and thallium were not detected in any associated sample; therefore, no qualifications were required.

Several analytes were detected in the calibration blanks bracketing all samples reported in this SDG. The following table presents the initial and continuing calibration blank detections:

Continuing Calibration Blank	Analyte	Blank Detection (µg/L)	LOQ (µg/L)	Assigned Flags	Samples Qualified
280-352617/57	Zinc	3.64 J	20	U B	FWGmw-015-110916-GW FWGmw-005-110916-GW
280-352617/68	Manganese	0.784 J		None	None
	Thallium	0.059 J	1	None	None
	Zinc	4.09 J	20	U B	FWGmw-015-110916-GW FWGmw-005-110916-GW

Zinc detections less than the LOQ in associated samples are qualified as not detected at the LOQ (U B). Manganese was detected at concentrations greater than the LOQ in all associated samples and thallium was not detected in any associated sample; therefore, no qualifications were required.

1.4.4.2 Initial/Continuing Calibration Verification

Antimony (125%) recovered above the QC limits (80-120%) in the low level ICV 280-352617/8. Antimony was not detected in any associated sample; therefore, no qualification was required.

Manganese (126 %) was recovered above the QC limits (80-120%) in the low level CCV 280-352617/69 associated with all samples. Manganese was detected in all associated samples. These sample results were qualified as estimated (J CC).

1.4.4.3 Interference Check Standards

Manganese was detected in the interference check standard A (ISC-A) at a concentration (1.51 µg/L) greater than the LOD (0.95 µg/L). The laboratory noted manganese is a verified trace impurity and is not indicative of matrix interference. Based on reviewer's professional judgment, no qualification was necessary.

1.4.5 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blank
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

No analytical or quality parameters required further discussion for Method 9012B.

1.4.6 Alkalinity by Method SM 2320B

The following parameters were evaluated and met the required criteria:

- Holding time
- LODs and LOQs
- LCS/LCSD recoveries and RPDs
- Initial calibration verification
- Continuing calibration verification

All analytical or quality parameters requiring further discussion for Method SM 2320B are described in the sections below.

1.4.6.1 Method Blanks

Alkalinity (2.58 µg/L) was detected in the method blank at a concentration below the LOQ (5.0 µg/L). Because alkalinity was detected in the associated samples at concentrations above the LOQ, no qualifiers were assigned.

1.4.6.2 Calibration Blanks

Alkalinity (ranging from 2.11 µg/L to 2.37 µg/L) was detected in the initial and continuing calibration blanks at concentrations below the LOQ (5.0 µg/L). Because alkalinity was detected in the associated samples at concentrations above the LOQ, no qualifiers were assigned.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	Result	Units	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Group	Reason Code
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	Manganese	590	µg/L	q	j	y	3.5	0.95	0.31	Metals	CC
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	Zinc	20	µg/L	j	u	n	20	8	2	Metals	B
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	1,1,1-Trichloroethane	1	µg/L	u h	uj	n	1	0.4	0.16	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	1,1,2,2-Tetrachloroethane	1	µg/L	u h	uj	n	1	0.8	0.2	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	1,1,2-Trichloroethane	1	µg/L	u h	uj	n	1	0.8	0.32	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	1,1-Dichloroethane	1	µg/L	u h	uj	n	1	0.8	0.16	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	1,1-Dichloroethene	1	µg/L	u h	uj	n	1	0.8	0.14	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	1,2-Dibromoethane	1	µg/L	u h	uj	n	1	0.4	0.18	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	1,2-Dichloroethane	1	µg/L	u h	uj	n	1	0.4	0.13	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	1,2-Dichloroethene	1	µg/L	u h	uj	n	1	0.2	0.15	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	1,2-Dichloropropane	1	µg/L	u h	uj	n	1	0.4	0.13	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	2-Butanone	6	µg/L	u h	uj	n	6	4	1.8	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	2-Hexanone	5	µg/L	u h	uj	n	5	4	1.4	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	4-Methyl-2-pentanone	5	µg/L	u h	uj	n	5	3.2	1	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	Acetone	10	µg/L	j h	uj	n	10	6.4	1.9	VOCs	B H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	Benzene	1	µg/L	u h	uj	n	1	0.4	0.16	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	Bromodichloromethane	1	µg/L	u h	uj	n	1	0.4	0.17	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	Bromoform	1	µg/L	u h	uj	n	1	0.4	0.19	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	Bromomethane	2	µg/L	u h	uj	n	2	0.8	0.21	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	Carbon disulfide	2	µg/L	u h	uj	n	2	1.6	0.45	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	Carbon tetrachloride	2	µg/L	u h	uj	n	2	0.4	0.19	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	Chlorobenzene	1	µg/L	u h	uj	n	1	0.4	0.17	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	Chlorobromomethane	1	µg/L	u h	uj	n	1		0.1	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	Chloroethane	2	µg/L	u h	uj	n	2	1.6	0.41	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	Chloroform	1	µg/L	u h	uj	n	1	0.4	0.16	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	Chloromethane	2	µg/L	u h	uj	n	2	0.8	0.3	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	cis-1,3-Dichloropropene	1	µg/L	u h	uj	n	1	0.4	0.16	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	Dibromochloromethane	1	µg/L	u h	uj	n	1	0.4	0.17	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	Ethylbenzene	1	µg/L	u h	uj	n	1	0.4	0.16	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	Methylene chloride	5	µg/L	u h	uj	n	5	0.8	0.32	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	Styrene	1	µg/L	u h	uj	n	1	0.4	0.17	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	Tetrachloroethene	1	µg/L	u h	uj	n	1	0.4	0.2	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	Toluene	1	µg/L	u h	uj	n	1	0.4	0.17	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	trans-1,3-Dichloropropene	1	µg/L	u h	uj	n	1	0.2	0.19	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	Trichloroethene	1	µg/L	u h	uj	n	1	0.8	0.16	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	Vinylchloride	1.5	µg/L	u h	uj	n	1.5	0.4	0.1	VOCs	H
280-90779-1	FWGmw-015-110916-GW	280-90779-1	Water	Xylene (Total)	2	µg/L	u h	uj	n	2	0.4	0.19	VOCs	H
280-90779-1	FWGmw-016-110916-GW	280-90779-2	Water	Manganese	200	µg/L	q	j	y	3.5	0.95	0.31	Metals	CC
280-90779-1	SCFmw-004-110916-GW	280-90779-3	Water	Manganese	730	µg/L	q	j	y	3.5	0.95	0.31	Metals	CC
280-90779-1	SCFmw-004-110916-GW	280-90779-3	Water	Aldrin	0.052	µg/L	u q	uj	n	0.052	0.021	0.0025	Pesticides	L
280-90779-1	SCFmw-004-110916-GW	280-90779-3	Water	Heptachlor	0.052	µg/L	u q	uj	n	0.052	0.051	0.01	Pesticides	L
280-90779-1	SCFmw-004-110916-GW	280-90779-3	Water	4-Methyl-2-pentanone	5	µg/L	u q	uj	n	5	3.2	1	VOCs	L
280-90779-1	SCFmw-004-110916-GW	280-90779-3	Water	Bromoform	1	µg/L	u q	uj	n	1	0.4	0.19	VOCs	CC
280-90779-1	SCFmw-004-110916-GW	280-90779-3	Water	Methylene chloride	5	µg/L	u q	uj	n	5	0.8	0.32	VOCs	L CC

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	Result	Units	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Group	Reason Code
280-90779-1	FWGmw-005-110916-GW	280-90779-4	Water	Manganese	280	µg/L	q	j	y	3.5	.95	0.31	Metals	CC
280-90779-1	FWGmw-005-110916-GW	280-90779-4	Water	Zinc	20	µg/L	j	u	n	20	8	2	Metals	B
280-90779-1	TRIP BLANK	280-90779-5	Water	4-Methyl-2-pentanone	5	µg/L	u q	uj	n	5	3.2	1	VOCs	L
280-90779-1	TRIP BLANK	280-90779-5	Water	Bromoform	1	µg/L	u q	uj	n	1	0.4	0.19	VOCs	CC
280-90779-1	TRIP BLANK	280-90779-5	Water	Methylene chloride	5	µg/L	u q	uj	n	5	0.8	0.32	VOCs	L CC

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90781-1

Prepared For:



National Guard Bureau
NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture
2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Project Chemist and Secondary QC Review was performed by the Validation Chemist. Signatures indicate the report is approved for release.



Heather A. Miner

2017.01.19 11:25:09 -07'00'

Heather Miner, Project Chemist, TEC-WESTON JV

Date



Travis Withers

2017.01.19 12:00:28 -07'00'

Travis Withers, Validation Chemist, TEC-WESTON JV

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90781-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Explosives	8330B	Denver, CO
Hexavalent Chromium	7196A	Denver, CO
Cyanide	9012B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above

referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	Explosives	Cr(VI)	Cyanide
ASYmw-004-110916-GW	280-90781-1	11/09/16	Groundwater			✓	✓
ASYmw-005-110916-GW	280-90781-2	11/09/16	Groundwater		✓	✓	✓
DET-3-110916-GW	280-90781-3	11/09/16	Groundwater			✓	

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
UJ	H	Estimated non-detection; holding time exceeded.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 10, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

The sample ID for DETmw-003-110916-GW, as listed on the chain-of-custody, was logged and reported as DET-3-110916-GW to be consistent with historical samples and the database structure.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- LCS recoveries
- Initial calibration
- Initial calibration verification
- Continuing calibration verification

No analytical or quality parameters required further discussion for Method 8330B.

1.4.2 Hexavalent Chromium by Method 7196A

The following parameters were evaluated and met the required criteria:

- LODs and LOQs
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

All analytical or quality issues for Method 7196A are described in the sections below.

1.4.2.1 Holding Times

Samples ASYmw-004-110916-GW, ASYmw-005-110916-GW, and DET-3-110916-GW were collected on November 9, 2016 at 15:37, 15:12, and 14:14 (EST), respectively, and were analyzed on November 10, 2016 at 15:43 (EST) outside of the 24 hour holding time, but within 2x of the holding time. The sample results were qualified as estimated (J/UJ H).

1.4.3 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blanks
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

No analytical or quality parameters required further discussion for Method 9012B.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	Result	Units	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Group	Reason Code
280-90781-1	ASYmw-004-110916-GW	280-90781-1	Water	Chromium, hexavalent	20	µg/L	u h	uj	n	20	4	4	Hexavalent Chromium	H
280-90781-1	ASYmw-005-110916-GW	280-90781-2	Water	Chromium, hexavalent	20	µg/L	u h	uj	n	20	4	4	Hexavalent Chromium	H
280-90781-1	DET-3-110916-GW	280-90781-3	Water	Chromium, hexavalent	20	µg/L	u h	uj	n	20	4	4	Hexavalent Chromium	H

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90785-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by a Chemist and Secondary QC Review was performed by the Project Chemist. Signatures indicate the report is approved for release.



Pete Chapman, Chemist, TEC-WESTON JV

2/2/17

Date



Heather Miner, Project Chemist, TEC-WESTON JV

2/3/17

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90785-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Polycyclic Aromatic Hydrocarbons (PAHs)	8270D SIM	Denver, CO
Explosives	8330B	Denver, CO
Metals	6010C/6020A/7470A	Denver, CO
Total Cyanide	9012B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above

referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	PAHs	Explosives	Metals	Cyanide
UCLPmw-001-110916-GW	280-90785-1	11/09/16	Groundwater	MS/MSD		✓		✓
UCLPmw-003-110916-GW	280-90785-2	11/09/16	Groundwater			✓	✓	✓
UCLPmw-006-110916-GW	280-90785-3	11/09/16	Groundwater		✓		✓	
UCLPmw-500-110916-GW	280-90785-4	11/09/16	Groundwater	Field Duplicate		✓		✓

Note: Sample UCLPmw-500-110916-GW is the field duplicate of parent sample UCLPmw-001-110916-GW

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
U	B	Not detected; target analyte was detected in the method or calibration blank.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 10, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

The following sample was received with insufficient chemical preservation for the metals analyses: ULCPmw-006-110916-GW (280-90785-3). The laboratory added Nitric Acid to lower the pH.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Polycyclic Aromatic Hydrocarbons by Method 8270D SIM

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Method blank
- MS/MSD recoveries and RPDs
- LCS recoveries
- Instrument tuning
- Internal standards
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification

No analytical or quality issues were found for Method 8270D SIM.

1.4.2 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Method blank
- LCS Recoveries
- MS/MSD recoveries and RPDs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Second column confirmation
- Field duplicate

All analytical or quality issues for Method 8330B are described in the sections below.

1.4.3 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blank
- LCS recoveries
- MS/MSD recoveries and RPDs
- Initial and continuing calibraton
- Lower control interference check standard
- Contract required detection limit standard
- Instrument tuning

All analytical or quality issues for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.3.1 Interference Check Solutions

Manganese (1.51 µg/L) was detected in the interference check standard A (ISC-A) at a concentration greater than the LOD (0.95 µg/L). The lab confirmed this element is a trace impurity and is consistent with concentrations found by the manufacturer of the ICS-A solution. Based on reviewer's professional judgment, no qualification was necessary.

1.4.4 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- LCS recoveries
- MS/MSD recoveries and RPDs
- Method blank
- Low and high level control samples
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank
- Field duplicate

All analytical or quality parameters requiring further discussion for Method 9012B are described in the sections below.

1.4.4.1 Method Blanks

Cyanide (4.4 ug/L) was detected in method blank sample MB 280-352264/4-A at a concentration below the LOQ (10.0 µg/L). Cyanide was also detected in the associated samples UCLPmw-001-110916-GW, UCLPmw-003-110916-GW, and UCLPmw-500-110916-GW below the LOQ. These samples results were qualified as not detected at the LOQ (U B).

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90785-1	UCLPmw-001-110916-GW	280-90785-1	Water	Cyanide	74-90-8	µg/L	5.0	j	u	n	10.0	5.0	2.0	Cyanide	B
280-90785-1	UCLPmw-003-110916-GW	280-90785-2	Water	Cyanide	74-90-8	µg/L	5.0	j	u	n	10.0	5.0	2.0	Cyanide	B
280-90785-1	UCLPmw-500-110916-GW	280-90785-4	Water	Cyanide	74-90-8	µg/L	5.0	j	u	n	10.0	5.0	2.0	Cyanide	B

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90847-1

Prepared for:



National Guard Bureau
NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared by:

TEC-WESTON Joint Venture
2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by a Chemist and Secondary QC Review was performed by the Project Chemist. Signatures indicate the report is approved for release.



Pete Chapman, Chemist, TEC-WESTON JV

2/2/17

Date



Heather Miner, Project Chemist, TEC-WESTON JV

2/3/17

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90847-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Semi-Volatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polycyclic Aromatic Hydrocarbons (PAHs)	8270D SIM	Denver, CO
Explosives	8330B	Denver, CO
Pesticides	8081B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above

referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	SVOCs	PAHs	Explosives	Pesticides
LLmw-007-111016-GW	280-90847-1	11/10/16	Groundwater		✓	✓	✓	✓
LLmw-500-111016-GW	280-90847-2	11/10/16	Groundwater	Field Duplicate	✓	✓	✓	✓

Note: Sample LLmw-500-111016-GW is the field duplicate of parent sample LLmw-007-111016-GW

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
UJ	L	Estimated non-detection; the associated LCS/LCSD recovery and/or RPD were outside QC limits.
UJ	S	Estimated non-detection; the surrogate recovery was outside QC limits.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 10, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

The following sample was received with insufficient chemical preservation for the metals analyses: ULCPmw-006-110916-GW (280-90785-3). The laboratory added Nitric Acid to lower the pH.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Semi-Volatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Method blank
- MS/MSD recoveries and RPDs
- LCS recoveries
- Instrument tuning
- Internal standards
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Field duplicate

No analytical or quality issues were found for Method 8270D.

1.4.2 Polycyclic Aromatic Hydrocarbons by Method 8270D SIM

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blank
- MS/MSD recoveries and RPDs
- LCS recoveries
- Instrument tuning
- Internal standards
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Field duplicate

1.4.2.1 Surrogate recoveries

Surrogate 2-Fluorobiphenyl (50%) was recovered below QC limits (53-106%) in sample LL9mw-500-111016-GW. The laboratory noted that there was insufficient holding time to reanalyze the sample. All associated analytes in sample LL9mw-500-111016-GW were qualified as estimated (UJ S).

No other analytical or quality issues were found for Method 8270D SIM.

1.4.3 Pesticides by Method 8081B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Method blank
- MS/MSD recoveries and RPDs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Second column confirmation
- Field duplicate

1.4.3.1 LCS Recoveries

Endosulfan I (59%) was recovered below the QC limits (62-126%) in the LCS. All associated Endosulfan I results were qualified as estimated (UJ L).

No other analytical or quality issues were found for Method 8081B.

1.4.4 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Method blank
- LCS Recoveries
- MS/MSD recoveries and RPDs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Second column confirmation
- Field duplicates

1.4.4.1 Method Blanks

Nitroglycerin (1.3 ug/L) was detected in method blank sample MB 280-351958/1-A at a concentration below the LOQ (3.0 µg/L). Nitroglycerin was not detected in the associated samples. Therefore, no sample results were qualified.

There were no other analytical or quality issues for Method 8330B.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90847-1	LL9mw-007-111016-GW	280-90847-1	Water	Acenaphthalene	82-32-9	µg/L	0.041	u q	uj	n	0.10	0.041	0.004	PAHs	S
280-90847-1	LL9mw-007-111016-GW	280-90847-1	Water	Acenaphthylene	208-96-8	µg/L	0.041	u q	uj	n	0.10	0.041	0.005	PAHs	S
280-90847-1	LL9mw-007-111016-GW	280-90847-1	Water	Anthracene	120-12-7	µg/L	0.041	u q	uj	n	0.10	0.041	0.006	PAHs	S
280-90847-1	LL9mw-007-111016-GW	280-90847-1	Water	Fluoranthene	206-44-0	µg/L	0.012	u q	uj	n	0.10	0.012	0.005	PAHs	S
280-90847-1	LL9mw-007-111016-GW	280-90847-1	Water	Fluorene	86-73-7	µg/L	0.041	u q	uj	n	0.10	0.041	0.006	PAHs	S
280-90847-1	LL9mw-007-111016-GW	280-90847-1	Water	Phenanthrene	85-01-8	µg/L	0.021	u q	uj	n	0.10	0.021	0.010	PAHs	S
280-90847-1	LL9mw-007-111016-GW	280-90847-1	Water	Pyrene	129-00-0	µg/L	0.021	u q	uj	n	0.10	0.021	0.006	PAHs	S
280-90847-1	LL9mw-007-111016-GW	280-90847-1	Water	Endosulfan I	959-98-8	µg/L	0.022	u q	uj	n	0.051	0.022	0.002	Pesticides	S
280-90847-1	LL9mw-500-111016-GW	280-90847-2	Water	Endosulfan I	959-98-8	µg/L	0.024	u q	uj	n	0.055	0.024	0.002	Pesticides	S

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90848-1

Prepared for:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared by:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by a Chemist and Secondary QC Review was performed by the Project Chemist. Signatures indicate the report is approved for release.



Pete Chapman, Chemist, TEC-WESTON JV

2/1/17

Date



Heather Miner, Project Chemist, TEC-WESTON JV

2/2/17

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90848-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Explosives	8330B	Denver, CO
Cyanide	9021B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend

using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	Explosives	Cyanide
EBGmw-128-111016-GW	280-90848-1	11/10/16	Groundwater		✓	✓
EBGmw-126-111016-GW	280-90848-2	11/10/16	Groundwater		✓	✓
EBGmw-131-111016-GW	280-90848-3	11/10/16	Groundwater		✓	✓
EBGmw-125-111016-GW	280-90848-4	11/10/16	Groundwater		✓	✓

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
		No samples required qualification in this SDG.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 11, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- MS/MSD recoveries and RPDs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Second column confirmation
- Field duplicates

1.4.1.1 Method Blanks

Nitroglycerin (1.3 ug/L) was detected in method blank sample MB 280-351958/1-A at a concentration below the LOQ (3.0 µg/L). Nitroglycerin was not detected in the associated samples. Therefore, no sample results were qualified.

1.4.1.2 LCS Recoveries

The laboratory control sample (LCS) and/or laboratory control sample duplicate (LCSD) for preparation batch 280-351958 and analytical batch 280-354108 were recovered outside control limits for 2,4,6-Trinitrotoluene on the confirmation column. This analyte was biased high in the LCS and was not detected in the associated samples on the primary column; therefore, no data have been qualified.

There were no other analytical or quality issues for Method 8330B.

1.4.2 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- LCS recoveries
- MS/MSD recoveries and RPDs
- Method blank
- Low and high level control samples
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank

All analytical or quality parameters requiring further discussion for Method 9012B are described in the sections below.

1.4.2.1 Method Blanks

Cyanide (4.4 ug/L) was detected in method blank sample MB 280-352264/4-A at a concentration below the LOQ (10.0 µg/L). The field samples in this SDG were not associated with the method blank contamination, therefore, no samples were qualified.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
-----	-----------------	---------------	--------	-----------	------------	-------	--------	----------	---------	-----------	-----	-----	-----	-------------------	-------------

No samples required qualification in this SDG.

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90850-1

Prepared For:



National Guard Bureau
NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture
2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Project Chemist and Secondary QC Review was performed by the Validation Chemist. Signatures indicate the report is approved for release.



Heather A. Miner
2017.01.19 11:30:54 -07'00'

Heather Miner, Project Chemist, TEC-WESTON JV

Date



Travis Withers
2017.01.19 12:01:11 -07'00'

Travis Withers, Validation Chemist, TEC-WESTON JV

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90850-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polychlorinated Biphenyls (PCBs)	8082A	Denver, CO
Polycyclic Aromatic Hydrocarbons (PAHs)	8270D SIM	Denver, CO
Organochlorine Pesticides	8081B	Denver, CO
Explosives	8330B	Denver, CO
Metals	6010C/6020A/7470A	Denver, CO
Total Cyanide	9012B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	SVOCs (phthalates, phenols)	PAHs	Pesticides	PCBs	Explosives	Metals	Cyanide
RQLmw-008-1111016-GW	280-90850-1	11/10/16	Groundwater		✓	✓	✓	✓	✓	✓	✓	✓
TRIP BLANK	280-90850-2	11/10/16	Water	Trip Blank	✓							

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
J	P	Estimated detection; the RPD between the primary and confirmation column was outside QC limits.
J	Q	Estimated detection; this reason code is applied based on reviewer's professional judgment. An explanation is provided in the data validation report.
U	B	Not detected; target analyte was detected in the method or calibration blank.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 11, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

The trip blank was submitted but was not listed on the chain-of-custody.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blank
- LCS recoveries
- Instrument tuning
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Internal standard area counts
- Trip Blank

All analytical or quality parameters requiring further discussion for Method 8260B are described in the sections below.

1.4.1.1 Surrogates

Surrogate toluene-d8 (121%) was recovered above QC limits (89-112%) in sample TRIP BLANK. No analytes were detected; therefore, no validation flags were deemed necessary.

1.4.1 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- LCS/LCSD recoveries and RPDs
- Instrument tuning
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Internal standard area counts

No analytical or quality parameters required further discussion for Method 8270D.

1.4.2 Polycyclic Aromatic Compounds by Method 8270D SIM

The following parameters were evaluated and met the required criteria:

- LODs and LOQs
- Method blank
- LCS/LCSD recoveries and RPDs
- Instrument tuning
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Internal standard area counts

No analytical or quality parameters required further discussion for Method 8270D SIM.

1.4.3 Organochlorine Pesticides by Method 8081B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Endrin/DDT breakdown check

All analytical or quality parameters requiring further discussion for Method 8081B are described in the sections below.

1.4.3.1 Laboratory Control Sample

An LCS/LCSD was performed. Endosulfan I (59%) was recovered below the QC limits (62-126%) in the LCS. Because the LCSD recovery and RPD were within control limits, no qualification was necessary for endosulfan I.

1.4.4 Polychlorinated Biphenyls by Method 8082A

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS/LCSD recoveries and RPDs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification

No analytical or quality parameters required further discussion for Method 8082A.

1.4.5 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- LCS/LCSD recoveries and RPDs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification

All analytical or quality parameters requiring further discussion for Method 8330B are described in the sections below.

1.4.5.1 Method Blank

Nitroglycerin (1.29 µg/L) was detected in the method blank at a concentration below the LOQ (3.0 µg/L). Nitroglycerin was not detected in any associated sample. No qualification was necessary.

1.4.5.2 Second Column Confirmation

HMX and RDX were detected in the both the primary and confirmation columns; however, the RPD between the detections (177% and 41.2%, respectively) exceeds the 40% criterion. The result was reported from the primary column. The HMX and RDX results are qualified as estimated (J P).

2,4,6-Trinitrotoluene was detected in the primary column, but could not be confirmed on the second column. Because the laboratory noted evidence of matrix interference, the primary column detection was reported. The 2,4,6-trinitrotoluene result was qualified as estimated (J Q) based on reviewer's professional judgment.

1.4.6 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blank
- LCS recoveries
- Initial calibration verification
- Low-level calibration check standard
- Contract required detection limit standard
- Instrument tuning
- Interference check standards

All analytical or quality parameters requiring further discussion for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.6.1 Calibration Blanks

Antimony was detected in ICB 280-352858/11 (0.744 µg/L) at a concentration below the LOQ (6 µg/L). Antimony was also detected in the associated sample RQLmw-111016-GW at a concentration below the LOQ. Antimony was qualified as not detected at the LOQ (U B).

Sodium was detected in CCB 280-353819/62 (100 µg/L) at a concentration below the LOQ (5000 µg/L). Sodium was detected in the associated sample above the LOQ; therefore, no qualifiers were assigned.

1.4.7 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blank
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

No analytical or quality parameters required further discussion for Method 9012B.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	Result	Units	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Group	Reason Code
280-90850-1	RQLMW-008-111016-GW	280-90850-1	Water	Antimony	6	µg/L	j	u	n	6.0	1.0	0.4	Metals	B
280-90850-1	RQLMW-008-111016-GW	280-90850-1	Water	2,4,6-Trinitrotoluene	0.19	µg/L	j	j	y	0.42	1.1	0.077	Explosives and Propellants	Q
280-90850-1	RQLMW-008-111016-GW	280-90850-1	Water	HMX	6.7	µg/L	m	j	y	0.42	1.1	0.093	Explosives and Propellants	P
280-90850-1	RQLMW-008-111016-GW	280-90850-1	Water	RDX	1.2	µg/L	m	j	y	0.21	0.66	0.056	Explosives and Propellants	P

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90851-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Project Chemist and Secondary QC Review was performed by a Senior Chemist. Signatures indicate the report is approved for release.



Heather A. Miner
2017.01.23 10:24:28 -07'00'

Heather Miner, Project Chemist, TEC-WESTON JV

Date



Peter Chapman, Senior Chemist, TEC-WESTON JV

1/17/17
Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90851-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polychlorinated Biphenyls (PCBs)	8082A	Denver, CO
Organochlorine Pesticides	8081B	Denver, CO
Explosives	8330B	Denver, CO
Metals	6010C/6020A/7470A	Denver, CO
Hexavalent Chromium	353.2	Denver, CO
Total Cyanide	9012B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	SVOCs (phthalates)	SVOCs (full list)	PAHs	PCBs	Pesticides	Explosives	Metals	Cr(VI)	Cyanide
DET-3-110916-GW	280-90851-1	11/09/16	Groundwater	MS/MSD	✓		✓	✓	✓	✓	✓	✓		✓
DA2mw-115-111016-GW	280-90851-2	11/10/16	Groundwater			✓			✓		✓	✓		✓
DET-500-110916-GW	280-90851-3	11/09/16	Groundwater	Field Duplicate	✓		✓	✓	✓	✓	✓	✓		✓
DA2mw-108-111016-GW	280-90851-4	11/09/16	Groundwater							✓	✓	✓	✓	
TRIP BLANK	280-90851-5	11/10/16	Water	Trip Blank	✓									

Notes: Sample DET-500-110916-GW is a field duplicate of parent sample DET-3-110916-GW.

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
R	L	Rejected result, result is not usable; the associated LCS/LCSD recovery was extremely low.
UJ	L	Estimated non-detection; The associated LCS/LCSD recoveries and/or RPD were outside QC limits.
UJ	M	Estimated non-detection; The associated MS/MSD recoveries and/or RPD were outside QC limits.
U	B	Not detected; target analyte was detected in the method or calibration blank.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 11, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Instrument tuning
- Initial calibration
- Initial calibration verification
- Internal standard area counts
- Closing calibration verification
- Trip blank

All analytical or quality parameters requiring further discussion for Method 8260B are described in the sections below.

1.4.1.1 Method Blank

Methylene chloride (1.10 µg/L) was detected in the method blank at a concentration below the LOQ (5.0 µg/L). Methylene chloride was not detected in any associated sample. No qualification was necessary.

1.4.1.2 Laboratory Control Sample

Methylene chloride (128%) was recovered in the LCS above the control limits (74-124%). All associated sample results were qualified as non-detect; therefore, no qualification was necessary.

1.4.1.3 Matrix Spike/Matrix Spike Duplicate

An MS/MSD was performed on sample DET-3-110916-GW. Vinyl chloride was recovered below control limits (58-137%) in the MSD (57%). Because the MS recovery and the RPD were within control limits, no qualifications were deemed necessary.

1.4.1.4 Field Duplicates

One field duplicate (DET-500-110916-GW), associated with parent sample DET-3-110916-GW, was analyzed for VOCs. No detections were reported in either the parent or duplicate sample.

1.4.1.5 Continuing Calibration Verification

Bromomethane (34.6 %D) and chloroethane (26.7%) was recovered outside of the acceptance criteria ($\pm 20\%$ D) in CCV 280-352834/10. All associated sample results were reported as non-detect; therefore, no qualification was necessary.

1.4.1 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- MS/MSD recoveries and RPDs
- Instrument tuning
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Internal standard area counts

All analytical or quality parameters requiring further discussion for Method 8270D are described in the sections below.

1.4.1.1 Field Duplicates

One field duplicate (DET-500-110916-GW), associated with parent sample DET-3-110916-GW, was analyzed for SVOCs. No detections were reported in either the parent or duplicate sample.

1.4.1.2 Laboratory Control Sample

Hexachlorocyclopentadiene was not recovered (0%) in the LCS. Because of the extremely low recovery (less than 10%), all associated hexachlorocyclopentadiene results are rejected (R L).

1.4.1 Polycyclic Aromatic Compounds by Method 8270D SIM

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries

- LODs and LOQs
- Surrogate recoveries
- Method blank
- LCS recoveries
- Instrument tuning
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Internal standard area counts

All analytical or quality parameters requiring further discussion for Method 8270D SIM are described in the sections below.

1.4.1.1 Matrix Spike/Matrix Spike Duplicate

An MS/MSD was performed on sample DET-3-110916-GW. All MS/MSD recoveries and RPDs were within control limits with the exception of the exceedances presented in the following table:

Parent Sample	Analyte	MS %R	MSD %R	%R QC Limits	RPD	RPD Limits	Assigned Flags
DET-3-110916-GW	Acenaphthene	130	103	48-114	20	20	None
	Acenaphthylene	123	95	35-121	23	20	UJ M
	Anthracene	125	102	53-119	17	20	None
	Chrysene	122	114	57-120	4	20	None
	Fluoranthene	124	111	58-120	8	20	None
	Flourene	137	109	50-118	19	20	None
	Naphthalene	123	97	43-114	20	20	None
	Phenanthrene	126	104	53-115	16	20	None

%R = percent recovery

Bolded values are outside control limits.

The MS recovery and the RPD were outside QC limits for acenaphthylene. Acenaphthylene in the associated parent sample is qualified as estimated (UJ M).

The MS recoveries were above the QC limits for acenaphthylene, anthracene, chrysene, fluoranthene, fluorene, naphthalene, and phenanthrene. Because the MSD recovery and RPD were within control limits, no qualifications were deemed necessary. It should be noted that none of these analytes were detected in the associated parent sample.

1.4.1.2 Field Duplicates

One field duplicate (DET-500-110916-GW), associated with parent sample DET-3-110916-GW, was analyzed for PAHs. No detections were reported in either the parent or duplicate sample.

1.4.2 Organochlorine Pesticides by Method 8081B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Endrin/DDT breakdown

All analytical or quality parameters requiring further discussion for Method 8081B are described in the sections below.

1.4.2.1 Laboratory Control Sample

One LCS and one LCS/LCSD were performed. Several analytes were recovered below QC limits in the LCS and/or LCSD. The table below presents the LCS/LCSD exceedances:

LCS/LCSD	Analyte	LCS %R	LCSD %R	%R QC Limits	RPD	RPD Limit (%)	Assigned Flags
280-351608/2-A	Aldrin	32	--	45-134	--	--	J/UJ L
	Heptachlor	41	--	54-130	--	--	J/UJ L
280-351820/2-A 280-351820/3-A	Endosulfan I	59	74	62-126	21	30	None

-- = An LCSD was not performed.

%R = percent recovery

Bolded values are outside control limits.

The analytes for samples DET-3-110916-GW and DET-500-110916-GW which are associated with LCS 280-351608/2-A were qualified as estimated (UJ L). Because the LCSD and RPD were within control limits, no qualification was necessary for endosulfan I.

1.4.2.2 Matrix Spike/Matrix Spike Duplicates

An MS/MSD was performed on sample DET-3-110916-GW. The RPD for toxaphene (36%) exceeded the RPD limit (30%). Toxaphene was not detected in the associated parent sample; therefore, no qualifications were required.

1.4.2.3 Field Duplicates

One field duplicate (DET-500-110916-GW), associated with parent sample DET-3-110916-GW, was analyzed for pesticides. gamma-Chlordane was detected in the field duplicate (0.0069 µg/L) at a concentration less than the LOQ (0.053 µg/L). gamma-Chlordane was not detected in the parent sample. The acceptance criterion for detections less than the 5x the LOQ is ± the LOQ; the detection is within the acceptance criterion. No qualifications were necessary.

1.4.3 Polychlorinated Biphenyls by Method 8082A

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS/LCSD recoveries and RPDs
- MS/MSD recoveries and RPDs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification

All analytical or quality parameters requiring further discussion for Method 8082A are described in the sections below.

1.4.3.1 Field Duplicates

One field duplicate (DET-500-110916-GW), associated with parent sample DET-3-110916-GW, was analyzed for PCBs. No detections were reported in either the parent or duplicate sample.

1.4.4 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- LCS recoveries
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Second column confirmation

All analytical or quality parameters requiring further discussion for Method 8330B are described in the sections below.

1.4.4.1 Matrix Spike/Matrix Spike Duplicates

An MS/MSD was performed on sample DET-3-110916-GW. The RPD for 3-nitrotoluene (28%) exceeded the RPD limit (20%). 3-Nitrotoluene was not detected in the associated parent sample; therefore, no qualifications were required.

1.4.4.2 Field Duplicates

One field duplicate (DET-500-110916-GW), associated with parent sample DET-3-110916-GW, was analyzed for explosives. No detections were reported in either the parent or duplicate sample.

1.4.5 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blanks
- LCS recoveries
- Serial dilution
- Post-digestion spike
- Continuing calibration verification
- Low-level calibration check standard
- Contract required detection limit standard
- Instrument tuning
- Interference check standards

All analytical or quality parameters requiring further discussion for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.5.1 Calibration Blanks

Antimony was detected in ICB 280-352858/11 (0.744 µg/L) at a concentration below the LOQ (6 µg/L). Antimony was not detected in any associated samples; therefore, no qualifiers were assigned.

Sodium was detected in CCB 280-353819/62 (100 µg/L) at a concentration below the LOQ (5000 µg/L) associated with sample DA2mw-108-110916-GW. Sodium was detected in the associated sample above the LOQ; therefore, no qualifiers were assigned.

1.4.5.2 Initial Calibration Verification

Antimony (121%) was recovered above the QC limits (80-120%) in the low level ICV 280-352828/12 associated with all samples reported in this SDG. Antimony was not detected in any sample; therefore, no qualifiers were assigned.

1.4.5.3 Matrix Spike/Matrix Spike Duplicates

An MS/MSD was performed on sample DET-3-110916-GW. Calcium was recovered above control limits (87-113%) in the MSD (115%). Because the MS recovery and the RPD were within control limits, no qualifications were deemed necessary.

The parent sample concentration was greater than four times the spike concentration for manganese. The MS/MSD recoveries could not be evaluated. No qualifiers were assigned.

1.4.5.4 Field Duplicates

One field duplicate (DET-500-110916-GW) was collected and analyzed for total metals. For detections greater than 5x the LOQ in both samples, an RPD was calculated. For detections less than 5x the LOQ, the difference in values was compared to \pm the LOQ. The following table shows the detections in the parent and field duplicate sample:

Primary/Duplicate Sample ID	Analyte	Primary Sample Result ($\mu\text{g/L}$)	Field Duplicate Result ($\mu\text{g/L}$)	LOQ ($\mu\text{g/L}$)	RPD (%)	RPD Limit (%) ¹
DET-3-110916-GW/ DET-500-110916-GW	Calcium	99000	96000	1000	3	20
	Iron	1900	1900	100	0	20
	Magnesium	37000	37000	500	0	20
	Potassium	2600 J	2500 J	3000	N/A	\pm LOQ
	Sodium	14000	14000	5000	N/A	\pm LOQ
	Arsenic	13	14	5	N/A	\pm LOQ
	Barium	49	49	3	0	20
	Cobalt	0.33 J	0.33 J	1	N/A	\pm LOQ
	Lead	0.70 U	0.2 J	3	N/A	\pm LOQ
Manganese	260	250	3.5	4	20	

¹ The RPD limit is 20% for detections greater than 5x the LOQ; \pm the LOQ for detections less than 5x the LOQ.

J Laboratory flag indicating the result is less than the LOQ and is estimated.

U Laboratory flag indicating the result is not detected.

N/A Not applicable

All calculated RPDs and difference in detections met criteria. No validation flags were assigned.

1.4.6 Hexavalent Chromium by Method 7196A

The following parameters were evaluated and met the required criteria:

- Holding time
- LODs and LOQs
- Method blank
- LCS/LCSD recoveries and RPDs
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

No analytical or quality parameters required further discussion for Method 7196A.

1.4.7 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- LCS recoveries
- MS/MSD recoveries and RPDs
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

All analytical or quality parameters requiring further discussion for Method 9012B are described in the sections below.

1.4.7.1 Method Blanks

Total cyanide (4.42 µg/L) was detected in the method blank at a concentration below the LOQ (10 µg/L). Cyanide was also detected in the associated samples, DET-3-110916-GW and DET-500-110916-GW at concentrations below the LOQ. These sample results were qualified as non-detect at the LOQ (U B).

1.4.7.2 Field Duplicates

One field duplicate (DET-500-110916-GW), associated with parent sample DET-3-110916-GW, was collected and analyzed for total metals. The detections in the parent and field duplicate samples were qualified as non-detect based on method blank contamination. No validation flags were assigned.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	Result	Units	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Group	Reason Code
208-90850-1	DET-3-110916-GW	280-90851-1	Water	Aldrin	0.055	µg/L	u q	uj	n	0.055	0.21	0.0026	Pesticides	L
208-90850-1	DET-3-110916-GW	280-90851-1	Water	Heptachlor	0.055	µg/L	u q	uj	n	0.055	0.051	0.011	Pesticides	L
208-90850-1	DET-3-110916-GW	280-90851-1	Water	Hexachlorocyclopentadiene	48	µg/L	u	r	n	48	30	9.6	SVOCs	L
208-90850-1	DET-3-110916-GW	280-90851-1	Water	Acenaphthylene	0.1	µg/L	u j	uj	n	0.1	0.04	0.0053	PAHs	M
208-90850-1	DET-3-110916-GW	280-90851-1	Water	Total Cyanide	10	µg/L	j	u	n	10	5.0	2	Total Cyanide	B
208-90850-1	DET-500-110916-GW	280-90851-3	Water	Aldrin	0.053	µg/L	u q	uj	n	0.053	0.021	00.0025	Pesticides	L
208-90850-1	DET-500-110916-GW	280-90851-3	Water	Heptachlor	0.053	µg/L	u q	uj	n	0.053	0.051	0.011	Pesticides	L
208-90850-1	DET-500-110916-GW	280-90851-3	Water	Hexachlorocyclopentadiene	48	µg/L	u q	r	n	48	30	9.5	SVOCs	L
208-90850-1	DET-500-110916-GW	280-90851-3	Water	Total Cyanide	10	µg/L	j	u	n	10	5.0	2	Total Cyanide	B

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90856-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by the Project Chemist. Signatures indicate the report is approved for release.



Heather A. Miner

2017.01.19 11:20:37 -07'00'

Heather Miner, Project Chemist, TEC-WESTON JV

Date



Travis Withers

2017.01.19 12:01:47 -07'00'

Travis Withers, Validation Chemist, TEC-WESTON JV

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90856-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polychlorinated Biphenyls (PCBs)	8082A	Denver, CO
Polycyclic Aromatic Hydrocarbons (PAHs)	8270D SIM	Denver, CO
Organochlorine Pesticides	8081B	Denver, CO
Explosives	8330B	Denver, CO
Metals	6010C/6020A/7470A	Denver, CO
Hexavalent Chromium	353.2	Denver, CO
Total Cyanide	9012B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	SVOCs (phthalates)	SVOCs (full list)	PAHs	PCBs	Pesticides	Explosives	Metals	Cr(VI)	Cyanide
SCFmw-002-111016-GW	280-90856-1	11/10/16	Groundwater		✓	✓			✓	✓	✓	✓	✓	✓
SCFmw-003-111016-GW	280-90856-2	11/10/16	Groundwater		✓		✓	✓	✓		✓			✓
FWGmw-011-111016-GW	280-90856-3	11/10/16	Groundwater			✓			✓		✓	✓		
FWGmw-012-111016-GW	280-90856-4	11/10/16	Groundwater			✓			✓		✓	✓		
FWGmw-011-111016-GF	280-90856-5	11/10/16	Groundwater									✓		
FWGmw-010-111016-GW	280-90856-6	11/10/16	Groundwater		✓		✓	✓	✓		✓			✓
FWGmw-007-111016-GW	280-90856-7	11/10/16	Groundwater		✓	✓			✓		✓	✓		✓
TRIP BLANK	280-90856-8	11/10/16	Water	Trip Blank	✓									

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
R	L	Rejected result, result is not usable; the associated LCS/LCSD recovery was extremely low.
UJ	CC	Estimated non-detection; continuing calibration verification did not meet acceptance criteria.
UJ	H	Estimated non-detection; holding time exceeded.
UJ	L	Estimated non-detection; the associated LCS/LCSD recovery and/or RPD were outside QC limits.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 11, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

Sample FWGmw-007-111016 was received at the laboratory, but was not listed on the chain-of-custody. The sample was logged per the information on the sample labels.

Sample FWGmw-010-111016-GW was listed on the chain-of-custody, but no volume was received. Sample containers for sample FWGmw-004-111016-GW were received; however, this sample was not listed on the chain-of-custody. It was determined that the sample labels were incorrect; the sample was logged in as FWGmw-010-111016-GW.

Sample FWGmw-010-111016-GW was not submitted with sample volume for explosives. Explosives requires a 500 mL bottle and the bottle is rinsed during sample preparation. A portion of sample volume from a 1 liter bottle was used for extraction; the bottle was not rinsed.

Note samples indicated as field filtered on the chain-of-custody were filtered through a 5-micron filter; these filtered results are considered “total” results.

The trip blank was submitted but was not listed on the chain-of-custody.

The chain-of-custody lists the sample collection time as 15:48 for sample SCFmw-002-111016-GW; however, a sample time of 15:40 is recorded on the sample labels. The sample was logged per the chain-of-custody.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- Surrogate recoveries
- Method blank
- LCS recoveries
- LODs and LOQs
- Instrument tuning

- Internal standard area counts
- Initial calibration
- Initial calibration verification
- Closing calibration verification
- Trip blank

All analytical or quality parameters requiring further discussion for Method 8260B are described in the sections below.

1.4.1.1 Continuing Calibration Verification

Bromomethane (-25.0 %D) and chloroethane (-24.0%) was recovered outside of the acceptance criteria ($\pm 20\%$ D) in CCV 280-352952/2. No corrective action was performed. All bromomethane and chloroethane results were qualified as estimated (UJ CC).

1.4.2 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- Instrument tuning
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Internal standard area counts

All analytical or quality parameters requiring further discussion for Method 8270D are described in the sections below.

1.4.2.1 Laboratory Control Sample

Several analytes were recovered below QC limits in the LCS. The table below presents the LCS exceedances:

Analyte	LCS %R	%R QC Limits	Assigned Flags
2,4-Dinitrophenol	0	23-143	R L
2-Nitrophenol	27	47-123	J/UJ L
4,6-Dinitro-2-methylphenol	0	44-137	R L
4-Nitrophenol	5	59-129	R L
Benzoic acid	0	41-120	R L
Hexachlorocyclopentadiene	0	10-120	R L

Pentachlorophenol	0	35-138	R L
-------------------	---	--------	-----

%R = percent recovery

Bolded values are outside control limits.

The LCS recoveries for 2,4-dinitrophenol, 4,6-dinitro-2-methylphenol, 4-nitrophenol, benzoic acid, hexachlorocyclopentadiene, and pentachlorophenol were extremely low (less than 10%). These analytes in associated samples are rejected (R L). The LCS recovery for 2-nitrophenol is below the lower control limit; associated results are qualified as estimated (J/UJ L).

1.4.3 Polycyclic Aromatic Compounds by Method 8270D SIM

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- LODs and LOQs
- Method blank
- LCS/LCSD recoveries and RPDs
- Instrument tuning
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Internal standard area counts

All analytical or quality parameters requiring further discussion for Method 8270D SIM are described in the sections below.

1.4.3.1 Sample Preparation

A portion (500 mL) of sample FWGmw-010-111016-GW was decanted prior to preparation from a 1 L amber bottle and the solvent rinse of the original container was not performed. Based on reviewer's professional judgment, no qualifications were assigned.

1.4.3.2 Holding Time

Samples FWGmw-010-111016-GW was extracted 1 day past its 7-day extraction holding time. The laboratory noted this holding time exceedance occurred because the sample volume received was in excess of their analytical capacity. All results were qualified as estimated (J/UJ H).

1.4.3.3 Surrogates

Surrogate terphenyl-d14 was recovered above QC limits (28-132%) in samples SCFmw-003-111016-GW (279%) and FWGmw-010-111016-GW (687%). No analytes were detected in the samples; therefore, no qualifications were assigned.

1.4.4 Organochlorine Pesticides by Method 8081B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Endrin/DDT breakdown check

All analytical or quality parameters requiring further discussion for Method 8081B are described in the sections below.

1.4.4.1 Laboratory Control Sample

An LCS/LCSD was performed. Endosulfan I (59%) was recovered below the QC limits in the LCS. Because the LCSD recovery and RPD were within control limits, no qualification was necessary for endosulfan I.

1.4.5 Polychlorinated Biphenyls by Method 8082A

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- LCS/LCSD recoveries and RPDs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification

No analytical or quality parameters required further discussion for Method 8082A.

1.4.6 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries

- LODs and LOQs
- LCS/LCSD recoveries and RPDs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- 2nd column confirmation

All analytical or quality parameters requiring further discussion for Method 8330B are described in the sections below.

1.4.6.1 Method Blank

Nitroglycerin (1.29 µg/L) was detected in the method blank at a concentration below the LOQ (3.0 µg/L). Nitroglycerin was not detected in any associated sample. No qualification was necessary.

1.4.7 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blank
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Low-level calibration check standard
- Contract required detection limit standard
- Instrument tuning
- Interference check standards

All analytical or quality parameters requiring further discussion for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.7.1 Calibration Blanks

Antimony was detected in ICB 280-352858/11 (0.744 µg/L) at a concentration below the LOQ (6 µg/L). Antimony was not detected in any associated sample; therefore, no qualifiers were assigned.

Sodium was detected in CCB 280-353819/62 (100 µg/L) at a concentration below the LOQ (5000 µg/L). Sodium was detected in all associated samples above the LOQ; therefore, no qualifiers were assigned.

1.4.8 Hexavalent Chromium by Method 7196A

The following parameters were evaluated and met the required criteria:

- Holding time
- LODs and LOQs

- Method blank
- LCS/LCSD recoveries and RPD
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

No analytical or quality parameters required further discussion for Method 7196A.

1.4.9 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blank
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

No analytical or quality parameters required further discussion for Method 9012B.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	AnalyticMethod	Reason Code
280-90856-1	SCFmw-002-111016-GW	280-90856-1	Water	Bromomethane	74-83-9	µg/L	2	u q	uj	n	2	0.8	0.21	VOCs	CC
280-90856-1	SCFmw-002-111016-GW	280-90856-1	Water	Chloroethane	75-00-3	µg/L	2	u q	uj	n	2	1.6	0.41	VOCs	CC
280-90856-1	SCFmw-003-111016-GW	280-90856-2	Water	Bromomethane	74-83-9	µg/L	2	u q	uj	n	2	0.8	0.21	VOCs	CC
280-90856-1	SCFmw-003-111016-GW	280-90856-2	Water	Chloroethane	75-00-3	µg/L	2	u q	uj	n	2	1.6	0.41	VOCs	CC
280-90856-1	SCFmw-003-111016-GW	280-90856-2	Water	2,4-Dinitrophenol	51-28-5	µg/L	79	u q	r	n	79	30	9.9	SVOCs	L
280-90856-1	SCFmw-003-111016-GW	280-90856-2	Water	2-Nitroaniline	88-74-4	µg/L	49	u	uj	n	49	4.4	1.7	SVOCs	L
280-90856-1	SCFmw-003-111016-GW	280-90856-2	Water	4,6-Dinitro-2-methylphenol	534-52-1	µg/L	79	u q	r	n	79	8.8	3.9	SVOCs	L
280-90856-1	SCFmw-003-111016-GW	280-90856-2	Water	4-Nitrophenol	100-02-7	µg/L	49	u q	r	n	49	4	1.2	SVOCs	L
280-90856-1	SCFmw-003-111016-GW	280-90856-2	Water	Benzoic acid	65-85-0	µg/L	79	u q	r	n	79	30	9.9	SVOCs	L
280-90856-1	SCFmw-003-111016-GW	280-90856-2	Water	Hexachlorocyclopentadiene	77-47-4	µg/L	49	u q	r	n	49	30	9.9	SVOCs	L
280-90856-1	SCFmw-003-111016-GW	280-90856-2	Water	Pentachlorophenol	87-86-5	µg/L	79	u q	r	n	79	60	20	SVOCs	L
280-90856-1	FWGmw-010-111016-GW	280-90856-6	Water	Bromomethane	74-83-9	µg/L	2	u q	uj	n	2	0.8	0.21	VOCs	CC
280-90856-1	FWGmw-010-111016-GW	280-90856-6	Water	Chloroethane	75-00-3	µg/L	2	u q	uj	n	2	1.6	0.41	VOCs	CC
280-90856-1	FWGmw-010-111016-GW	280-90856-6	Water	2,4-Dinitrophenol	51-28-5	µg/L	78	u q	r	n	78	30	9.7	SVOCs	L
280-90856-1	FWGmw-010-111016-GW	280-90856-6	Water	2-Nitrophenol	88-75-5	µg/L	19	u q	uj	n	19	1	0.38	SVOCs	L
280-90856-1	FWGmw-010-111016-GW	280-90856-6	Water	4,6-Dinitro-2-methylphenol	534-52-1	µg/L	78	u q	r	n	78	8.8	3.9	SVOCs	L
280-90856-1	FWGmw-010-111016-GW	280-90856-6	Water	4-Nitrophenol	100-02-7	µg/L	49	u q	r	n	49	4	1.2	SVOCs	L
280-90856-1	FWGmw-010-111016-GW	280-90856-6	Water	Benzoic acid	65-85-0	µg/L	78	u q	r	n	78	30	9.7	SVOCs	L
280-90856-1	FWGmw-010-111016-GW	280-90856-6	Water	Hexachlorocyclopentadiene	77-47-4	µg/L	49	u q	r	n	49	30	9.7	SVOCs	L
280-90856-1	FWGmw-010-111016-GW	280-90856-6	Water	Pentachlorophenol	87-86-5	µg/L	78	u q	r	n	78	60	19	SVOCs	L
280-90856-1	FWGmw-010-111016-GW	280-90856-6	Water	Acenaphthene	83-32-9	µg/L	0.1	u h	uj	n	0.1	1	0.0042	PAHs	H
280-90856-1	FWGmw-010-111016-GW	280-90856-6	Water	Acenaphthylene	208-96-8	µg/L	0.1	u h	uj	n	0.1	1	0.0051	PAHs	H
280-90856-1	FWGmw-010-111016-GW	280-90856-6	Water	Anthracene	120-12-7	µg/L	0.1	u h	uj	n	0.1	1	0.0056	PAHs	H
280-90856-1	FWGmw-010-111016-GW	280-90856-6	Water	Benz(a)anthracene	56-55-3	µg/L	0.1	u h q	uj	n	0.1	1	0.0042	PAHs	H
280-90856-1	FWGmw-010-111016-GW	280-90856-6	Water	Benzo(a)pyrene	50-32-8	µg/L	0.1	u h q	uj	n	0.1	1	0.0069	PAHs	H
280-90856-1	FWGmw-010-111016-GW	280-90856-6	Water	Benzo(b)fluoranthene	205-99-2	µg/L	0.1	u h q	uj	n	0.1	2	0.0031	PAHs	H
280-90856-1	FWGmw-010-111016-GW	280-90856-6	Water	Benzo(g,h,i)perylene	191-24-2	µg/L	0.1	u h q	uj	n	0.1	1	0.0062	PAHs	H
280-90856-1	FWGmw-010-111016-GW	280-90856-6	Water	Benzo(k)fluoranthene	207-08-9	µg/L	0.1	u h q	uj	n	0.1	1	0.0063	PAHs	H
280-90856-1	FWGmw-010-111016-GW	280-90856-6	Water	Chrysene	218-01-9	µg/L	0.1	u h q	uj	n	0.1	2	0.0033	PAHs	H
280-90856-1	FWGmw-010-111016-GW	280-90856-6	Water	Dibenz(a,h)anthracene	53-70-3	µg/L	0.1	u h q	uj	n	0.1	2	0.0041	PAHs	H
280-90856-1	FWGmw-010-111016-GW	280-90856-6	Water	Fluoranthene	206-44-0	µg/L	0.1	u h	uj	n	0.1	0.5	0.0048	PAHs	H
280-90856-1	FWGmw-010-111016-GW	280-90856-6	Water	Fluorene	86-73-7	µg/L	0.1	u h	uj	n	0.1	1	0.0055	PAHs	H
280-90856-1	FWGmw-010-111016-GW	280-90856-6	Water	Indeno(1,2,3-cd)pyrene	193-39-5	µg/L	0.1	u h q	uj	n	0.1	2	0.0045	PAHs	H
280-90856-1	FWGmw-010-111016-GW	280-90856-6	Water	Naphthalene	91-20-3	µg/L	0.1	u h	uj	n	0.1	1	0.008	PAHs	H
280-90856-1	FWGmw-010-111016-GW	280-90856-6	Water	Phenanthrene	85-01-8	µg/L	0.1	u h	uj	n	0.1	1	0.0093	PAHs	H
280-90856-1	FWGmw-010-111016-GW	280-90856-6	Water	Pyrene	129-00-0	µg/L	0.1	u h	uj	n	0.1	1	0.0061	PAHs	H
280-90856-1	FWGmw-007-111016-GW	280-90856-7	Water	Bromomethane	74-83-9	µg/L	2	u q	uj	n	2	0.8	0.21	VOCs	CC
280-90856-1	FWGmw-007-111016-GW	280-90856-7	Water	Chloroethane	75-00-3	µg/L	2	u q	uj	n	2	1.6	0.41	VOCs	CC
280-90856-1	TRIP BLANK	280-90856-8	Water	Bromomethane	74-83-9	µg/L	2	u q	uj	n	2	0.8	0.21	VOCs	CC

280-90856-1	TRIP BLANK	280-90856-8	Water	Chloroethane	75-00-3	µg/L	2	u	q	uj	n	2	1.6	0.41	VOCs	CC
-------------	------------	-------------	-------	--------------	---------	------	---	---	---	----	---	---	-----	------	------	----

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90960-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Project Chemist and Secondary QC Review was performed by the Validation Chemist. Signatures indicate the report is approved for release.



Erica Fisher, Validator, TEC-WESTON JV

02/08/2017

Date



Pete Chapman, Validation Chemist, TEC-WESTON JV

2/8/17

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90960-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Polycyclic Aromatic Hydrocarbons (PAHs)	8270D SIM	Denver, CO
Polychlorinated Biphenyls (PCBs)	8082A	Denver, CO
Organochlorine Pesticides	8081B	Denver, CO
Explosives	8330B	Denver, CO
Metals	6010C/6020A/7470A	Denver, CO
Hexavalent Chromium	353.2	Denver, CO
Total Cyanide	9012B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	PAHs	PCBs	Pesticides	Explosives	Metals	Cr(VI)	Cyanide
DA2mw-105-111416-GW	280-90960-1	11/02/16	Groundwater					✓			
DA2mw-107-111416-GW	280-90960-2	11/02/16	Groundwater			✓					
DA2mw-104-111416-GW	280-90960-3	11/02/16	Groundwater		✓	✓	✓	✓	✓	✓	✓

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
U	B	Not detected; target analyte was detected in the method or calibration blank.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 15, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Polycyclic Aromatic Hydrocarbons (PAHs) by Method 8270D SIM

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Method blank
- LCS/LCSD recoveries and RPDs
- Instrument tuning
- Internal standards
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification

No analytical or quality parameters requiring further discussion for Method 8270D SIM were identified.

1.4.2 Organochlorine Pesticides by Method 8081B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- LCS/LCSD recoveries and RPDs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- DDT/Endrin breakdown

All analytical or quality parameters requiring further discussion for Method 8081B are described in the sections below.

1.4.2.1 Laboratory Control Samples

Endosulfan I (59%) recovered below QC limits (62-126%) in the LCS. However, Endosulfan I was within QC limits in the LCSD sample and the LCS/LCSD RPD was within QC limits. Therefore, no qualification was considered to be necessary.

1.4.3 Polychlorinated Biphenyls by Method 8082A

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- MS/MSD
- Initial calibration

- Initial calibration verification
- Continuing calibration verification

All analytical or quality parameters requiring further discussion for Method 8082A are described in the sections below.

1.4.3.1 Sample Preparation

The following samples underwent a sulfuric acid clean-up (EPA 3665A) to reduce matrix interferences: DA2mw-107-111416-GW and DA2mw-104-111416-GW.

1.4.3.2 Laboratory Control Samples

PCB 1260 (137%) recovered above QC limits (45-134%) in the LCSD. However, PCB 1260 was within QC limits in the LCS sample and the LCS/LCSD RPD was also within QC limits (30%). Therefore, no qualification was considered to be necessary.

1.4.4 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- LCS/LCSD recoveries and RPDs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Second column confirmation

All analytical or quality parameters requiring further discussion for Method 8330B are described in the sections below.

1.4.4.1 Method Blanks

Nitroglycerin (1.29 µg/L) was detected in the method blank at a concentration below the LOQ (3 µg/L). Nitroglycerin was not detected in the associated samples, therefore no qualification was necessary.

1.4.5 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- LCS/LCSD recoveries and RPDs
- Method blanks

- Low level calibration check standard
- Interference check solutions
- Instrument tuning
- Serial dilutions

All analytical or quality parameters requiring further discussion for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.5.1 Calibration Blanks

Antimony was detected in initial calibration blank ICB 280-352858/11 (0.744 µg/L) below the LOQ (6 µg/L). Antimony was not detected in associated sample DA2mw-104-111416-GW, therefore no qualification was necessary.

Sodium was detected (100 µg/L) in continuing calibration blank CCB 280-353819/62 below the LOQ (5000 µg/L). Sodium was also detected below the LOQ in associated sample DA2mw-104-111416-GW and has been qualified as non-detect at the LOQ (U B).

1.4.5.2 Continuing Calibration Verification

Antimony recovered above the QC limits (80-120%) in the low level continuing calibration verification ICVL 280-352858/12 (121%). Antimony was not detected in associated sample DA2mw-104-111416-GW and was therefore not qualified.

1.4.6 Hexavalent Chromium by Method 7196A

The following parameters were evaluated and met the required criteria

- Holding time
- LODs and LOQs
- Method blank
- LCS/LCSD recoveries and RPD
- MS/MSD recovery and RPD
- Sample duplicate RPD
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

No analytical or quality issues for Method 7196A were identified.

1.4.7 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs

- Method blank
- LCS recoveries
- Low and high level control sample recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

No analytical or quality issues for Method 9012B were identified.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90960-1	DA2mw-104-111416-GW	280-90960-3	Water	Sodium	7440-23-5	µg/L	5000	j	u	n	5000	350	92	Metals	B

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90961-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Project Chemist and Secondary QC Review was performed by the Validation Chemist. Signatures indicate the report is approved for release.



Erica Fisher, Validator, TEC-WESTON JV

02/08/2017

Date



Pete Chapman, Validation Chemist, TEC-WESTON JV

2/8/17

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90961-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Polychlorinated Biphenyls (PCBs)	8082A	Denver, CO
Explosives	8330B	Denver, CO
Metals	6010C/6020A/7470A	Denver, CO
Total Cyanide	9012B	Denver, CO
Alkalinity	2320B	Denver, CO
Sulfide	9034	Denver, CO
Anions	9056A	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	PCBs	Explosives	Metals	Cyanide	Alkalinity
SCFmw-006-111416	280-90961-1	11/14/16	Ground water		✓	✓	✓	✓	✓	✓
TB-111416	280-90961-2	11/14/16	Water		✓					

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
UJ	CC	Estimated non-detection; continuing calibration verification did not meet acceptance criteria.
J	CC	Estimated detection; continuing calibration verification did not meet acceptance criteria.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 15, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

As a sample date and collection time was not provided for the trip blank that travelled with the samples, the laboratory assigned the date and collection time of the earliest associated groundwater sample (November 14 2016, 09:47).

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- Instrument tuning
- Surrogate recoveries
- Method blank
- LCS recoveries
- Initial calibration
- Initial calibration verification
- Internal Standards
- Trip blank

All analytical or quality parameters requiring further discussion for Method 8260B are described in the sections below.

1.4.1.1 Continuing Calibration Verification

Bromomethane (27.2%) exceeded the QC limit ($\pm 20\%D$) in continuing calibration verification sample CCV 280-353377/4. Bromomethane was not detected in the associated samples, which were therefore qualified estimated (UJ CC).

1.4.2 Polychlorinated Biphenyls by Method 8082A

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS/LCSD RPDs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification

All analytical or quality parameters requiring further discussion for Method 8082A are described in the sections below.

1.4.2.1 Sample Preparation

Samples SCFmw-006-111416-GW underwent a sulfuric acid clean-up (EPA 3665A) to reduce matrix interferences.

1.4.2.2 Laboratory Control Samples

PCB-1260 recovered above the control limits (45-134%) in laboratory control sample duplicate LCSD 280-352026/3-A (137%) associated with sample SCFmw-006-111416-GW. The associated sample results were non-detect for PCB-1260; therefore, no qualification was necessary

1.4.3 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- LCS/LCSD recoveries and RPDs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Second column confirmation

All analytical or quality parameters requiring further discussion for Method 8330B are described in the sections below.

1.4.3.1 Method Blanks

Nitroglycerin (1.29 µg/L) was detected in the method blank at a concentration below the LOQ (2.0 µg/L). Nitroglycerin was not detected in the associated sample. No qualification was necessary.

1.4.4 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- LCS recoveries
- Method blank
- Low level calibration check standard
- Interference check standards
- Instrument tuning
- Contract required detection limit standard
- Serial dilutions

All analytical or quality parameters requiring further discussion for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.4.1 Calibration Blanks

Antimony (0.774 µg/L) was detected in initial calibration blank ICB 280-352858-11 below the LOQ (6 µg/L). Antimony was not detected in associated sample SCFmw-006-111416-GW, therefore, no qualification was necessary.

Sodium was detected in continuing calibration blank CCB 280-353819/62 (100 µg/L) below the LOQ (5000 µg/L). Sodium was detected above the LOQ in the associated sample, therefore no qualification was necessary.

1.4.4.2 Continuing Calibration Verification

Sodium (111% and 114%) recovered above the QC limits (90-110%) in CCV 280-353642/145 and CCV 280-353642/158. Sodium was detected in the associated sample and was qualified as estimated (J CC).

Antimony (121%) recovered above the QC limits (80-120%) in the initial low level calibration ICVL 280-352858/12. Antimony was not detected in the associated sample and therefore, no qualification was necessary.

1.4.5 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blank
- LCS recoveries
- Low and high level control sample recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

No analytical or quality parameters requiring further discussion for Method 9012B were identified.

1.4.6 Alkalinity by Method SM 2320B

The following parameters were evaluated and met the required criteria:

- Holding time
- LODs and LOQs
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

All analytical or quality parameters requiring further discussion for Method SM 2320 are described in the sections below.

1.4.6.1 Method Blanks

Alkalinity (1.37 mg/L) was detected in the method blank at a concentration below the LOQ (5.0 mg/L). Because alkalinity was detected in the associated sample (SCFmw-006-111416-GW) at concentrations above the LOQ, no qualifiers were assigned.

1.4.6.2 Calibration Blanks

Alkalinity (1.74 mg/L) was detected in the continuing calibration blank at a concentration below the LOQ (5.0 µg/L). Because alkalinity was detected in the associated sample, SCFmw-006-111416-GW, at concentrations above the LOQ, no qualifiers were assigned.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-90961-1	SCFmw-006-111416	280-90961-1	Water	Sodium	7440-23-5	µg/L	8900	v	j	y	5000	350	92	Metals	CC
280-90961-1	SCFmw-006-111416	280-90961-1	Water	Bromomethane	74-83-9	µg/L	0.8	u q	uj	n	2	0.8	0.21	VOCs	CC
280-90961-1	TB-111416	280-90961-2	Water	Bromomethane	74-83-9	µg/L	0.8	u q	uj	n	2	0.8	0.21	VOCs	CC

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-90963-1

Prepared for:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared by:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by a Chemist and Secondary QC Review was performed by the Project Chemist. Signatures indicate the report is approved for release.



Pete Chapman, Chemist, TEC-WESTON JV

2/8/17

Date



Heather Miner, Project Chemist, TEC-WESTON JV

2/8/17

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-90963-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Polychlorinated Biphenyls (PCBs)	8082A	Denver, CO
Explosives	8330B	Denver, CO
Cyanide	9012B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend

using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	PCBs	Explosives	Cyanide
CBPmw-001-111416-GW	280-90963-1	11/14/16	Groundwater		✓	✓	✓
LL5mw-005-111416-GW	280-90963-2	11/14/16	Groundwater		✓		
LL2mw-270-111416-GW	280-90963-3	11/14/16	Groundwater		✓		
EBGmw-123-111416-GW	280-90963-4	11/14/16	Groundwater			✓	✓
NTAmw-113-111416-GW	280-90963-5	11/14/16	Groundwater		✓		
NTAmw-118-111416-GW	280-90963-6	11/14/16	Groundwater		✓		
NTAmw-115-111416-GW	280-90963-7	11/14/16	Groundwater		✓		
NTAmw-500-111416-GW	280-90963-8	11/14/16	Groundwater	Field Duplicate	✓		

Note: NTAmw-500-111416-GW is a field duplicate of parent sample NTAmw-113-111416-GW.

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
		No data was qualified in this SDG.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 15, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

The container label for the following sample did not match the information listed on the Chain-of-Custody (COC): LL5mw-002-111416-GW (280-90963-2). The container labels list LL5mw-002-111416-GW while the COC lists LL5mw-005-111416-GW. As instructed by the client, the samples were logged using the sample ID as referenced on the sample container labels.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Polychlorinated Biphenyls by Method 8082A

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Method blank
- MS/MSD recoveries and RPDs
- LCS recoveries
- Instrument tuning
- Internal standards
- Initial calibration
- Continuing calibration
- Closing calibration verification
- Field duplicate

1.4.1.1 LCS Recoveries

PCB-1260 failed the recovery criteria high for LCSD 280-352026/3-A. This analyte was biased high in the LCSD and was not detected in the associated samples; therefore, no data have been qualified.

No other analytical or quality issues were found for Method 8082A.

1.4.2 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Method blank
- LCS Recoveries
- MS/MSD recoveries and RPDs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Second column confirmation
- Field duplicate

1.4.2.1 Method Blanks

Nitroglycerin (1.3 ug/L) was detected in method blank sample MB 280-351958/1-A at a concentration below the LOQ (3.0 µg/L). Nitroglycerin was not detected in the associated samples. Therefore, no sample results were qualified.

There were no other analytical or quality issues for Method 8330B.

1.4.3 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- LCS recoveries
- MS/MSD recoveries and RPDs
- Method blank
- Low and high level control samples
- Initial calibration
- Continuing calibration
- Initial calibration blank
- Continuing calibration blank
- Field duplicate

There were no analytical or quality parameters requiring further discussion for Method 9012B .

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
-----	-----------------	---------------	--------	-----------	------------	-------	--------	----------	---------	-----------	-----	-----	-----	-------------------	-------------

No data was qualified in this SDG.

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-91046-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Project Chemist and Secondary QC Review was performed by the Validation Chemist. Signatures indicate the report is approved for release.



Heather A. Miner
2017.01.19 11:19:28 -07'00'

Heather Miner, Project Chemist, TEC-WESTON JV

Date



Travis Withers
2017.01.19 12:04:14 -07'00'

Travis Withers, Validation Chemist, TEC-WESTON JV

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-91046-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polychlorinated Biphenyls (PCBs)	8082A	Denver, CO
Polycyclic Aromatic Hydrocarbons (PAHs)	8270D SIM	Denver, CO
Organochlorine Pesticides	8081B	Denver, CO
Explosives	8330B	Denver, CO
Metals	6010C/6020A/7470A	Denver, CO
Hexavalent Chromium	353.2	Denver, CO
Total Cyanide	9012B	Denver, CO
Anions	9056A	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R)

should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	SVOCs (phthalates)	SVOCs (full list)	PAHs	Pesticides	PCBs	Explosives	Metals	Cr(VI)	Cyanide	Alkalinity
LL3mw-238-111516-GW	280-91046-1	11/15/16	Groundwater		✓	✓			✓	✓	✓	✓		✓	
LL2mw-264-111516-GW	280-91046-2	11/15/16	Groundwater			✓				✓	✓			✓	
RQLmw-011-111516-GW	280-91046-3	11/15/16	Groundwater		✓		✓	✓		✓	✓	✓	✓	✓	✓
LL3mw-238-111516-GF	280-91046-4	11/15/16	Groundwater									✓			

Notes: LL3mw-238-111516-GF was filtered in the field through a 5-micron filter; these filtered results are considered “total” results.

Samples were also analyzed for natural attenuation parameters; these parameters were not validated.

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
J	P	Estimated detection; the RPD between the primary and confirmation column was outside QC limits.
J	Q	Estimated detection; this reason code is applied based on reviewer's professional judgment. An explanation is provided in the data validation report.
UJ	CC	Estimated non-detection; continuing calibration verification did not meet acceptance criteria.
UJ	L	Estimated non-detection; The associated LCS/LCSD recoveries and/or RPD were outside QC limits.
UJ	S	Estimated non-detection; the surrogate recovery was outside QC limits.
U	B	Not detected; target analyte was detected in the method or calibration blank.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 16, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

Sample RQLmw-011-111516-GW was analyzed for nitrate, nitrite and sulfate anions in addition to the methods requested on the COC.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- Surrogate recoveries
- Method blank
- LCS recoveries
- LODs and LOQs
- Instrument tuning
- Internal standard area counts
- Initial calibration
- Initial calibration verification
- Closing calibration verification

All analytical or quality parameters requiring further discussion for Method 8260B are described in the sections below.

1.4.1.1 Continuing Calibration Verification

Bromomethane (-27.2 %D) was recovered outside of the acceptance criteria ($\pm 20\%$ D) in CCV 280-352952/2. No corrective action was performed. All bromomethane results were qualified as estimated (UJ CC).

1.4.1.2 Trip Blank

The trip blank associated with samples reported in this SDG is reported in SDG 280-91050-1. No detections were reported in the trip blank sample.

1.4.2 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- LCS/LCSD recoveries and RPDs
- Instrument tuning
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Internal standard area counts

No analytical or quality parameters required further discussion for Method 8270D.

1.4.3 Polycyclic Aromatic Compounds by Method 8270D SIM

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- LCS/LCSD recoveries and RPDs
- Instrument tuning
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Internal standard area counts

No analytical or quality parameters required further discussion for Method 8270D SIM.

1.4.4 Organochlorine Pesticides by Method 8081B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- LCS/LCSD recoveries and RPDs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Endrin/DDT breakdown check

All analytical or quality parameters requiring further discussion for Method 8081B are described in the sections below.

1.4.4.1 Second Column Confirmation

beta-BHC was detected in the both the primary and confirmation columns; however, the RPD between the detections (197%) exceeds the 40% criterion. The result was reported from the primary column. The beta-BHC result is qualified as estimated (J P).

1.4.5 Polychlorinated Biphenyls by Method 8082A

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Second column confirmation

All analytical or quality parameters requiring further discussion for Method 8082A are described in the sections below.

1.4.5.1 Laboratory Control Sample/Laboratory Control Sample Duplicate

Two LCS/LCSDs were performed. PCB-1260 (137%) was recovered above the QC limits in the LCSD associated with samples LL3mw-238-111516-GW and RQLmw-011-111516-GW. Because the LCS recovery and RPD were within control limits, no qualification was necessary for PCB-1260.

1.4.6 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blank
- Initial calibration
- Initial calibration verification
- Continuing calibration verification

All analytical or quality parameters requiring further discussion for Method 8330B are described in the sections below.

1.4.6.1 Dilutions

Sample LL3mw-238-111516-GW was analyzed at a 5x dilution due to high concentrations of both target and non-target analytes.

1.4.6.2 LODs and LOQs

As a result of the 5x dilution performed on sample LL3mw-238-111516-GW, LODs and LOQs are elevated. As a result of the higher LODs, several non-detected explosive analytes do not meet

Project Action Level (PAL) presented in the QAPP. The table below presents the PAL exceedances:

Analyte	PAL (µg/L)	UFP-QAPP LOD (µg/L)	Reported LOD (µg/L)
1,3-Dinitrobenzene	0.2	0.2	1.1
2,4-Dinitrotoluene	0.24	0.2	1.1
2,6-Dinitrotoluene	0.049	0.2	1.1
2-Nitrotoluene	0.31	0.2	1.1
3-Nitrotoluene	0.17	0.2	1.1
Nitrobenzene	0.14	0.2	1.1
Nitroglycerin	0.2	2	11
PETN	3.9	1.2	6.6

Bolded values are above screening criteria.

1.4.6.3 Surrogates

Surrogate 1,2-dinitrobenzene was recovered below QC limits (83-119%) in samples LL3mw-238-111516-GW (65%) and LL2mw-264-111516-GW (76%). The laboratory noted evidence of matrix interference for sample LL2mw-264-111516-GW. All analytes in these two samples were qualified as estimated (J/UJ S).

1.4.6.4 Laboratory Control Sample

2-Amino-4,6-dinitrotoluene (76%) was recovered below the QC limits (79-120%) in the LCS. All associated 2-amino-4,6-dinitrotoluene results were qualified as estimated (J/UJ L).

1.4.7 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Low-level calibration check standard
- Contract required detection limit standard
- Interference check standards

All analytical or quality parameters requiring further discussion for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.7.1 Method Blanks

Calcium (43.2 µg/L), sodium (116 µg/L), lead (0.190 µg/L), and zinc (2.27 µg/L) were detected in the method blank at concentrations below their respective LOQs (1000 µg/L, 5000 µg/L, 3 µg/L, and 20 µg/L). Sodium was detected at concentrations below the LOQ in all samples (ranging from 2500 to 3600 µg/L); lead was detected at concentrations below the LOQ in all samples (ranging from 0.24 µg/L to 0.87 µg/L); zinc was detected at concentrations below the LOQ in all samples (ranging from 2.7 µg/L to 6.7 µg/L); these results were qualified as not detected at the LOQ (U B). All calcium results were detected above the LOQ; therefore, no qualification was necessary.

1.4.7.2 Calibration Blanks

Antimony was detected in ICB 280-353024/11 (0.870 µg/L) at a concentration below the LOQ (6 µg/L). Antimony was not detected in any associated sample. No qualification was necessary.

Lead was detected in CCB 280-353024/103 (0.198 µg/L). All associated lead results were already qualified as non-detect for method blank contamination; therefore, no qualification was necessary. See section Method Blank discussion for details.

1.4.7.3 Filtered Samples

Sample LL3mw-238-111516-GW was reported as an unfiltered sample and as a filtered sample (LL3mw-238-111516-GF). All detections are lower in concentration in the filtered sample except calcium, magnesium, sodium, and copper. Calcium, magnesium, and sodium detections are marginally higher (less than 4% RPD) than their unfiltered result. These marginal differences are attributed to normal variations in the analytical process. Copper was detected at an estimated concentration below the LOQ (0.95 µg/L) in the unfiltered sample and at a concentration 4x higher (3.9 µg/L) in the filtered sample. The copper RPD (122%) is quite high and cannot be explained by the analytical process as all instrument and QC criteria were met for copper. Based on reviewer's professional judgment, the unfiltered and filtered copper results for LL3mw-238-111516-GW and LL3mw-238-111516-GF, respectively, were qualified as estimated (J Q).

1.4.8 Hexavalent Chromium by Method 7196A

The following parameters were evaluated and met the required criteria:

- Holding time
- LODs and LOQs
- Method blank
- LCS/LCSD recoveries and RPDs
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

All analytical or quality issues for Method 7196A are described in the sections below.

1.4.9 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria:

- Holding time
- LODs and LOQs
- Method blank
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

No analytical or quality parameters required further discussion for Method 9012B.

1.4.10 Alkalinity by Method SM 2320B

The following parameters were evaluated and met the required criteria:

- Holding time
- LODs and LOQs
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification

All analytical or quality parameters requiring further discussion for Method SM 2320 are described in the sections below.

1.4.10.1 Method Blanks

Alkalinity (2.56 µg/L) was detected in the method blank at a concentration below the LOQ (5.0 µg/L). Because alkalinity was detected in the associated sample, RQLmw-011-111516-GW (120 µg/L), at a concentration above the LOQ, no qualifiers were assigned.

1.4.10.2 Calibration Blanks

Alkalinity (ranging from 2.27 µg/L to 2.46 µg/L) was detected in the initial and continuing calibration blanks at concentrations below the LOQ (5.0 µg/L). Because alkalinity was detected in the associated

sample, RQLmw-011-111516-GW (120 µg/L), at a concentration above the LOQ, no qualifiers were assigned.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	Result	Units	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Group	Reason Code
280-91046-1	LL3mw-238-111516-GW	280-91046-1	Water	Sodium	5000	µg/L	j	u	n	5000	350	92	Metals	B
280-91046-1	LL3mw-238-111516-GW	280-91046-1	Water	Copper	0.95	µg/L	j	j	y	2	1.8	0.56	Metals	Q
280-91046-1	LL3mw-238-111516-GW	280-91046-1	Water	Lead	3	µg/L	j	u	n	3	0.7	0.18	Metals	B
280-91046-1	LL3mw-238-111516-GW	280-91046-1	Water	Zinc	20	µg/L	j	u	n	20	8	2	Metals	B
280-91046-1	LL3mw-238-111516-GW	280-91046-1	Water	Beta-BHC	0.036	µg/L	j	j	y	0.05	0.04	0.01	Pesticides	P
280-91046-1	LL3mw-238-111516-GW	280-91046-1	Water	Bromomethane	2	µg/L	u q	uj	n	2	0.8	0.21	VOCs	CC
280-91046-1	LL3mw-238-111516-GW	280-91046-1	Water	1,3,5-Trinitrobenzene	5.5	µg/L	u q	uj	n	5.5	2.2	1.1	Explosives	S
280-91046-1	LL3mw-238-111516-GW	280-91046-1	Water	1,3-Dinitrobenzene	2.2	µg/L	u q m	uj	n	2.2	1.1	0.49	Explosives	S
280-91046-1	LL3mw-238-111516-GW	280-91046-1	Water	2,4,6-Trinitrotoluene	34	µg/L	q d	j	y	2.2	1.1	0.4	Explosives	S
280-91046-1	LL3mw-238-111516-GW	280-91046-1	Water	2,4-Dinitrotoluene	2.2	µg/L	u q	uj	n	2.2	1.1	0.46	Explosives	S
280-91046-1	LL3mw-238-111516-GW	280-91046-1	Water	2,6-Dinitrotoluene	1.1	µg/L	u q	uj	n	1.1	1.1	0.36	Explosives	S
280-91046-1	LL3mw-238-111516-GW	280-91046-1	Water	2-Amino-4,6-dinitrotoluene	8.6	µg/L	q d	j	y	1.1	0.66	0.28	Explosives	S L
280-91046-1	LL3mw-238-111516-GW	280-91046-1	Water	2-Nitrotoluene	2.2	µg/L	u q	uj	n	2.2	1.1	0.47	Explosives	S
280-91046-1	LL3mw-238-111516-GW	280-91046-1	Water	3-Nitrotoluene	2.2	µg/L	u q	uj	n	2.2	1.1	0.46	Explosives	S
280-91046-1	LL3mw-238-111516-GW	280-91046-1	Water	4-Amino-2,6-dinitrotoluene	23	µg/L	q d	j	y	1.1	0.66	0.32	Explosives	S
280-91046-1	LL3mw-238-111516-GW	280-91046-1	Water	Nitrobenzene	2.2	µg/L	u q	uj	n	2.2	0.21	0.5	Explosives	S
280-91046-1	LL3mw-238-111516-GW	280-91046-1	Water	Nitroglycerin	17	µg/L	u q	uj	n	17	2.1	5.1	Explosives	S
280-91046-1	LL3mw-238-111516-GW	280-91046-1	Water	PETN	11	µg/L	u q	uj	n	11	1.2	2.3	Explosives	S
280-91046-1	LL3mw-238-111516-GW	280-91046-1	Water	Tetryl	1.3	µg/L	u q	uj	n	1.3	0.21	0.44	Explosives	S
280-91046-1	LL2mw-264-111516-GW	280-91046-2	Water	1,3,5-Trinitrobenzene	1.1	µg/L	u q	uj	n	1.1	2.2	0.22	Explosives	S
280-91046-1	LL2mw-264-111516-GW	280-91046-2	Water	1,3-Dinitrobenzene	0.44	µg/L	u q	uj	n	0.44	1.1	0.1	Explosives	S
280-91046-1	LL2mw-264-111516-GW	280-91046-2	Water	2,4,6-Trinitrotoluene	0.44	µg/L	u q	uj	n	0.44	1.1	0.08	Explosives	S
280-91046-1	LL2mw-264-111516-GW	280-91046-2	Water	2,4-Dinitrotoluene	0.44	µg/L	u q	uj	n	0.44	1.1	0.09	Explosives	S
280-91046-1	LL2mw-264-111516-GW	280-91046-2	Water	2,6-Dinitrotoluene	0.22	µg/L	u q	uj	n	0.22	1.1	0.07	Explosives	S
280-91046-1	LL2mw-264-111516-GW	280-91046-2	Water	2-Amino-4,6-dinitrotoluene	0.22	µg/L	u q	uj	n	0.22	0.66	0.06	Explosives	S L
280-91046-1	LL2mw-264-111516-GW	280-91046-2	Water	2-Nitrotoluene	0.44	µg/L	u q	uj	n	0.44	1.1	0.09	Explosives	S
280-91046-1	LL2mw-264-111516-GW	280-91046-2	Water	3-Nitrotoluene	0.44	µg/L	u q	uj	n	0.44	1.1	0.09	Explosives	S
280-91046-1	LL2mw-264-111516-GW	280-91046-2	Water	4-Amino-2,6-dinitrotoluene	0.22	µg/L	u q	uj	n	0.22	0.66	0.06	Explosives	S
280-91046-1	LL2mw-264-111516-GW	280-91046-2	Water	4-Nitrotoluene	1.1	µg/L	u q	uj	n	1.1	0.42	0.22	Explosives	S
280-91046-1	LL2mw-264-111516-GW	280-91046-2	Water	HMX	0.44	µg/L	u q	uj	n	0.44	0.21	0.1	Explosives	S
280-91046-1	LL2mw-264-111516-GW	280-91046-2	Water	Nitrobenzene	0.44	µg/L	u q	uj	n	0.44	0.21	0.1	Explosives	S
280-91046-1	LL2mw-264-111516-GW	280-91046-2	Water	Nitroglycerin	3.3	µg/L	u q	uj	n	3.3	2.1	1	Explosives	S
280-91046-1	LL2mw-264-111516-GW	280-91046-2	Water	PETN	2.2	µg/L	u q	uj	n	2.2	1.2	0.46	Explosives	S
280-91046-1	LL2mw-264-111516-GW	280-91046-2	Water	RDX	0.22	µg/L	u q	uj	n	0.22	0.12	0.06	Explosives	S
280-91046-1	LL2mw-264-111516-GW	280-91046-2	Water	Tetryl	0.26	µg/L	u q	uj	n	0.26	0.21	0.09	Explosives	S
280-91046-1	RQLmw-011-111516-GW	280-91046-3	Water	Sodium	5000	µg/L	j	u	n	5000	350	92	Metals	B
280-91046-1	RQLmw-011-111516-GW	280-91046-3	Water	Lead	3	µg/L	j	u	n	3	0.7	0.18	Metals	B
280-91046-1	RQLmw-011-111516-GW	280-91046-3	Water	Zinc	20	µg/L	j	u	n	20	8	2	Metals	B
280-91046-1	RQLmw-011-111516-GW	280-91046-3	Water	Bromomethane	2	µg/L	u q	uj	n	2	0.8	0.21	VOCs	CC
280-91046-1	RQLmw-011-111516-GW	280-91046-3	Water	2-Amino-4,6-dinitrotoluene	0.21	µg/L	u q	uj	n	0.21	0.66	0.05	Explosives	L
280-91046-1	LL3mw-238-111516-GF	280-91046-4	Water	Sodium	5000	µg/L	j	u	n	5000	350	92	Metals	B
280-91046-1	LL3mw-238-111516-GF	280-91046-4	Water	Copper	3.9	µg/L	v	j	y	2	1.8	0.56	Metals	Q
280-91046-1	LL3mw-238-111516-GF	280-91046-4	Water	Lead	3	µg/L	j	u	n	3	0.7	0.18	Metals	B
280-91046-1	LL3mw-238-111516-GF	280-91046-4	Water	Zinc	20	µg/L	j	u	n	20	8	2	Metals	B

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-91048-1

Prepared for:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared by:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by a Chemist and Secondary QC Review was performed by the Project Chemist. Signatures indicate the report is approved for release.



Pete Chapman, Chemist, TEC-WESTON JV

2/8/17

Date



Heather Miner, Project Chemist, TEC-WESTON JV

2/8/17

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-91048-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Poly-Chlorinated Biphenyls(PCBs)	8082A	Denver, CO
Explosives	8330B	Denver, CO
Hexavalent Chromium	7196A	Denver, CO
Cyanide	9012B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above

referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	PCBs	Explosives	Hex. Chromium	Cyanide
LL5mw-001-111516-GW	280-91048-1	11/15/16	Groundwater		✓			
LL5mw-006-111516-GW	280-91048-2	11/15/16	Groundwater		✓			
NTAmw-109-111516-GW	280-91048-3	11/15/16	Groundwater		✓			
NTAmw-114-111516-GW	280-91048-4	11/15/16	Groundwater		✓			
NTAmw-116-111516-GW	280-91048-5	11/15/16	Groundwater		✓			
NTAmw-117-111516-GW	280-91048-6	11/15/16	Groundwater		✓			
NTAmw-119-111516-GW	280-91048-7	11/15/16	Groundwater		✓			
ASYmw-010-111516-GW	280-91048-8	11/10/16	Groundwater			✓	✓	✓

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
UJ	L	Estimated non-detection; the associated LCS/LCSD recovery and/or RPD were outside QC limits.
UJ	S	Estimated non-detection; the surrogate recovery was outside QC limits.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 16, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Poly-Chlorinated Biphenyls by Method 8082A

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Method blank
- MS/MSD recoveries and RPDs
- LCS recoveries
- Instrument tuning
- Internal standards
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification

1.4.1.1 Surrogate recoveries

Tetrachloro-m-xylene (TCX) failed the surrogate recovery criteria low for LCSD 280-354322/3-A. All associated samples have TCX in control and are ND for target analytes; therefore, no data was qualified due to this issue.

1.4.1.2 LCS Recoveries

PCB-1260 failed the recovery criteria high for LCSD 280-352026/3-A. This analyte was biased high in the LCSD and was not detected in the associated samples; therefore, no data have been qualified.

No other analytical or quality issues were found for Method 8082A.

1.4.2 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Method blank
- LCS Recoveries
- MS/MSD recoveries and RPDs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Second column confirmation

1.4.2.1 Surrogate recoveries

1,2-Dinitrobenzene failed the surrogate recovery criteria low for ASYmw-010-111516-GW (280-91048-8). Evidence of matrix interference is present; therefore, re-extraction and/or re-analysis was not performed. All analytes in this sample were qualified as estimated (UJ S).

1.4.2.2 LCS recoveries

2-Amino-4,6-dinitrotoluene (76%) was recovered below the QC limits (79-120%) in the LCS. The 2-amino-4,6-dinitrotoluene result for ASYmw-010-111516-GW (280-91048-8) was qualified as estimated (UJ L).

There were no other analytical or quality issues for Method 8330B.

1.4.3 Hexavalent Chromium by Method 7196A

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- LCS recoveries
- MS/MSD recoveries and RPDs
- Method blank
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank

There were no analytical or quality issues for Method 7196A.

1.4.4 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria. No validation flags were assigned:

- Holding times
- LODs and LOQs
- LCS recoveries
- MS/MSD recoveries and RPDs
- Method blank
- Low and high level control samples
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blank

There were no analytical or quality parameters requiring further discussion for Method 9012B .

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-91048-1	ASYmw-010-111516-GW	280-91048-8	Waste	1,3,5-Trinitrobenzene	99-35-4	µg/L	0.41	u q	uj	n	1	0.41	0.21	Explosives and Propellants	S
280-91048-1	ASYmw-010-111516-GW	280-91048-8	Waste	1,3-Dinitrobenzene	99-65-0	µg/L	0.21	u q	uj	n	0.41	0.21	0.092	Explosives and Propellants	S
280-91048-1	ASYmw-010-111516-GW	280-91048-8	Waste	2,4,6-Trinitrotoluene	118-96-7	µg/L	0.21	u q	uj	n	0.41	0.21	0.075	Explosives and Propellants	S
280-91048-1	ASYmw-010-111516-GW	280-91048-8	Waste	2,4-Dinitrotoluene	121-14-2	µg/L	0.21	u q	uj	n	0.41	0.21	0.087	Explosives and Propellants	S
280-91048-1	ASYmw-010-111516-GW	280-91048-8	Waste	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u q	uj	n	0.21	0.21	0.067	Explosives and Propellants	S
280-91048-1	ASYmw-010-111516-GW	280-91048-8	Waste	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.12	u q	uj	n	0.21	0.12	0.053	Explosives and Propellants	S L
280-91048-1	ASYmw-010-111516-GW	280-91048-8	Waste	2-Nitrotoluene	88-72-2	µg/L	0.21	u q	uj	n	0.41	0.21	0.089	Explosives and Propellants	S
280-91048-1	ASYmw-010-111516-GW	280-91048-8	Waste	3-Nitrotoluene	99-08-1	µg/L	0.21	u q	uj	n	0.41	0.21	0.086	Explosives and Propellants	S
280-91048-1	ASYmw-010-111516-GW	280-91048-8	Waste	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.12	u q	uj	n	0.21	0.12	0.06	Explosives and Propellants	S
280-91048-1	ASYmw-010-111516-GW	280-91048-8	Waste	4-Nitrotoluene	99-99-0	µg/L	0.41	u q	uj	n	1	0.41	0.21	Explosives and Propellants	S
280-91048-1	ASYmw-010-111516-GW	280-91048-8	Waste	HMX	2691-41-0	µg/L	0.21	u q	uj	n	0.41	0.21	0.091	Explosives and Propellants	S
280-91048-1	ASYmw-010-111516-GW	280-91048-8	Waste	Nitrobenzene	98-95-3	µg/L	0.21	u q	uj	n	0.41	0.21	0.094	Explosives and Propellants	S
280-91048-1	ASYmw-010-111516-GW	280-91048-8	Waste	Nitroglycerin	55-63-0	µg/L	2.1	u q	uj	n	3.1	2.1	0.95	Explosives and Propellants	S
280-91048-1	ASYmw-010-111516-GW	280-91048-8	Waste	PETN	78-11-5	µg/L	1.2	u q	uj	n	2.1	1.2	0.43	Explosives and Propellants	S
280-91048-1	ASYmw-010-111516-GW	280-91048-8	Waste	RDX	121-82-4	µg/L	0.12	u q	uj	n	0.21	0.12	0.054	Explosives and Propellants	S
280-91048-1	ASYmw-010-111516-GW	280-91048-8	Waste	Tetryl	479-45-8	µg/L	0.21	u q	uj	n	0.25	0.21	0.082	Explosives and Propellants	S

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-91050-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Project Chemist and Secondary QC Review was performed by a Senior Chemist. Signatures indicate the report is approved for release.



Heather A. Miner
2017.01.23 10:25:07 -07'00'

Heather Miner, Project Chemist, TEC-WESTON JV

Date



Peter Chapman, Senior Chemist, TEC-WESTON JV

1/17/17

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-91050-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polychlorinated Biphenyls (PCBs)	8082A	Denver, CO
Polycyclic Aromatic Hydrocarbons (PAHs)	8270D SIM	Denver, CO
Organochlorine Pesticides	8081B	Denver, CO
Explosives	8330B	Denver, CO
Metals	6010C/6020A/7470A	Denver, CO
Total Cyanide	9012B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*. Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	SVOCs (full list)	PAHs	PCBs	Pesticides	Explosives	Metals	Cyanide
BKGmw-024-111516-GW	280-91050-1	11/15/16	Groundwater		✓	✓	✓	✓	✓	✓	✓	✓
FWGmw-017-111516-GW	280-91050-2	11/15/16	Groundwater		✓	✓	✓	✓	✓	✓	✓	✓
FWGmw-024-111516-GW	280-91050-3	11/15/16	Groundwater		✓	✓	✓	✓	✓	✓	✓	✓
FWGmw-021-111516-GW	280-91050-4	11/15/16	Groundwater		✓	✓	✓	✓	✓	✓	✓	✓
BKGmw-025-111516-GW	280-91050-5	11/15/16	Groundwater		✓	✓	✓	✓	✓	✓	✓	✓
BKGmw-022-111516-GW	280-91050-6	11/15/16	Groundwater		✓	✓	✓	✓	✓	✓	✓	✓
SCFmw-006-111516-GW	280-91050-7	11/15/16	Groundwater				✓					
BKGmw-023-111516-GW	280-91050-8	11/15/16	Groundwater		✓	✓	✓	✓	✓	✓	✓	✓
FWGmw-020-111516-GW	280-91050-9	11/15/16	Groundwater		✓	✓	✓	✓	✓	✓	✓	✓
FWGmw-018-111516-GW	280-91050-10	11/15/16	Groundwater		✓	✓	✓	✓	✓	✓	✓	✓
TRIP BLANK	280-91050-11	11/15/16	Water	Trip Blank	✓							

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
J	S	Estimated detection; the surrogate recovery was outside QC limits.
UJ	L	Estimated non-detection; the associated LCS/LCSD recovery and/or RPD were outside QC limits.
UJ	S	Estimated non-detection; the surrogate recovery was outside QC limits.
U	B	Not detected; target analyte was detected in the method or calibration blank.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 16, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

Minor anomalies were noted in the laboratory case narrative; all anomalies were reviewed and were determined to not impact project results. See the laboratory case narrative for further information.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Holding times
- Method blank
- LODs and LOQs
- Instrument tuning
- Internal standard area counts
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Trip blank

All analytical or quality parameters requiring further discussion for Method 8260B are described in the sections below.

1.4.1.1 Surrogates

Surrogate 1,2-dichloroethane-d4 was recovered above QC limits in several samples. The table below shows surrogate exceedances:

Sample ID	Surrogate	%R	%R QC Limits	Assigned Flags
FWGmw-017-1151516-GW	1,2-Dichloroethane-d4	123	81-118	J S (Detections only)
FWGmw-018-1151516-GW	1,2-Dichloroethane-d4	119	81-118	J S (Detections only)
TB-1151516-GW	1,2-Dichloroethane-d4	119	81-118	No flags

Bolded values exceed QC limits.

All detected analytes were qualified as estimated detections (J S) in the associated samples. Note no analytes were detected in sample TB-1151516-GW; therefore, no qualifiers were assigned.

1.4.1.2 Laboratory Control Sample

1,2-Dichloropropane (77%) was recovered in the LCS below the control limits (78-122%). All associated 1,2-dichloropropane results were qualified as estimated (J/UJ L).

1.4.2 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- LCS/LCSD recoveries and RPDs
- Instrument tuning
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Internal standard area counts

No analytical or quality parameters required further discussion for Method 8270D.

1.4.3 Polycyclic Aromatic Compounds by Method 8270D SIM

The following parameters were evaluated and met the required criteria:

- Holding time
- LODs and LOQs
- Method blank
- LCS/LCSD recoveries and RPDs
- Instrument tuning
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Closing calibration verification
- Internal standard area counts

All analytical or quality parameters requiring further discussion for Method 8270D SIM are described in the sections below.

1.4.3.1 Surrogates

Several surrogates in several samples were recovered outside QC limits. The following table presents the surrogate exceedances:

Sample ID	Surrogate	%R	%R QC Limits	Assigned Flags
BKGMw-024-111516-GW	2-Fluorobiphenyl	48	53-106	J/UJ S
	Nitrobenzene-d5	49	55-111	J/UJ S
FWGMw-017-111516-GW	2-Fluorobiphenyl	49	53-106	J/UJ S
	Nitrobenzene-d5	51	55-111	J/UJ S
BKGMw-022-111516-GW	Terphenyl-d14	159	58-132	Detections only
	2-Fluorobiphenyl	51	53-106	J/UJ S

FWGmw-020-111516-GW	Nitrobenzene-d5	50	55-111	J/UJ S
---------------------	-----------------	-----------	--------	--------

Bolded values exceed QC limits.

Analytes associated with low surrogate recoveries in samples BKGmw-024-111516-GW, FWGmw-017-111516-GW, and FWGmw-020-111516-GW are qualified as estimated (J/UJ S). All analytes in sample BKGmw-022-111516-GW were not detected; therefore, no qualifications were assigned.

1.4.4 Organochlorine Pesticides by Method 8081B

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- LCS/LCSD recoveries and RPDs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Endrin/DDT breakdown check

No analytical or quality parameters required further discussion for Method 8081B.

1.4.5 Polychlorinated Biphenyls by Method 8082A

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blank
- LCS/LCSD recoveries and RPDs
- Initial calibration verification
- Continuing calibration verification
- Second column confirmation

No analytical or quality parameters required further discussion for Method 8082A.

1.4.6 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification

All analytical or quality parameters requiring further discussion for Method 8330B are described in the sections below.

1.4.6.1 Method Blank

4-Amino-2,6-dinitrotoluene (0.122 µg/L) was detected in the method blank at a concentration below the LOQ (0.20 µg/L). 4-Amino-2,6-dinitrotoluene was not detected in any associated sample. No qualification was necessary.

1.4.6.2 Surrogates

Surrogate 1,2-dinitrobenzene (68%) was recovered below QC limits (83-119%) in sample FWGmw-020-111516-GW. The laboratory noted evidence of matrix interference was present and the sample was not reanalyzed. All analytes in sample FWGmw-020-111516-GW were qualified as estimated (UJ S).

1.4.6.3 Laboratory Control Sample

One LCS and one LCS/LSCD was performed. 2-Amino-4,6-dinitrotoluene (76%) was recovered below the QC limits (79-120%) in the LCS associated with samples BKGmw-024-111516-GW, FWGmw-017-111516-GW, FWGmw-024-111516-GW, and FWGmw021-1115161-GW. All associated 2-amino-4,6-dinitrotoluene results were qualified as estimated (J/UJ L).

1.4.7 Total Metals by Method 6010C/6020A/7470A

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Low-level calibration check standard
- Contract required detection limit standard
- Interference check standards

All analytical or quality parameters requiring further discussion for Methods 6010C, 6020A, and/or 7470A are described in the sections below.

1.4.7.1 Method Blanks

Calcium (43.2 µg/L), sodium (116 µg/L), lead (0.190 µg/L), and zinc (2.27 µg/L) were detected in the method blank at concentrations below their respective LOQs (1000 µg/L, 5000 µg/L, 3 µg/L, and 20 µg/L). Sodium was detected at concentrations below the LOQ in samples FWGmw-021-111516-GW (4400 µg/L) and BKGmw-022-111516-GW (2700 µg/L) and lead was detected at concentrations below the LOQ in samples BKGmw-024-111516-GW (0.18 µg/L), FWGmw-021-111516-GW (0.18 µg/L), and BKGmw-025-111516-GW (0.26 µg/L), zinc was detected at concentrations below the LOQ in all samples (ranging from 2.1 µg/L to 14 µg/L); these results were qualified as not detected at the LOQ (U B). All other associated sample results were either not detected or detected above the LOQ; therefore, no qualification was necessary.

1.4.7.2 Calibration Blanks

Antimony was detected in ICB 280-353024/11 (0.870 µg/L) at a concentration below the LOQ (6 µg/L). Antimony was also detected in several samples below the LOQ. All associated results were qualified as non-detect at the LOQ (U B).

Lead was detected in CCB 280-353024/103 (0.198 µg/L). All associated lead results were already qualified as non-detect for method blank contamination; therefore, no qualification was necessary. See section Method Blank discussion for details.

1.4.8 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria:

- Holding time
- LODs and LOQs
- Method blank
- LCS recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

No analytical or quality parameters required further discussion for Method 9012B.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-91050-1	BKGmw-024-111516-GW	280-91050-1	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.21	u q	uj	n	0.21	0.12	0.053	Explosives and Propellants	L
280-91050-1	BKGmw-024-111516-GW	280-91050-1	Water	Lead	7439-92-1	µg/L	3	j	u	n	3	0.7	0.18	Metals	B
280-91050-1	BKGmw-024-111516-GW	280-91050-1	Water	Zinc	7440-66-6	µg/L	20	j	u	n	20	8	2	Metals	B
280-91050-1	BKGmw-024-111516-GW	280-91050-1	Water	Acenaphthene	83-32-9	µg/L	0.1	u q	uj	n	0.1	1	0.0042	PAHs	S
280-91050-1	BKGmw-024-111516-GW	280-91050-1	Water	Acenaphthylene	208-96-8	µg/L	0.1	u q	uj	n	0.1	1	0.0051	PAHs	S
280-91050-1	BKGmw-024-111516-GW	280-91050-1	Water	Anthracene	120-12-7	µg/L	0.1	u q	uj	n	0.1	1	0.0056	PAHs	S
280-91050-1	BKGmw-024-111516-GW	280-91050-1	Water	Fluoranthene	206-44-0	µg/L	0.1	u q	uj	n	0.1	0.5	0.0048	PAHs	S
280-91050-1	BKGmw-024-111516-GW	280-91050-1	Water	Fluorene	86-73-7	µg/L	0.1	u q	uj	n	0.1	1	0.0055	PAHs	S
280-91050-1	BKGmw-024-111516-GW	280-91050-1	Water	Naphthalene	91-20-3	µg/L	0.1	u q	uj	n	0.1	1	0.008	PAHs	S
280-91050-1	BKGmw-024-111516-GW	280-91050-1	Water	Phenanthrene	85-01-8	µg/L	0.1	u q	uj	n	0.1	1	0.0093	PAHs	S
280-91050-1	BKGmw-024-111516-GW	280-91050-1	Water	Pyrene	129-00-0	µg/L	0.1	u q	uj	n	0.1	1	0.0061	PAHs	S
280-91050-1	BKGmw-024-111516-GW	280-91050-1	Water	1,2-Dichloropropane	78-87-5	µg/L	1	u q	uj	n	1	0.4	0.13	VOCs	L
280-91050-1	FWGmw-018-111516-GW	280-91050-10	Water	Antimony	7440-36-0	µg/L	6	j	u	n	6	1	0.4	Metals	B
280-91050-1	FWGmw-018-111516-GW	280-91050-10	Water	Zinc	7440-66-6	µg/L	20	j	u	n	20	8	2	Metals	B
280-91050-1	FWGmw-018-111516-GW	280-91050-10	Water	1,2-Dichloropropane	78-87-5	µg/L	1	u q	uj	n	1	0.4	0.13	VOCs	L
280-91050-1	FWGmw-018-111516-GW	280-91050-10	Water	Chloroform	67-66-3	µg/L	0.18	j	j	y	1	0.4	0.16	VOCs	S
280-91050-1	FWGmw-018-111516-GW	280-91050-10	Water	Ethylbenzene	100-41-4	µg/L	0.67	j	j	y	1	0.4	0.16	VOCs	S
280-91050-1	FWGmw-018-111516-GW	280-91050-10	Water	Xylene (Total)	1330-20-7	µg/L	2.5	v	j	y	2	0.8	0.19	VOCs	S
280-91050-1	TB-111516-GW	280-91050-11	Water	1,2-Dichloropropane	78-87-5	µg/L	1	u q	uj	n	1	0.4	0.13	VOCs	L
280-91050-1	FWGmw-017-111516-GW	280-91050-2	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.21	u q	uj	n	0.21	0.12	0.053	Explosives and Propellants	L
280-91050-1	FWGmw-017-111516-GW	280-91050-2	Water	Antimony	7440-36-0	µg/L	6	j	u	n	6	1	0.4	Metals	B
280-91050-1	FWGmw-017-111516-GW	280-91050-2	Water	Zinc	7440-66-6	µg/L	20	j	u	n	20	8	2	Metals	B
280-91050-1	FWGmw-017-111516-GW	280-91050-2	Water	Acenaphthene	83-32-9	µg/L	0.1	u q	uj	n	0.1	1	0.0043	PAHs	S
280-91050-1	FWGmw-017-111516-GW	280-91050-2	Water	Acenaphthylene	208-96-8	µg/L	0.1	u q	uj	n	0.1	1	0.0052	PAHs	S
280-91050-1	FWGmw-017-111516-GW	280-91050-2	Water	Anthracene	120-12-7	µg/L	0.1	u q	uj	n	0.1	1	0.0058	PAHs	S
280-91050-1	FWGmw-017-111516-GW	280-91050-2	Water	Fluoranthene	206-44-0	µg/L	0.1	u q	uj	n	0.1	0.5	0.0049	PAHs	S
280-91050-1	FWGmw-017-111516-GW	280-91050-2	Water	Fluorene	86-73-7	µg/L	0.1	u q	uj	n	0.1	1	0.0057	PAHs	S
280-91050-1	FWGmw-017-111516-GW	280-91050-2	Water	Naphthalene	91-20-3	µg/L	0.1	u q	uj	n	0.1	1	0.0082	PAHs	S
280-91050-1	FWGmw-017-111516-GW	280-91050-2	Water	Phenanthrene	85-01-8	µg/L	0.1	u q	uj	n	0.1	1	0.0096	PAHs	S
280-91050-1	FWGmw-017-111516-GW	280-91050-2	Water	Pyrene	129-00-0	µg/L	0.1	u q	uj	n	0.1	1	0.0063	PAHs	S
280-91050-1	FWGmw-017-111516-GW	280-91050-2	Water	1,2-Dichloropropane	78-87-5	µg/L	1	uj	u	n	1	0.4	0.13	VOCs	L
280-91050-1	FWGmw-017-111516-GW	280-91050-2	Water	Chloroform	67-66-3	µg/L	0.37	j	j	y	1	0.4	0.16	VOCs	S
280-91050-1	FWGmw-017-111516-GW	280-91050-2	Water	Ethylbenzene	100-41-4	µg/L	2.4	v	j	y	1	0.4	0.16	VOCs	S
280-91050-1	FWGmw-017-111516-GW	280-91050-2	Water	Xylene (Total)	1330-20-7	µg/L	10	v	j	y	2	0.8	0.19	VOCs	S
280-91050-1	FWGmw-024-111516-GW	280-91050-3	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.21	u q	uj	n	0.21	0.12	0.053	Explosives and Propellants	L
280-91050-1	FWGmw-024-111516-GW	280-91050-3	Water	1,2-Dichloropropane	78-87-5	µg/L	1	u q	uj	n	1	0.4	0.13	VOCs	L
280-91050-1	FWGmw-021-111516-GW	280-91050-4	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.21	u q	uj	n	0.21	0.12	0.052	Explosives and Propellants	L
280-91050-1	FWGmw-021-111516-GW	280-91050-4	Water	Lead	7439-92-1	µg/L	3	j	u	n	3	0.7	0.18	Metals	B
280-91050-1	FWGmw-021-111516-GW	280-91050-4	Water	Sodium	7440-23-5	µg/L	5000	j	u	n	5000	350	92	Metals	B
280-91050-1	FWGmw-021-111516-GW	280-91050-4	Water	Zinc	7440-66-6	µg/L	20	j	u	n	20	8	2	Metals	B
280-91050-1	FWGmw-021-111516-GW	280-91050-4	Water	1,2-Dichloropropane	78-87-5	µg/L	1	u q	uj	n	1	0.4	0.13	VOCs	L
280-91050-1	BKGmw-025-111516-GW	280-91050-5	Water	Antimony	7440-36-0	µg/L	6	j	u	n	6	1	0.4	Metals	B
280-91050-1	BKGmw-025-111516-GW	280-91050-5	Water	Lead	7439-92-1	µg/L	3	j	u	n	3	0.7	0.18	Metals	B
280-91050-1	BKGmw-025-111516-GW	280-91050-5	Water	Zinc	7440-66-6	µg/L	20	j	u	n	20	8	2	Metals	B

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-91050-1	BKGmw-025-111516-GW	280-91050-5	Water	1,2-Dichloropropane	78-87-5	µg/L	1	u q	uj	n	1	0.4	0.13	VOCs	L
280-91050-1	BKGmw-022-111516-GW	280-91050-6	Water	Sodium	7440-23-5	µg/L	5000	j	u	n	5000	350	92	Metals	B
280-91050-1	BKGmw-022-111516-GW	280-91050-6	Water	Zinc	7440-66-6	µg/L	20	j	u	n	20	8	2	Metals	B
280-91050-1	BKGmw-022-111516-GW	280-91050-6	Water	1,2-Dichloropropane	78-87-5	µg/L	1	u q	uj	n	1	0.4	0.13	VOCs	L
280-91050-1	BKGmw-023-111516-GW	280-91050-8	Water	Zinc	7440-66-6	µg/L	20	j	u	n	20	8	2	Metals	B
280-91050-1	BKGmw-023-111516-GW	280-91050-8	Water	1,2-Dichloropropane	78-87-5	µg/L	1	u q	uj	n	1	0.4	0.13	VOCs	L
280-91050-1	FWGmw-020-111516-GW	280-91050-9	Water	1,3,5-Trinitrobenzene	99-35-4	µg/L	1	u q	uj	n	1	0.4	0.21	Explosives and Propellants	S
280-91050-1	FWGmw-020-111516-GW	280-91050-9	Water	1,3-Dinitrobenzene	99-65-0	µg/L	0.42	u q	uj	n	0.42	0.2	0.093	Explosives and Propellants	S
280-91050-1	FWGmw-020-111516-GW	280-91050-9	Water	2,4,6-Trinitrotoluene	118-96-7	µg/L	0.42	u q	uj	n	0.42	0.2	0.076	Explosives and Propellants	S
280-91050-1	FWGmw-020-111516-GW	280-91050-9	Water	2,4-Dinitrotoluene	121-14-2	µg/L	0.42	u q	uj	n	0.42	4.4	0.088	Explosives and Propellants	S
280-91050-1	FWGmw-020-111516-GW	280-91050-9	Water	2,6-Dinitrotoluene	606-20-2	µg/L	0.21	u q	uj	n	0.21	4.4	0.067	Explosives and Propellants	S
280-91050-1	FWGmw-020-111516-GW	280-91050-9	Water	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.21	u q	uj	n	0.21	0.12	0.053	Explosives and Propellants	S
280-91050-1	FWGmw-020-111516-GW	280-91050-9	Water	2-Nitrotoluene	88-72-2	µg/L	0.42	u q	uj	n	0.42	0.2	0.089	Explosives and Propellants	S
280-91050-1	FWGmw-020-111516-GW	280-91050-9	Water	3-Nitrotoluene	99-08-1	µg/L	0.42	u q	uj	n	0.42	0.2	0.087	Explosives and Propellants	S
280-91050-1	FWGmw-020-111516-GW	280-91050-9	Water	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.21	u q	uj	n	0.21	0.12	0.06	Explosives and Propellants	S
280-91050-1	FWGmw-020-111516-GW	280-91050-9	Water	4-Nitrotoluene	99-99-0	µg/L	1	u q	uj	n	1	0.4	0.21	Explosives and Propellants	S
280-91050-1	FWGmw-020-111516-GW	280-91050-9	Water	HMX	2691-41-0	µg/L	0.42	u q	uj	n	0.42	0.2	0.091	Explosives and Propellants	S
280-91050-1	FWGmw-020-111516-GW	280-91050-9	Water	Nitrobenzene	98-95-3	µg/L	0.42	u q	uj	n	0.42	2	0.095	Explosives and Propellants	S
280-91050-1	FWGmw-020-111516-GW	280-91050-9	Water	Nitroglycerin	55-63-0	µg/L	3.1	u q	uj	n	3.1	2	0.96	Explosives and Propellants	S
280-91050-1	FWGmw-020-111516-GW	280-91050-9	Water	PETN	78-11-5	µg/L	2.1	u q	uj	n	2.1	1.2	0.43	Explosives and Propellants	S
280-91050-1	FWGmw-020-111516-GW	280-91050-9	Water	RDX	121-82-4	µg/L	0.21	u q	uj	n	0.21	0.12	0.055	Explosives and Propellants	S
280-91050-1	FWGmw-020-111516-GW	280-91050-9	Water	Tetryl	479-45-8	µg/L	0.25	u q	uj	n	0.25	0.2	0.083	Explosives and Propellants	S
280-91050-1	FWGmw-020-111516-GW	280-91050-9	Water	Antimony	7440-36-0	µg/L	6	j	u	n	6	1	0.4	Metals	B
280-91050-1	FWGmw-020-111516-GW	280-91050-9	Water	Zinc	7440-66-6	µg/L	20	j	u	n	20	8	2	Metals	B
280-91050-1	FWGmw-020-111516-GW	280-91050-9	Water	Acenaphthene	83-32-9	µg/L	0.1	u q	uj	n	0.1	1	0.0043	PAHs	S
280-91050-1	FWGmw-020-111516-GW	280-91050-9	Water	Acenaphthylene	208-96-8	µg/L	0.1	u q	uj	n	0.1	1	0.0052	PAHs	S
280-91050-1	FWGmw-020-111516-GW	280-91050-9	Water	Anthracene	120-12-7	µg/L	0.1	u q	uj	n	0.1	1	0.0058	PAHs	S
280-91050-1	FWGmw-020-111516-GW	280-91050-9	Water	Fluoranthene	206-44-0	µg/L	0.1	u q	uj	n	0.1	0.5	0.0049	PAHs	S
280-91050-1	FWGmw-020-111516-GW	280-91050-9	Water	Fluorene	86-73-7	µg/L	0.1	u q	uj	n	0.1	1	0.0057	PAHs	S
280-91050-1	FWGmw-020-111516-GW	280-91050-9	Water	Naphthalene	91-20-3	µg/L	0.1	u q	uj	n	0.1	1	0.0082	PAHs	S
280-91050-1	FWGmw-020-111516-GW	280-91050-9	Water	Phenanthrene	85-01-8	µg/L	0.1	u q	uj	n	0.1	1	0.0096	PAHs	S
280-91050-1	FWGmw-020-111516-GW	280-91050-9	Water	Pyrene	129-00-0	µg/L	0.1	u q	uj	n	0.1	1	0.0063	PAHs	S
280-91050-1	FWGmw-020-111516-GW	280-91050-9	Water	1,2-Dichloropropane	78-87-5	µg/L	1	u q	uj	n	1	0.4	0.13	VOCs	L

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-91166-1

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Project Chemist and Secondary QC Review was performed by the Validation Chemist. Signatures indicate the report is approved for release.



Erica Fisher, Validator, TEC-WESTON JV

02/08/2017

Date



Pete Chapman, Validation Chemist, TEC-WESTON JV

2/8/17

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **280-91166-1**.

TestAmerica, Inc., Denver, Colorado performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Volatile Organic Compounds (VOCs)	8260B	Denver, CO
Semivolatile Organic Compounds (SVOCs)	8270D	Denver, CO
Polycyclic Aromatic Hydrocarbons (PAHs)	8270D SIM	Denver, CO
Explosives	8330B	Denver, CO
Total Cyanide	9012B	Denver, CO

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The data was reviewed and validated by calculating Relative Percent Difference (RPD) between spiked sample values according to the *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)* and *USEPA National Functional Guidelines for Inorganic Data Review (EPA*

2014). Therefore, the RPDs were calculated using the percent recovery values as stated in the above referenced USEPA documents. SW-846 Methods were utilized for this project and they recommend using the actual spiked sample values to calculate RPD values. However, the laboratory used varying spike amounts due to sample aliquot and percent moisture differences which lead to variations in the spike amounts making it very difficult to compare the spiked sample values. These differences would have created poor precision results for the spiked sample values that were not necessarily indicative of the data quality. The use of comparing spike recovery values in this case was a much better indicator of analytical precision.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	VOCs	SVOCs (phthalates, phenols, nitroaromatics)	PAHs	Explosives	Cyanide
WBGmw-008-111616-GW	280-91166-1	11/16/16	Groundwater		✓			✓	✓
LNWmw-025-111616-GW	280-91166-2	11/16/16	Groundwater			✓	✓	✓	✓
LNWmw-026-111616-GW	280-91166-3	11/16/16	Groundwater			✓	✓	✓	✓
TB-111616	280-91166-4	11/16/16	Water		✓				

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

The following validation flags and reason codes were applied:

Validation Flag	Reason Code	Description
UJ	H	Estimated non-detection; the holding time was exceeded.
UJ	S	Estimated non-detection; the surrogate recovery was outside QC limits.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 17, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

The laboratory reported that the number of sample containers noted on the COC differed from that received. Six vials were received for the trip blank that travelled with the samples and only two were noted on the COC. The laboratory logged the extra vials as sample TB-111616.

As a collection date/time was not provided for the trip blank that travelled with the samples, the laboratory assigned a collection date/time of the earliest associated groundwater sample (11/16/16 09:55).

1.4 TECHNICAL DATA VALIDATION

1.4.1 Volatile Organic Compounds by Method 8260B

The following parameters were evaluated and met the required criteria. No validation flags were assigned based on the following:

- Surrogate recoveries
- LODs and LOQs
- Method blanks
- Instrument tuning
- Method blanks
- LCS recoveries
- Initial calibration
- Initial and continuing calibration verification
- Internal Standards
- Trip blank

All analytical or quality parameters requiring further discussion for Method 8260B are described in the sections below.

1.4.1.1 Holding Time

Samples WBGmw-008-11616-GW and TB-111616 were extracted and analyzed 8 days past the recommended method holding time. The laboratory report that this was due to receiving sample volumes in excess of the analytical capacity. All sample results have been qualified as estimated (J/UJ H).

1.4.2 Semivolatile Organic Compounds by Method 8270D

The following parameters were evaluated and met the required criteria:

- Holding times
- Surrogate recoveries
- LODs and LOQs
- Method blanks
- Instrument tuning
- Initial calibration
- Initial calibration verification
- Continuing calibration verification

- Closing calibration verification
- Internal standard recoveries

All analytical or quality parameters requiring further discussion for Method 8270D are described in the sections below.

1.4.2.1 Laboratory Control Samples

The LCS/LCSD pair RPDs were outside QC limits (20%) for 3-nitroaniline (28%) and 4-chloroaniline (37%). As the recoveries for the analytes were within QC limits in both the LCS and LCSD samples, no qualification was necessary.

1.4.3 Polycyclic Aromatic Hydrocarbons (PAHs) by Method 8270D SIM

The following parameters were evaluated and met the required criteria:

- | | |
|--------------------------------|---------------------------------------|
| • Holding times | • Internal standards |
| • LODs and LOQs | • Initial calibration |
| • Method blank | • Initial calibration verification |
| • LCS/LCSD recoveries and RPDs | • Continuing calibration verification |
| • Instrument tuning | • Closing calibration verification |

All analytical or quality parameters requiring further discussion for Method 8270D SIM are described in the sections below.

1.4.3.1 Surrogates

Surrogates 2-fluorobiphenyl (52%) and nitrobenzene-d5 (54%) recovered below their respective QC limits (53-106% and 55-111%) in sample LNwmw-026-111616-GW. The results associated with the surrogate outliers are qualified as estimated (UJ S).

1.4.4 Explosives by Method 8330B

The following parameters were evaluated and met the required criteria:

- | | |
|--------------------------------|---------------------------------------|
| • Holding times | • Initial calibration |
| • Surrogate recoveries | • Initial calibration verification |
| • LODs and LOQs | • Continuing calibration verification |
| • LCS/LCSD recoveries and RPDs | • Second column confirmation |

All analytical or quality parameters requiring further discussion for Method 8330B are described in the sections below.

1.4.4.1 Method Blank

4-amino-2,6-dinitrotoluene (0.122 µg/L) was detected in the method blank below the LOQ (0.2 µg/L). As 4-amino-2,6-dinitrotoluene was not detected in the associated samples, no qualification was considered to be necessary.

1.4.5 Total Cyanide by Method 9012B

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blank
- LCS recoveries
- Low and high level control sample recoveries
- Initial calibration verification
- Continuing calibration verification
- Initial calibration blank
- Continuing calibration blanks

No analytical or quality parameters requiring further discussion for Method 9012B were identified.

DATA VALIDATION TABLE

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	1,1,1-Trichloroethane	71-55-6	µg/L	0.4	u h	uj	n	1	0.4	0.16	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	1,1,2,2-Tetrachloroethane	79-34-5	µg/L	0.8	u h	uj	n	1	0.8	0.2	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	1,1,2-Trichloroethane	79-00-5	µg/L	0.8	u h	uj	n	1	0.8	0.32	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	1,1-Dichloroethane	75-34-3	µg/L	0.8	u h	uj	n	1	0.8	0.16	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	1,1-Dichloroethene	75-35-4	µg/L	0.8	u h	uj	n	1	0.8	0.14	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	1,2-Dibromoethane	106-93-4	µg/L	0.4	u h	uj	n	1	0.4	0.18	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	1,2-Dichloroethane	107-06-2	µg/L	0.4	u h	uj	n	1	0.4	0.13	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	1,2-Dichloroethene	540-59-0	µg/L	0.2	u h	uj	n	1	0.2	0.15	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	1,2-Dichloropropane	78-87-5	µg/L	0.4	u h	uj	n	1	0.4	0.13	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	2-Butanone	78-93-3	µg/L	4	u h	uj	n	6	4	1.8	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	2-Hexanone	591-78-6	µg/L	4	u h	uj	n	5	4	1.4	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	4-Methyl-2-pentanone	108-10-1	µg/L	3.2	u h	uj	n	5	3.2	1	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	Acetone	67-64-1	µg/L	6.4	u h	uj	n	10	6.4	1.9	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	Benzene	71-43-2	µg/L	0.4	u h	uj	n	1	0.4	0.16	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	Bromodichloromethane	75-27-4	µg/L	0.4	u h	uj	n	1	0.4	0.17	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	Bromoform	75-25-2	µg/L	0.4	u h	uj	n	1	0.4	0.19	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	Bromomethane	74-83-9	µg/L	0.8	u h	uj	n	2	0.8	0.21	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	Carbon disulfide	75-15-0	µg/L	1.6	u h	uj	n	2	1.6	0.45	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	Carbon tetrachloride	56-23-5	µg/L	0.4	u h	uj	n	2	0.4	0.19	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	Chlorobenzene	108-90-7	µg/L	0.4	u h	uj	n	1	0.4	0.17	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	Chlorobromomethane	74-97-5	µg/L	0.2	u h	uj	n	1	0.2	0.1	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	Chloroethane	75-00-3	µg/L	1.6	u h	uj	n	2	1.6	0.41	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	Chloroform	67-66-3	µg/L	0.4	u h	uj	n	1	0.4	0.16	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	Chloromethane	74-87-3	µg/L	0.8	u h	uj	n	2	0.8	0.3	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	cis-1,3-Dichloropropene	10061-01-5	µg/L	0.4	u h	uj	n	1	0.4	0.16	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	Dibromochloromethane	124-48-1	µg/L	0.4	u h	uj	n	1	0.4	0.17	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	Ethylbenzene	100-41-4	µg/L	0.4	u h	uj	n	1	0.4	0.16	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	Methylene chloride	75-09-2	µg/L	0.8	u h	uj	n	5	0.8	0.32	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	Styrene	100-42-5	µg/L	0.4	u h	uj	n	1	0.4	0.17	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	Tetrachloroethene	127-18-4	µg/L	0.4	u h	uj	n	1	0.4	0.2	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	Toluene	108-88-3	µg/L	0.4	u h	uj	n	1	0.4	0.17	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	trans-1,3-Dichloropropene	10061-02-6	µg/L	0.4	u h	uj	n	1	0.4	0.19	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	Trichloroethene	79-01-6	µg/L	0.4	u h	uj	n	1	0.4	0.16	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	Vinylchloride	75-01-4	µg/L	0.2	u h	uj	n	1.5	0.2	0.1	VOCs	H
280-91166-1	WBGmw-008-111616-GW	280-91166-1	Water	Xylene (Total)	1330-20-7	µg/L	0.8	u h	uj	n	2	0.8	0.19	VOCs	H
280-91166-1	LNWmw-026-111616-GW	280-91166-3	Water	Acenaphthene	83-32-9	µg/L	0.041	u q	uj	n	0.1	0.041	0.0043	PAHs	S
280-91166-1	LNWmw-026-111616-GW	280-91166-3	Water	Acenaphthylene	208-96-8	µg/L	0.041	u q	uj	n	0.1	0.041	0.0052	PAHs	S
280-91166-1	LNWmw-026-111616-GW	280-91166-3	Water	Anthracene	120-12-7	µg/L	0.041	u q	uj	n	0.1	0.041	0.0057	PAHs	S

SDG	Field Sample ID	Lab Sample ID	Matrix	Parameter	CAS Number	Units	Result	Lab Flag	DV Flag	Detection	LOQ	LOD	MDL	Analytical Method	Reason Code
280-91166-1	LNWmw-026-111616-GW	280-91166-3	Water	Fluoranthene	206-44-0	µg/L	0.012	u q	uj	n	0.1	0.012	0.0049	PAHs	S
280-91166-1	LNWmw-026-111616-GW	280-91166-3	Water	Fluorene	86-73-7	µg/L	0.041	u q	uj	n	0.1	0.041	0.0056	PAHs	S
280-91166-1	LNWmw-026-111616-GW	280-91166-3	Water	Naphthalene	91-20-3	µg/L	0.012	u q	uj	n	0.1	0.012	0.0082	PAHs	S
280-91166-1	LNWmw-026-111616-GW	280-91166-3	Water	Phenanthrene	85-01-8	µg/L	0.02	u q	uj	n	0.1	0.02	0.0095	PAHs	S
280-91166-1	LNWmw-026-111616-GW	280-91166-3	Water	Pyrene	129-00-0	µg/L	0.02	u q	uj	n	0.1	0.02	0.0062	PAHs	S
280-91166-1	TB-111616	280-91166-4	Water	1,1,1-Trichloroethane	71-55-6	µg/L	0.4	u h	uj	n	1	0.4	0.16	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	1,1,2,2-Tetrachloroethane	79-34-5	µg/L	0.8	u h	uj	n	1	0.8	0.2	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	1,1,2-Trichloroethane	79-00-5	µg/L	0.8	u h	uj	n	1	0.8	0.32	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	1,1-Dichloroethane	75-34-3	µg/L	0.8	u h	uj	n	1	0.8	0.16	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	1,1-Dichloroethene	75-35-4	µg/L	0.8	u h	uj	n	1	0.8	0.14	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	1,2-Dibromoethane	106-93-4	µg/L	0.4	u h	uj	n	1	0.4	0.18	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	1,2-Dichloroethane	107-06-2	µg/L	0.4	u h	uj	n	1	0.4	0.13	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	1,2-Dichloroethene	540-59-0	µg/L	0.2	u h	uj	n	1	0.2	0.15	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	1,2-Dichloropropane	78-87-5	µg/L	0.4	u h	uj	n	1	0.4	0.13	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	2-Butanone	78-93-3	µg/L	4	u h	uj	n	6	4	1.8	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	2-Hexanone	591-78-6	µg/L	4	u h	uj	n	5	4	1.4	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	4-Methyl-2-pentanone	108-10-1	µg/L	3.2	u h	uj	n	5	3.2	1	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	Acetone	67-64-1	µg/L	6.4	u h	uj	n	10	6.4	1.9	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	Benzene	71-43-2	µg/L	0.4	u h	uj	n	1	0.4	0.16	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	Bromodichloromethane	75-27-4	µg/L	0.4	u h	uj	n	1	0.4	0.17	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	Bromoform	75-25-2	µg/L	0.4	u h	uj	n	1	0.4	0.19	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	Bromomethane	74-83-9	µg/L	0.8	u h	uj	n	2	0.8	0.21	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	Carbon disulfide	75-15-0	µg/L	1.6	u h	uj	n	2	1.6	0.45	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	Carbon tetrachloride	56-23-5	µg/L	0.4	u h	uj	n	2	0.4	0.19	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	Chlorobenzene	108-90-7	µg/L	0.4	u h	uj	n	1	0.4	0.17	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	Chlorobromomethane	74-97-5	µg/L	0.2	u h	uj	n	1	0.2	0.1	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	Chloroethane	75-00-3	µg/L	1.6	u h	uj	n	2	1.6	0.41	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	Chloroform	67-66-3	µg/L	0.4	u h	uj	n	1	0.4	0.16	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	Chloromethane	74-87-3	µg/L	0.8	u h	uj	n	2	0.8	0.3	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	cis-1,3-Dichloropropene	10061-01-5	µg/L	0.4	u h	uj	n	1	0.4	0.16	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	Dibromofluoromethane	1868-53-7	µg/L	96	v	uj	y	2	1	0.5	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	Ethylbenzene	100-41-4	µg/L	0.4	u h	uj	n	1	0.4	0.16	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	Methylene chloride	75-09-2	µg/L	0.8	u h	uj	n	5	0.8	0.32	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	Styrene	100-42-5	µg/L	0.4	u h	uj	n	1	0.4	0.17	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	Tetrachloroethene	127-18-4	µg/L	0.4	u h	uj	n	1	0.4	0.2	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	Toluene	108-88-3	µg/L	0.4	u h	uj	n	1	0.4	0.17	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	trans-1,3-Dichloropropene	10061-02-6	µg/L	0.4	u h	uj	n	1	0.4	0.19	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	Trichloroethene	79-01-6	µg/L	0.4	u h	uj	n	1	0.4	0.16	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	Vinylchloride	75-01-4	µg/L	0.2	u h	uj	n	1.5	0.2	0.1	VOCs	H
280-91166-1	TB-111616	280-91166-4	Water	Xylene (Total)	1330-20-7	µg/L	0.8	u h	uj	n	2	0.8	0.19	VOCs	H

µg/L - micrograms per liter

Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual Sampling Event for October 2016

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG RVN01

Prepared For:



National Guard Bureau

NGB-ZC-AQ
111 South George Mason Drive
Building 2, 4th Floor
Arlington, VA 22204-1373

Prepared By:

TEC-WESTON Joint Venture

2496 Old Ivy Road, Suite 300
Charlottesville, VA 22903-4895

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

TEC-WESTON Joint Venture has completed this Data Validation Report. Data validation was performed by the Validation Chemist and Secondary QC Review was performed by the Project Chemist. Signatures indicate the report is approved for release.



Travis Withers

2017.01.19 12:04:55 -07'00'

Travis Withers, Validation Chemist, TEC-WESTON JV

Date



Heather A. Miner

2017.01.19 12:21:54 -07'00'

Heather Miner, Project Chemist, TEC-WESTON JV

Date

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

This report summarizes the results of the **EPA Stage 2B** data validation performed on groundwater samples and quality control (QC) sample data for the Remedial Investigation for RVAAP-66, Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio. Results are reported in laboratory sample delivery group (SDG) **RVN01**.

Eurofins Lancaster Laboratories Environmental, Lancaster PA, performed the analyses listed in the table below:

Parameters	Analytical Method	Laboratory Location
Hydrazine	8135A	Lancaster, PA

The data were reviewed using guidance and quality control criteria documented in the *Draft Remedial Investigation Work Plan for Groundwater and Environmental Services for RVAAP-66 Facility-Wide Groundwater, Appendix A: Sampling Analysis Plan, A.2: Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Former Ravenna Army Ammunition Plant, Portage and Trumbull Counties, Ohio Attachment A Data Validation Evaluation Sheets (January 2016)* which are based on the *Department of Defense Quality Systems Manual (DoD QSM), Version 5.0*; *USEPA National Functional Guidelines for Organic Data Review (EPA 2014)*; and *USEPA National Functional Guidelines for Inorganic Data Review (EPA 2014)*, the analytical methods, and professional judgment.

During data validation, qualifiers are assigned to assist in proper data interpretation. If values are estimated, data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Results with no qualifiers meet all data quality goals as outlined in the UFP-QAPP.

The following samples were validated:

Sample ID	Laboratory ID	Sample Date	Matrix	QC Sample	Hydrazine
L12mw-244-110416-GW	8689742	11/04/16	Groundwater	MS/MSD	✓
L12mw-187-110716-GW	8689745	11/07/16	Groundwater		✓
L12mw-501-110416-GW	8689746	11/04/16	Groundwater	Field Duplicate	✓

Note: L12mw-501-110416-GW is a field duplicate of parent sample L12mw-244-110416-GW.

DATA VALIDATION REPORT

1.1 DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative. All requested target analytes were reported for each sample.

1.2 DEFINITIONS

Detection limit (DL): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. At the DL, the false positive rate is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific matrix with a specific method with 99% confidence.

Limit of detection (LOD): The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate is 1%. An LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method with 99% confidence.

Limits of Quantitation (LOQ): The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

1.3 SAMPLE RECEIPT

The samples were received by the laboratory on November 9, 2016; the samples were received in good condition, under chain-of-custody, and custody seals intact. Samples were properly preserved and cooler temperatures were less than 6°C.

1.4 TECHNICAL DATA VALIDATION

1.4.1 Hydrazine by Method 8315A

The following parameters were evaluated and met the required criteria:

- Holding times
- LODs and LOQs
- Method blank
- LCS recoveries
- MS/MSD recoveries and RPDs
- Instrument Calibration
- Initial Calibration Verification
- Continuing Calibration Verification
- Initial Calibration Blanks
- Continuing Calibration Blanks

All analytical or quality issues for Method 8315A are described in the sections below.

1.4.1.1 *Field Duplicates*

One field duplicate (L12mw-501-110416-GW), associated with parent sample L12mw-244-110416-GW, was analyzed for hydrazine. No detections were reported in either the parent or duplicate sample.

No data qualifications were made in this SDG.