Data Validation Report
Remedial Investigation at RVAAP-66 Facility Wide Groundwater
Semi-Annual & Quarterly Sampling Event for April/May 2017

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

Contract Number: W9133L-14-D-0008

Task Order Number: 0003

Laboratory SDG 280-96560-1

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

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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
2017.06.08 09:09:50 -06'00'

Travis Withers, Validation Chemist, TEC-WESTON JV — Date

6/8/17

Peter Chapman, Senior Chemist, TEC-WESTON JV — Date

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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) **280-96560-1**.

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
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
Hexavalent Chromium	7196A	Denver, CO
Sulfide	9034	Denver, CO
Chloride, Sulfate, Nitrate, Nitrite	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	Alkalinity	Total Cyanide	Hexavalent Chromium
RQLmw-007-050117-GW	280-96560-1	05/01/17	Groundwater	MS/MSD	✓		✓	✓	✓	✓	✓	✓		✓	
RQLmw-008-050117-GW	280-96560-2	05/01/17	Groundwater		✓		✓	✓	✓	✓	✓	✓		✓	
RQLmw-009-050117-GW	280-96560-3	05/01/17	Groundwater		✓		✓	✓	✓	✓	✓	✓		✓	
RQLmw-017-050117-GW	280-96560-4	05/01/17	Groundwater							✓					
RQLmw-016-050117-GW	280-96560-5	05/01/17	Groundwater											✓	
RQLmw-508-050117-GW	280-96560-6	05/01/17	Groundwater	Field duplicate			✓				✓	✓			
TB-050117	280-96560-7	05/01/17	Groundwater		✓	✓									
LL1mw-083-050117-GW	280-96560-8	05/01/17	Groundwater						✓		✓		✓		✓
RQLmw-011-050117-GW	280-96560-9	05/01/17	Groundwater	MS/MSD			✓	✓					✓		✓
RQLmw-013-050117-GW	280-96560-10	05/01/17	Groundwater										✓		✓
RQLmw-016-050117-GW	280-96560-11	05/01/17	Groundwater												✓

Some samples were analyzed for natural attenuation parameters. Natural attenuation parameters are reported, but not validated in accordance with the QAPP.
Sample RQLmw-508-050117-GW is the field duplicate of sample RQLmw-007-050117-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 SAMPLE RECEIPT

The samples were received by the laboratory on May 2, 2017; 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.

1.3 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	Non-detection at the LOQ; target analyte detected in blank.
UJ	S	Estimated non-detection; surrogate outlier.
UJ	H	Estimated non-detection; holding time exceedance.
UJ	M	Estimated non-detection; MS/MSD recovery or RPD criteria not met.
J	S	Estimated detection; surrogate outlier.

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
- LCS recoveries
- Method blanks
- Surrogate recoveries
- MS/MSD recoveries and RPDs
- LODs and LOQs
- Instrument tuning
- 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 Internal Standards

The internal standard area response for TBA-d9 was below acceptance criteria. TBA-d9 does not correspond to any of the requested target compounds; 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 based on the following:

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

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

1.4.2.1 Method Blanks

Benzyl alcohol (0.885 µg/L) was detected in the method blank at a concentration below the LOQ (25 µg/L). Benzyl alcohol was also detected in samples RQLmw-007-050117-GW (0.59 µg/L) and

RQLmw-508-050117-GW (0.39 µg/L) at concentrations below the LOQ. These sample results were qualified as non-detect at the LOQ (U B).

1.4.2.2 Surrogate Recoveries

Surrogate terphenyl-d14 (20%) recovered below the control limits (50-134%) in sample RQLmw-007-050117-GW. All associated sample results were qualified as estimated (J/UJ S).

1.4.2.3 Matrix Spike/Matrix Spike Duplicate

The RPD for 3,3'-Dichlorobenzidine (23%) exceeded the RPD limit (20%) for the MS/MSD. The MS and MSD recoveries were within control limits; 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. No validation flags were assigned based on the following:

- Holding times
- Method blanks
- Surrogate recoveries
- Laboratory control samples
- MS/MSD recoveries and RPDs
- LODs and LOQs
- Instrument tuning
- Internal standard area counts
- Initial calibration
- Initial calibration verification
- Closing calibration verification

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. No validation flags were assigned based on the following:

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Method blank
- LCS recoveries
- MS/MSD recoveries and RPDs
- Initial calibration
- Initial calibration verification
- Internal standards
- Endrin/DDT breakdown check
- Second column confirmation

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

1.4.4.1 Continuing Calibration Verification

4,4'-DDT (20.7%D) and methoxychlor (29.5%D) recovered above control limits (±20%D) in the continuing calibration verification CCV 280-373137/53. All associated samples were non-detect for 4,4'-DDT and methoxychlor; therefore, no qualification was necessary.

The toxaphene standard used for CCV 280-373137/51 was loaded on the instrument prior to expiring, but was injected after midnight, when the standard expired. All analytes in the CCV recovered within control limits. Based on professional judgement, no qualifications were made.

1.4.5 Polychlorinated Biphenyls by Method 8082A

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

- Holding times
- LODs and LOQs
- Surrogate recoveries
- Method blank
- LCS recoveries
- MS/MSD recoveries and RPDs
- Initial calibration
- Initial calibration verification
- Continuing calibration verification
- Internal standards
- Second column confirmation

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

1.4.5.1 Sample Preparation

Samples RQLmw-007-050117-GW, RQLmw-008-050117-GW, RQLmw-009-050117-GW, RQLmw-017-050117-GW, RQLmw-508-050117-GW underwent a sulfuric acid clean up prior to analysis to reduce matrix interferences.

1.4.6 Explosives by Method 8330B

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

- Holding times
- LCS recoveries
- Initial calibration
- Initial calibration verification
- Initial calibration blank
- Continuing calibration verification

- Continuing calibration blank
- LODs and LOQs
- Initial calibration verification
- 2nd column confirmation
- Field Duplicates

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

1.4.6.1 Sample Preparation

Sample RQLmw-008-050117-GW was filtered prior to analysis to reduce matrix interferences.

1.4.6.2 Surrogate Recoveries

Surrogate 1,2-dinitrobenzene (122%) recovered above control limits (83-119%) in sample LL1mw-083-050117-GW. The associated 2,4,6-trinitrotoluene result in sample LL1mw-083-050117-GW was qualified as estimated (J S).

1.4.6.3 Method Blanks

Nitrobenzene (0.122 µg/L) was detected in the method blank at a concentration below the LOQ (0.4 µg/L). All associated samples were non-detect for nitrobenzene; therefore, no qualifications were necessary.

1.4.6.4 Matrix Spike/Matrix Spike Duplicate

An MS/MSD was performed on sample RQLmw-007-050117-GW. 3-Nitrotoluene recovered above the control limits (73-125%) in the MS (133%) and MSD (137%). 3-Nitrotoluene was non-detect in the parent sample; therefore, no qualification was necessary. 4-Nitrotoluene (147%) recovered above the control limits (71-127%) in the MS. 4-Nitrotoluene was non-detect in the parent sample; therefore, no qualification was necessary.

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

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

- Holding times
- LODs and LOQs
- LCS recoveries
- Post digestion spike
- Serial dilution
- Continuing calibration verification

- Contract required detection limit standard
- Instrument tuning
- Interference check solutions
- Field duplicates

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

1.4.7.1 Method Blanks

Iron (32.1 µg/L) and sodium (156 µg/L) were detected in the method blank at concentrations below their respective LOQs (100 µg/L, 5000 µg/L). Sodium was detected at a concentration below the LOQ in samples RQLmw-007-050117-GW (4200 µg/L), RQLmw-008-050117-GW (3000 µg/L), and RQLmw-009-050117-GW (1500 µg/L). These sample results were qualified as non-detect at the LOQ (U B). All other iron or sodium sample results were either non-detect or above the LOQ; therefore, no qualification was necessary.

1.4.7.2 Continuing calibration Blanks

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

Calibration Blank	Associated Samples	Analyte	Blank Detection (µg/L)	LOQ (µg/L)	Assigned Flags	Samples Qualified
CCB 280-373288/76	RQLmw-007-050117-GW	Potassium	345	3000	N/A	None
		Sodium	209	5000	U B	RQLmw-007-050117-GW
CCB 280-373288/90	RQLmw-008-050117-GW	Potassium	265	3000	U B	RQLmw-008-050117-GW
	RQLmw-009-050117-GW					RQLmw-009-050117-GW
	RQLmw-508-050117-GW					
ICB 280-373525/10	RQLmw-007-050117-GW	Antimony	0.9	2	U B	RQLmw-007-050117-GW
	RQLmw-008-050117-GW					RQLmw-008-050117-GW
	RQLmw-009-050117-GW					RQLmw-508-050117-GW
	RQLmw-508-050117-GW	Vanadium	0.764	5	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).

1.4.7.3 Initial Calibration Verification

Antimony (123%) recovered above control limits (80-120%) in the low-level initial calibration verification ICVL 280-373525/11. All associated antimony detections were qualified as non-detect due to blank contamination; therefore, no qualification was necessary.

1.4.7.4 Matrix Spike/Matrix Spike Duplicate

Manganese (131%) recovered above control limits (87-115%) in the MS. The MSD recovery and RPD were within control limits; therefore, no qualification was necessary.

1.4.8 Hexavalent Chromium by Method 7196A

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

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

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

1.4.8.1 Holding Times

Samples LL1mw-083-050117-GW were received by the laboratory with insufficient time remaining to perform the analysis within holding time. The hexavalent chromium results in these samples were qualified as estimated (UJ H).

1.4.8.2 Matrix Spike/Matrix Spike Duplicate

An MS/MSD was performed on samples RQLmw-007-050117-GW and RQLmw-011-050117-GW. Hexavalent chromium recovered below control limits (90-111%) in the MS (74%) and MSD (73%) on sample RQLmw-011-050117-GW. The RQLmw-011-050117-GW parent sample result was qualified as estimated (UJ M).

1.4.9 Total Cyanide by Method 9012B

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

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

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

1.4.9.1 Method Blanks

Total cyanide (2.29 µg/L) was detected in the method blank at a concentration below the LOQ (10 µg/L). Total cyanide was also detected at a concentration below the LOQ in samples RQLmw-007-050117-GW (4.5 µg/L), RQLmw-008-050117-GW (4.0 µg/L), RQLmw-016-050117-GW (2.3 µg/L). These sample results were qualified as non-detect at the LOQ (U B).

1.4.10 Alkalinity by Method 2320B

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

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

No analytical or quality issues required further discussion for Method 2320B.

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
280-96560-1	RQLmw-007-050117-GW	280-96560-1	Ground Water	Sodium	7440-23-5	µg/L	5000	j	u	n	5000	350	120	Metals	B
280-96560-1	RQLmw-007-050117-GW	280-96560-1	Ground Water	Antimony	7440-36-0	µg/L	6	j	u	n	6	1	0.4	Metals	B
280-96560-1	RQLmw-007-050117-GW	280-96560-1	Ground Water	3,3'-Dichlorobenzidine	91-94-1	µg/L	4.2	u q	uj	n	48	4.2	1.9	SVOCs	S
280-96560-1	RQLmw-007-050117-GW	280-96560-1	Ground Water	Benzyl alcohol	100-51-6	µg/L	24	j	u	n	24	0.48	0.22	SVOCs	B
280-96560-1	RQLmw-007-050117-GW	280-96560-1	Ground Water	bis(2-Ethylhexyl)phthalate	117-81-7	µg/L	0.97	j q	j	y	9.6	1.9	0.54	SVOCs	S
280-96560-1	RQLmw-007-050117-GW	280-96560-1	Ground Water	Butyl benzyl phthalate	85-68-7	µg/L	1.9	u q	uj	n	19	1.9	0.96	SVOCs	S
280-96560-1	RQLmw-007-050117-GW	280-96560-1	Ground Water	Di-N-Octyl phthalate	117-84-0	µg/L	0.96	u q	uj	n	19	0.96	0.34	SVOCs	S
280-96560-1	RQLmw-007-050117-GW	280-96560-1	Ground Water	Total Cyanide	57-12-5	µg/L	10	j	u	n	10	5	2	Total Cyanide	B
280-96560-1	RQLmw-008-050117-GW	280-96560-2	Ground Water	Potassium	7440-09-7	µg/L	3000	j	u	n	3000	940	240	Metals	B
280-96560-1	RQLmw-008-050117-GW	280-96560-2	Ground Water	Sodium	7440-23-5	µg/L	5000	j	u	n	5000	350	120	Metals	B
280-96560-1	RQLmw-008-050117-GW	280-96560-2	Ground Water	Antimony	7440-36-0	µg/L	6	j	u	n	6	1	0.4	Metals	B
280-96560-1	RQLmw-008-050117-GW	280-96560-2	Ground Water	Total Cyanide	57-12-5	µg/L	10	j	u	n	10	5	2	Total Cyanide	B
280-96560-1	RQLmw-009-050117-GW	280-96560-3	Ground Water	Potassium	7440-09-7	µg/L	3000	j	u	n	3000	940	240	Metals	B
280-96560-1	RQLmw-009-050117-GW	280-96560-3	Ground Water	Sodium	7440-23-5	µg/L	5000	j	u	n	5000	350	120	Metals	B
280-96560-1	RQLmw-016-050117-GW	280-96560-5	Ground Water	Total Cyanide	57-12-5	µg/L	10	j	u	n	10	5	2	Total Cyanide	B
280-96560-1	RQLmw-508-050117-GW	280-96560-6	Ground Water	Antimony	7440-36-0	µg/L	6	j	u	n	6	1	0.4	Metals	B
280-96560-1	RQLmw-508-050117-GW	280-96560-6	Ground Water	Benzyl alcohol	100-51-6	µg/L	24	j	u	n	25	0.51	0.23	SVOCs	B
280-96560-1	LL1mw-083-050117-GW	280-96560-8	Ground Water	Chromium, hexavalent	18540-29-9	µg/L	4	u h	uj	n	20	4	4	Hexavalent Chromium	H
280-96560-1	LL1mw-083-050117-GW	280-96560-8	Ground Water	2,4,6-Trinitrotoluene	118-96-7	µg/L	3.2	q	j	y	0.43	0.21	0.077	Explosives	S
280-96560-1	RQLmw-011-050117-GW	280-96560-9	Ground Water	Chromium, hexavalent	18540-29-9	µg/L	4	u j	uj	n	20	4	4	Hexavalent Chromium	M