LABORATORY DATA CONSULTANTS, INC.
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Cardno
1658 Cole Blvd, Suite 190
Golden, CO 80401
ATTN: Travis Withers

June 20, 2017

SUBJECT: Camp Ravenna, Data Validation

Dear Mr. Withers,

Enclosed are the final validation reports for the fractions listed below. This SDG was received on May 22, 2017. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #38756:

SDG #	Fraction
280-96239-1	Volatiles, Semivolatiles, Chlorinated Pesticides, Polychlorinated Biphenyls, Metals, Nitroguanidine, Explosives, Wet Chemistry, Perchlorate

The data validation was performed under Stage 4 guidelines. The analyses were validated using the following documents, as applicable to each method:

- Final Remedial Investigation Work Plan for Groundwater and Environmental Investigation Services for RVAAP-66 Facility-Wide Groundwater Appendix A: Sampling Analysis Plan, A.2 - Quality Assurance Project Pan, Former Ravenna Army Ammunition Plant, Portage and Trumbull Countries, Ohio, December 2016
- U.S. Department of Defense, Quality Systems Manual, for Environmental Laboratories, Version 5.0 July, 2013
- USEPA, National Functional Guidelines for Superfund Organic Methods Data Review, August 2014
- USEPA, National Functional Guidelines for Inorganic Superfund Data Review, August 2014
- EPA SW 846, Third Edition, Test Methods for Evaluating Solid Waste, update 1, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996; update IIIA, April 1998; IIIB, November 2004; update IV, February 2007, update V, July 2014

Please feel free to contact us if you have any questions.

Sincerely,

Pei Geng
Project Manager/Senior Chemist

4,656 pages-DL

Attachment 1

Stage 4 EDD

LDC #38756 (Cardno-Golden, CO / Camp Ravenna)

LDC	SDG#	DATE REC'D	(3) DATE DUE	VOA (8260C)		SVOA (8270D)		PAHs (8270D -SIM)		Pest. (8081B)		PCBs (8082A)		Metals (SW846)		Expl. (8330B)		Nitro-guanidine (8330M)		CLO_4 (6860)		Alk. (2320B)		Total CN- (9012B)		Cl,SO_4 NO_3-N NO_2-N		Cr(VI) (7196A)		Nitro-cellulose (353.2)		S= (9034)			
Matrix:	Water/Soil			W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S
A	280-96239-1	05/22/17	06/13/17	7	0	7	0	4	0	5	0	5	0	13	0	9	0	4	0	3	0	10	0	6	0	7	0	5	0	4	0	8	0		
Total	T/PG			7	0	7	0	4	0	5	0	5	0	13	0	9	0	4	0	3	0	10	0	6	0	7	0	5	0	4	0	8	0	0	97

Shaded cells indicate Stage 4 validation (all other cells are Stage 2B validation). Sample counts do not include MS, MSD, or DUP's.

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Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Camp Ravenna

LDC Report Date: June 19, 2017

Parameters: Volatiles

Validation Level: Stage 4

Laboratory: TestAmerica, Inc.

Sample Delivery Group (SDG): 280-96239-1

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
BKGmw-024-042017-GW	280-96239-2	Water	04/20/17
BKGmw-023-042017-GW	280-96239-3	Water	04/20/17
TB-042117	280-96239-8	Water	04/20/17
LL5mw-001-042117-GW	280-96239-14	Water	04/21/17
TB-042117-2	280-96239-15	Water	04/21/17
BKGmw-022-042117-GW	280-96239-17	Water	04/21/17
BKGmw-510-042117-GW	280-96239-18	Water	04/21/17

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Remedial Investigation Work Plan for Groundwater and Environmental Investigation Services for RVAAP-66 Facility-Wide Groundwater Appendix A: Sampling Analysis Plan, A.2 – Quality Assurance Project Plan, Former Ravenna Army Ammunition Plant, Portage and Trumbull Countries, Ohio (December 2016), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Superfund Organic Methods Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Volatile Organic Compounds (VOCs) by Environmental Protection Agency (EPA) SW 846 Method 8260B

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A bromofluorobenzene (BFB) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, the percent relative standard deviations (%RSD) were less than or equal to 15.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the ending continuing calibration verifications (CCVs) were less than or equal to 50.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

Samples TB-042117 and TB-042117-2 were identified as trip blanks. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
TB-042117	04/20/17	Acetone	7.4 ug/L	BKGmw-024-042017-GW BKGmw-023-042017-GW
TB-042117-2	04/21/17	Acetone	7.2 ug/L	LL5mw-001-042117-GW BKGmw-022-042117-GW BKGmw-510-042117-GW

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated field blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
BKGmw-024-042017-GW	Acetone	6.6 ug/L	6.6U ug/L
BKGmw-023-042017-GW	Acetone	4.8 ug/L	6.4U ug/L
BKGmw-022-042117-GW	Acetone	5.5 ug/L	6.4U ug/L
BKGmw-510-042117-GW	Acetone	6.9 ug/L	6.9U ug/L

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

IX. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples BKGmw-022-042117-GW and BKGmw-510-042117-GW were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	BKGmw-022-042117-GW	BKGmw-510-042117-GW				
Acetone	5.5	6.9	-	1.4 (≤10)	-	-
Toluene	0.38	0.37	-	0.01 (≤1.0)	-	-

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

All compound quantitations met validation criteria.

XIII. Target Compound Identifications

All target compound identifications met validation criteria.

XIV. System Performance

The system performance was acceptable.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to trip blank contamination, data were qualified as not detected in four samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Based upon the data validation all other results are considered valid and usable for all purposes.

Camp Ravenna
Volatiles - Data Qualification Summary - SDG 280-96239-1

No Sample Data Qualified in this SDG

Camp Ravenna
Volatiles - Laboratory Blank Data Qualification Summary - SDG 280-96239-1

No Sample Data Qualified in this SDG

Camp Ravenna
Volatiles - Field Blank Data Qualification Summary - SDG 280-96239-1

Sample	Compound	Modified Final Concentration	A or P
BKGmw-024-042017-GW	Acetone	6.6U ug/L	A
BKGmw-023-042017-GW	Acetone	6.4U ug/L	A
BKGmw-022-042117-GW	Acetone	6.4U ug/L	A
BKGmw-510-042117-GW	Acetone	6.9U ug/L	A

LDC #: 38756A1 **VALIDATION COMPLETENESS WORKSHEET** Date: 06/06/17

SDG #: 280-96239-1 Stage 4 Page: 1 of 1

Laboratory: Test America, Inc. Reviewer: JVG

2nd Reviewer:

METHOD: GC/MS Volatiles (EPA SW 846 Method 8260B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	ICAL ≤ 15% rr ICV ≤ 20%
IV.	Continuing calibration	A	CCV ≤ 20/50%
V.	Laboratory Blanks	A	
VI.	Field blanks	SW	TB = 3, 5
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	SW	D = 6/7
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	A	
XIII.	Target compound identification	A	
XIV.	System performance	A	
XV.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	BKGmw-024-042017-GW	280-96239-2	Water	04/20/17
2	BKGmw-023-042017-GW	280-96239-3	Water	04/20/17
3	TB-042117	280-96239-8	Water	04/20/17
4	LL5mw-001-042117-GW	280-96239-14	Water	04/21/17
5	TB-042117-2	280-96239-15	Water	04/21/17
6	BKGmw-022-042117-GW D	280-96239-17	Water	04/21/17
7	BKGmw-540-042117-GW D	280-96239-18	Water	04/21/17
8				
9				
10				
11	MB 280-371985/6			
12				
13				

LDC #: 38736A1

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer:

Method: Volatiles (EPA SW 846 Method 8260B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
II. GC/MS Instrument performance check				
Were the BFB performance results reviewed and found to be within the specified criteria?	✓			
Were all samples analyzed within the 12 hour clock criteria?	✓			
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?	✓			
Were all percent relative standard deviations (%RSD) ≤ 30%/15% and relative response factors (RRF) ≥ 0.05?	✓			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?				
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	✓			
Were all percent differences (%D) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	✓			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) ≥ 0.05?	✓			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed at least once every 12 hours for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
VI. Field blanks				
Were field blanks were identified in this SDG?	✓			
Were target compounds detected in the field blanks?	✓			
VII. Surrogate spikes				
Were all surrogate percent recovery (%R) within QC limits?	✓			
If the percent recovery (%R) for one or more surrogates was out of QC limits, was a reanalysis performed to confirm samples with %R outside of criteria?			✓	

LDC #: 38756A1

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer:

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.		✓		
Was a MS/MSD analyzed every 20 samples of each matrix?		✓		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	✓			
Were retention times within + 30 seconds of the associated calibration standard?	✓			
XII. Compound quantitation				
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XIII. Target compound identification				
Were relative retention times (RRT's) within ± 0.06 RRT units of the standard?	✓			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	✓			
Were chromatogram peaks verified and accounted for?	✓			
XIV. System performance				
System performance was found to be acceptable.	✓			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

TARGET COMPOUND WORKSHEET

METHOD: VOA

A. Chloromethane	AA. Tetrachloroethene	AAA. 1,3,5-Trimethylbenzene	AAAA. Ethyl tert-butyl ether	A1. 1,3-Butadiene	A2.
B. Bromomethane	BB. 1,1,2,2-Tetrachloroethane	BBB. 4-Chlorotoluene	BBBB. tert-Amyl methyl ether	B1. Hexane	B2.
C. Vinyl choride	CC. Toluene	CCC. tert-Butylbenzene	CCCC. 1-Chlorohexane	C1. Heptane	C2.
D. Chloroethane	DD. Chlorobenzene	DDD. 1,2,4-Trimethylbenzene	DDDD. Isopropyl alcohol	D1. Propylene	D2.
E. Methylene chloride	EE. Ethylbenzene	EEE. sec-Butylbenzene	EEEE. Acetonitrile	E1. Freon 11	E2.
F. Acetone	FF. Styrene	FFF. 1,3-Dichlorobenzene	FFFF. Acrolein	F1. Freon 12	F2.
G. Carbon disulfide	GG. Xylenes, total	GGG. p-Isopropyltoluene	GGGG. Acrylonitrile	G1. Freon 113	G2.
H. 1,1-Dichloroethene	HH. Vinyl acetate	HHH. 1,4-Dichlorobenzene	HHHH. 1,4-Dioxane	H1. Freon 114	H2.
I. 1,1-Dichloroethane	II. 2-Chloroethylvinyl ether	III. n-Butylbenzene	IIII. Isobutyl alcohol	I1. 2-Nitropropane	I2.
J. 1,2-Dichloroethene, total	JJ. Dichlorodifluoromethane	JJJ. 1,2-Dichlorobenzene	JJJJ. Methacrylonitrile	J1. Dimethyl disulfide	J2.
K. Chloroform	KK. Trichlorofluoromethane	KKK. 1,2,4-Trichlorobenzene	KKKK. Propionitrile	K1. 2,3-Dimethyl pentane	K2.
L. 1,2-Dichloroethane	LL. Methyl-tert-butyl ether	LLL. Hexachlorobutadiene	LLLL. Ethyl ether	L1. 2,4-Dimethyl pentane	L2.
M. 2-Butanone	MM. 1,2-Dibromo-3-chloropropane	MMM. Naphthalene	MMMM. Benzyl chloride	M1. 3,3-Dimethyl pentane	M2.
N. 1,1,1-Trichloroethane	NN. Methyl ethyl ketone	NNN. 1,2,3-Trichlorobenzene	NNNN. Iodomethane	N1. 2-Methylpentane	N2.
O. Carbon tetrachloride	OO. 2,2-Dichloropropane	OOO. 1,3,5-Trichlorobenzene	OOOO.1,1-Difluoroethane	O1. 3-Methylpentane	O2.
P. Bromodichloromethane	PP. Bromochloromethane	PPP. trans-1,2-Dichloroethene	PPPP. Tetrahydrofuran	P1. 3-Ethylpentane	P2.
Q. 1,2-Dichloropropane	QQ. 1,1-Dichloropropene	QQQ. cis-1,2-Dichloroethene	QQQQ. Methyl acetate	Q1. 2,2-Dimethylpentane	Q2.
R. cis-1,3-Dichloropropene	RR. Dibromomethane	RRR. m,p-Xylenes	RRRR. Ethyl acetate	R1. 2,2,3- Trimethylbutane	R2.
S. Trichloroethene	SS. 1,3-Dichloropropane	SSS. o-Xylene	SSSS. Cyclohexane	S1. 2,2,4-Trimethylpentane	S2.
T. Dibromochloromethane	TT. 1,2-Dibromoethane	TTT. 1,1,2-Trichloro-1,2,2-trifluoroethane	TTTT. Methylcyclohexane	T1. 2-Methylhexane	T2.
U. 1,1,2-Trichloroethane	UU. 1,1,1,2-Tetrachloroethane	UUU. 1,2-Dichlorotetrafluoroethane	UUUU. Allyl chloride	U1. Nonanal	U2.
V. Benzene	VV. Isopropylbenzene	VVV. 4-Ethyltoluene	VVVV. Methyl methacrylate	V1. 2-Methylnaphthalene	V2.
W. trans-1,3-Dichloropropene	WW. Bromobenzene	WWW. Ethanol	WWWW. Ethyl methacrylate	W1. Methanol	W2.
X. Bromoform	XX. 1,2,3-Trichloropropane	XXX. Di-isopropyl ether	XXXX. cis-1,4-Dichloro-2-butene	X1. 1,2,3-Trimethylbenzene	X2.
Y. 4-Methyl-2-pentanone	YY. n-Propylbenzene	YYY. tert-Butanol	YYYY. trans-1,4-Dichloro-2-butene	Y1.	Y2.
Z. 2-Hexanone	ZZ. 2-Chlorotoluene	ZZZ. tert-Butyl alcohol	ZZZZ. Pentachloroethane	Z1.	Z2.

LDC #: 38756 A1

VALIDATION FINDINGS WORKSHEET
Field Blanks

Reviewer: JVG
2nd Reviewer: [signature]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

(Y) N N/A Were field blanks identified in this SDG?
Y (N) N/A Were target compounds detected in the field blanks?

Blank units: ug/L **Associated sample units:** ug/L
Sampling date: 04/20/17
Field blank type: (circle one) Field Blank / Rinsate / (Trip Blank) / Other: _____ Associated Samples: 1, 2

Compound	Blank ID	Sample Identification								
	3		#1	#2						
F	7.4		6.6/U	4.8/6.4U						

Blank units: ug/L **Associated sample units:** ug/L
Sampling date: 04/21/17
Field blank type: (circle one) Field Blank / Rinsate / (Trip Blank) / Other: _____ Associated Samples: 4, 6, 7

Compound	Blank ID	Sample Identification								
	5		6	7						
F	7.2		5.5/6.4U	6.9/U						

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Common contaminants such as Methylene chloride, Acetone, 2-Butanone and Carbon disulfide that were detected in samples within ten times the associated field blank concentration were qualified as not detected, "U". Other contaminants within five times the field blank concentration were also qualified as not detected, "U".

LDC#: 35756A1

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JWG
2nd Reviewer:

METHOD: GC MS Volatiles (EPA SW 846 Method 8260B)

Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ug/L)		RPD (≤30%)	Difference (ug/L)	Limits (ug/L)	Qualifications (Parent Only)
	6	7				
F	5.5	6.9		1.4	(≤ 10)	
CC	0.38	0.37		0.01	(≤ 1.0)	
					(≤)	
					(≤)	
					(≤)	
					(≤)	
					(≤)	

Compound	Concentration (ug/L)		RPD (≤30%)	Difference (ug/L)	Limits (ug/L)	Qualifications (Parent Only)
					(≤)	
					(≤)	
					(≤)	
					(≤)	
					(≤)	
					(≤)	
					(≤)	

Compound	Concentration (ug/L)		RPD (≤30%)	Difference (ug/L)	Limits (ug/L)	Qualifications (Parent Only)
					(≤)	
					(≤)	
					(≤)	
					(≤)	
					(≤)	
					(≤)	
					(≤)	

LDC #: 38756A1

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$ — A_x = Area of Compound — A_{is} = Area of associated internal standard

average RRF = sum of the RRFs/number of standards — C_x = Concentration of compound — C_{is} = Concentration of internal standard

%RSD = 100 * (S/X) — S= Standard deviation of the RRFs — X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (IS)	Reported RRF (RRF 10 std)	Recalculated RRF (RRF 10 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL GC MS9	5/3/2017	Toluene (FB)	1.2970	1.2970	1.2264	1.2264	5.6	5.6
			o-Xylene (CBZ)	2.8403	2.8403	2.5765	2.5765	5.1	5.1
			1,1,2,2-TCA (DCB)	0.4497	0.4497	0.4192	0.4192	4.5	4.5

LDC#: 38756A1

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = (Ax)(Cis)/(Ais)(Cx)

Where:
ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
Ax = Area of compound
Cx = Concentration of compound,
Ais = Area of associated internal standard
Cis = Concentration of internal standard

#	Standard ID	Calibration Date	Compound	(IS)	Average RRF (Initial)	Reported RRF (CCV)	Recalculated RRF (CCV)	Reported % D	Recalculated %D
1	MS9_5858	5/3/2017	Toluene	(FB)	1.2264	1.1524	1.1524	6.0	6.0
			o-Xylene	(CBZ)	2.577	2.382	2.382	7.5	7.5
			1,1,2,2-TCA	(DCB)	0.4192	0.397	0.397	5.2	5.2

LDC #: 38756A1

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Page: 1 of 1
Reviewer: JVG
2nd reviewer: [signature]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: #1

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane	9.00	10.2	113	113	0
1,2-Dichloroethane-d4	↓	9.5	106	106	↓
Toluene-d8	↓	9.03	100	100	↓
Bromofluorobenzene	↓	8.04	89	89	↓

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

LDC #: 38756 A1

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratoy control sample and laboratory control sample duplicate (if applicable) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * SSC/SA Where: SSC = Spiked sample concentration
SA = Spike added

RPD = I LCSC - LCSDC I * 2/(LCSC + LCSDC) LCSC = Laboraotry control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS ID: LCS 280-371985/4

Compound	Spike Added (ug/L)		Spiked Sample Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalculated
1,1-Dichloroethene	5.0	NA	4.81	NA	96	96				
Trichloroethene			4.84		97	97				
Benzene			4.93		99	99				
Toluene			4.91		98	98				
Chlorobenzene			4.95		99	99				

Comments: Refer to Laboratory Control Sample findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 38756A1

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JVG
2nd reviewer:

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Y N N/A Were all reported results recalculated and verified for all level IV samples?

Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(DF)}{(A_{is})(RRF)(V_o)(\%S)}$

A_x = Area of the characteristic ion (EICP) for the compound to be measured

A_{is} = Area of the characteristic ion (EICP) for the specific internal standard

I_s = Amount of internal standard added in nanograms (ng)

RRF = Relative response factor of the calibration standard.

V_o = Volume or weight of sample pruged in milliliters (ml) or grams (g).

Df = Dilution factor.

%S = Percent solids, applicable to soils and solid matrices only.

Example:

Sample I.D. 6 , Tol :

Conc. = $\frac{(30926)(12.5)(\quad)}{(830893)(1.2264)(\quad)(\quad)}$

= 0.379

≈ 0.38 ug/L

#	Sample ID	Compound	Reported Concentration (ug/L)	Calculated Concentration ( )	Qualification
			0.38		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Camp Ravenna

LDC Report Date: June 7, 2017

Parameters: Semivolatiles

Validation Level: Stage 4

Laboratory: TestAmerica, Inc.

Sample Delivery Group (SDG): 280-96239-1

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
BKGmw-024-042017-GW	280-96239-2	Water	04/20/17
BKGmw-023-042017-GW	280-96239-3	Water	04/20/17
LL1mw-065-042117-GW	280-96239-11	Water	04/21/17
LL1mw-084-042117-GW	280-96239-12	Water	04/21/17
LL1mw-086-042117-GW	280-96239-13	Water	04/21/17
BKGmw-022-042117-GW	280-96239-17	Water	04/21/17
BKGmw-510-042117-GW	280-96239-18	Water	04/21/17

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Remedial Investigation Work Plan for Groundwater and Environmental Investigation Services for RVAAP-66 Facility-Wide Groundwater Appendix A: Sampling Analysis Plan, A.2 – Quality Assurance Project Plan, Former Ravenna Army Ammunition Plant, Portage and Trumbull Countries, Ohio (December 2016), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Superfund Organic Methods Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270D

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, percent relative standard deviations (%RSD) were less than or equal to 15.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the ending continuing calibration verifications (CCVs) were less than or equal to 50.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
MB 280-370565/1-A	04/24/17	Bis(2-ethylhexyl)phthalate Dimethylphthalate	5.48 ug/L 0.316 ug/L	All samples in SDG 280-96239-1
MB 280-370565/1-A	04/24/17	2,4,6-Trichlorophenol 3&4-Methylphenol Dibenzofuran N-Nitroso-di-n-propylamine	0.348 ug/L 0.281 ug/L 0.354 ug/L 0.406 ug/L	BKGmw-024-042017-GW BKGmw-023-042017-GW BKGmw-022-042117-GW BKGmw-510-042117-GW

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits with the following exceptions:

LCS ID (Associated Samples)	Compound	LCS %R (Limits)	LCSD %R (Limits)	Flag	A or P
LCS/D280-370565/2,3-A (All samples in SDG 280-96239-1)	Hexachlorocyclopentadiene	0 (10-120)	-	R (all non-detects)	P

Relative percent differences (RPD) were within QC limits with the following exceptions:

LCS ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
LCS/D280-370565/2,3-A (All samples in SDG 280-96239-1)	Hexachlorocyclopentadiene	200 (≤20)	NA	-

Although the above listed RPD flagged "NA" demonstrate a high bias, the affected compound in the associated samples were non-detected and did not warrant the qualification of the data.

X. Field Duplicates

Samples BKGmw-022-042117-GW and BKGmw-510-042117-GW were identified as field duplicates. No results were detected in any of the samples.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

All compound quantitations were within validation criteria.

XIII. Target Compound Identifications

All target compound identifications were within validation criteria.

XIV. System Performance

The system performance was acceptable.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to LCS/LCSD %R, data were rejected in four samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be rejected (R) are unusable for all purposes. Based upon the data validation all other results are considered valid and usable for all purposes.

Camp Ravenna
Semivolatiles - Data Qualification Summary - SDG 280-96239-1

Sample	Compound	Flag	A or P	Reason
BKGmw-024-042017-GW BKGmw-023-042017-GW BKGmw-022-042117-GW BKGmw-510-042117-GW	Hexachlorocyclopentadiene	R (all non-detects)	P	Laboratory control samples (%R)

Camp Ravenna
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG 280-96239-1

No Sample Data Qualified in this SDG

Camp Ravenna
Semivolatiles - Field Blank Data Qualification Summary - SDG 280-96239-1

No Sample Data Qualified in this SDG

LDC #: 38756A2a **VALIDATION COMPLETENESS WORKSHEET** Date: 06/06/17
SDG #: 280-96239-1 Stage 4 Page: 1 of 1
Laboratory: Test America, Inc. Reviewer:
2nd Reviewer:

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270D)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	ICAL ≤ 15% r ICV ≤ 20%
IV.	Continuing calibration /ending	A	CCV ≤ 20/50%
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	SW	LCS/D
X.	Field duplicates	ND	D = 6/7
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	A	
XIII.	Target compound identification	A	
XIV.	System performance	A	
XV.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID		Lab ID	Matrix	Date
1	BKGmw-024-042017-GW		280-96239-2	Water	04/20/17
2	BKGmw-023-042017-GW		280-96239-3	Water	04/20/17
3	LL1mw-065-042117-GW		280-96239-11	Water	04/21/17
4	LL1mw-084-042117-GW		280-96239-12	Water	04/21/17
5	LL1mw-086-042117-GW		280-96239-13	Water	04/21/17
6	BKGmw-022-042117-GW	D	280-96239-17	Water	04/21/17
7	BKGmw-540-042117-GW	D	280-96239-18	Water	04/21/17
8					
9					
10					
11					
12	MB 280-370565/1-A				
13					

1,2,6,7 - long list
3 - 5 - phthalates only

LDC #: 38756 A2c

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: CJ

Method: Semivolatiles (EPA SW 846 Method 8270D)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
II. GC/MS Instrument performance check				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	✓			
Were all samples analyzed within the 12 hour clock criteria?	✓			
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ ~~20%~~ 15 and relative response factors (RRF) within method criteria?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?	✓			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ ~~30%~~ 20 or percent recoveries (%R) ~~70-130%~~?	✓			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	✓			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) within method criteria?	✓			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed at least once every 12 hours for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.	✓			
VI. Field blanks				
Were field blanks were identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VII. Surrogate spikes				
Were all surrogate percent recovery (%R) within QC limits?	✓			
If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis?			✓	
If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?			✓	

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.		✓		
Was a MS/MSD analyzed every 20 samples of each matrix?		✓		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?		✓		
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?		✓		
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	✓			
Were retention times within ± 30 seconds of the associated calibration standard?	✓			
XII. Compound quantitation				
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XIII. Target compound identification				
Were relative retention times (RRT's) within ± 0.06 RRT units of the standard?	✓			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	✓			
Were chromatogram peaks verified and accounted for?	✓			
XIV. System performance				
System performance was found to be acceptable.	✓			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethylamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o''-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachlorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU.. 2,3,4,6-Tetrachlorophenol	U1.
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1.
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW.. 2-Picoline	W1.
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1.
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1.
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ. Hexachloropropene	Z1.

LDC #: 38756 A 29

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: JVG
2nd Reviewer: [signature]

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a method blank analyzed for each matrix?
Y N N/A Was a method blank analyzed for each concentration preparation level?
Y N N/A Was a method blank associated with every sample?
Y N N/A Was the blank contaminated? If yes, please see qualification below.

Blank extraction date: 04/24/17 **Blank analysis date:** 05/05/17
Conc. units: ug/L Associated Samples: All = EEE, ~~JJ~~ CC (MD)
1, 2, 6, 7 = Y, QQQQ, JJ, J

Compound	Blank ID								
MB	280-370565/1-A								
Y	0.348								
QQQQ	0.281								
EEE	5.48								
JJ	0.354								
CC	0.316								
J	0.406								

Blank extraction date: _____ **Blank analysis date:** _____
Conc. units: _____ Associated Samples: _____

Compound	Blank ID								

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Common contaminants such as the phthalates and TICs noted above that were detected in samples within ten times the associated method blank concentration were qualified as not detected, "U". Other contaminants within five times the method blank concentration were also qualified as not detected, "U".

LDC #: 38756A2a

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: Q

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Was a LCS required?

Y (N) N/A Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	Date	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		LCS/D 280-370565/2,3-A	X	0 (10-120)	( )	( )	All (ND)	J/R/P
			X	( )	( )	200 (20)	↓ ↓	J dets/P
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		

LDC #: 38756A2a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS SVOA (EPA SW 846 Method 8270D)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$ — A_x = Area of Compound — A_{is} = Area of associated internal standard

average RRF = sum of the RRFs/number of standards — C_x = Concentration of compound, — C_{is} = Concentration of internal standard

%RSD = 100 * (S/X) — S= Standard deviation of the RRFs, — X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (IS)	Reported RRF (50 std)	Recalculated RRF (50 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL SMS Y	5/3/2017	Phenol (DCB)	1.6679	1.6679	1.6156	1.6156	6.8	6.8
			Nitrobenzene (NPT)	0.3394	0.3394	0.3320	0.3320	6.6	6.6
			Diethyl phthalate (ANT)	1.1582	1.1582	1.1182	1.1182	11.1	11.1
			Hexachlorobenzene (PHN)	0.1378	0.1378	0.1369	0.1369	6.9	7.0
			BEPH (CRY)	0.7961	0.7961	0.7865	0.7865	3.2	3.2

LDC #_38756A2a_

VALIDATION FINDINGS WORSHEET
Continuing Calibration Results Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS SVOA (EPA SW 846 Method 8270D)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = (Ax)(Cis)/(Ais)(Cx)

Where:
ave. RRF = initial calibration average RRF
Ax = Area of compound
Cx = Concentration of compound

RRF = continuing calibration RRF
Ais = Area of associated internal standard
Cis = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (IS)	Average RRF (Initial RRF)	Reported (CC RRF)	Recalculated (CC RRF)	Reported %D	Recalculated %D
1	y15116	05/05/17	Phenol (DCB)	1.6156	1.7659	1.7659	9.3	9.3
			Nitrobenzene (NPT)	0.3320	0.3681	0.3681	10.9	10.9
	SMS Y		Diethyl phthalate (ANT)	1.1182	1.1799	1.1799	5.5	5.5
			Hexachlorobenzene (PHN)	0.1369	0.1444	0.1444	5.5	5.5
			BEPH (CRY)	0.7865	0.8177	0.8177	4.0	4.0

LDC #: 38756 A2a

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Reviewer: JVG
2nd reviewer:

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270D)

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: # 1

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5	100	91.0	91	91	0
2-Fluorobiphenyl		91.6	92	92	
Terphenyl-d14		99.3	99	99	
Phenol-d5		94.5	94	94	
2-Fluorophenol		94.6	95	95	
2,4,6-Tribromophenol		104.0	104	104	
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

LDC #: 38756A2a

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SC/SA Where: SSC = Spike concentration
SA = Spike added

RPD = I LCSC - LCSDC I * 2/(LCSC + LCSDC) LCSC = Laboratory control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS/LCSD samples: LCS/D 280-370525/2,3-A

Compound	Spike Added (ug/L)		Spike Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
Phenol	80.0		81.7	79.0	102	102	99	99	3	3
N-Nitroso-di-n-propylamine	↓		77.4	77.4	97	97	97	97	0	0
4-Chloro-3-methylphenol	↓		84.3	84.6	105	105	106	106	0	0
~~Acenaphthene~~										
Pentachlorophenol	160		181	187	113	113	117	117	3	3
~~Pyrene~~										

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 38756A2q

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JVG
2nd reviewer:

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(V_t)(DF)(2.0)}{(A_{is})(RRF)(V_o)(V_i)(\%S)}$

A_x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
I_s	=	Amount of internal standard added in nanograms (ng)
V_o	=	Volume or weight of sample extract in milliliters (ml) or grams (g).
V_i	=	Volume of extract injected in microliters (ul)
V_t	=	Volume of the concentrated extract in microliters (ul)
Df	=	Dilution Factor.
%S	=	Percent solids, applicable to soil and solid matrices only.
2.0	=	Factor of 2 to account for GPC cleanup

Example:

Sample I.D. MD LCS, Phenol

Conc. = (349897)(40.0)(1ml)(1000)( ) / (105976)(1.6156)(1000 ml)( )( )

= 81.7 ug/L

#	Sample ID	Compound	Reported Concentration (ug/L)	Calculated Concentration ( )	Qualification
			81.7		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Camp Ravenna

LDC Report Date: June 7, 2017

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: Stage 4

Laboratory: TestAmerica, Inc.

Sample Delivery Group (SDG): 280-96239-1

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
BKGmw-024-042017-GW	280-96239-2	Water	04/20/17
BKGmw-023-042017-GW	280-96239-3	Water	04/20/17
BKGmw-022-042117-GW	280-96239-17	Water	04/21/17
BKGmw-510-042117-GW	280-96239-18	Water	04/21/17

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Remedial Investigation Work Plan for Groundwater and Environmental Investigation Services for RVAAP-66 Facility-Wide Groundwater Appendix A: Sampling Analysis Plan, A.2 – Quality Assurance Project Plan, Former Ravenna Army Ammunition Plant, Portage and Trumbull Countries, Ohio (December 2016), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Superfund Organic Methods Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polynuclear Aromatic Hydrocarbons (PAHs) by Environmental Protection Agency (EPA) SW 846 Method 8270D in Selected Ion Monitoring (SIM) mode

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 15.0% for all compounds.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

The percent differences (%D) of the ending continuing calibration verifications (CCVs) were less than or equal to 50.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits with the following exceptions:

LCS ID (Associated Samples)	Compound	LCS %R (Limits)	LCSD %R (Limits)	Flag	A or P
LCS/D280-370964/2,3-A (All samples in SDG 280-96239-1)	Chrysene	121 (57-120)	121 (57-120)	NA	-

Although the above listed %Rs flagged "NA" demonstrate a high bias, the affected compound in the associated samples were non-detected and did not warrant the qualification of the data.

Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

Samples BKGmw-022-042117-GW and BKGmw-510-042117-GW were identified as field duplicates. No results were detected in any of the samples.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

All compound quantitations were within validation criteria.

XIII. Target Compound Identifications

All target compound identifications were within validation criteria.

XIV. System Performance

The system performance was acceptable.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Camp Ravenna
Polynuclear Aromatic Hydrocarbons - Data Qualification Summary - SDG 280-96239-1

No Sample Data Qualified in this SDG

Camp Ravenna
Polynuclear Aromatic Hydrocarbons - Laboratory Blank Data Qualification Summary - SDG 280-96239-1

No Sample Data Qualified in this SDG

Camp Ravenna
Polynuclear Aromatic Hydrocarbons - Field Blank Data Qualification Summary - SDG 280-96239-1

No Sample Data Qualified in this SDG

LDC #: 38756A2b **VALIDATION COMPLETENESS WORKSHEET** Date: 06/06/17
SDG #: 280-96239-1 Stage 4 Page: 1 of 1
Laboratory: Test America, Inc. Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS Polynuclear Aromatic Hydrocarbons (EPA SW 846 Method 8270D-SIM)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	ICAL ≤ 15%. ICV ≤ 20 %.
IV.	Continuing calibration pending	A	CCV ≤ 20/50 %.
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	SW	LCS/D
X.	Field duplicates	ND	LCS D = 3/4
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	A	
XIII.	Target compound identification	A	
XIV.	System performance	A	
XV.	Overall assessment of data	A	

Note: A = Acceptable
N = Not provided/applicable
SW = See worksheet
ND = No compounds detected
R = Rinsate
FB = Field blank
D = Duplicate
TB = Trip blank
EB = Equipment blank
SB=Source blank
OTHER:

	Client ID		Lab ID	Matrix	Date
1	BKGmw-024-042017-GW		280-96239-2	Water	04/20/17
2	BKGmw-023-042017-GW		280-96239-3	Water	04/20/17
3	BKGmw-520-042117-GW	D	280-96239-18	Water	04/21/17
4	BKGmw-022-042117-GW	D	L-17	L	L
5					
6					
7					
8					

Notes:

-	MB 280-370969/1-A						

LDC #: 38756 A 26

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: CK

Method: PAH (EPA SW 846 Method 8270D-SIM)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
II. GC/MS instrument performance check (Not required)				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	✓			
Were all samples analyzed within the 12 hour clock criteria?	✓			
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤~~20~~ 15% and relative response factors (RRF) ≥ 0.05?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?		✓		
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤~~30%~~ 20 or percent recoveries (%R) ~~70-130%?~~	✓			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	✓			
Were all percent differences (%D) < 20% and relative response factors (RRF) > 0.05?	✓			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
VI. Field blanks				
Were field blanks identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VII. Surrogate spikes				
Were all surrogate percent differences (%R) within QC limits?	✓			
If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?			✓	
If any percent recoveries (%R) was less than 10 percent, was a reanalysis performed to confirm %R?			✓	

LDC #: 38756A26

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer:

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.		✓		
Was a MS/MSD analyzed every 20 samples of each matrix?		✓		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?		✓		
X. Field duplicates				
Were field duplicate pairs identified in this SDG?				
Were target compounds detected in the field duplicates?				
XI. Internal standards				
Were internal standard area counts within -50% or +100% of the associated calibration standard?	✓			
Were retention times within ± 30 seconds of the associated calibration standard?	✓			
XII. Compound quantitation				
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XIII. Target compound identification				
Were relative retention times (RRT's) within ± 0.06 RRT units of the standard?	✓			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	✓			
Were chromatogram peaks verified and accounted for?	✓			
XIV. System performance				
System performance was found to be acceptable.	✓			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

LDC #: 38754A2b

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Was a LCS required?
Y (N) N/A Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	Date	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		LCS/D 280-370964/2,3-A	DDD	121 (57-120)	121 (57-120)	( )	All (ND)	J dets/P
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		

LDC#: 38756A2b

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer: [signature]

METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = (Ax)(Cis)/(Ais)(Cx)

Where:
ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
Ax = Area of compound
Cx = Concentration of compound
Ais = Area of associated internal standard
Cis = Concentration of internal standard

#	Standard ID	Calibration Date	Compound	Ave RRF	Reported RRF	Recalculated RRF	Reported % D	Recalculated %D
1	F6418	5/4/2017	Naphthalene (ANT)	1.828	2.044	2.044	11.8	11.8
			Pyrene (PHN)	1.360	1.413	1.413	3.9	3.9
			Benzo(a)pyrene (CRY)	1.264	1.184	1.184	6.3	6.3

LDC#: 38756A2b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

A_x = Area of Compound
C_x = Concentration of compound,
S= Standard deviation of the RRFs,

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard
X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (IS)	Reported RRF (600 std)	Recalculated RRF (600 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL SMS F	4/17/17	Naphthalene (ANT)	1.9389	1.9389	1.8283	1.8283	5.6	5.6
			Pyrene (PHN)	1.3185	1.3185	1.3598	1.3598	6.7	6.7
			Benzo(a)pyrene (CRY)	1.2308	1.2308	1.2638	1.2638	9.6	9.6

LDC #: 38756 A2b

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Reviewer: JVG
2nd reviewer: [signature]

METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: # 1

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5	125.0	103.6	83	83	0
2-Fluorobiphenyl	↓	84.1	67	67	↓
Terphenyl-d14	↓	97.2	78	78	↓

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					

LDC #: 38756 A2b

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SC/SA Where: SSC = Spike concentration
SA = Spike added

RPD = | LCSC - LCSDC | * 2/(LCSC + LCSDC) LCSC = Laboratory control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS/LCSD samples: LCS/D 280-370964/2,3-A

Compound	Spike Added (ug/L)		Spike Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
Acenaphthene	0.900	0.900	0.976	0.974	108	108	108	108	0	0
Pyrene	↓	↓	1.03	1.05	115	115	116	116	1	1

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 38756 A26

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JVG
2nd reviewer:

METHOD: GC/MS PAH (EPA SW 846 Method 8270D-SIM)

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(V_t)(DF)(2.0)}{(A_{is})(RRF)(V_o)(V_i)(\%S)}$

A_x = Area of the characteristic ion (EICP) for the compound to be measured

A_{is} = Area of the characteristic ion (EICP) for the specific internal standard

I_s = Amount of internal standard added in nanograms (ng)

V_o = Volume or weight of sample extract in milliliters (ml) or grams (g).

V_i = Volume of extract injected in microliters (ul)

V_t = Volume of the concentrated extract in microliters (ul)

Df = Dilution Factor.

%S = Percent solids, applicable to soil and solid matrices only.

2.0 = Factor of 2 to account for GPC cleanup

Example:

Sample I.D. MD LCSD, Naphthalene

Conc. = $\frac{(13008)(600)(1\text{ ml})(\quad)(\quad)}{(18152)(1.8283)(250\text{ ml})(\quad)(\quad)}$

= 0.9407

≈ 0.941 ug/L

#	Sample ID	Compound	Reported Concentration (ug/L)	Calculated Concentration ( )	Qualification
			0.941		

LDC Report# 38756A3a

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Camp Ravenna

LDC Report Date: June 7, 2017

Parameters: Chlorinated Pesticides

Validation Level: Stage 4

Laboratory: TestAmerica, Inc.

Sample Delivery Group (SDG): 280-96239-1

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
BKGmw-024-042017-GW	280-96239-2	Water	04/20/17
BKGmw-023-042017-GW	280-96239-3	Water	04/20/17
LL1mw-084-042117-GW	280-96239-12	Water	04/21/17
BKGmw-022-042117-GW	280-96239-17	Water	04/21/17
BKGmw-510-042117-GW	280-96239-18	Water	04/21/17

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Remedial Investigation Work Plan for Groundwater and Environmental Investigation Services for RVAAP-66 Facility-Wide Groundwater Appendix A: Sampling Analysis Plan, A.2 – Quality Assurance Project Plan, Former Ravenna Army Ammunition Plant, Portage and Trumbull Countries, Ohio (December 2016), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Superfund Organic Methods Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Chlorinated Pesticides by Environmental Protection Agency (EPA) SW 846 Method 8081B

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC Instrument Performance Check

Instrument performance was checked at 12 hour intervals.

The individual 4,4'-DDT and Endrin breakdowns (%BD) were less than or equal to 15.0%.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average calibration factors were utilized, percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

Retention time windows were established as required by the method.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Flag	A or P
05/04/17	05040030	CLP 1	Endrin	23.5	All samples in SDG 280-96239-1	UJ (all non-detects)	A

Retention times of all compounds in the calibration standards were within the established retention time windows.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
MB 280-371191/1-A	04/27/17	alpha-BHC	0.00885 ug/L	All samples in SDG 280-96239-1

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits with the following exceptions:

LCS ID (Associated Samples)	Compound	LCS %R (Limits)	LCSD %R (Limits)	Flag	A or P
LCS/D280-371191/,3-A (All samples in SDG 280-96239-1)	Aldrin	-	43 (45-134)	UJ (all non-detects)	P

Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

Samples BKGmw-022-042117-GW and BKGmw-510-042117-GW were identified as field duplicates. No results were detected in any of the samples.

XI. Compound Quantitation

All compound quantitations met validation criteria.

The sample results for detected compounds from the two columns were within 40% relative percent difference (RPD) with the following exceptions:

Sample	Compound	RPD	Flag	A or P
LL1mw-084-042117-GW	Endosulfan I	198.6	J (all detects)	A

XII. Target Compound Identification

All target compound identifications met validation criteria.

XIII. System Performance

The system performance was acceptable.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to continuing calibration %D, LCS/LCSD %R, and RPD between two columns, data were qualified as estimated in five samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

Camp Ravenna
Chlorinated Pesticides - Data Qualification Summary - SDG 280-96239-1

Sample	Compound	Flag	A or P	Reason
BKGmw-024-042017-GW BKGmw-023-042017-GW LL1mw-084-042117-GW BKGmw-022-042117-GW BKGmw-510-042117-GW	Endrin	UJ (all non-detects)	A	Continuing calibration (%D)
BKGmw-024-042017-GW BKGmw-023-042017-GW LL1mw-084-042117-GW BKGmw-022-042117-GW BKGmw-510-042117-GW	Aldrin	UJ (all non-detects)	P	Laboratory control samples (%R)
LL1mw-084-042117-GW	Endosulfan I	J (all detects)	A	Compound quantitation (RPD between two columns)

Camp Ravenna
Chlorinated Pesticides - Laboratory Blank Data Qualification Summary - SDG 280-96239-1

No Sample Data Qualified in this SDG

Camp Ravenna
Chlorinated Pesticides - Field Blank Data Qualification Summary - SDG 280-96239-1

No Sample Data Qualified in this SDG

LDC #: 38756A3a
SDG #: 280-96239-1
Laboratory: Test America, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 4

Date: 06/06/17
Page: 1 of 1
Reviewer: JC
2nd Reviewer: JC

METHOD: GC Chlorinated Pesticides (EPA SW846 Method 8081B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	GC Instrument Performance Check	A	
III.	Initial calibration/ICV	A / A	ICAL ≤ 20% rr ICV ≤ 20%
IV.	Continuing calibration	SW	CCV ≤ 20%
V.	Laboratory Blanks	SW	
VI.	Field blanks	N	
VII.	Surrogate spikes /LS	A/A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	SW	LCS/D
X.	Field duplicates	ND	D = 4/5
XI.	Compound quantitation/RL/LOQ/LODs	SW	
XII.	Target compound identification	A	
XIII.	System Performance	A	
XIV.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	BKGmw-024-042017-GW	280-96239-2	Water	04/20/17
2	BKGmw-023-042017-GW	280-96239-3	Water	04/20/17
3	LL1mw-084-042117-GW	280-96239-12	Water	04/21/17
4	BKGmw-022-042117-GW	280-96239-17	Water	04/21/17
5	BKGmw-540-042117-GW	280-96239-18	Water	04/21/17
6				
7				
8				
9				
10				

Notes:

	MB 280-371191/1-A						

LDC #: 38756 A2q

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: G

Method: Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
II. GC/ECD Instrument performance check				
Was the instrument performance found to be acceptable?	✓			
Were Evaluation mix standards analyzed prior to the initial calibration and at beginning of each 12-hour shift?	✓			
Were endrin and 4,4'-DDT breakdowns ≤ 15% for individual breakdown in the Evaluation mix standards?	✓			
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20%?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?	✓			
Were the RT windows properly established?	✓			
IIIb. Initial calibration verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
IV. Continuing calibration				
Was a continuing calibration analyzed daily?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?		✓		
Were all the retention times within the acceptance windows?	✓			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.	✓			
VI. Field blanks				
Were field blanks identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VII. Surrogate spikes/Internal Standards				
Were all surrogate percent recovery (%R) within the QC limits?	✓			

LDC #: 38756 A3a

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer:

Validation Area	Yes	No	NA	Findings/Comments
If the percent recovery (%R) of one or more surrogates was outside QC limits, was a reanalysis performed to confirm %R?			✓	
If any percent recovery (%R) was less than 10 percent, was a reanalysis performed to confirm %R?			✓	
Were internal standard area counts within ± 50% of the average area calculated during calibration?	✓			
VII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	✓	✓		
Was a MS/MSD analyzed every 20 samples of each matrix?		✓		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?		✓		
X. Field duplicates				
Were field duplicate pairs identified in this SDG?				
Were target compounds detected in the field duplicates?				
XI. Compound quantitation				
Were compound quantitation and RLs adjusted to reflect all sample dilutions, dry weight factors, and clean-up activities applicable to level IV validation?	✓			
Were relative percent difference (RPD) of the results between two columns ≤ 40%?	✓	✓		
XII. Target compound identification				
Were the retention times of reported detects within the RT windows?	✓			
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

LDC #: 38756 A3a

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N" Not applicable questions are identified as "N/A".

(Y) N N/A Were Evaluation mix standards run before initial calibration and before samples?
(Y) N N/A Were Endrin & 4,4'-DDT breakdowns acceptable in the Evaluation Mix standard (≤15.0% for individual breakdowns)?
(Y) N N/A Was at least one standard run daily to verify the working curve?
Y (N) N/A Did the continuing calibration standards meet the percent difference (%D) / relative percent difference (RPD) criteria of ≤20.0%?

Level IV/D Only

(Y) N N/A Were the retention times for all calibrated compounds within their respective acceptance windows?

#	Date	Standard ID	Column	Compound	%D (Limit ≤ 20.0)	RT (Limits)	Associated Samples	Qualifications
	05/04/17	05040030	CLP1	K	23.5	( )	All (ND)	J/UJ/A
						( )		
						( )		
						( )		
						( )		
						( )		
						( )		
						( )		
						( )		
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						( )		
						( )		

A. alpha-BHC
B. beta-BHC
C. delta-BHC
D. gamma-BHC
E. Heptachlor
F. Aldrin
G. Heptachlor epoxide
H. Endosulfan I
I. Dieldrin
J. 4,4'-DDE
K. Endrin
L. Endosulfan II
M. 4,4'-DDD
N. Endosulfan sulfate
O. 4,4'-DDT
P. Methoxychlor
Q. Endrin ketone
R. Endrin aldehyde
S. alpha-Chlordane
T. gamma-Chlordane
U. Toxaphene
V. Aroclor-1016
W. Aroclor-1221
X. Aroclor-1232
Y. Aroclor-1242
Z. Aroclor-1248
AA. Aroclor-1254
BB. Aroclor-1260
CC. 2,4'-DDD
DD. 2,4'-DDE
EE. 2,4'-DDT
FF. Hexachlorobenzene
GG. Chlordane
HH. Chlordane (Tech)
II. Aroclor 1262
JJ. Aroclor 1268
KK. Oxychlordane
LL. trans- Nonachlor
MM. cis-Nonachlor
NN. ___________
OO. ___________
PP. ___________
QQ. ___________
RR. ___________
SS. ___________

LDC #: 38756A3a

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: JVG
2nd Reviewer:

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were all samples associated with a method blank?
Y N N/A Was a method blank performed for each matrix and whenever a sample extraction was performed?
Y N N/A If extract clean-up was performed, were extract clean-up blanks analyzed at the proper frequencies?
Y N N/A Was there contamination in the method blanks? If yes, please see the qualifications below.

Blank extraction date: 04/27/17 **Blank analysis date:** 05/04/17 **Associated samples:** All (MD)
Conc. units: ug/L

Compound	Blank ID	Sample Identification								
MB	280-371191/1-A									
A	0.00885									

Blank extraction date: _____ **Blank analysis date:** _____ **Associated samples:** _____
Conc. units: _____

Compound	Blank ID	Sample Identification								

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
All contaminants within five times the method blank concentration were qualified as not detected, "U".

LDC #: 38756A3a

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were a laboratory control samples (LCS) and laboratory control sample duplicate (LCSD) analyzed for each matrix in this SDG?

Y (N) N/A Were the LCS percent recoveries (%R) and relative percent differences (RPD) within the QC limits?

Level IV/D Only

(Y) N N/A Was a LCS analyzed every 20 samples for each matrix or whenever a sample extraction was performed?

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	LCS/D 280-371191/2,3-A	F	( )	43 (45-134)	( )	All (ND)	J/UJ P
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

LDC #: 38756 A3a

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: [signature]

METHOD: ✓ GC __ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Level IV/D Only

Y N N/A Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?
Y N N/A Did the reported results for detected target compounds agree within 10.0% of the recalculated results?
Y N N/A Did the percent difference of detected compounds between two columns./detectors ≤40%?
If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD/%D Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	H	3	198.6	J dets / A

Comments: See sample calculation verification worksheet for recalculations

LDC #: 38756A3a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC Pesticides (EPA SW 846 Method 8081B)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$

average RRF = sum of the RRFs/number of standards

%RSD = 100 * (S/X)

Where

A_x = Area of Compound

C_x = Concentration of compound,

S= Standard deviation of the RRFs,

A_{is} = Area of associated internal standard

C_{is} = Concentration of internal standard

X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (IS = BNB)	Reported RRF (25 std)	Recalculated RRF (25 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL SGC_P1	4/15/2017	DDT (CLP1)	see r2 calc					
			g-BHC (CLP1)	see r2 calc					
			DDT (CLP2)	see r2 calc					
			Endosulfan I (CLP2)	0.7702	0.7702	0.7910	0.7910	6.2	6.2

LDC#: 38756A3a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

METHOD: Pesticides (EPA SW 846 Method 8081B)

Parameter: DDT

Order of regression: Linear

Date	Instrument	Compound	Points	x Response ratio	y Conc ratio
4/15/2017	SGC P1 CLP1	DDT	Point 1	0.021018441	0.027
			Point 2	0.054481114	0.067
			Point 3	0.144270078	0.167
			Point 4	0.311940414	0.333
			Point 5	0.479473983	0.500
			Point 6	0.675665023	0.667

Regression Output: Regression Output:			Reported WLR	
Constant	b =	-0.01708	b =	-0.38500
Std Err of Y Est		0.04		
R Squared	r^2 =	0.99802	r^2 =	0.99600
No. of Observations		6.00		
Degrees of Freedom		4.00		
X Coefficient(s)	m =	1.01666	m =	0.95210
Std Err of Coef.	0.01			

LDC#: 38756A3a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

METHOD: Pesticides (EPA SW 846 Method 8081B)

Parameter: g-BHC

Order of regression: Linear

Date	Instrument	Compound	Points	x Response ratio	y Conc ratio
4/15/2017	SGC P1 CLP1	g-BHC	Point 1	0.030879497	0.027
			Point 2	0.082507585	0.067
			Point 3	0.215060565	0.167
			Point 4	0.461096976	0.333
			Point 5	0.708772492	0.500
			Point 6	0.989175429	0.667

Regression Output: Regression Output:			Reported WLR	
Constant	b =	-0.02242	b =	-0.56800
Std Err of Y Est		0.04		
R Squared	r^2 =	0.99856	r^2 =	0.99700
No. of Observations		6.00		
Degrees of Freedom		4.00		
X Coefficient(s)	m =	1.48977	m =	1.41040
Std Err of Coef.	0.01			

LDC#: 38756A3a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer: [signature]

METHOD: Pesticides (EPA SW 846 Method 8081B)

Parameter: DDT

Order of regression: Linear

Date	Instrument	Compound	Points	x Response ratio	y Conc ratio
4/15/2017	SGC P1 CLP2	DDT	Point 1	0.029312657	0.027
			Point 2	0.072600805	0.067
			Point 3	0.176316571	0.167
			Point 4	0.354543185	0.333
			Point 5	0.53286071	0.500
			Point 6	0.723552817	0.667

Regression Output: Regression Output:			Reported WLR	
Constant	b =	-0.00178	b =	0.07830
Std Err of Y Est		0.04		
R Squared	r^2 =	0.99977	r^2 =	1.00000
No. of Observations		6.00		
Degrees of Freedom		4.00		
X Coefficient(s)	m =	1.07946	m =	0.65080
Std Err of Coef.	0.01			

LDC # 38756A3a

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC Pesticides (EPA SW 846 Method 8081B)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = (Ax)(Cis)/(Ais)(Cx)

Where:
ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
Ax = Area of compound,
Cx = Concentration of compound,
Ais = Area of associated internal standard
Cis = Concentration of internal standard

#	Standard ID	Calibration Date	Compound	Average RRF Conc	Reported RRF (CC)	Recalculated RRF (CC)	Reported % D	Recalculated % D
1	5040028	5/4/2017	DDT (CLP1)	25.00	29.1	29.1	16.5	16.5
			g-BHC (CLP1)	25.00	23.9	23.9	4.5	4.5
			DDT (CLP2)	25.00	26.3	26.3	5.4	5.4
			Endosulfan I (CLP2)	25.00	24.8	24.8	0.9	0.9

LDC #: 38756A39

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Reviewer: JVG
2nd reviewer: [signature]

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: #1

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
Tetrachloro-m-xylene						
Tetrachloro-m-xylene	CLP 1	10.0	7.20	72	72	0
Decachlorobiphenyl	↓	↓	8.31	83	83	↓
Decachlorobiphenyl						

Sample ID:

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
Tetrachloro-m-xylene						
Tetrachloro-m-xylene						
Decachlorobiphenyl						
Decachlorobiphenyl						

Sample ID:

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
Tetrachloro-m-xylene						
Tetrachloro-m-xylene						
Decachlorobiphenyl						
Decachlorobiphenyl						

Sample ID:

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
Tetrachloro-m-xylene						
Tetrachloro-m-xylene						
Decachlorobiphenyl						
Decachlorobiphenyl						

Notes:

LDC #: 38752 A39

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicate Results Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

The percent recoveries (%R) and Relative Percent difference (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100* (SSC-SC)/SA

Where: SSC = Spiked sample concentration
SA = Spike added
SC = Concentration

RPD = I LCS - LCSD I * 2/(LCS + LCSD)

LCS = Laboratory control sample percent recovery

LCSD = Laboratory control sample duplicate percent recovery

LCS/LCSD samples: LCS ID 280-371191/2,3-A

Compound	Spike Added (ug/L)		Spiked Sample Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
gamma-BHC	0.500	0.500	0.459	0.438	92	92	88	88	5	5
4,4'-DDT	↓	↓	0.498	0.529	100	100	106	106	6	6
Aroclor 1260										

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicate findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 38758 A3a

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JVG
2nd reviewer: ~~X~~

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Example:

Sample I.D. 3 H : CLP 2

Conc. = $\frac{(2717973)(75.0)(5\,ml)}{(40848971)(0.7910)(242.5\,ml)}$

= 0.013 ug/L

#	Sample ID	Compound	Reported Concentration (ug/L)	Calculated Concentration ( )	Qualification
			0.013		

Note:

LDC Report# 38756A3b

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Camp Ravenna

LDC Report Date: June 7, 2017

Parameters: Polychlorinated Biphenyls

Validation Level: Stage 4

Laboratory: TestAmerica, Inc.

Sample Delivery Group (SDG): 280-96239-1

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
BKGmw-024-042017-GW	280-96239-2	Water	04/20/17
BKGmw-023-042017-GW	280-96239-3	Water	04/20/17
LL1mw-084-042117-GW	280-96239-12	Water	04/21/17
BKGmw-022-042117-GW	280-96239-17	Water	04/21/17
BKGmw-510-042117-GW	280-96239-18	Water	04/21/17

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Remedial Investigation Work Plan for Groundwater and Environmental Investigation Services for RVAAP-66 Facility-Wide Groundwater Appendix A: Sampling Analysis Plan, A.2 – Quality Assurance Project Plan, Former Ravenna Army Ammunition Plant, Portage and Trumbull Countries, Ohio (December 2016), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Superfund Organic Methods Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polychlorinated Biphenyls (PCBs) by Environmental Protection Agency (EPA) SW 846 Method 8082A

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

A curve fit, based on the initial calibration, was established for quantitation. The coefficient of determination (r^2) was greater than or equal to 0.990.

Retention time windows were established as required by the method.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds.

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

Retention times of all compounds in the calibration standards were within the established retention time windows.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates/Internal Standards

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

All internal standard areas and retention times were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Field Duplicates

Samples BKGmw-022-042117-GW and BKGmw-510-042117-GW were identified as field duplicates. No results were detected in any of the samples.

X. Compound Quantitation

All compound quantitations met validation criteria.

XI. Target Compound Identification

All target compound identifications met validation criteria.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Camp Ravenna
Polychlorinated Biphenyls - Data Qualification Summary - SDG 280-96239-1

No Sample Data Qualified in this SDG

Camp Ravenna
Polychlorinated Biphenyls - Laboratory Blank Data Qualification Summary - SDG 280-96239-1

No Sample Data Qualified in this SDG

Camp Ravenna
Polychlorinated Biphenyls - Field Blank Data Qualification Summary - SDG 280-96239-1

No Sample Data Qualified in this SDG

LDC #: 38756A3b
SDG #: 280-96239-1
Laboratory: Test America, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 4

Date: 06/06/17
Page: 1 of 1
Reviewer: JW
2nd Reviewer: [signature]

METHOD: GC Polychlorinated Biphenyls (EPA SW846 Method 8082A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	Initial calibration/ICV	A / A	ICAL ~~≤ 20%~~ all r ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes /IS	A / A	
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples	A	LCS/D
IX.	Field duplicates	ND	D = 4/5
X.	Compound quantitation/RL/LOQ/LODs	A	
XI.	Target compound identification	A	
XII	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	BKGmw-024-042017-GW	280-96239-2	Water	04/20/17
2	BKGmw-023-042017-GW	280-96239-3	Water	04/20/17
3	LL1mw-084-042117-GW	280-96239-12	Water	04/21/17
4	BKGmw-022-042117-GW	280-96239-17	Water	04/21/17
5	BKGmw-540-042117-GW	280-96239-18	Water	04/21/17
6				
7				
8				
9				
10				
11				
12				

Notes:

-	MB 250-372814/1-A						

LDC #: 38736 A3b

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: CJ

Method: Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
II. GC/ECD Instrument performance check				
Was the instrument performance found to be acceptable?	✓			
Were Evaluation mix standards analyzed prior to the initial calibration and at beginning of each 12-hour shift?			✓	
Were endrin and 4,4'-DDT breakdowns ≤ 15% for individual breakdown in the Evaluation mix standards?			✓	
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20%?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?	✓			
Were the RT windows properly established?	✓			
IIIb. Initial calibration verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
IV. Continuing calibration				
Was a continuing calibration analyzed daily?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
Were all the retention times within the acceptance windows?	✓			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
VI. Field blanks				
Were field blanks identified in this SDG?	-	✓		
Were target compounds detected in the field blanks?			✓	
VII. Surrogate spikes/Internal Standards				
Were all surrogate percent recovery (%R) within the QC limits?	✓			

LDC #: 38756 A36

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer:

Validation Area	Yes	No	NA	Findings/Comments
If the percent recovery (%R) of one or more surrogates was outside QC limits, was a reanalysis performed to confirm %R?			✓	
If any percent recovery (%R) was less than 10 percent, was a reanalysis performed to confirm %R?			✓	
Were internal standard area counts within ± 50% of the average area calculated during calibration?	✓			
VII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.		✓		
Was a MS/MSD analyzed every 20 samples of each matrix?		✓		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?				
Were target compounds detected in the field duplicates?				
XI. Compound quantitation				
Were compound quantitation and RLs adjusted to reflect all sample dilutions, dry weight factors, and clean-up activities applicable to level IV validation?	✓			
Were relative percent difference (RPD) of the results between two columns ≤ 40%?	✓			
XII. Target compound identification				
Were the retention times of reported detects within the RT windows?	✓			
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

LDC#: 38756A3b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

METHOD: PCBs (EPA SW 846 Method 8082A)

Parameter: 1260-1

Order of regression: Linear

Date	Instrument	Compound	Points	x Response ratio	y Conc ratio
5/8/2017	SGC P3 CLP1	1260-1	Point 1	0.02211	0.025
			Point 2	0.04083	0.050
			Point 3	0.07665	0.100
			Point 4	0.17867	0.250
			Point 5	0.33149	0.500
			Point 6	0.49614	0.750
			Point 7	0.65586	1.000

Regression Output:			Reported WLR	
Constant	b =	0.01020	b =	7.45950
Std Err of Y Est		0.04		
R Squared	r^2 =	0.99979	r^2 =	0.99900
No. of Observations		6.00		
Degrees of Freedom		4.00		
X Coefficient(s)	m =	0.64687	m =	0.65400
Std Err of Coef.	0.01			

LDC#: 38756A3b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

METHOD: PCBs (EPA SW 846 Method 8082A)

Parameter: 1260-1

Order of regression: Linear

Date	Instrument	Compound	Points	x Response ratio	y Conc ratio
5/8/2017	SGC P3 CLP2	1260-1	Point 1	0.02836	0.025
			Point 2	0.05269	0.050
			Point 3	0.09888	0.100
			Point 4	0.22979	0.250
			Point 5	0.43915	0.500
			Point 6	0.66131	0.750
			Point 7	0.90514	1.000

Regression Output:			Reported WLR	
Constant	b =	0.00594	b =	7.34470
Std Err of Y Est		0.04		
R Squared	r^2 =	0.99944	r^2 =	1.00000
No. of Observations		6.00		
Degrees of Freedom		4.00		
X Coefficient(s)	m =	0.88738	m =	0.88370
Std Err of Coef.	0.01			

LDC#: 38756A3b

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC / HPLC_____

The percent difference (%D) of the initial calibration average Calibration Factors (CF) and the continuing calibration percent difference (%D) values were recalculated for the compounds identified below using the following calculation:

Percent difference (%D) = 100 * (N - C)/N

Where:

N = Initial Calibration Factor or Nominal Amount

C = Calibration Factor from Continuing Calibration Standard or Calculated Amount

#	Standard ID	Calibration Date	Compound	CCV Conc	Reported Conc	Recalculated Conc	Reported % D	Recalculated %D
1	05120021	5/12/2017	1260-1 CLP1	500	501.2	501.2	0.2	0.2
			1260-2 CLP2	500	542.8	542.8	8.6	8.6

LDC #: 38756A3b

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Reviewer: JVG

2nd reviewer: ✓

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: #1

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Tetrachloro-m-xylene						
Tetrachloro-m-xylene	CLP 2	20.0	8.15	41	41	0
Decachlorobiphenyl	↓	↓	15.3	76	76	↓
Decachlorobiphenyl						

Sample ID:

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Tetrachloro-m-xylene						
Tetrachloro-m-xylene						
Decachlorobiphenyl						
Decachlorobiphenyl						

Sample ID:

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Tetrachloro-m-xylene						
Tetrachloro-m-xylene						
Decachlorobiphenyl						
Decachlorobiphenyl						

Sample ID:

Surrogate	Column	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Tetrachloro-m-xylene						
Tetrachloro-m-xylene						
Decachlorobiphenyl						
Decachlorobiphenyl						

Notes:

LDC #: 38756 A2h

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicate Results Verification

Reviewer: JVG
2nd Reviewer: [signature]

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

The percent recoveries (%R) and Relative Percent difference (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100* (SSC-SC)/SA

Where: SSC = Spiked sample concentration; SA = Spike added; SC = Concentration

RPD = I LCS - LCSD I * 2/(LCS + LCSD)

LCS = Laboratory control sample percent recovery; LCSD = Laboratory control sample duplicate percent recovery

LCS/LCSD samples: LCS/D 280-372814/2,3-A

Compound	Spike Added (ug/L)		Spiked Sample Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
gamma-BHC										
4,4'-DDT										
Aroclor 1260	0.200	0.200	0.202	0.154	101	101	77	77	27	27

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicate findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 38756A36

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: JVG
2nd reviewer:

METHOD: GC Pesticides/PCBs (EPA SW 846 Method 8081/8082)

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Example:

Sample I.D. MD LCS 1260 CLP 2

1260-1 Conc. = $\frac{[(35913669)(1000)] - (7.3447)}{(21493069)} \div (0.8837)$

= 180.77

1260 total = $\frac{180.77 + 180.5 + 214.5 + 216.3 + 215.9}{5}$

= 201.494

final conc. = $\frac{(201.5)(1ml)}{(1000ml)}$

= 0.2015

≈ 0.202 ug/L

#	Sample ID	Compound	Reported Concentration (ug/L)	Calculated Concentration ( )	Qualification
			0.202		

Note:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Camp Ravenna

LDC Report Date: June 19, 2017

Parameters: Metals

Validation Level: Stage 4

Laboratory: TestAmerica, Inc.

Sample Delivery Group (SDG): 280-96239-1

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
BKGmw-021-042117-GW	280-96239-1	Water	04/21/17
BKGmw-024-042017-GW	280-96239-2	Water	04/20/17
BKGmw-023-042017-GW	280-96239-3	Water	04/20/17
BKGmw-018-042017-GW	280-96239-4	Water	04/20/17
BKGmw-509-042017-GW	280-96239-5	Water	04/20/17
BKGmw-017-042017-GW	280-96239-6	Water	04/20/17
BKGmw-017-042017-GF	280-96239-7	Water	04/20/17
LL1mw-065-042117-GW	280-96239-11	Water	04/21/17
LL1mw-084-042117-GW	280-96239-12	Water	04/21/17
LL1mw-086-042117-GW	280-96239-13	Water	04/21/17
LL1mw-086-042117-GF	280-96239-16	Water	04/21/17
BKGmw-022-042117-GW	280-96239-17	Water	04/21/17
BKGmw-510-042117-GW	280-96239-18	Water	04/21/17
BKGmw-021-042117-GWMS	280-96239-1MS	Water	04/21/17
BKGmw-021-042117-GWMSD	280-96239-1MSD	Water	04/21/17

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Remedial Investigation Work Plan for Groundwater and Environmental Investigation Services for RVAAP-66 Facility-Wide Groundwater Appendix A: Sampling Analysis Plan, A.2 – Quality Assurance Project Plan, Former Ravenna Army Ammunition Plant, Portage and Trumbull Countries, Ohio (December 2016), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, and Zinc by Environmental Protection Agency (EPA) SW 846 Methods 6010C/6020A
Mercury by EPA SW 846 Method 7470A

All sample results were subjected to Stage 4 evaluation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. Instrument Calibration

Initial and continuing calibrations were performed as required by the methods.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

IV. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
PB (prep blank)	Sodium	608 ug/L	All was samples in SDG 280-96239-1
ICB/CCB	Sodium Vanadium	147ug/L 0.550ug/L	All was samples in SDG 280-96239-1
ICB/CCB	Beryllium	0.0810ug/L	BKGmw-017-042017-GW BKGmw-017-042017-GF LL1mw-065-042117-GW LL1mw-084-042117-GW LL1mw-086-042117-GW LL1mw-086-042117-GF BKGmw-022-042117-GW BKGmw-510-042117-GW

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
BKGmw-017-042017-GF	Vanadium	1.1 ug/L	2.0U ug/L
BKGmw-510-042117-GW	Sodium	3000 ug/L	3000U ug/L
BKGmw-017-042017-GW	Beryllium	0.15 ug/L	0.30U ug/L
LL1mw-084-042117-GW	Beryllium	0.15 ug/L	0.30U ug/L

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Duplicate Sample Analysis

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

IX. Serial Dilution

Serial dilution analysis was performed on an associated project sample. Percent differences (%D) were within QC limits.

X. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

XI. Field Duplicates

Samples BKGmw-018-042017-GW and BKGmw-509-042017-GW and samples BKGmw-022-042117-GW and BKGmw-510-042117-GW were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (ug/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	BKGmw-018-042017-GW	BKGmw-509-042017-GW				
Calcium	23000	23000	0 (≤30)	-	-	-
Magnesium	3000	2800	7 (≤30)	-	-	-
Sodium	3400	3200	-	200 (≤5000)	-	-
Barium	7.6	6.7	-	0.9 (≤15)	-	-
Copper	0.99	1.8U	-	0.81 (≤2.0)	-	-
Lead	0.53	0.70U	-	0.17 (≤3.0)	-	-
Manganese	1.6	0.70	-	0.9 (≤3.5)	-	-
Nickel	0.33	0.40	-	0.07 (≤3.0)	-	-
Zinc	4.2	8.0U	-	3.8 (≤20)	-	-

Analyte	Concentration (ug/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	BKGmw-022-042117-GW	BKGmw-510-042117-GW				
Calcium	23000	22000	4 (≤30)	-	-	-
Iron	9700	9100	6 (≤30)	-	-	-
Magnesium	6600	6300	5 (≤30)	-	-	-
Potassium	280	250	-	30 (≤3000)	-	-
Sodium	3300	3000	-	300 (≤5000)	-	-
Arsenic	3.1	3.0	-	0.1 (≤5.0)	-	-
Barium	82	84	2 (≤30)	-	-	-
Chromium	0.75	1.8U	-	1.05 (≤10)	-	-
Cobalt	2.2	2.3	-	0.1 (≤1.0)	-	-
Manganese	370	380	3 (≤30)	-	-	-
Nickel	2.5	2.4	-	0.1 (≤3.0)	-	-

Analyte	Concentration (ug/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	BKGmw-022-042117-GW	BKGmw-510-042117-GW				
Zinc	3.2	3.3	-	0.1 (≤20)	-	-

XII. Internal Standards (ICP-MS)

All internal standard percent recoveries (%R) were within QC limits.

XIII. Sample Result Verification

All sample result verifications were acceptable.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

Due to laboratory blank contamination, data were qualified as not detected in four samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Based upon the data validation all other results are considered valid and usable for all purposes.

Camp Ravenna
Metals - Data Qualification Summary - SDG 280-96239-1

No Sample Data Qualified in this SDG

Camp Ravenna
Metals - Laboratory Blank Data Qualification Summary - SDG 280-96239-1

Sample	Analyte	Modified Final Concentration	A or P
BKGmw-017-042017-GF	Vanadium	2.0U ug/L	A
BKGmw-510-042117-GW	Sodium	3000U ug/L	A
BKGmw-017-042017-GW	Beryllium	0.30U ug/L	A
LL1mw-084-042117-GW	Beryllium	0.30U ug/L	A

Camp Ravenna
Metals - Field Blank Data Qualification Summary - SDG 280-96239-1

No Sample Data Qualified in this SDG

LDC #: 38756A4a
SDG #: 280-96239-1
Laboratory: Test America, Inc.

VALIDATION COMPLETENESS WORKSHEET
Stage 4

Date: 6/8/17
Page: 1 of 2
Reviewer: VB
2nd Reviewer: [illegible]

METHOD: Metals (EPA SW 846 Method 6010C/6020A/7470A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	SW	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	A	
VIII.	Duplicate sample analysis	N	
IX.	Serial Dilution	A	
X.	Laboratory control samples	A	LCS
XI.	Field Duplicates	SW	(4,5) (12,13)
XII.	Internal Standard (ICP-MS)	A	
XIII.	Sample Result Verification	A	
XIV.	Overall Assessment of Data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	BKGmw-021-042117-GW	280-96239-1	Water	04/21/17
2	BKGmw-024-042017-GW	280-96239-2	Water	04/20/17
3	BKGmw-023-042017-GW	280-96239-3	Water	04/20/17
4	BKGmw-018-042017-GW	280-96239-4	Water	04/20/17
5	BKGmw-509-042017-GW	280-96239-5	Water	04/20/17
6	BKGmw-017-042017-GW	280-96239-6	Water	04/20/17
7	BKGmw-017-042017-GF	280-96239-7	Water	04/20/17
8	LL1mw-065-042117-GW	280-96239-11	Water	04/21/17
9	LL1mw-084-042117-GW	280-96239-12	Water	04/21/17
10	LL1mw-086-042117-GW	280-96239-13	Water	04/21/17
11	LL1mw-086-042117-GF	280-96239-16	Water	04/21/17
12	BKGmw-022-042117-GW	280-96239-17	Water	04/21/17
13	BKGmw-540-042117-GW	280-96239-18	Water	04/21/17
14	BKGmw-021-042117-GWMS	280-96239-1MS	Water	04/21/17
15	BKGmw-021-042117-GWMSD	280-96239-1MSD	Water	04/21/17

6020/Hg J

LDC #: 38756A4a

SDG #: 280-96239-1

Laboratory: Test America, Inc.

VALIDATION COMPLETENESS WORKSHEET

Stage 4

Date: 6/8/17

Reviewer:

2nd Reviewer:

METHOD: Metals (EPA SW 846 Method 6010C/6020A/7470A)

	Client ID	Lab ID	Matrix	Date
16				
17				
18				
19				
20				

Notes:

DC #: 387564A4a

VALIDATION FINDINGS CHECKLIST

Reviewer: JB
2nd Reviewer:

Method: Metals (EPA SW 846 Method 6010/6020/7000)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. ICP/MS Tune				
Were all isotopes in the tuning solution mass resolution within 0.1 amu?	✓			
Were %RSD of isotopes in the tuning solution ≤5%?	✓			
III. Calibration				
Were all instruments calibrated daily, each set-up time?	✓			
Were the proper number of standards used?	✓			
Were all initial and continuing calibration verification %Rs within the 90-110% (80-120% for mercury) QC limits?	✓			
Were the low standard checks within 70-130%	✓			
Were all initial calibration correlation coefficients within limits as specified by the method?	✓			
IV. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.	✓			
V. ICP Interference Check Sample				
Were ICP interference check samples performed daily?	✓			
Were the AB solution percent recoveries (%R) with the 80-120% QC limits?	✓			
VI. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and duplicate (DUP) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil / Water.	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the 75-125 QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.	✓			
Were the MS/MSD or duplicate relative percent differences (RPD) ≤ 20% for waters and ≤ 35% for soil samples? A control limit of +/- RL(+/-2X RL for soil) was used for samples that were ≤ 5X the RL, including when only one of the duplicate sample values were ≤ 5X the RL.	✓			
VII. Laboratory control samples				
Was an LCS anaylzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓	✓		
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 80-120% QC limits for water samples and laboratory established QC limits for soils?	✓			

Validation Area	Yes	No	NA	Findings/Comments
VIII. Internal Standards (EPA SW 846 Method 6020/EPA 200.8)				
Were all the percent recoveries (%R) within the 30-120% (6020)/60-125% (200.8) of the intensity of the internal standard in the associated initial calibration?	✓			
If the %Rs were outside the criteria, was a reanalysis performed?			✓	
IX. ICP Serial Dilution				
Was an ICP serial dilution analyzed if analyte concentrations were > 50X the MDL (ICP)/>100X the MDL(ICP/MS)?	✓			
Were all percent differences (%Ds) < 10%?			✓	
Was there evidence of negative interference? If yes, professional judgement will be used to qualify the data.		✓		
X. Sample Result Verification				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XI. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			
XII. Field duplicates				
Field duplicate pairs were identified in this SDG.	✓			
Target analytes were detected in the field duplicates.	✓			
XIII. Field blanks				
Field blanks were identified in this SDG.		✓		
Target analytes were detected in the field blanks.			✓	

LDC #: 38756A4a

VALIDATION FINDINGS WORKSHEET
Sample Specific Element Reference

Reviewer: JB
2nd reviewer:

All circled elements are applicable to each sample.

Sample ID	Matrix	Target Analyte List (TAL)
1-13	W	Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, U, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, U, ___
QC		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, U, ___
14, 15	W	Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, U, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, U, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, U, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, U, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, U, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, U, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, U, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, U, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, U, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, U, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, U, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, U, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, U, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, U, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, U, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, U, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, U, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, U, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, U, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, U, ___
Analysis Method		
ICP		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, U, ___
ICP-MS		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, U, ___
GFAA		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, U, ___

Comments: Mercury by CVAA if performed

LDC #: 38756A4a

VALIDATION FINDINGS WORKSHEET
PB/ICB/CCB QUALIFIED SAMPLES

Reviewer: JB
2nd Reviewer:

METHOD: Trace metals (EPA SW 864 Method 6010B/6020/7000)
Soil preparation factor applied: NA
Sample Concentration units, unless otherwise noted: ug/L
Associated Samples: All Waters

Analyte	Maximum PB[a] (mg/Kg)	Maximum PB[a] (ug/L)	Maximum ICB/CCB[a] (ug/L)	Action Level	7	13							
Na		608	147	3040		3000							
V			0.550	2.75	1.1 / 2.0								

Sample Concentration units, unless otherwise noted: ug/L
Associated Samples: 6 - 13

Analyte	Maximum PB[a] (mg/Kg)	Maximum PB[a] (ug/L)	Maximum ICB/CCB[a] (ug/L)	Action Level	6	9							
Be			0.0810	0.405	0.15 / 0.30	0.15 / 0.30							

Samples with analyte concentrations within five times the associated ICB, CCB or PB concentration are listed above with the identifications from the Validation Completeness Worksheet. These sample results were qualified as not detected, "U".
Note : a - The listed analyte concentration is the highest ICB, CCB, or PB detected in the analysis of each element.

LDC#: 38756A4a
SDG#: See Cover

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JB
2nd Reviewer:

METHOD: Metals (EPA Method 6010B/7000)

Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Analyte	Concentration (ug/L)		RPD (≤ 30)	Difference (< LOQ)	Qualifier (Parent Only)
	4	5			
Calcium	23000	23000	0		
Magnesium	3000	2800	7		
Sodium	3400	3200		200 (5000)	
Barium	7.6	6.7		0.9 (15)	
Copper	0.99	1.8U		0.81 (2.0)	
Lead	0.53	0.70U		0.17 (3.0)	
Manganese	1.6	0.70		0.9 (3.5)	
Nickel	0.33	0.40		0.07 (3.0)	
Zinc	4.2	8.0U		3.8 (20)	

Analyte	Concentration (ug/L)		RPD (≤ 30)	Difference (< LOQ)	Qualifier (Parent Only)
	12	13			
Calcium	23000	22000	4		
Iron	9700	9100	6		
Magnesium	6600	6300	5		
Potassium	280	250		30 (3000)	
Sodium	3300	3000		300 (5000)	
Arsenic	3.1	3.0		0.1 (5.0)	
Barium	82	84	2		
Chromium	0.75	1.8U		1.05 (10)	

LDC#: 38756A4a
SDG#: See Cover

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JB
2nd Reviewer:

METHOD: Metals (EPA Method 6010B/7000)

Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Analyte	Concentration (ug/L)		RPD (≤ 30)	Difference (< LOQ)	Qualifier (Parent Only)
	12	13			
Cobalt	2.2	2.3		0.1 (1.0)	
Manganese	370	380	3		
Nickel	2.5	2.4		0.1 (3.0)	
Zinc	3.2	3.3		0.1 (20)	

LDC #: 38756A4a

VALIDATION FINDINGS WORKSHEET
Initial and Continuing Calibration Calculation Verification

Reviewer: JB
2nd Reviewer:

METHOD: Trace metals (EPA SW 846 Method 6010/6020/7000)

An initial and continuing calibration verification percent recovery (%R) was recalculated for each type of analysis using the following formula:

%R = Found x 100 / True

Where, Found = concentration (in ug/L) of each analyte measured in the analysis of the ICV or CCV solution
True = concentration (in ug/L) of each analyte in the ICV or CCV source

Standard ID	Type of Analysis	Element	Found (ug/L)	True (ug/L)	Recalculated %R	Reported %R	Acceptable (Y/N)
ICV	ICP (Initial calibration) 5/1	Na	2.047330 mg/L	2000 ug/L	102%	102%	Y
ICV	ICP/MS (Initial calibration)	Pb	40.395 ug/L	40.0 ug/L	101%	101%	Y
ICV	CVAA (Initial calibration)	Hg	3.99 ug/L	4.00 ug/L	100%	100%	Y
CCV	ICP (Continuing calibration) 21:37	Ca	4.994804 mg/L	5000 ug/L	100%	100%	Y
CCV	ICP/MS (Continuing calibration) 12:30	Ag	50.921 ug/L	50.0 ug/L	102%	102%	Y
CCV	CVAA (Continuing calibration) 9:04	Hg	4.893 ug/L	5.00 ug/L	98%	98%	Y

Comments:

LDC #: 38756A4a
SDG #: 280-96239-1

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Reviewer: JB
2nd Reviewer:

METHOD: Trace metals (EPA CLP SOW ILM02.1)

Percent recoveries (%R) for an ICP interference check sample, a laboratory control sample and a matrix spike sample were recalculated using the following formula:

$$\%R = \frac{Found}{True} \times 100$$

Where, Found = Concentration of each analyte measured in the analysis of the sample. For the matrix spike calculation, Found = SSR (spiked sample result) - SR (sample result).
True = Concentration of each analyte in the source.

A sample and duplicate relative percent difference (RPD) was recalculated using the following formula:

$$RPD = \frac{|S-D|}{(S+D)/2} \times 100$$

Where, S = Original sample concentration
D = Duplicate sample concentration

An ICP serial dilution percent difference (%D) was recalculated using the following formula:

$$\%D = \frac{|I-SDR|}{I} \times 100$$

Where, I = Initial Sample Result (ug/L)
SDR = Serial Dilution Result (ug/L) (Instrument Reading x 5)

Sample ID	Type of Analysis	Element	Found / S / I (units)	True / D / SDR (units)	Recalculated %R / RPD / %D	Reported %R / RPD / %D	Acceptable (Y/N)
ICSAB	ICP interference check	Be	96.293 ug/L	100 ug/L	96%	96%	Y
LCS	Laboratory control sample	Al	2.029850 mg/L	2000 ug/L	100%	100%	Y
MS	Matrix spike	Hg	ND (SSR-SR) 5.0016 ug/L	5.00 ug/L	100%	100%	Y
MSD	Duplicate	Hg	4.965 ug/L	FOUND: 5.0016 ug/L	1 RPD	1 RPD	Y
	ICP serial dilution						

Comments: Refer to appropriate worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 38756A4a
SDG #: 280-96239-1

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: JB
2nd reviewer:

METHOD: Trace metals (EPA CLP SOW ILM02.1)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Have results been reported and calculated correctly?
Y N N/A Are results within the calibrated range of the instruments and within the linear range of the ICP?
Y N N/A Are all detection limits below the CRDL?

Detected analyte results for Zn #4 were recalculated and verified using the following equation:

Concentration = $\frac{(RD)(FV)(Dil)}{(In.\ Vol.)}$

RD = Raw data concentration
FV = Final volume (ml)
In. Vol. = Initial volume (ml) or weight (G)
Dil = Dilution factor

Recalculation:

From Raw Data Zn = 4.249 ug/L

#	Sample ID	Analyte	Reported Concentration (ug/L)	Calculated Concentration (ug/L)	Acceptable (Y/N)
	1	Ca	85000	85000	Y
	2	Na	11000	11000	Y
	3	Fe	300	300	Y
	4	Zn	4.2	4.2	Y
	5	Mg	2800	2800	Y
	6	As	21	21	Y
	7	Ni	1.8	1.8	Y
	8	Ba	50	50	Y
	9	Tl	0.29	0.29	Y
	10	Al	470	470	Y
	11	Co	0.26	0.26	Y
	12	Mn	370	370	Y
	13	K	250	250	Y

Note:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Camp Ravenna

LDC Report Date: June 19, 2017

Parameters: Wet Chemistry

Validation Level: Stage 4

Laboratory: TestAmerica, Inc.

Sample Delivery Group (SDG): 280-96239-1

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
BKGmw-021-042117-GW	280-96239-1	Water	04/21/17
BKGmw-024-042017-GW	280-96239-2	Water	04/20/17
BKGmw-023-042017-GW	280-96239-3	Water	04/20/17
BKGmw-018-042017-GW	280-96239-4	Water	04/20/17
BKGmw-509-042017-GW	280-96239-5	Water	04/20/17
BKGmw-017-042017-GW	280-96239-6	Water	04/20/17
LL1mw-081-042117-GW	280-96239-9	Water	04/21/17
LL1mw-084-042117-GW	280-96239-12	Water	04/21/17
LL1mw-086-042117-GW	280-96239-13	Water	04/21/17
BKGmw-022-042117-GW	280-96239-17	Water	04/21/17
BKGmw-510-042117-GW	280-96239-18	Water	04/21/17
LL1mw-084-042117-GW	280-96239-19	Water	04/21/17
BKGmw-021-042117-GWMS	280-96239-1MS	Water	04/21/17
BKGmw-021-042117-GWMSD	280-96239-1MSD	Water	04/21/17
BKGmw-021-042117-GWDUP	280-96239-1DUP	Water	04/21/17
BKGmw-024-042017-GWMS	280-96239-2MS	Water	04/20/17
BKGmw-024-042017-GWMSD	280-96239-2MSD	Water	04/20/17
BKGmw-024-042017-GWDUP	280-96239-2DUP	Water	04/20/17
LL1mw-084-042117-GWMS	280-96239-12MS	Water	04/21/17
LL1mw-084-042117-GWMSD	280-96239-12MSD	Water	04/21/17
LL1mw-084-042117-GWDUP	280-96239-12DUP	Water	04/21/17
BKGmw-022-042117-GWMS	280-96239-17MS	Water	04/21/17
BKGmw-022-042117-GWMSD	280-96239-17MSD	Water	04/21/17
BKGmw-022-042117-GWDUP	280-96239-17DUP	Water	04/21/17

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Remedial Investigation Work Plan for Groundwater and Environmental Investigation Services for RVAAP-66 Facility-Wide Groundwater Appendix A: Sampling Analysis Plan, A.2 – Quality Assurance Project Plan, Former Ravenna Army Ammunition Plant, Portage and Trumbull Countries, Ohio (December 2016), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Alkalinity by Standard Method 2320B
Total Cyanide by Environmental Protection Agency (EPA) SW 846 Method 9012B
Chloride, Nitrate as Nitrogen, Nitrite as Nitrogen, and Sulfate by EPA SW 846 Method 9056A
Hexavalent Chromium by EPA SW 846 Method 7196A
Nitrocellulose by EPA Method 352.2
Sulfide by EPA SW 846 Method 9034

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met with the following exceptions:

Sample	Analyte	Total Time From Sample Collection Until Analysis	Required Holding Time From Sample Collection Until Analysis	Flag	A or P
BKGmw-021-042117-GW	Hexavalent chromium	24.15 hours	24 hours	UJ (all non-detects)	P
LL1mw-084-042117-GW	Hexavalent chromium	58.82 hours	24 hours	UJ (all non-detects)	P
BKGmw-022-042117-GW	Hexavalent chromium	25.00	24 hours	UJ (all non-detects)	P
BKGmw-510-042117-GW	Hexavalent chromium	25.83	24 hours	UJ (all non-detects)	P
LL1mw-084-042117-GW	Hexavalent chromium	24.92	24 hours	UJ (all non-detects)	P
BKGmw-024-042017-GW	Nitrate as N Nitrite as N	53.52 hours 53.52 hours	48 hours 48 hours	UJ (all non-detects) UJ (all non-detects)	P
BKGmw-023-042017-GW	Nitrate as N Nitrite as N	55.52 hours 55.52 hours	48 hours 48 hours	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	P
BKGmw-018-042017-GW	Nitrate as N Nitrite as N	55.88 hours 55.88 hours	48 hours 48 hours	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	P
BKGmw-017-042017-GW	Nitrate as N Nitrite as N	55.85 hours 55.85 hours	48 hours 48 hours	UJ (all non-detects) UJ (all non-detects)	P

II. Initial Calibration

All criteria for the initial calibration of each method were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
PB (prep blank)	Sulfate	326 ug/L	BKGmw-021-042117-GW BKGmw-024-042017-GW BKGmw-023-042017-GW BKGmw-018-042017-GW LL1mw-084-042117-GW BKGmw-022-042117-GW BKGmw-510-042117-GW
ICB/CCB	Sulfate	0.328 mg/L	BKGmw-021-042117-GW BKGmw-024-042017-GW BKGmw-023-042017-GW BKGmw-018-042017-GW LL1mw-084-042117-GW BKGmw-022-042117-GW BKGmw-510-042117-GW
PB (prep blank)	Chloride	606 ug/L	BKGmw-021-042117-GW BKGmw-024-042017-GW BKGmw-023-042017-GW BKGmw-018-042017-GW BKGmw-022-042117-GW BKGmw-510-042117-GW
ICB/CCB	Chloride	0.604 mg/L	BKGmw-021-042117-GW BKGmw-024-042017-GW BKGmw-023-042017-GW BKGmw-018-042017-GW BKGmw-022-042117-GW BKGmw-510-042117-GW
PB1 280-371837/31	Alkalinity	2.15 mg/L	BKGmw-021-042117-GW BKGmw-024-042017-GW BKGmw-023-042017-GW BKGmw-018-042017-GW BKGmw-509-042017-GW BKGmw-017-042017-GW LL1mw-084-042117-GW LL1mw-086-042117-GW BKGmw-022-042117-GW BKGmw-510-042117-GW
PB2 280-371837/5	Alkalinity	2.79 mg/L	BKGmw-021-042117-GW BKGmw-024-042017-GW BKGmw-023-042017-GW BKGmw-018-042017-GW BKGmw-509-042017-GW BKGmw-017-042017-GW LL1mw-084-042117-GW LL1mw-086-042117-GW BKGmw-022-042117-GW BKGmw-510-042117-GW
ICB/CCB	Alkalinity	2.32 mg/L	BKGmw-018-042017-GW LL1mw-084-042117-GW LL1mw-086-042117-GW BKGmw-022-042117-GW

Blank ID	Analyte	Maximum Concentration	Associated Samples
ICB/CCB	Alkalinity	2.37 mg/L	BKGmw-021-042117-GW BKGmw-024-042017-GW BKGmw-023-042017-GW BKGmw-509-042017-GW BKGmw-017-042017-GW BKGmw-510-042117-GW

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
BKGmw-017-042017-GW	Chloride	1800 ug/L	1800U ug/L
BKGmw-022-042117-GW	Chloride	2900 ug/L	2900U ug/L
BKGmw-510-042117-GW	Chloride	2600 ug/L	2600U ug/L

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. For LL1mw-084-042117-GWMS/MSD, no data were qualified for Sulfate percent recoveries (%R) outside the QC limits since the parent sample results were greater than 4X the spike concentration. Relative percent differences (RPD) were within QC limits.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Field Duplicates

Samples BKGmw-018-042017-GW and BKGmw-509-042017-GW and samples BKGmw-022-042117-GW and BKGmw-510-042117-GW were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	BKGmw-018-042017-GW	BKGmw-509-042017-GW				
Alkalinity	94	57	49 (≤30)		J (all detects)	A

Analyte	Concentration (mg/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	BKGmw-022-042117-GW	BKGmw-510-042117-GW				
Total cyanide	5.5	5.0U	-	0.5 (≤10)	-	-
Chloride	2900	2600	-	300 (≤3000)	-	-
Nitrate as N	190	43	-	147 (≤500)	-	-
Sulfate	25000	25000	0 (≤30)	-	-	-
Alkalinity	67	63	6 (≤30)	-	-	-

X. Sample Result Verification

All sample result verifications were acceptable.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

Due to technical holding time and field duplicate RPD, data were qualified as estimated in nine samples.

Due to laboratory blank contamination, data were qualified as not detected in three samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

Camp Ravenna
Wet Chemistry - Data Qualification Summary - SDG 280-96239-1

Sample	Analyte	Flag	A or P	Reason
BKGmw-021-042117-GW LL1mw-084-042117-GW BKGmw-022-042117-GW BKGmw-510-042117-GW LL1mw-084-042117-GW	Hexavalent chromium	UJ (all non-detects)	P	Technical holding times
BKGmw-024-042017-GW BKGmw-023-042017-GW BKGmw-018-042017-GW BKGmw-017-042017-GW	Nitrate as N Nitrite as N	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	P	Technical holding times
BKGmw-018-042017-GW BKGmw-509-042017-GW	Alkalinity	J (all detects)	A	Field duplicates (RPD)

Camp Ravenna
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 280-96239-1

Sample	Analyte	Modified Final Concentration	A or P
BKGmw-017-042017-GW	Chloride	1800U ug/L	A
BKGmw-022-042117-GW	Chloride	2900U ug/L	A
BKGmw-510-042117-GW	Chloride	2600U ug/L	A

Camp Ravenna
Wet Chemistry - Field Blank Data Qualification Summary - SDG 280-96239-1

No Sample Data Qualified in this SDG

LDC #: 38756A6 **VALIDATION COMPLETENESS WORKSHEET** Date: 6/8/17

SDG #: 280-96239-1 Stage 4 Page: 1 of 2

Laboratory: Test America, Inc. Reviewer: JB

2nd Reviewer:

METHOD: (Analyte) Alkalinity (SM2320B), Total Cyanide (EPA SW846 Method 9012B), Chloride, Nitrate-N, Nitrite-N, Sulfate (EPA SW846 Method 9056A), Hexavalent Chromium (EPA SW846 Method 7196A), Nitrocellulose (EPA Method 353.2), Sulfide (EPA SW846 Method 9034)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A /SW	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	(19,20) - SO_4 > 4x
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS/D
IX.	Field duplicates	SW	(4,5) (12,13)
X.	Sample result verification	A	
XI.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	BKGmw-021-042117-GW	280-96239-1	Water	04/21/17
2	BKGmw-024-042017-GW	280-96239-2	Water	04/20/17
3	BKGmw-023-042017-GW	280-96239-3	Water	04/20/17
4	BKGmw-018-042017-GW	280-96239-4	Water	04/20/17
5	BKGmw-509-042017-GW	280-96239-5	Water	04/20/17
6	BKGmw-017-042017-GW	280-96239-6	Water	04/20/17
7	LL1mw-081-042117-GW	280-96239-9	Water	04/21/17
8	LL1mw-084-042117-GW	280-96239-12	Water	04/21/17
9	LL1mw-086-042117-GW	280-96239-13	Water	04/21/17
10	BKGmw-022-042117-GW	280-96239-17	Water	04/21/17
11	BKGmw-540-042117-GW	280-96239-18	Water	04/21/17
12	LL1mw-084-042117-GW	280-96239-19	Water	04/21/17
13	BKGmw-021-042117-GWMS	280-96239-1MS	Water	04/21/17
14	BKGmw-021-042117-GWMSD	280-96239-1MSD	Water	04/21/17
15	BKGmw-021-042117-GWDUP	280-96239-1DUP	Water	04/21/17
16	BKGmw-024-042017-GWMS	280-96239-2MS	Water	04/20/17

LDC #: 38756A6 **VALIDATION COMPLETENESS WORKSHEET** Date: 6/8/17

SDG #: 280-96239-1 Stage 4 Page: 2 of 2

Laboratory: Test America, Inc. Reviewer: JB

2nd Reviewer: [signature]

METHOD: (Analyte) Alkalinity (SM2320B), Total Cyanide (EPA SW846 Method 9012B), Chloride, Nitrate-N, Nitrite-N, Sulfate (EPA SW846 Method 9056A), Hexavalent Chromium (EPA SW846 Method 7196A), Nitrocellulose (EPA Method 353.2), Sulfide (EPA SW846 Method 9034)

	Client ID	Lab ID	Matrix	Date
17	BKGmw-024-042017-GWMSD A	280-96239-2MSD	Water	04/20/17
18	BKGmw-024-042017-GWDUP A,N	280-96239-2DUP	Water	04/20/17
19	LL1mw-084-042117-GWMS	280-96239-12MS	Water	04/21/17
20	LL1mw-084-042117-GWMSD	280-96239-12MSD	Water	04/21/17
21	LL1mw-084-042117-GWDUP	280-96239-12DUP	Water	04/21/17
22	BKGmw-022-042117-GWMS Cr6	280-96239-17MS	Water	04/21/17
23	BKGmw-022-042117-GWMSD	280-96239-17MSD	Water	04/21/17
24	BKGmw-022-042117-GWDUP	280-96239-17DUP	Water	04/21/17
25				
26				
27				
28				
29				

Notes:

LDC #: 38756A4

VALIDATION FINDINGS CHECKLIST

Reviewer: JB
2nd Reviewer: [signature]

Method: Inorganics (EPA Method See Cover)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.		✓		
II. Calibration				
Were all instruments calibrated daily, each set-up time?	✓			
Were the proper number of standards used?	✓			
Were all initial calibration correlation coefficients ≥ 0.995?	✓			
Were all initial and continuing calibration verification %Rs within the 90-110% QC limits?	✓			
Were titrant checks performed as required? (Level IV only)	✓			
Were balance checks performed as required? (Level IV only)			✓	
III. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.	✓			
IV. Matrix spike/Matrix spike duplicates and Duplicates				
Were a matrix spike (MS) and duplicate (DUP) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil / Water.	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the 75-125 QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.	✓			
Were the MS/MSD or duplicate relative percent differences (RPD) ≤ 20% for waters and ≤ 35% for soil samples? A control limit of ≤ CRDL(≤ 2X CRDL for soil) was used for samples that were ≤ 5X the CRDL, including when only one of the duplicate sample values were ≤ 5X the CRDL.	✓			
V. Laboratory control samples				
Was an LCS anaylzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 80-120% (85-115% for Method 300.0) QC limits?	✓			
VI. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?			✓	
Were the performance evaluation (PE) samples within the acceptance limits?			✓	

LDC #: 38756A4

VALIDATION FINDINGS CHECKLIST

Reviewer: JB
2nd Reviewer: [signature]

Validation Area	Yes	No	NA	Findings/Comments
VII. Sample Result Verification				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
Were detection limits < RL?	✓			
VIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			
IX. Field duplicates				
Field duplicate pairs were identified in this SDG.	✓			
Target analytes were detected in the field duplicates.	✓			
X. Field blanks				
Field blanks were identified in this SDG.		✓		
Target analytes were detected in the field blanks.			✓	

C #: 38756A6

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Reviewer: JB
2nd reviewer: [initials]

circled methods are applicable to each sample.

Sample ID	Parameter
1	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 S^2
2,3	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 S^2
4,6	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 S^2
5,9	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
7	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
8	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 S^2
10,11	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 S^2
12	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 Nitrocellulose
2,3,10,11	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
Dc	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
13,14	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 S^2
15	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
16,17	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
18	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
19-21	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
22-24	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4

Comments:

LDC #: 38756A6

VALIDATION FINDINGS WORKSHEET
Technical Holding Times

Reviewer: JB
2nd reviewer:

All circled dates have exceeded the technical holding time.
Y N N/A Were all samples preserved as applicable to each method ?
Y N N/A Were all cooler temperatures within validation criteria?

Method:	EPA 7196A						
Parameters:	Hexavalent Chromium						
Technical holding time:	24 Hours						
Sample ID	Sampling date/ time	Analysis date/time	Total Time	Qualifier			
1	4/21/17 14:36	4/22/17 14:45	26.15	J/UJ/P (ND)			
8	4/21/17 10:10	4/23/17 20:59	60.82	J/UJ/P (ND)			
10	4/21/17 15:45	4/22/17 14:45	25.00	J/UJ/P (ND)			
11	4/21/17 14:55	4/22/17 14:45	25.83	J/UJ/P (ND)			
12	4/21/17 15:50	4/22/17 14:45	24.92	J/UJ/P (ND)			

Method:	EPA 9056A				EPA 9056A		
Parameters:	Nitrite as N				Nitrate as N		
Technical holding time:	48 Hours				48 Hours		
Sample ID	Sampling date/ time	Analysis date/time	Total Time	Qualifier	Analysis date/time	Total Time	Qualifier
2	4/20/17 15:35	4/22/17 21:06	55.52	J/UJ/P (ND)	4/22/17 21:06	55.52	J/UJ/P (ND)
3	4/20/17 14:55	4/22/17 22:26	57.52	J/UJ/P (ND)	4/22/17 22:26	57.52	J/UJ/P (Det)
4	4/20/17 14:53	4/22/17 22:46	57.88	J/UJ/P (ND)	4/22/17 22:46	57.88	J/UJ/P (Det)
6	4/20/17 15:15	4/22/17 23:06	57.85	J/UJ/P (ND)	4/22/17 23:06	57.85	J/UJ/P (ND)

+ 2 HR Time A from OHIO - COLORADO +

LDC #: 38756A6

VALIDATION FINDINGS WORKSHEET
Blanks

Page: 1 of 1
Reviewer: √3
2nd Reviewer:

METHOD: Inorganics, Method See Cover

Conc. units: ug/L **Associated Samples:** 1 - 4, 6, 8, 10, 11

Analyte	Blank ID	Blank ID	Blank Action Limit										
	PB (ug/L)	ICB/CCB (mg/L)		6	10	11							
Sulfate	326	0.328	1640										

Conc. units: ug/L **Associated Samples:** 1 - 4, 6, 10, 11

Analyte	Blank ID	Blank ID	Blank Action Limit										
	PB (ug/L)	ICB/CCB (mg/L)		6	10	11							
Chloride	606	0.604	3030	1800 /3000	2900 /3000	2600 /3000							

Conc. units: mg/L **Associated Samples:** 1 - 6, 8 - 11

Analyte	Blank ID	Blank ID	Blank Action Limit										
	PB1 280-371837/31	PB2 280-371837/5		No Qualifiers									
Alkalinity (mg/L)	2.15	2.79	13.95										

Conc. units: mg/L **Associated Samples:** 4, 8 - 10

Analyte	Blank ID	Blank ID	Blank Action Limit										
	PB (mg/L)	ICB/CCB (mg/L)		No Qualifiers									
Alkalinity		2.32	11.6										

Conc. units: mg/L **Associated Samples:** 1 - 3, 5, 6, 11

Analyte	Blank ID	Blank ID	Blank Action Limit										
	PB (ug/L)	ICB/CCB (mg/L)		No Qualifiers									
Alkalinity		2.37	11.85										

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
All contaminants within five times the method blank concentration were qualified as not detected, "U".

LDC# 38756A6

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JB
2nd Reviewer:

Inorganics: Method See Cover

Analyte	Concentration (mg/L)		RPD (≤ 30)	Difference (< LOQ)	Qualifiers (parent only)
	4	5			
Alkalinity	94	57	49		Jdet/A

Analyte	Concentration (mg/L)		RPD (≤ 30)	Difference (< LOQ)	Qualifiers (parent only)
	12	13			
Cyanide, Total	5.5	5.0U		0.5 (10)	
Chloride	2900	2600		300 (3000)	
Nitrate as N	190	43		147 (500)	
Sulfate	25000	25000	0		
Alkalinity	67	63	6		

LDC #: 38756A4

Validation Findings Worksheet
Initial and Continuing Calibration Calculation Verification

Page: 1 of 1
Reviewer: JB
2nd Reviewer:

Method: Inorganics, Method See Cover

The correlation coefficient (r) for the calibration of CN^- was recalculated. Calibration date: 5/4/17

An initial or continuing calibration verification percent recovery (%R) was recalculated for each type of analysis using the following formula:

$\%R = \frac{\text{Found} \times 100}{\text{True}}$ Where, Found = concentration of each analyte measured in the analysis of the ICV or CCV solution
True = concentration of each analyte in the ICV or CCV source

Type of analysis	Analyte	Standard	Conc. (ug/L)	Response	Recalculated r or r^2	Reported r or r^2	Acceptable (Y/N)
Initial calibration	CN^-	s1	0	197.289703	*0.999858*	0.999858	Y
		s2	10	8234.15332			
		s3	20	16556.0918			
		s4	50	40139.14453			
		s5	100	79288.0625			
		s6	200	157841.3438			
		s7	400	305134.5938			
4/12 Calibration verification	NO_3	ICV	FOUND: 3.866 mg/L	TRUE: 4.00 mg/L	97%	97%	Y
10:07 Calibration verification	SO_4	CCV_1	FOUND: 103.873 mg/L	TRUE: 100 mg/L	104%	105%	Y
Calibration verification							

Comments: Refer to Calibration Verification findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 39756A4c

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Reviewer: JB
2nd Reviewer: _____

METHOD: Inorganics, Method See Cover

Percent recoveries (%R) for a laboratory control sample and a matrix spike sample were recalculated using the following formula:

%R = Found / True x 100 Where, Found = concentration of each analyte measured in the analysis of the sample. For the matrix spike calculation, Found = SSR (spiked sample result) - SR (sample result).
True = concentration of each analyte in the source.

A sample and duplicate relative percent difference (RPD) was recalculated using the following formula:

RPD = |S-D| / (S+D)/2 x 100 Where, S = Original sample concentration
D = Duplicate sample concentration

Sample ID	Type of Analysis	Element	Found / S (units)	True / D (units)	Recalculated %R / RPD	Reported %R / RPD	Acceptable (Y/N)
LCS	Laboratory control sample 53714	All	195.2 mg/L	200 mg/L	98%	98%	Y
MS	Matrix spike sample -12	NO_2 (Nitrite)	SR = ND (SSR-SR) 5213.769 ug/L	5000 ug/L	104%	104%	Y
MSD	Duplicate sample	NO_2 (Nitrite)	5231.071 ug/L	Found: 5213.769 ug/L	ORP	ORPD	Y

Comments: _____

LDC #: 38752A4

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: JB
2nd reviewer:

METHOD: Inorganics, Method See Cover

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Have results been reported and calculated correctly?
Y N N/A Are results within the calibrated range of the instruments?
Y N N/A Are all detection limits below the CRQL?

Compound (analyte) results for CN# 10 reported with a positive detect were recalculated and verified using the following equation:

Concentration = $CN = y = mx + b$

$y = 5352$

$m = 757.62427$

$b = 1162.613772$

Recalculation: $CN = 5352 = 757.62427x + 1162.613772$

$x = 5.52964$ ug/L

#	Sample ID	Analyte	Reported Concentration ( )	Calculated Concentration ( )	Acceptable (Y/N)
	1	~~Alk~~ SO_4	50000 ug/L	50000 ug/L	Y
	2	Cl^-	6800 ug/L	6800 ug/L	Y
	3	NO_3	1000 ug/L	1000 ug/L	Y
	4	SO_4	14000 ug/L	14000 ug/L	Y
	5	Alk^-	57 mg/L	57 mg/L	Y
	6	Cl^-	1800 ug/L	1800 ug/L	Y
	8	NO_3	450 ug/L	460 ug/L	Y
	9	Alk^-	110 mg/L	110 mg/L	Y
	10	CN^-	5.5 ug/L	5.5 ug/L	Y
	11	Alk^-	63 mg/L	63 mg/L	Y

Note:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Camp Ravenna

LDC Report Date: June 7, 2017

Parameters: Nitroguanidine

Validation Level: Stage 4

Laboratory: TestAmerica, Inc.

Sample Delivery Group (SDG): 280-96239-1

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
BKGmw-024-042017-GW	280-96239-2	Water	04/20/17
BKGmw-023-042017-GW	280-96239-3	Water	04/20/17
BKGmw-022-042117-GW	280-96239-17	Water	04/21/17
BKGmw-510-042117-GW	280-96239-18	Water	04/21/17

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Remedial Investigation Work Plan for Groundwater and Environmental Investigation Services for RVAAP-66 Facility-Wide Groundwater Appendix A: Sampling Analysis Plan, A.2 – Quality Assurance Project Plan, Former Ravenna Army Ammunition Plant, Portage and Trumbull Countries, Ohio (December 2016), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Superfund Organic Methods Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Nitroguanidine by Environmental Protection Agency (EPA) SW 846 Method 8330 Modified

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 20.0%.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 15.0%.

III. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 15.0%.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates

Surrogates were not required by the method.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples BKGmw-022-042117-GW and BKGmw-510-042117-GW were identified as field duplicates. No results were detected in any of the samples.

X. Compound Quantitation

All compound quantitations met validation criteria.

XI. Target Compound Identifications

All target compound identifications were within validation criteria.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Camp Ravenna
Nitroguanidine - Data Qualification Summary - SDG 280-96239-1

No Sample Data Qualified in this SDG

Camp Ravenna
Nitroguanidine - Laboratory Blank Data Qualification Summary - SDG 280-96239-1

No Sample Data Qualified in this SDG

Camp Ravenna
Nitroguanidine - Field Blank Data Qualification Summary - SDG 280-96239-1

No Sample Data Qualified in this SDG

LDC #: 38756A26 **VALIDATION COMPLETENESS WORKSHEET** Date: 06/06/17
SDG #: 280-96239-1 Stage 4 Page: 1 of 1
Laboratory: Test America, Inc. Reviewer:
2nd Reviewer:

METHOD: HPLC Nitroguanidine (EPA SW 846 Method 8330 Modified)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	Initial calibration/ICV	A/A	ICAL ≤ 20%. ICV ≤ 15%.
III.	Continuing calibration	A	CCV ≤ 15%.
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes	N	Not req'd.
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	ND	D = 3/4
X.	Compound quantitation RL/LOQ/LODs	A	
XI.	Target compound identification	A	
XII.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	BKGmw-024-042017-GW	280-96239-2	Water	04/20/17
2	BKGmw-023-042017-GW	280-96239-3	Water	04/20/17
3	BKGmw-022-042117-GW	280-96239-17	Water	04/21/17
4	BKGmw-510-042117-GW	280-96239-18	Water	04/21/17
5				
6				
7				
8				
9				
10				
11				
12				
13				

Notes:

-	MB 280-162343/1-	A					

LDC #: 38756A26

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer:

Method: ____ GC ✓ HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
IIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20%?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥0.990?			✓	
Were the RT windows properly established?	✓			
IIb. Initial calibration verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ ~~20%~~ 15 or percent recoveries (%R) ~~80-120~~%?	✓			
III. Continuing calibration				
Was a continuing calibration analyzed daily?	✓			
Were all percent differences (%D) ≤ ~~20%~~ 15 or percent recoveries (%R) ~~80-120%~~?	✓			
Were all the retention times within the acceptance windows?	✓			
IV. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
V. Field Blanks				
Were field blanks identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VI. Surrogate spikes				
Were all surrogate percent recovery (%R) within the QC limits?		✓		
If the percent recovery (%R) of one or more surrogates was outside QC limits, was a reanalysis performed to confirm %R?			✓	
If any %R was less than 10 percent, was a reanalysis performed to confirm %R?			✓	
VII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.		✓		
Was a MS/MSD analyzed every 20 samples of each matrix?		✓		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?		•		
Were target compounds detected in the field duplicates?				
X. Compound quantitation				
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XI. Target compound identification				
Were the retention times of reported detects within the RT windows?	✓			
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

LDC #: 38756A26

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC _____ HPLC ✓

The calibration factors (CF), average CF, and relative standard deviation (%RSD) were recalculated for compounds identified below using the following calculations:

CF = A/C
average CF = sum of the CF/number of standards
%RSD = 100 * (S/X)

Where:
A = Area of compound
C = Concentration of compound
S = Standard deviation of calibration factors
X = Mean of calibration factors

#	Standard ID	Calibration Date	Compound	Reported CF (100 std)	Recalculated CF (100 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL PDA1	3/27/2017	Nitroguanadine	30.040	30.040	30.578	30.578	8.0	8.0

LDC # 38756A26

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC____HPLC✓

The percent difference (%D) of the initial calibration average Calibration Factors (CF) and the continuing calibration percent difference (%D) values were recalculated for the compounds identified below using the following calculation:

Percent difference (%D) = 100 * (N - C)/N

Where:
N = Initial Calibration Factor or Nominal Amount
C = Calibration Factor from Continuing Calibration Standard or Calculated Amount

#	Standard ID	Calibration Date	Compound	CCV Conc	Reported Conc	Recalculated Conc	Reported % D	Recalculated %D
1	0042600-010-1	5/3/2017	Nitroguanadine	100.0	97.6	97.6	2.4	2.4

LDC #: 38756 A26

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: JVG
2nd Reviewer:

METHOD: ___ GC / HPLC

The percent recoveries (%R) and relative percent differences (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

%Recovery = 100 * (SSC/SA)
RPD =(({SSCLCS - SSCLCSD} * 2) / (SSCLCS + SSCLCSD))*100

Where SSC = Spiked sample concentration; SA = Spike added
LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample duplicate

LCS/LCSD samples: LCS 320-162343/2-A

Compound	Spike Added (ug/L)		Spike Sample Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline (8015)										
Diesel (8015)										
Benzene (8021B)										
Methane (RSK-175)										
2,4-D (8151)										
Dinoseb (8151)										
Naphthalene (8310)										
Anthracene (8310)										
HMX (8330)										
2,4,6-Trinitrotoluene (8330)										
Phorate (8141A)										
Malathion (8141A)										
Formaldehyde (8315A)										
Nitroguanadine (8330)	250	NA	237	NA	95	95				

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicate findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 38756A26

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JVG
2nd Reviewer: _____

METHOD: __ GC / HPLC

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds within 10% of the reported results?

Concentration= $\frac{(A)(Fv)(Df)}{(RF)(Vs \text{ or } Ws)(\%S/100)}$

A= Area or height of the compound to be measured
Fv= Final Volume of extract
Df= Dilution Factor
RF= Average response factor of the compound In the initial calibration
Vs= Initial volume of the sample
Ws= Initial weight of the sample
%S= Percent Solid

Example:

Sample ID. MD / LCS Compound Name Nitroguanadine

Concentration = $\frac{(7252)(10\text{ ml})}{(30.578)(10\text{ ml})}$ = 237.2 ug/L

#	Sample ID	Compound	Reported Concentrations (ug/L)	Recalculated Results Concentrations ( )	Qualifications
			237		

Comments: _____

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Camp Ravenna

LDC Report Date: June 7, 2017

Parameters: Explosives

Validation Level: Stage 4

Laboratory: TestAmerica, Inc.

Sample Delivery Group (SDG): 280-96239-1

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
BKGmw-024-042017-GW	280-96239-2	Water	04/20/17
BKGmw-023-042017-GW	280-96239-3	Water	04/20/17
LL1mw-081-042117-GW	280-96239-9	Water	04/21/17
LL1mw-080-042117-GW	280-96239-10	Water	04/21/17
LL1mw-065-042117-GW	280-96239-11	Water	04/21/17
LL1mw-084-042117-GW	280-96239-12	Water	04/21/17
LL1mw-086-042117-GW	280-96239-13	Water	04/21/17
BKGmw-022-042117-GW	280-96239-17	Water	04/21/17
BKGmw-510-042117-GW	280-96239-18	Water	04/21/17

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Remedial Investigation Work Plan for Groundwater and Environmental Investigation Services for RVAAP-66 Facility-Wide Groundwater Appendix A: Sampling Analysis Plan, A.2 – Quality Assurance Project Plan, Former Ravenna Army Ammunition Plant, Portage and Trumbull Countries, Ohio (December 2016), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Superfund Organic Methods Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Explosives by Environmental Protection Agency (EPA) SW 846 Method 8330B

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average calibration factors were utilized, percent relative standard deviations (%RSD) were less than or equal to 15.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds.

Retention time windows were established as required by the method.

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

Retention times of all compounds in the calibration standards were within the established retention time windows.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits with the following exceptions:

Sample	Column	Surrogate	%R (Limits)	Affected Compound	Flag	A or P
LL1mw-080-042117-GW	Luna-phenyl	1,2-Dinitrobenzene	81 (83-119)	All compounds	J (all detects) UJ (all non-detects)	P
LL1mw-080-042117-GW	ultracarb	1,2-Dinitrobenzene	76 (83-119)	All compounds	J (all detects) UJ (all non-detects)	P

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples BKGmw-022-042117-GW and BKGmw-510-042117-GW were identified as field duplicates. No results were detected in any of the samples.

X. Compound Quantitation

All compound quantitations met validation criteria.

The sample results for detected compounds from the two columns were within 40% relative percent difference (RPD) with the following exceptions:

Sample	Compound	RPD	Flag	A or P
LL1mw-081-042117-GW	RDX 2-Amino-4,6-dinitrotoluene 3-Nitrotoluene	74.5 43.3 129.2	J (all detects) J (all detects) J (all detects)	A
LL1mw-080-042117-GW	4-Amino-2,6-dinitrotoluene	41.6	J (all detects)	A
LL1mw-084-042117-GW	RDX 1,3,5-Trinitrobenzene 1,3-Dinitrobenzene	56.7 45.5 162.7	J (all detects) J (all detects) J (all detects)	A

XI. Target Compound Identifications

All target compound identifications met validation criteria.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to surrogate %R and RPD between two columns, data were qualified as estimated in three samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

Camp Ravenna
Explosives - Data Qualification Summary - SDG 280-96239-1

Sample	Compound	Flag	A or P	Reason
LL1mw-080-042117-GW	All compounds	J (all detects) UJ (all non-detects)	P	Surrogate spikes (%R)
LL1mw-081-042117-GW	RDX 2-Amino-4,6-dinitrotoluene 3-Nitrotoluene	J (all detects) J (all detects) J (all detects)	A	Compound quantitation (RPD between two columns)
LL1mw-080-042117-GW	4-Amino-2,6-dinitrotoluene	J (all detects)	A	Compound quantitation (RPD between two columns)
LL1mw-084-042117-GW	RDX 1,3,5-Trinitrobenzene 1,3-Dinitrobenzene	J (all detects) J (all detects) J (all detects)	A	Compound quantitation (RPD between two columns)

Camp Ravenna
Explosives - Laboratory Blank Data Qualification Summary - SDG 280-96239-1

No Sample Data Qualified in this SDG

Camp Ravenna
Explosives - Field Blank Data Qualification Summary - SDG 280-96239-1

No Sample Data Qualified in this SDG

LDC #: 38756A40 **VALIDATION COMPLETENESS WORKSHEET** Date: 06/06/17

SDG #: 280-96239-1 Stage 4 Page: 1 of 1

Laboratory: Test America, Inc. Reviewer:

2nd Reviewer:

METHOD: HPLC Explosives (EPA SW 846 Method 8330B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	Initial calibration/ICV	A / A	ICAL ≤ 15%, r² ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes	SW	
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	ND	D = 8/9
X.	Compound quantitation RL/LOQ/LODs	SW	
XI.	Target compound identification	A	
XII.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID		Lab ID	Matrix	Date
1	BKGmw-024-042017-GW		280-96239-2	Water	04/20/17
2	BKGmw-023-042017-GW		280-96239-3	Water	04/20/17
3	LL1mw-081-042117-GW		280-96239-9	Water	04/21/17
4	LL1mw-080-042117-GW		280-96239-10	Water	04/21/17
5	LL1mw-065-042117-GW		280-96239-11	Water	04/21/17
6	LL1mw-084-042117-GW		280-96239-12	Water	04/21/17
7	LL1mw-086-042117-GW		280-96239-13	Water	04/21/17
8	BKGmw-022-042117-GW	D	280-96239-17	Water	04/21/17
9	BKGmw-540-042117-GW	D	280-96239-18	Water	04/21/17
10					
11					
12					
13					

Notes:

	MB 280-371222/LA						

LDC #: 38752 A4D

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer:

Method: ____ GC ✓ HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
IIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20%?	✓		✓	
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥0.990?	✓			
Were the RT windows properly established?	✓			
IIb. Initial calibration verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
III. Continuing calibration				
Was a continuing calibration analyzed daily?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
Were all the retention times within the acceptance windows?	✓			
IV. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
V. Field Blanks				
Were field blanks identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VI. Surrogate spikes				
Were all surrogate percent recovery (%R) within the QC limits?	•	✓		
If the percent recovery (%R) of one or more surrogates was outside QC limits, was a reanalysis performed to confirm %R?		✓		
If any %R was less than 10 percent, was a reanalysis performed to confirm %R?			✓	
VII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.		✓		
Was a MS/MSD analyzed every 20 samples of each matrix?		✓		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?				
Were target compounds detected in the field duplicates?				
X. Compound quantitation				
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XI. Target compound identification				
Were the retention times of reported detects within the RT windows?	✓			
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

VALIDATION FINDINGS WORKSHEET

METHOD: ____GC ___/HPLC

8310	8330	8151	8141	8141(Con't)	8021B
A. Acenaphthene	A. HMX	A. 2,4-D	A. Dichlorvos	X. EPN	V. Benzene
B. Acenaphthylene	B. RDX	B. 2,4-DB	B. Mevinphos	Y. Azinphos-methyl	CC. Toluene
C. Anthracene	C. 1,3,5-Trinitrobenzene	C. 2,4,5-T	C. Demeton-O	Z. Coumaphos	EE. Ethyl Benzene
D. Benzo(a)anthracene	D. 1,3-Dinitrobenzene	D. 2,4,5-TP	D. Demeton-S	AA. Parathion	SSS. O-Xylene
E. Benzo(a)pyrene	E. Tetryl	E. Dinoseb	E. Ethoprop	BB. Trichloronate	RRR. MP-Xylene
F. Benzo(b)fluoranthene	F. Nitrobenzene	F. Dichlorprop	F. Naled	CC. Trichlorinate	GG. Total Xylene
G. Benzo(g,h,i)perylene	G. 2.4.6-Trinitrotoluene	G. Dicamba	G. Sulfotep	DD. Trifluralin	
H. Benzo(k)fluoranthene	H. 4-Amino-2,6-dinitrotoluene	H. Dalapon	H. Phorate	EE. Def	**8315A**
I. Chrysene	I. 2-Amino-4,6-dinitrotoluene	I. MCPP	I. Dimethoate	FF. Prowl	A. Formaldehyde
J. Dibenz(a,h)anthracene	J. 2,4-Dinitrotoluene	J. MCPA	J. Diazinon	GG. Ethion	B. Acetaldehyde
K. Fluoranthene	K. 2,6-Dinitrotoluene	K. Pentachlorophenol	K. Disulfoton	HH. Famphur	C. Benzaldehyde
L. Fluorene	L. 2-Nitrotoluene	L. 2,4,5-TP (silvex)	L. Parathion-methyl	II. Phosmet	D. Butyraldehyde
M. Indeno(1,2,3-cd)pyrene	M. 3-Nitrotoluene	M. Silvex	M. Ronnel	JJ. Tetrachlorvinphos	
N. Naphthalene	N. 4-Nitrotoluene	N.	N. Malathion	KK. Demeton (total)	
O. Phenanthrene	O. Nitroglycerin	O.	O. Chlorpyrifos		
P. Pyrene	P. Picric acid	P.	P. Fenthion		
Q.	Q. 2,4-Dinitrophenol	Q.	Q. Parathion-ethyl		
R.	R. 3,5-Dinitroaniline		R. Trichlornate		
S.	S. 2-Nitrophenol		S. Merphos		
	T. 4-Nitrophenol		T. Stirofos		
	U. Picramic acid		U. Tokuthion		
	V. PETN		V. Fensulfothion		
			W. Bolstar		

Notes:_____

LDC #: 38756 A40

VALIDATION FINDINDS WORKSHEET
Surrogate Recovery

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: [signature]

METHOD: __ GC / HPLC
Are surrogates required by the method? Yes / or No____.
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
Y N N/A Were surrogates spiked into all samples and blanks?
Y N N/A Did all surrogate recoveries (%R) meet the QC limits?

#	Sample ID	Detector/ Column	Surrogate Compound	%R (Limits)	Qualifications
	4	Luna-phenyl	FF	81 (83-119)	J / UJ / P
	(MD + Det)	Ultracarb	↓	76 (↓)	↓
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
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				( )	
				( )	
				( )	

	Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound
A	Chlorobenzene (CBZ)	H	Ortho-Terphenyl	O	Decachlorobiphenyl (DCB)	V	Tri-n-propyltin	CC	2,5-Dibromotoluene
B	4-Bromofluorobenzene (BFB)	I	Fluorobenzene (FBZ)	P	1-methylnaphthalene	W	Tributyl Phosphate	DD	n-Nonatriacontane
C	a,a,a-Trifluorotoluene	J	n-Triacontane	Q	Dichlorophenyl Acetic Acid (DCAA)	X	Triphenyl Phosphate	EE	1,2-Dibromopropane
D	Bromochlorobenene	K	Hexacosane	R	4-Nitrophenol	Y	Tetrachloro-m- xylene	FF	1,2-Dinitrobenzene
E	1,4-Dichlorobutane	L	Bromobenzene	S	1-Chloro-3-Nitrobenzene	Z	2-Bromonaphthalene	GG	2-Nitro-m-xylene
F	1,4-Difluorobenzene (DFB)	M	Benzo(e)Pyrene	T	3,4-Dinitrotoluene	AA	1-Chlorooctadecane	HH	p-Terphenyl
G	Octacosane	N	Terphenyl-D14	U	Tripentyltin	BB	2,4-Dichlorophenylacetic acid	II	

LDC #: 38756 A 40

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: [signature]

METHOD: __ GC / HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Level IV/D Only

Y N N/A Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?
Y N N/A Did the reported results for detected target compounds agree within 10.0% of the recalculated results?
Y N N/A Did the percent difference of detected compounds between two columns./detectors ≤40%?
If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD/%D Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	B	3	74.5	J dets /A
	I		43.3	
	M		129.2	
	H	4	41.6	
	B	6	56.7	
	C		45.5	
	D		162.7	

Comments: See sample calculation verification worksheet for recalculations

LDC #: 38756A40

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC _____ HPLC ✓

The calibration factors (CF), average CF, and relative standard deviation (%RSD) were recalculated for compounds identified below using the following calculations:

CF = A/C
average CF = sum of the CF/number of standards
%RSD = 100 * (S/X)

Where:
A = Area of compound
C = Concentration of compound
S = Standard deviation of calibration factors
X = Mean of calibration factors

#	Standard ID	Calibration Date	Compound	Reported CF (0.10 std)	Recalculated CF (0.10 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL LC G2	5/4/2017	RDX (Luna-phenyl)	see r2 calc					
			2-A-4,6-DNT (Luna-phenyl)	see r2 calc					
2	ICAL LC X3	5/9/2017	RDX (Ultracarb5u)	99820.00	99820.00	105871.78	105871.86	5.9	5.9
			2-A-4,6-DNT (Ultracarb5u)	197980.00	197980.00	208659.90	208660.00	4.6	4.6

LDC#: 38756A40

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

METHOD: HPLC Explosives (EPA SW 846 Method 8330B)

Parameter: RDX

Order of regression: Linear

Date	Instrument	Compound	STD	x area	y conc (ug/L)
5/4/2017	CHHPLC_G2_LUNA	2-Amino-4,6-Dinitrotoluene	1	5102	0.01
			2	24488	0.05
			3	40985	0.10
			4	97209	0.25
			5	152049	0.40
			6	292028	0.70
			7	416137	1.00
			8	1057477	2.50

Regression Output: Regression Output:			Reported WLR	
Constant	c =	-4532.22102	c =	1083.490490
Std Err of Y Est		0.04		
R Squared	r^2 =	0.99965	r^2 =	0.99500
No. of Observations		6.00		
Degrees of Freedom		4.00		
X Coefficient(s)	m =	423499.55453	m =	410514.7470
Std Err of Coef.		0.01		

LDC#: 38756A40

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

METHOD: HPLC Explosives (EPA SW 846 Method 8330B)

Parameter: RDX

Order of regression: Linear

Date	Instrument	Compound	STD	x area	y conc (ug/L)
5/4/2017	CHHPLC_G2_LUNA	RDX	1	3143	0.01
			2	12919	0.05
			3	23056	0.10
			4	49821	0.25
			5	76270	0.40
			6	145563	0.70
			7	202501	1.00
			8	511309	2.50

Regression Output: Regression Output:			Reported WLR	
Constant	c =	304.60999	c =	1359.984650
Std Err of Y Est		0.04		
R Squared	r^2 =	0.99972	r^2 =	0.99900
No. of Observations		6.00		
Degrees of Freedom		4.00		
X Coefficient(s)	m =	204020.98205	m =	202335.7530
Std Err of Coef.		0.01		

LDC # 37756A40

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: JVG
2nd Reviewer:

METHOD: GC_____HPLC✓

The percent difference (%D) of the initial calibration average Calibration Factors (CF) and the continuing calibration percent difference (%D) values were recalculated for the compounds identified below using the following calculation:

Percent difference (%D) = 100 * (N - C)/N

Where:
N = Initial Calibration Factor or Nominal Amount
C = Calibration Factor from Continuing Calibration Standard or Calculated Amount

#	Standard ID	Calibration Date	Compound	CCV Conc	Reported Conc	Recalculated Conc	Reported % D	Recalculated %D
1	05101731 x3	5/10/2017	RDX (Ultracarb5u)	0.2500	0.2441	0.2441	2.4	2.4
			2-A-4,6-DNT (Ultracarb5u)	0.2500	0.2509	0.2509	0.4	0.4
2	05101743 x3	5/11/2017	RDX (Ultracarb5u)	0.2500	0.2436	0.2436	2.6	2.6
			2-A-4,6-DNT (Ultracarb5u)	0.2500	0.2520	0.2520	0.8	0.8
3	51717015 g2	5/16/2017	RDX (Luna-phenyl)	0.2500	0.2569	0.2569	2.8	2.8
			2-A-4,6-DNT (Luna-phenyl)	0.2500	0.2650	0.2650	6.0	6.0

LDC #: 38756 A90

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Reviewer: JVG
2nd reviewer: [signature]

METHOD: ___ GC / HPLC

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: #1

Surrogate	Column/Detector	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
FF	Ultracarb	0.200	0.1761	88	88	0

Sample ID: _____

Surrogate	Column/Detector	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	

	Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound
A	Chlorobenzene (CBZ)	H	Ortho-Terphenyl	O	Decachlorobiphenyl (DCB)	V	Tri-n-propyltin	CC	2,5-Dibromotoluene
B	4-Bromofluorobenzene (BFB)	I	Fluorobenzene (FBZ)	P	1-methylnaphthalene	W	Tributyl Phosphate	DD	n-Nonatriacontane
C	a,a,a-Trifluorotoluene	J	n-Triacontane	Q	Dichlorophenyl Acetic Acid (DCAA)	X	Triphenyl Phosphate	EE	1,2-Dibromopropane
D	Bromochlorobenene	K	Hexacosane	R	4-Nitrophenol	Y	Tetrachloro-m- xylene	FF	1,2-Dinitrobenzene
E	1,4-Dichlorobutane	L	Bromobenzene	S	1-Chloro-3-Nitrobenzene	Z	2-Bromonaphthalene	GG	2-Nitro-m-xylene
F	1,4-Difluorobenzene (DFB)	M	Benzo(e)Pyrene	T	3,4-Dinitrotoluene	AA	1-Chlorooctadecane	HH	p-Terphenyl
G	Octacosane	N	Terphenyl-D14	U	Tripentyltin	BB	2,4-Dichlorophenylacetic acid	II	

LDC #: 38756A40

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: JVG
2nd Reviewer:

METHOD: __ GC / HPLC

The percent recoveries (%R) and relative percent differences (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

%Recovery = 100 * (SSC/SA)
RPD =(({SSCLCS - SSCLCSD} * 2) / (SSCLCS + SSCLCSD))*100

Where SSC = Spiked sample concentration; SA = Spike added; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample duplicate

LCS/LCSD samples: LCS 280- 371222/2-A

Compound	Spike Added (ug/L)		Spike Sample Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline (8015)										
Diesel (8015)										
Benzene (8021B)										
Methane (RSK-175)										
2,4-D (8151)										
Dinoseb (8151)										
Naphthalene (8310)										
Anthracene (8310)										
HMX (8330)	2.00	NA	1.88	NA	94	94				
2,4,6-Trinitrotoluene (8330)	↓	↓	2.15	↓	108	108				
Phorate (8141A)										
Malathion (8141A)										
Formaldehyde (8315A)										

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicate findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 38756A40

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: (1)

METHOD: ___ GC ✓ HPLC

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds within 10% of the reported results?

Concentration= $\frac{(A)(Fv)(Df)}{(RF)(Vs \text{ or } Ws)(\%S/100)}$

A= Area or height of the compound to be measured
Fv= Final Volume of extract
Df= Dilution Factor
RF= Average response factor of the compound In the initial calibration
Vs= Initial volume of the sample
Ws= Initial weight of the sample
%S= Percent Solid

Example:

Sample ID. 3 Compound Name 2-a-4,6-DNT (X3)

Concentration = $\frac{(12681)(5ml)(1000)}{(2086599)(467.9ml)} = 0.649$

≈ 0.65 ug/L

#	Sample ID	Compound	Reported Concentrations (ug/L)	Recalculated Results Concentrations ( )	Qualifications
			0.65		

Comments: _____

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Camp Ravenna

LDC Report Date: June 7, 2017

Parameters: Perchlorate

Validation Level: Stage 4

Laboratory: TestAmerica, Inc.

Sample Delivery Group (SDG): 280-96239-1

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
BKGmw-023-042017-GW	280-96239-3	Water	04/20/17
BKGmw-022-042117-GW	280-96239-17	Water	04/21/17
BKGmw-510-042117-GW	280-96239-18	Water	04/21/17

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Remedial Investigation Work Plan for Groundwater and Environmental Investigation Services for RVAAP-66 Facility-Wide Groundwater Appendix A: Sampling Analysis Plan, A.2 – Quality Assurance Project Plan, Former Ravenna Army Ammunition Plant, Portage and Trumbull Countries, Ohio (December 2016), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Superfund Organic Methods Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Perchlorate by Environmental Protection Agency (EPA) SW 846 Method 6860

All sample results were subjected to Stage 4 data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. LC/MS Instrument Performance Check

Instrument performance check was performed prior to initial calibration.

All perchlorate ion signal to noise ratio requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

A curve fit, based on the initial calibration, was established for quantitation. The coefficient of determination (r^2) was greater than or equal to 0.990.

The isotope ratios were within QC limits.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 15.0%.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 15.0%.

The percent differences (%D) of the limit of detection verification (LODV) standard were less than or equal to 30.0%.

The isotope ratios were within QC limits.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples BKGmw-022-042117-GW and BKGmw-510-042117-GW were identified as field duplicates. No results were detected in any of the samples.

X. Internal Standards

All internal standard recoveries (%R) were within QC limits.

XI. Compound Quantitation

All compound quantitations were within validation criteria.

XII. Target Compound Identifications

All target compound identifications were within validation criteria.

XIII. System Performance

The system performance was acceptable.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Camp Ravenna
Perchlorate - Data Qualification Summary - SDG 280-96239-1

No Sample Data Qualified in this SDG

Camp Ravenna
Perchlorate - Laboratory Blank Data Qualification Summary - SDG 280-96239-1

No Sample Data Qualified in this SDG

Camp Ravenna
Perchlorate - Field Blank Data Qualification Summary - SDG 280-96239-1

No Sample Data Qualified in this SDG

LDC #: 38756A87 **VALIDATION COMPLETENESS WORKSHEET** Date: 06/06/17

SDG #: 280-96239-1 Stage 4 Page: 1 of 1

Laboratory: Test America, Inc. Reviewer: JR

2nd Reviewer:

METHOD: LC/MS Perchlorate (EPA SW846 Method 6860)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	GC/MS Instrument performance check	N	
III.	Initial calibration/ICV	A / A	r ICV ≤ 15%.
IV.	Continuing calibration	A	CCV ≤ 15%. LODV ≤ 30%.
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	N	Not req'd.
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	ND	D = 2/3
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	A	
XIII.	Target compound identification	A	
XIV.	System performance	A	
XV.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
+ 1	BKGmw-023-042017-GW	280-96239-3	Water	04/20/17
− 2	BKGmw-022-042117-GW	280-96239-17	Water	04/21/17
− 3	BKGmw-540-042117-GW	280-96239-18	Water	04/21/17
4				
5				
6				
7				
8				

Notes:

	MB 280-371646/12						
	CCB 280-371646/35						

LDC #: 38756 A87

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer:

Method: Perchlorate (EPA SW 846 Method 6850)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
II. LC/MS Instrument performance check				
Were the instrument performance reviewed and found to be within the specified criteria?	✓			
Were the Perchlorate ions within ±0.3 m/z of mass 99,101 and 107?	✓			
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20%?	.		✓	
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit criteria of ≥ 0.990?	✓			
Was the isotope ratio of $^{35}Cl/^{37}Cl$ or m/z 99/101 within 2.3 to 3.8?	✓			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 15%?	✓			
IV. Continuing calibration				
Was a continuing calibration analyzed daily?	✓			
Were all percent differences (%D) of the mid-range continuing calibration ≤ 15%?	✓			
Were all percent differences (%D) of the low-range continuing calibration ≤ 50%?	✓			
Was the isotope ratio of $^{35}Cl/^{37}Cl$ or m/z 99/101 within 2.3 to 3.8?	✓			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
VI. Field blanks				
Were field blanks identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.		✓	.	
Was a MS/MSD analyzed every 20 samples of each matrix?		✓		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	

LDC #: 38756 A87

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer:

Validation Area	Yes	No	NA	Findings/Comments
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?				
Were target compounds detected in the field duplicates?.				
XI. Internal standards				
Were internal standard area counts within ± 50% of the associated calibration standard?	✓			
Were retention times of m/z 89 ($Cl^{18}O_3^-$) within 0.2 minutes of m/z 83 (ClO_3^-)?	✓			
XII. Compound quantitation				
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XIII. Target compound identification				
Were relative retention times (RRT's) within 0.98 to 1.02?	✓			
Was the isotope ratio of $^{35}Cl/^{37}Cl$ or m/z 99/101 within 2.3 to 3.8?	✓			
XIV. System performance				
System performance was found to be acceptable.	✓			
XIII. Overall assessment of data	✓			
Overall assessment of data was found to be acceptable.				

LDC#: 38756A87

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

Method: LCMS Perchlorate (EPASW 846 Method 6860)

Calibration Date	System	Compound	Standard	(Y) Area ratio	(X) Conc ratio
5/1/2017	LCMS2	Perchlorate	1	0.18546	0.10
			2	0.45738	0.25
			3	0.97474	0.49
			4	2.01609	0.98
			5	4.60392	2.45
			6	9.39034	4.90

Regression Output		*Calculated*	*Reported WLR*
Constant	*b* =	*0.027038*	*0.8492*
R Squared	*r2* =	*0.999583*	*0.999000*
X Coefficient(s)	*m* =	*1.905348*	*1.9203*
Correlation Coefficient		*0.999791*	
Coefficient of Determination (r^2)		*0.999583*	*0.999000*

LDC#: 38756A87

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer:

Method: LCMS Perchlorate (EPASW 846 Method 6860)

The percent difference (%D) of the initial calibration average Calibration Factors (CF) and the continuing calibration percent difference (%D) values were recalculated for the compounds identified below using the following calculation:

Percent difference (%D) = 100 * (N - C)/N

Where:
N = Initial Calibration Factor or Nominal Amount
C = Calibration Factor from Continuing Calibration Standard or Calculated Amount

#	Standard ID	Calibration Date	Compound	CCV Conc	Reported Conc	Recalculated Conc	Reported % D	Recalculated %D
1	IC217D28031B	5/1/2017	Perchlorate	0.200	0.189	0.189	5.6	5.6

LDC #: 38156 A87

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: JVG
2nd Reviewer: [signature]

METHOD: LC/MS Perchlorate (EPA SW 846 Method 6850/6860)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SC/SA Where: SSC = Spike concentration
SA = Spike added

RPD = I LCS - LCSD I * 2/(LCS + LCSD) LCS = Laboratory control sample percent recovery LCSD = Laboratory control sample duplicate percent recovery

LCS/LCSD samples: LCS 280 - 371696 /14

Compound	Spike Added (ug/L)		Spike Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc	Reported	Recalc	Reported	Recalc
Perchlorate	0.0500	NA	0.0515	NA	103	103				

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 38756 A87

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: JVG
2nd reviewer:

METHOD: LCMS Perchlorate (EPA SW 846 Method 6850/6860)

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(V_t)(DF)(2.0)}{(A_{is})(RRF)(V_o)(V_i)(\%S)}$

A_x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
I_s	=	Amount of internal standard added in nanograms (ng)
V_o	=	Volume or weight of sample extract in milliliters (ml) or grams (g).
V_i	=	Volume of extract injected in microliters (ul)
V_t	=	Volume of the concentrated extract in microliters (ul)
Df	=	Dilution Factor.
%S	=	Percent solids, applicable to soil and solid matrices only.
2.0	=	Factor of 2 to account for GPC cleanup

Example:

Sample I.D. 1, Perchlorate:

Conc. $\frac{\left[\frac{(872734)(204.0)}{(3472234)}\right] - (0.8492)}{(1.9203)\quad(1000)}$

$= 0.0263$ ug/L

#	Sample ID	Compound	Reported Concentration (ug/L)	Calculated Concentration ( )	Qualification
			0.026		

LDC #: 38756

EDD POPULATION COMPLETENESS WORKSHEET

Date: 6/15/17
Page: 1 of 1
2nd Reviewer: BA

The LDC job number listed above was entered by AD.

	EDD Process		Comments/Action
I.	EDD Completeness	-	
Ia.	- All methods present?	y	
Ib.	- All samples present/match report?	y	
Ic.	- All reported analytes present?	y	
Id.	- 10% or 100% verification of EDD?	y	
II.	EDD Preparation/Entry	-	
IIa.	- Carryover U/J?	N	
IIb.	- Reason Codes used? If so, note which codes.	y	VOC
IIc.	- Additional Information (QC Level, Validator, Validated Y/N, etc.)	N	
III.	Reasonableness Checks	-	
IIIa.	- Do all qualified ND results have ND qualifier (e.g. UJ)?	y	
IIIb.	- Do all qualified detect results have detect qualifier (e.g. J)?	y	
IIIc.	- If reason codes are used, do all qualified results have reason code field populated, and vice versa?	—	
IIId.	-Does the detect flag require changing for blank qualifier? If so, are all U results marked ND?	N/A	
IIIe.	- Do blank concentrations in report match EDD where data was qualified due to blank contamination?	y	
IIIf.	- Were multiple results reported due to dilutions/reanalysis? If so, were results qualified appropriately?	N/A	
IIIg.	-Are there any discrepancies between the data packet and the EDD?	N	

Notes: *see discrepancy sheet