Appendix B-1
Data Validation Reports

(electronic only)

DATA VALIDATION AND USABILITY REPORT

VOLATILES by USEPA SW-846 Method 8260C
DISSOLVED GASES (MEE) by USEPA SW-846 Method RSK 175
MERCURY by USEPA SW-846 Method 7470A
METALS by USEPA SW-846 Method 6010C
CHEMICAL OXYGEN DEMAND by USEPA SW-846 Method 410.4
TOTAL ORGANIC CARBONS/TOTAL INORGANIC CARBONS by USEPA SW-846 Method 9060A
ANIONS by USEPA SW-846 Method 9056A
pH by USEPA SW-846 Method 9045C

Project: Radford Army Ammunitions Plant, Virginia – Long Term Monitoring
Project/Task Number: 10021896-242801-003
Sample Data Package: 122845, 122887, 122907, 122926
Laboratory: CT Laboratories, Baraboo, Wisconsin
Sample Matrix: Groundwater

Sampling Dates: 10-14 Oct 2016
Validation Guidelines: Project QAPP (Radford Army Ammunitions Plant, Virginia – LTM; United States Environmental Protection Agency (USEPA) Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, 3rd edition (SW-846); National Functional Guidelines for Inorganic Superfund Data Review (USEPA, August 2014); National Functional Guidelines for Superfund Organic Methods Data Review (October 2013); and professional judgment
Validation Level: Stage 2BVM (100 % of data)
Data Reviewer: Jennifer Chandler, Chemist with HDR (Henningson, Durham, Richardson)

Sample ID	Matrix	Lab ID	Data Package	VOC	MEE	Chloride/Nitrate/ SO4	TOC/TIC	pH/Metals/COD	Explosives/Perchlorate/ Chlorite/Chlorate	SVOC
54MW1	GW	787265	122845			X	X		X	
54MW12*	GW*	787283	128845			X	X		X	
54MW13	GW	787715	122887			X	X		X	
54TM12	GW	787716	122887			X	X		X	
54MW10	GW	787717	122887			X	X		X	
101216R1	QC	787718	122887			X	X		X	
54AOW01	QC*	787719	122887					X		
13MW3	GW	787720	122887	X	X	X	X			
13MW4	GW*	787721	122887	X	X	X	X			
13MW2	GW	787722	122887	X	X	X	X			
49MW04	GW	787723	122887	X	X	X	X			
101216T1	QC	787724	122887	X						
50MW02	GW	788209	122907	X	X	X	X			
49MW02	GW*	788210	122907	X	X	X	X			
48MW3	GW	788211	122907	X	X	X	X			
49TM01	GW	788212	122907	X	X	X	X			
48MW2	GW	788213	122907	X	X	X	X			
49MW01	GW	788214	122907	X	X	X	X			
101316T1	QC	788215	122907	X						
48MW06	GW*	788654	122926	X	X	X	X			
48MW1	GW	788655	122926	X	X	X	X			
101416R1	QC	788656	122926	X	X	X	X			
49AOW01	QC	788657	122926					X		
101416T1	QC	788658	122926	X						

*Denotes samples that were analyzed for Matrix Spike/Matrix Spike Duplicate (MS/MSD).

SUMMARY

All laboratory data were acceptable with qualification. All analyses were completed using the latest Quality Systems Manual version 5.0.

I. SAMPLE RECEIPT / CHAIN OF CUSTODY

Samples were received within the correct temperature range of 0-6°C, with temperatures between 2.7°C, 2.9°C, 3.9°C, and 5.1°C. The chains of custody (COCs) were filled out and signed. All samples had the proper preservation.

II. HOLDING TIMES

All analysis were analyzed within method criteria, with the exception of the following analysis:

Anions: Sulfate and Chloride were analyzed within 28 days after collection.

Three samples were analyzed, for Nitrate/Nitrogen (48MW1, 48MW06, AND 101416R1), outside of the 48 hour method requirements. The method states the Holding Time (HT) for Nitrate/Nitrogen analysis is within 48 hours of collection. These three samples were analyzed within the acceptable qualified control limit of 2 times the HT, which equals <4 days. Any analysis performed at a laboratory is considered outside of standard method criteria; therefore, analysis will be considered estimated.

pH: One sample was analyzed for pH (49AOW01). The Holding Time (HT) for pH analysis is considered a field test parameter and should be analyzed immediately. Any analysis performed, at the laboratory, is considered outside of method criteria; therefore, analysis will be considered estimated.

III. BLANKS

METHOD BLANKS (MB)

Target analytes were not detected in the method blanks except as noted below.

VOCs: 1,4-Dioxane and Chloromethane were detected in the method blanks. 1,4-Dioxane sample concentration were non-detect; therefore, no qualification was required. Chloromethane sample results were qualified as estimated.

Metals: Beryllium was detected in the MBs. Sample results were non-detect; therefore, no qualification was required.

TRIP BLANKS (TB)

VOCs: Chloromethane was detected in TB 10126T1. Sample results were qualified as estimated. No further qualification was necessary. Acetone and Chloromethane were detected in TB 101416T1. All sample results were non-detect; therefore, no qualification was required.

RINSATE BLANKS (RB)

Target analytes were not detected in the RBs except as noted below.

VOCs: Chloromethane were detected in the RB (101416R1). Sample results less than two times the blank concentration have been qualified as estimated.

Anions: Sulfate was detected in the RB (101416R1). Sample results were greater than two times the RB concentration; therefore no qualification was required.

IV. LABORATORY CONTROL SAMPLES (LCS)
All LCS recoveries were within control limits, except as noted below:

Explosives: Tetryl was high biased outside the control limit of 65-124, at 134%. All sample results were non-detect; therefore, no qualification was required.

V. SURROGATES
All surrogate recoveries were within control limits.

VI. MATRIX SPIKE / MATRIX SPIKE DUPLICATE (MS/MSD)
All MS/MSD recoveries were within control limits, except as noted below.

Metals: Potassium was outside control limits (86-114%), for the MS/MSD analysis for sample 54AOW01, at 114% and 115%. Samples were qualified as estimated.

Anions: Chloride was above the specified control limits (87-11%), for the MS/MSD analysis for 54MW12 at 112% and 114%. Samples were qualified as estimated.

Explosives: Tetryl was outside of the MS/MSD control limits, of 65-124, at 136% and 137%. Sample results were non-detect; therefore no qualification was required.

Perchlorate: Target analyte was outside control limits, for MS/MSD analysis on sample 54MW12. Spiked results were greater than four times the spiked concentration; therefore, sample results were not reviewed. No qualification was required.

XII. DUPLICATES

LABORATORY DUPLICATES
Laboratory duplicate samples were collected. All recoveries were within control limits, except as noted below.

Metals: Aluminum (92%), barium (100%), calcium (85%), chromium (120%), iron (97%), magnesium (89%), manganese (95%), nickel (200%), selenium (200%), silver (200%), vanadium (200%), and zinc (97%) failed outside the control limit of 20%RPD. Sample results are considered estimated.

FIELD DUPLICATES
Field duplicate samples were collected and identified in the following table.

Field Duplicate Sample	Parent Sample	Analysis
54TM12	54MW13	See table list above
49MW3	49TM01	See table list above

Water sample RPDs were within 20% except as noted below. Qualifiers were assigned to duplicate and parent samples for the specific analytes that fail the %RPDs (J). If the analyte was undetected then the qualifier assigned was UJ.

VOCs: Chloromethane %RPD was not within control limits in sample pairing 49TM01 AND 49MW3, AT 31.7%. The RPD was greater than 20%, therefore both the parent and field duplicate samples were qualified.

Explosives: 3,5-Dinitroaniline %RPD results were greater than 20%RPD, at 31.4% RPD. Sample results were qualified as estimated.

XIII. POST DIGESTION SPIKE AND DILUTION TEST

Post-digestion spike (PDS) analyses and serial dilution tests were performed for lead. PDS results were within the control limits of 75-125% except as noted below. The dilution tests were not applicable unless sample results were greater than 50 times the MDL.

Metals: None were reported.

IX. INTERFERENCE CHECK SAMPLES (ICS)

ICS results were applicable to the lead analysis. All Metals results were within control limits of 80-120%.

X. REPORTING LIMITS (RL) AND METHOD DETECTION LIMITS (MDL)

The required RLs as listed in the QAPP were met.

XI. SAMPLE RESULTS / TRANSCRIPTION VERIFICATION

Transcription between the data package and the EDDs was verified. Sample results reported between the MDL and RL were qualified as estimated (J). There were no issues with any analysis.

XII. DATA USABILITY

Data were usable. No data were rejected. Data required minimal qualification. All data are usable as qualified.

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LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

Bering Sea Environmental, LLC
ATTN: Ms. S. Julia Liu, P.E.

May 9, 2017

SUBJECT: Radford Army Ammunition Plant, VA, Data Validation

Dear Ms. Julia Liu,

Enclosed are the final validation reports for the fractions listed below. These SDGs were received on April 7, 2017. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #38427:

SDG #	Fraction
124700/FA40279/FA40351/380652/380797 124775	Volatiles, Metals, Explosives, Methane, Ethane, & Ethene, Wet Chemistry, Perchlorate

The data validation was performed under Stage 2B validation guidelines. The analyses were validated using the following documents and variances, as applicable to each method:

- SWMU 54, RAAP-14, Monitored Natural Attenuation Interim Measures Work Plan for Radford Army Ammunition Plant, Virginia, April 2011
- 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, October 2013
- 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

2,539 pages SF

Attachment 1

EDD Stage 2B **LDC #38427 (Bering Sea Environmental-Anchorage, AK / Radford Army Ammunition Plant, VA)**

LDC	SDG#	DATE REC'D	(3) DATE DUE	VOA (8260C)		Metals (6010C /7470A)		Expl. (8330B)		Methane Ethane Ethene		CLO_4 (6850)		Cl,SO_4 NO_3-N (9056A)		Chlorate Chlorite (300.1)		COD (410.4)		pH (9040C)		TIC (9060A)		TOC (9060A)													
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	W	S
A	124700/FA40279/ FA40351/380652/ 380797	04/07/17	04/28/17	-	-	1	0	6	0	-	-	6	0	6	0	6	0	1	0	1	0	6	0	6	0												
B	124775	04/07/17	04/28/17	20	0	1	0	-	-	17	0	-	-	17	0	-	-	1	0	1	0	-	-	17	0												
Total	T/PG			20	0	2	0	6	0	17	0	6	0	23	0	6	0	2	0	2	0	6	0	23	0	0	0	0	0	0	0	0	0	0	0	0	113

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

L:\Bering Sea Group\Radford\38427ST.wpd

LDC Report# 38427A4b

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Radford Army Ammunition Plant, VA

LDC Report Date: May 3, 2017

Parameters: Metals

Validation Level: Stage 2B

Laboratory: Curtis & Tompkins, Ltd.

Sample Delivery Group (SDG): 124700

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
54ADW01	826641	Water	01/10/17
54ADW01MS	826641MS	Water	01/10/17
54ADW01MSD	826641MSD	Water	01/10/17
54ADW01DUP	826641DUP	Water	01/10/17

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 SWMU 54 (RAAP-14) Monitored Natural Attenuation Interim Measures Work Plan for Radford Army Ammunition Plant, Virginia (April 2011), 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, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, and Zinc by Environmental Protection Agency (EPA) SW 846 Method 6010C
Mercury by EPA SW 846 Method 7470A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

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. 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.

III. ICP Interference Check Sample Analysis

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

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
ICB/CCB	Aluminum Beryllium Chromium Potassium Silver Vanadium	12.80 ug/L 0.128 ug/L 1.39 ug/L 99 ug/L 0.881 ug/L 1.48 ug/L	All samples in SDG 124700
PB (prep blank)	Aluminum Calcium Chromium Vanadium	8.42 ug/L 33.60 ug/L 1.04 ug/L 1.69 ug/L	All samples in SDG 124700

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 (>5X blank contaminants) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
54ADW01	Aluminum Chromium Vanadium	38.5 ug/L 2.7 ug/L 1.5 ug/L	38.5U ug/L 2.7U ug/L 2.5U 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. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
54ADW01MS/MSD (54ADW01)	Mercury	185 (80-120)	175 (80-120)	NA	-

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. Serial Dilution

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

Diluted Sample	Analyte	%D (Limits)	Associated Samples	Flag	A or P
54ADW01	Calcium	23 (≤10)	54ADW01	J (all detects)	A

IX. Laboratory Control Samples

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

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Sample Result Verification

All analytes reported below the limit of quantitation (LOQ) and above the method detection limit (MDL) were qualified as follows:

Sample	Analyte	Flag	A or P
All samples in SDG 124700	All analytes reported below the LOQ and above the MDL.	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

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

Due to serial dilution %D and results below the LOQ and above the MDL, data were qualified as estimated in one sample.

Due to laboratory blank contamination, data were qualified as not detected in one sample.

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.

Radford Army Ammunition Plant, VA
Metals - Data Qualification Summary - SDG 124700

Sample	Analyte	Flag	A or P	Reason
54ADW01	Calcium	J (all detects)	A	Serial dilution (%D)
54ADW01	All analytes reported below the LOQ and above the MDL.	J (all detects)	A	Sample result verification

Radford Army Ammunition Plant, VA
Metals - Laboratory Blank Data Qualification Summary - SDG 124700

Sample	Analyte	Modified Final Concentration	A or P
54ADW01	Aluminum Chromium Vanadium	38.5U ug/L 2.7U ug/L 2.5U ug/L	A

Radford Army Ammunition Plant, VA
Metals - Field Blank Data Qualification Summary - SDG 124700

No Sample Data Qualified in this SDG

LDC #: 38427A4b
SDG #: 124700
Laboratory: CT Laboratories

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 04/17/17
Page: 1 of 1
Reviewer: ATV
2nd Reviewer: [signature]

METHOD: Metals (EPA SW 846 Method 6010C/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.	Instrument Calibration	A	
III.	ICP Interference Check Sample (ICS) Analysis	A	
IV.	Laboratory Blanks	SW	
V.	Field Blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	SW	
VII.	Duplicate sample analysis	A	
VIII.	Serial Dilution	SW	
IX.	Laboratory control samples	A	LCS
X.	Field Duplicates	N	
XI.	Sample Result Verification	N	
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	54ADW01	826641	Water	01/10/17
2	54ADW01MS	826641MS	Water	01/10/17
3	54ADW01MSD	826641MSD	Water	01/10/17
4	54ADW01DUP	826641DUP	Water	01/10/17
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				

Notes:

LDC #: 38427A4b

VALIDATION FINDINGS WORKSHEET
Sample Specific Element Reference

Reviewer: ATL
2nd reviewer: Q

All circled elements are applicable to each sample.

Sample ID	Matrix	Target Analyte List (TAL)
1	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,
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,
2,3,4	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,
		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 #: 38427A4b

VALIDATION FINDINGS WORKSHEET
PB/ICB/CCB QUALIFIED SAMPLES

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

Analyte	Maximum PB[a] (mg/Kg)	Maximum PB[a] (ug/L)	Maximum ICB/CCB[a] (ug/L)	Action Level	1								
Al			12.80	64	38.5 U								
Be			0.128	0.64									
Cr			1.39	6.95	2.7 U								
K			99	495									
Ag			0.881	4.405									
V			1.48	7.4	1.5 / 2.5 U								

Sample Concentration units, unless otherwise noted: ug/L
Associated Samples: All

Analyte	Maximum PB[a] (mg/Kg)	Maximum PB[a] (ug/L)	Maximum ICB/CCB[a] (ug/L)	Action Level	1								
Al		8.42		42.1	See above								
Ca		33.60		168									
Cr		1.04		5.2	See above								
V		1.69		8.45	See above								

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 #: 38427A4b

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Reviewer: ATL
2nd Reviewer:

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

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

Y N N/A Was a matrix spike analyzed for each matrix in this SDG?

Y N N/A Were matrix spike percent recoveries (%R) within the control limits of 75-125? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.

Y N N/A Were all duplicate sample relative percent differences (RPD) ≤ 20% for samples?

LEVEL IV ONLY:

Y N N/A Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	MS/MSD ID	Matrix	Analyte	MS %Recovery	MSD %Recovery	RPD (Limits)	Associated Samples	Qualifications
	2/3	W	Hg	185 (80-120)	175 (80-120)		1	~~J/UJ/A~~ (non-detect) J Kdet /A

Comments:

LDC #: 38427A4b

VALIDATION FINDINGS WORKSHEET
ICP Serial Dilution

Reviewer: ATL
2nd Reviewer:

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

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

Y (N) N/A If analyte concentrations were > 50X the MDL (ICP) ,or >100X the MDL (ICP/MS), was a serial dilution analyzed?
Y (N) N/A Were ICP serial dilution percent differences (%D) ≤10%?
Y (N) N/A Is there evidence of negative interference? If yes, professional judgement will be used to qualify the data.

LEVEL IV ONLY:

Y N N/A Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	Diluted Sample ID	Matrix	Analyte	%D (Limits)	Associated Samples	Qualifications
	1	W	Ca	23 (< 10)	~~all~~ 4 1	J/UJ/A (detect)

Comments:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Radford Army Ammunition Plant, VA

LDC Report Date: May 3, 2017

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Curtis & Tompkins, Ltd./Eurofins

Sample Delivery Group (SDG): 124700/380652/380797

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
54MW10	826235/3618953	Water	01/09/17
54MW10	826236	Water	01/09/17
54MW13	826237/3618956	Water	01/09/17
54MW13	826238	Water	01/09/17
010917R1	826239/3618957	Water	01/09/17
010917R1	826240	Water	01/09/17
54MW1	826629	Water	01/10/17
54MW1	826633	Water	01/10/17
54MW12	826637	Water	01/10/17
54MW12	826638	Water	01/10/17
54TM12	826639	Water	01/10/17
54TM12	826640	Water	01/10/17
54ADW01	826641	Water	01/10/17
54MW10MS	826235/3618954MS	Water	01/09/17
54MW10MSD	826235/3618955MSD	Water	01/09/17
54MW10DUP	826235DUP	Water	01/09/17
54MW10MS	826236MS	Water	01/09/17
54MW10MSD	826236MSD	Water	01/09/17
54MW10DUP	826236DUP	Water	01/09/17
54MW1MS	826629MS	Water	01/10/17
54MW1MSD	826629MSD	Water	01/10/17
54MW1MS	826633MS	Water	01/10/17
54MW1MSD	826633MSD	Water	01/10/17
54MW1DUP	826633DUP	Water	01/10/17
54ADW01MS	826641MS	Water	01/10/17
54ADW01MSD	826641MSD	Water	01/10/17
54ADW01DUP	826641DUP	Water	01/10/17
54MW1DUP	826629DUP	Water	01/10/17

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 SWMU 54 (RAAP-14) Monitored Natural Attenuation Interim Measures Work Plan for Radford Army Ammunition Plant, Virginia (April 2011), 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:

Chloride, Sulfate, and Nitrate as Nitrogen by Environmental Protection Agency (EPA) SW 846 Method 9056A
Chlorate and Chlorite by EPA Method 300.1
Chemical Oxygen Demand by EPA Method 410.1
pH by EPA SW 846 Method 9040C
Total Inorganic Carbon, Total Organic Carbon, and Total Carbon by EPA SW 846 Method 9060A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

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
54ADW01	pH	3 days	48 hours	J (all 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	1.642 mg/L	54MW1 (826633) 54MW12 (826638) 54TM12 (826640)

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 (>5X blank contaminants) than the concentrations found in the associated laboratory blanks.

V. Field Blanks

Samples 010917R1 (826239/3618957) and 010917R1 (826240) were identified as rinsates. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Analyte	Concentration	Associated Samples
010917R1 (826239/3618957)	01/09/17	Total carbon Total inorganic carbon	0.81 mg/L 0.81 mg/L	54MW10 (826235/3618953) 54MW13 (826237/3618956)

Blank ID	Collection Date	Analyte	Concentration	Associated Samples
010917R1 (826240)	01/09/17	Sulfate	2.4 mg/L	54MW10 (826236) 54MW13 (826238)

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated field blanks.

VI. 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 with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
54MW10 (826236)MS/MSD (54MW10 (826236))	Chloride Nitrate as N	32 (80-120) 30 (80-120)	- -	J (all detects) J (all detects)	A

For 54MW10 (826236)MS/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) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples 54MW12 and 54TM12 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/L)		RPD (Limits)	Flag	A or P
	54MW12 (826637)	54TM12 (826639)			
Total organic carbon	1.4	1.4	0 (≤25)	-	-

Analyte	Concentration (mg/L)		RPD (Limits)	Flag	A or P
	54MW12 (826637)	54TM12 (826639)			
Total carbon	97	100	3 (≤25)	-	-
Total inorganic carbon	96	98	2 (≤25)	-	-

Analyte	Concentration (mg/L)		RPD (Limits)	Flag	A or P
	54MW12 (826638)	54TM12 (826640)			
Chloride	6.8	6.8	0 (≤25)	-	-
Nitrate as N	0.94	0.93	1 (≤25)	-	-
Sulfate	38	39	3 (≤25)	-	-

X. Sample Result Verification

All analytes reported below the limit of quantitation (LOQ) and above the method detection limit (MDL) were qualified as follows:

Sample	Analyte	Flag	A or P
All samples in SDG 124700/380652/380797	All analytes reported below the LOQ and above the MDL.	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

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, MS/MSD %R, and results below the LOQ and above the MDL, data were qualified as estimated in thirteen 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.

Radford Army Ammunition Plant, VA
Wet Chemistry - Data Qualification Summary - SDG 124700/380652/380797

Sample	Analyte	Flag	A or P	Reason
54ADW01	pH	J (all detects)	P	Technical holding times
54MW10 (826236)	Chloride Nitrate as N	J (all detects) J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
54MW10 54MW10 54MW13 54MW13 010917R1 010917R1 54MW1 54MW1 54MW12 54MW12 54TM12 54TM12 54ADW01	All analytes reported below the LOQ and above the MDL.	J (all detects)	A	Sample result verification

Radford Army Ammunition Plant, VA
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 124700/380652/380797

No Sample Data Qualified in this SDG

Radford Army Ammunition Plant, VA
Wet Chemistry - Field Blank Data Qualification Summary - SDG 124700/380652/380797

No Sample Data Qualified in this SDG

LDC #: 38427A6 **VALIDATION COMPLETENESS WORKSHEET** Date: 04/18/17
SDG #: 124700/380652/380797 Stage 2B Page: 1 of 2
Laboratory: CT Laboratories/Eurofins Reviewer: ATL
2nd Reviewer: Q

METHOD: (Analyte) Chloride, Nitrate-N, Sulfate (EPA SW846 Method 9056A), Chlorate, Chlorite (EPA Method 300.1), COD (EPA Method 410.1), pH (EPA SW846 Method 9040C), TIC, TOC, TC (EPA SW846 Method 9060A)

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 ISW	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	SW	5, 6, ~~13~~ = rinsate, ~~purge water = 13~~
VI.	Matrix Spike/Matrix Spike Duplicates	SW	
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	(9, 11) & (10, 12)
X.	Sample result verification	N	
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	54MW10	826235 / 3618953	Water	01/09/17
2	54MW10	826236	Water	01/09/17
3	54MW13	826237 / 3618956	Water	01/09/17
4	54MW13	826238	Water	01/09/17
5	010917R1	826239 / 3618957	Water	01/09/17
6	010917R1	826240	Water	01/09/17
7	54MW1	826629	Water	01/10/17
8	54MW1	826633	Water	01/10/17
9	54MW12	826637	Water	01/10/17
10	54MW12	826638	Water	01/10/17
11	54TM12	826639	Water	01/10/17
12	54TM12	826640	Water	01/10/17
13	54ADW01	826641	Water	01/10/17
14	54MW10MS	826235MS / 3618954	Water	01/09/17
15	54MW10MSD	826235MSD / 3618955	Water	01/09/17
16	54MW10DUP	826235DUP	Water	01/09/17

LDC #: 38427A6 **VALIDATION COMPLETENESS WORKSHEET** Date: 04/18/17
SDG #: 124700/380652/380797 Stage 2B Page: 2 of 2
Laboratory: CT Laboratories/Eurofins Reviewer: ATC
2nd Reviewer: a

METHOD: (Analyte) Chloride, Nitrate-N, Sulfate (EPA SW846 Method 9056A), Chlorate, Chlorite (EPA Method 300.1), COD (EPA Method 410.1), pH (EPA SW846 Method 9040C), TIC, TOC (EPA SW846 Method 9060A)

	Client ID	Lab ID	Matrix	Date
17	54MW10MS	826236MS	Water	01/09/17
18	54MW10MSD	826236MSD	Water	01/09/17
19	54MW10DUP	826236DUP	Water	01/09/17
20	54MW1MS	826629MS	Water	01/10/17
21	54MW1MSD	826629MSD	Water	01/10/17
22	54MW1MS	826633MS	Water	01/10/17
23	54MW1MSD	826633MSD	Water	01/10/17
24	54MW1DUP	826633DUP	Water	01/10/17
25	54ADW01MS	826641MS	Water	01/10/17
26	54ADW01MSD	826641MSD	Water	01/10/17
27	54ADW01DUP	826641DUP	Water	01/10/17
28	54MW1	826629DUP		
29				
30				
31				
32				

Notes:

LDC #: 38427A6

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Page: 1 of 1
Reviewer: ATL
2nd reviewer: [illegible]

All circled methods are applicable to each sample.

Sample ID	Parameter
2,4,6,8,10 10,12	pH TDS Cl F N NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
1,5,7,9,11	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 TIC
13	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 COD
1,3,5	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 ClO_3 ClO_2
5,3,9,7,11	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 TC TIC
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
QC	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
17,18,19 22,23,24	pH TDS Cl F N NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
20,21	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 COD
14,15,16	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
25,26	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 COD
27	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 COD
28	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
	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:

)C #: 38427A6

VALIDATION FINDINGS WORKSHEET
Technical Holding Times

Reviewer: ATL
2nd reviewer:

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

Method:	pH (EPA 9040C)	
Parameters:	water	
Technical holding time:	48hrs ~~24 hrs analyse immediately~~	

Sample ID	Sampling date	Analysis date	Total Time	Qualifier	Analysis date	Total Time	Qualifier
13	01/10/17	01/13/17	3days	J/UJ/P(detect)			

LDC #: 38427A6

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: ATL
2nd Reviewer:

METHOD: Inorganics, Method See Cover

Conc. units: mg/L **Associated Samples:** 8, 10, 12

Analyte	Blank ID	Blank ID	Blank Action Limit									
	PB	ICB/CCB (mg/L)										
SO4		1.642	8.21									

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 #: 38427A6

VALIDATION FINDINGS WORKSHEET
Field Blanks

Reviewer: ATL
2nd Reviewer:

METHOD: Inorganics, EPA Method See Cover
Blank units: mg/L **Associated sample units:** mg/L
Sampling date: 01/09/17 Soil factor applied NA
Field blank type: (circle one) Field Blank / Rinsate / Other: Associated Samples: 2, 4

Analyte	Blank ID	Action Limit	Sample Identification							
	6									
SO4	2.4	12								

Field blank type: (circle one) Field Blank / Rinsate / Other: Associated Samples: 1,3

Analyte	Blank ID	Action Limit	Sample Identification							
	5									
TC	0.81	4.05								
TIC	0.81	4.05								

Field blank type: (circle one) Field Blank / Rinsate / Other: Associated Samples: none

Analyte	Blank ID	Action Limit	Sample Identification							
	13									
pH (SU)	7.06									
COD	64	320								

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Samples with analyte concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as not detected, "U".

LDC #: 38427A6

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Reviewer: ATL
2nd Reviewer:

METHOD: Inorganics, EPA Method See cover

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

Y N N/A Was a matrix spike analyzed for each matrix in this SDG?

Y N N/A Were matrix spike percent recoveries (%R) within the control limits of 75-125? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.

Y N N/A Were all duplicate sample relative percent differences (RPD) ≤ 20% for water samples and ≤35% for soil samples?

LEVEL IV ONLY:

Y N N/A Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	MS/MSD ID	Matrix	Analyte	MS %Recovery	MSD %Recovery	RPD (Limits)	Associated Samples	Qualifications
	17/18	W	Cl	32 (80-120%)			2	~~J/UJ/A~~ (detect) UL J/UJ/A
	17/18	W	NO3-N	30 (80-120%)			2	~~J/UJ/A~~ (detect) UL J

Comments: 17 SO4>4x

LDC# 38427A6

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: ATL
2nd Reviewer:

Inorganics: Method See Cover

Analyte	Concentration (mg/L)		RPD (≤~~20~~ 25)	
	9	11		
TOC	1.4	1.4	0	
TC	97	100	3	
TIC	96	98	2	

Analyte	Concentration (mg/L)		RPD (≤~~20~~ 25)	
	10	12		
Cl	6.8	6.8	0	
NO3-N	0.94	0.93	1	
SO4	38	39	3	

V:\FIELD DUPLICATES\38427a6.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Radford Army Ammunition Plant, VA

LDC Report Date: May 3, 2017

Parameters: Explosives

Validation Level: Stage 2B

Laboratory: Curtis & Tompkins, Ltd./Accutest Laboratories

Sample Delivery Group (SDG): 124700/FA40279/FA40351

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
54MW10	826235/FA40279-1	Water	01/09/17
54MW13	826237/FA40279-2	Water	01/09/17
010917R1	826239/FA40279-3	Water	01/09/17
54MW1	826629/FA40351-1	Water	01/10/17
54MW12	826637/FA40351-2	Water	01/10/17
54TM12	826639/FA40351-3	Water	01/10/17
54MW10MS	826235/FA40279-1MS	Water	01/09/17
54MW10MSD	826235/FA40279-1MSD	Water	01/09/17

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 SWMU 54 (RAAP-14) Monitored Natural Attenuation Interim Measures Work Plan for Radford Army Ammunition Plant, Virginia (April 2011), 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 (October 2013). 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 2B data validation, which comprises an evaluation of quality control (QC) summary results.

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.

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.

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.

IV. Laboratory Blanks

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

V. Field Blanks

Sample 010917R1 was identified as a rinsate. No contaminants were found.

VI. Surrogates

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

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 with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
54MW10MS/MSD (54MW10)	HMX 2,4,6-Trinitrotoluene	66 (80-115) 42 (50-145)	- 56 (50-145)	J (all detects) J (all detects)	A
54MW10MS/MSD (54MW10)	DNX	-	130 (66-127)	NA	-

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

Spike ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
54MW10MS/MSD (54MW10)	DNX MNX TNX	34 (≤20) 34 (≤20) 32 (≤20)	NA	-

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 54MW12 and 54TM12 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD (Limits)	Flag	A or P
	54MW12	54TM12			
HMX	13.2	11.4	15 (≤20)	-	-
RDX	4.8	5.0	4 (≤20)	-	-
2-Amino-4,6-dinitrotoluene	5.2	5.3	2 (≤20)	-	-
4-Amino-2,6-dinitrotoluene	2.7	2.8	4 (≤20)	-	-
1,3,5-Trinitrobenzene	20.1	21.8	8 (≤20)	-	-
2,4,6-Trinitrotoluene	28.1	29.1	3 (≤20)	-	-

X. Compound Quantitation

All compounds reported below the limit of quantitation (LOQ) and above the method detection limit (MDL) were qualified as follows:

Sample	Compound	Flag	A or P
All samples in SDG 124700/FA40279/FA40351	All compounds reported below the LOQ and above the MDL.	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

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

Due to MS/MSD %R and results below the LOQ and above the MDL, data were qualified as estimated in six 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.

Radford Army Ammunition Plant, VA
Explosives - Data Qualification Summary - SDG 124700/FA40279/FA40351

Sample	Compound	Flag	A or P	Reason
54MW10	HMX 2,4,6-Trinitrotoluene	J (all detects) J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
54MW10 54MW13 010917R1 54MW1 54MW12 54TM12	All compounds reported below the LOQ and above the MDL.	J (all detects)	A	Compound quantitation

Radford Army Ammunition Plant, VA
Explosives - Laboratory Blank Data Qualification Summary - SDG 124700/FA40279/FA40351

No Sample Data Qualified in this SDG

Radford Army Ammunition Plant, VA
Explosives - Field Blank Data Qualification Summary - SDG 124700/FA40279/FA40351

No Sample Data Qualified in this SDG

LDC #: 38427A40 **VALIDATION COMPLETENESS WORKSHEET** Date: 04/21/17
SDG #: 124700/FA40279/FA40351 Stage 2B Page: 1 of 1
Laboratory: CT Laboratories/Accutest Reviewer: [illegible]
2nd Reviewer: [illegible]

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% r ICV ≤ 20 %
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	ND	R = 3
VI.	Surrogate spikes	A	
VII.	Matrix spike/Matrix spike duplicates	SW	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	D = 5/6
X.	Compound quantitation RL/LOQ/LODs	N	
XI.	Target compound identification	N	
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		Subcon ID	Lab ID	Matrix	Date
1/2x	1	54MW10		FA 40279-1	826235	Water	01/09/17
1/2x	2	54MW13		-2	826237	Water	01/09/17
	3	010917R1		-3	826239	Water	01/09/17
	4	54MW1		FA 40351-1	826629	Water	01/10/17
2x	5	54MW12	D	-2	826637	Water	01/10/17
1/3x	6	54TM12	D	-3	826639	Water	01/10/17
	7	54MW10MS		FA 40279-1MS	826235MS	Water	01/09/17
	8	54MW10MSD		-MSD	826235MSD	Water	01/09/17
	9						
	10						
	11						
	12						
	13						

Notes:

1	OP63431-MB						

VALIDATION FINDINGS WORKSHEET

METHOD: ___GC ___HPLC

8310	8330	8151	8141	8141(Con't)	8021B
A. Acenaphthene	A. HMX	A. 2,4-D	A. Dichlorvos	CC. Trichlorinate	V. Benzene
B. Acenaphthylene	B. RDX	B. 2,4-DB	B. Mevinphos	DD. Trifluralin	CC. Toluene
C. Anthracene	C. 1,3,5-Trinitrobenzene	C. 2,4,5-T	C. Demeton-O	EE. Def	EE. Ethyl Benzene
D. Benzo(a)anthracene	D. 1,3-Dinitrobenzene	D. 2,4,5-TP	D. Demeton-S	FF. Prowl	SSS. O-Xylene
E. Benzo(a)pyrene	E. Tetryl	E. Dinoseb	E. Ethoprop	GG. Ethion	RRR. MP-Xylene
F. Benzo(b)fluoranthene	F. Nitrobenzene	F. Dichlorprop	F. Naled	HH. Famphur	GG. Total Xylene
G. Benzo(g,h,i)perylene	G. 2.4.6-Trinitrotoluene	G. Dicamba	G. Sulfotep	II. Phosmet	
H. Benzo(k)fluoranthene	H. 4-Amino-2,6-dinitrotoluene	H. Dalapon	H. Phorate	JJ. Tetrachlorvinphos	**VPH**
I. Chrysene	I. 2-Amino-4,6-dinitrotoluene	I. MCPP	I. Dimethoate	KK. Demeton (total)	A. C5-C6 Aliphatics
J. Dibenz(a,h)anthracene	J. 2,4-Dinitrotoluene	J. MCPA	J. Diazinon		B. C6-C8 Aliphatics
K. Fluoranthene	K. 2,6-Dinitrotoluene	K. Pentachlorophenol	K. Disulfoton		C. C8-C10 Aliphatics
L. Fluorene	L. 2-Nitrotoluene	L. 2,4,5-TP (silvex)	L. Parathion-methyl	**8315A**	D. C10-C12 Aliphatics
M. Indeno(1,2,3-cd)pyrene	M. 3-Nitrotoluene	M. Silvex	M. Ronnel	A. Formaldehyde	E. C8-C10 Aromatics
N. Naphthalene	N. 4-Nitrotoluene	N.	N. Malathion	B. Acetaldehyde	F. C10-C12 Aromatics
O. Phenanthrene	O. Nitroglycerin	O.	O. Chlorpyrifos	C. Benzaldehyde	G. Total VPH
P. Pyrene	P. Picric acid	P.	P. Fenthion	D. Butyraldehyde	
Q.	Q. 2,4-Dinitrophenol	Q.	Q. Parathion-ethyl	C. Benzaldehyde	**EPH**
R.	R. 3,5-Dinitroaniline		R. Trichlornate	D. Butyraldehyde	A. C10-C12 Aromatics
S.	S. 2-Nitrophenol		S. Merphos		B. C12-C16 Aromatics
	T. 4-Nitrophenol		T. Stirofos		C. C16-C21 Aromatics
	U. Picramic acid		U. Tokuthion	**Organic acids**	D. C21-C34 Aromatics
	V. PETN		V. Fensulfothion	A. Acetic acid	E. C10-C12 Aliphatics
	W. Hexahydro-1,3,5-trinitroso-1,3,5-triazine		W. Bolstar	B. Butyric acid	F. C12-C16 Aliphatics
	X. MNX		X. EPN	C. Lactic acid	G. C16-C21 Aliphatics
	Y. Hexahydro-1,3-dinitroso-5-nitro-1,3,5-triazine		Y. Azinphos-methyl	D. Propionic acid	H. C21-C34 Aliphatics
	Z. DNX		Z. Coumaphos	E. Pyruvic acid	
	AA. TNX		AA. Parathion		
			BB. Trichloronate		

LDC #: 38427 AF0

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

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

METHOD: ___ GC _/_ HPLC

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

Y N N/A Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG?

Y N N/A Was an MS/MSD analyzed every 20 samples for each matrix or whenever a sample extraction was performed?

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

#	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	7/8	A	66 (80-115)	( )	( )	1 (Det)	J/UJ/A
		Z	( )	130 (66-127)	( )	(ND)	J dets/A
		G	42 (50-145)	56 (50-145)	( )	(Det)	J/UJ/A
		Z	( )	( )	34 (20)	(ND)	J dets/A
		X	( )	( )	34 ( )		
		AA	( )	( )	32 ( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

LDC#: 38427A40

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer:

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

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 (≤20%)	Qualifications (Parent only)
	5	6		
A	13.2	11.4	15	
B	4.8	5.0	4	
I	5.2	5.3	2	
H	2.7	2.8	4	
C	20.1	21.8	8	
G	28.1	29.1	3	

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LDC Report# 38427A87

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Radford Army Ammunition Plant, VA

LDC Report Date: May 3, 2017

Parameters: Perchlorate

Validation Level: Stage 2B

Laboratory: Curtis & Tompkins, Ltd./Accutest Laboratories

Sample Delivery Group (SDG): 124700/FA40279/FA40351

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
54MW10	826235/FA40279-1	Water	01/09/17
54MW13	826237/FA40279-2	Water	01/09/17
010917R1	826239/FA40279-3	Water	01/09/17
54MW1	826629/FA40351-1	Water	01/10/17
54MW12	826637/FA40351-2	Water	01/10/17
54TM12	826639/FA40351-3	Water	01/10/17
54MW10MS	826235/FA40279-1MS	Water	01/09/17
54MW10MSD	826235/FA40279-1MSD	Water	01/09/17

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 SWMU 54 (RAAP-14) Monitored Natural Attenuation Interim Measures Work Plan for Radford Army Ammunition Plant, Virginia (April 2011), 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 (October 2013). 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 6850

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

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 50.0%.

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

Sample 010917R1 was identified as a rinsate. No contaminants were found.

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. 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 54MW12 and 54TM12 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD (Limits)	Flag	A or P
	54MW12	54TM12			
Perchlorate	2.9	2.9	0 (≤20)	-	-

X. Internal Standards

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

XI. Compound Quantitation

All compounds reported below the limit of quantitation (LOQ) and above the method detection limit (MDL) were qualified as follows:

Sample	Compound	Flag	A or P
All samples in SDG 124700/FA40279/FA40351	All compounds reported below the LOQ and above the MDL.	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

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

Due to results below the LOQ and above the MDL, data were qualified as estimated in six 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.

Radford Army Ammunition Plant, VA
Perchlorate - Data Qualification Summary - SDG 124700/FA40279/FA40351

Sample	Analyte	Flag	A or P	Reason
54MW10 54MW13 010917R1 54MW1 54MW12 54TM12	All compounds reported below the LOQ and above the MDL.	J (all detects)	A	Compound quantitation

Radford Army Ammunition Plant, VA
Perchlorate - Laboratory Blank Data Qualification Summary - SDG 124700/FA40279/FA40351

No Sample Data Qualified in this SDG

Radford Army Ammunition Plant, VA
Perchlorate - Field Blank Data Qualification Summary - SDG 124700/FA40279/FA40351

No Sample Data Qualified in this SDG

LDC #: 38427A87 **VALIDATION COMPLETENESS WORKSHEET** Date: 4/21/17
SDG #: 124700/FA40279/FA40351 Stage 2B Page: 1 of 1
Laboratory: CT Laboratories/Accutest Reviewer: JM
2nd Reviewer: CL

METHOD: LC/MS Perchlorate (EPA SW846 Method 6850)

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	Not reqd.
III.	Initial calibration/ICV	A/A	ICAL = r ICV ≤ 152
IV.	Continuing calibration	A	CCV ≤ 152
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	R = 3
VII.	Surrogate spikes	N	Not reqd.
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	
X.	Field duplicates	SW	D = 5/6
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
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		Subcon ID	Lab ID	Matrix	Date
1	54MW10		FA40279-1	826235	Water	01/09/17
2	54MW13		-2	826237	Water	01/09/17
3	010917R1		-3	826239	Water	01/09/17
4	54MW1		FA40351-1	826629	Water	01/10/17
5	54MW12	D	-2	826637	Water	01/10/17
6	54TM12	D	-3	826639	Water	01/10/17
7	54MW10MS		FA40279-1MS	826235MS	Water	01/09/17
8	54MW10MSD		-MSD	826235MSD	Water	01/09/17
9						
10						
11	OP63460-MB					
12						
13						

LODV = Lowest ICAL

LDC#: 38427A87

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer:

METHOD: LCMS Perchlorate (EPA SW 846 Method 6850)

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 (≤20%)	Qualifications (Parent only)
	5	6		
Perchlorate	2.9	2.9	0	

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Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Radford Army Ammunition Plant, VA

LDC Report Date: May 3, 2017

Parameters: Volatiles

Validation Level: Stage 2B

Laboratory: Curtis & Tompkins, Ltd.

Sample Delivery Group (SDG): 124775

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
48MW07	827098	Water	01/11/17
49TM1	827101	Water	01/11/17
48MW06	827103	Water	01/11/17
48MW1	827105	Water	01/11/17
49MW04	827107	Water	01/11/17
49MW05	827109	Water	01/11/17
011117T1	827111	Water	01/11/17
49MW03	827474	Water	01/12/17
49MW01	827481	Water	01/12/17
50MW02	827490	Water	01/12/17
011217R1	827498	Water	01/12/17
011217T1	827500	Water	01/12/17
48MW2	827762	Water	01/13/17
48MW3	827764	Water	01/13/17
49MW02	827766	Water	01/13/17
13MW5	827768	Water	01/13/17
13MW4	827770	Water	01/13/17
13MW3	827772	Water	01/13/17
0113171T1	827774	Water	01/13/17
13MW2	827776	Water	01/13/17
48MW2MS	827762MS	Water	01/13/17
48MW2MSD	827762MSD	Water	01/13/17

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 SWMU 49 Monitored Natural Attenuation Ground Monitoring Work Plan for Radford Army Ammunition Plant, Virginia (October 2014), 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 (October 2013). 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 8260C

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

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.

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 with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
01/17/17	Bromoform	25.11	All samples in SDG 124775	UJ (all non-detects)	A

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 011117T1, 011217T1, and 0113171T1 were identified as trip blanks. No contaminants were found.

Sample 011217R1 was identified as a rinsate. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
011217R1	01/12/17	Acetone Chloroform Methylene chloride	14 ug/L 0.51 ug/L 0.61 ug/L	49MW03 49MW01 50MW02

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater (>10X for common contaminants, >5X for other contaminants) than the concentrations found in the associated field blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
49MW01	Chloroform	0.36 ug/L	0.50U ug/L
50MW02	Chloroform	0.16 ug/L	0.50U 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

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.

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 48MW07 and 49TM1 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 compounds reported below the limit of quantitation (LOQ) and above the method detection limit (MDL) were qualified as follows:

Sample	Compound	Flag	A or P
All samples in SDG 124775	All compounds reported below the LOQ and above the MDL.	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. 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 and results below the LOQ and above the MDL, data were qualified as estimated in twenty samples.

Due to rinsate contamination, data were qualified as not detected in two 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.

Radford Army Ammunition Plant, VA
Volatiles - Data Qualification Summary - SDG 124775

Sample	Compound	Flag	A or P	Reason
48MW07 49TM1 48MW06 48MW1 49MW04 49MW05 011117T1 49MW03 49MW01 50MW02 011217R1 011217T1 48MW2 48MW3 49MW02 13MW5 13MW4 13MW3 0113171T1 13MW2	Bromoform	UJ (all non-detects)	A	Continuing calibration (%D)
48MW07 49TM1 48MW06 48MW1 49MW04 49MW05 011117T1 49MW03 49MW01 50MW02 011217R1 011217T1 48MW2 48MW3 49MW02 13MW5 13MW4 13MW3 0113171T1 13MW2	All compounds reported below the LOQ and above the MDL.	J (all detects)	A	Compound quantitation

Radford Army Ammunition Plant, VA
Volatiles - Laboratory Blank Data Qualification Summary - SDG 124775

No Sample Data Qualified in this SDG

Radford Army Ammunition Plant, VA
Volatiles - Field Blank Data Qualification Summary - SDG 124775

Sample	Compound	Modified Final Concentration	A or P
49MW01	Chloroform	0.50U ug/L	A

Sample	Compound	Modified Final Concentration	A or P
50MW02	Chloroform	0.50U ug/L	A

LDC #: 38427B1 **VALIDATION COMPLETENESS WORKSHEET** Date: 04/21/17
SDG #: 124775 Stage 2B Page: 1 of 2
Laboratory: CT Laboratories Reviewer: JW
2nd Reviewer: [signature]

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

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	SW	CCV ≤ 20 %
V.	Laboratory Blanks	A	
VI.	Field blanks	SW	*TB = 7, 12, 19 R = 11
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	ND	D = 1/2
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
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	48MW07	D	827098	Water	01/11/17
2	49TM1	D	827101	Water	01/11/17
3	48MW06		827103	Water	01/11/17
4	48MW1		827105	Water	01/11/17
5	49MW04		827107	Water	01/11/17
6	49MW05		827109	Water	01/11/17
7	011117T1		827111	Water	01/11/17
8	49MW03		827474	Water	01/12/17
9	49MW01		827481	Water	01/12/17
10	50MW02		827490	Water	01/12/17
11	011217R1		827498	Water	01/12/17
12	011217T1		827500	Water	01/12/17
13	48MW2		827762	Water	01/13/17

LDC #: 38427B1 **VALIDATION COMPLETENESS WORKSHEET** Date: 04/21/17

SDG #: 124775 Stage 2B Page: 1 of 2

Laboratory: CT Laboratories Reviewer: MB

2nd Reviewer:

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

	Client ID	Lab ID	Matrix	Date
+ 14	48MW3	827764	Water	01/13/17
- 15	49MW02	827766	Water	01/13/17
- 16	13MW5	827768	Water	01/13/17
+ 17	13MW4	827770	Water	01/13/17
+ 18	13MW3	827772	Water	01/13/17
- 19	0113171T1	827774	Water	01/13/17
- 20	13MW2	827776	Water	01/13/17
21	48MW2MS	827762MS	Water	01/13/17
22	48MW2MSD	827762MSD	Water	01/13/17
23				
24				
25				
26				
27				

Notes:

-	134391 MB						

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 #: 38427B1

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Reviewer: JVG
2nd Reviewer:

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

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

Y N N/A Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?
Y N N/A Were percent differences (%D) and relative response factors (RRF) within method criteria for all CCC's and SPCC's ?
Y N N/A Were all %D and RRFs within the validation criteria of ≤20 %D and ≥0.05 RRF ?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤20.0%)	Finding RRF (Limit: ≥0.05)	Associated Samples	Qualifications
	01/17/17	CCV-LCS1	X	25.11		All (ND)	J/UJ/A

LDC #: 38427 B1

VALIDATION FINDINGS WORKSHEET
Field Blanks

Reviewer: JVG
2nd Reviewer:

METHOD: GC/MS VOA (EPA SW 846 Method 8260C)
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: 01/12/17
Field blank type: (circle one) Field Blank / Rinsate / Trip Blank / Other: Associated Samples: 8-10

Compound	Blank ID	Sample Identification								
	11		9	10						
F	14									
k	0.51		0.36/0.50U	0.16/0.50U						
E	0.61									

Blank units: **Associated sample units:**
Sampling date:
Field blank type: (circle one) Field Blank / Rinsate / Trip Blank / Other: Associated Samples:

Compound	Blank ID	Sample Identification								

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".

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Radford Army Ammunition Plant, VA

LDC Report Date: May 3, 2017

Parameters: Metals

Validation Level: Stage 2B

Laboratory: Curtis & Tompkins, Ltd.

Sample Delivery Group (SDG): 124775

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
49ADW01	827780	Water	01/13/17
49ADW01MS	827780MS	Water	01/13/17
49ADW01MSD	827780MSD	Water	01/13/17
49ADW01DUP	827780DUP	Water	01/13/17

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 SWMU 49 Monitored Natural Attenuation Ground Monitoring Work Plan for Radford Army Ammunition Plant, Virginia (October 2014), 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, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, and Zinc by Environmental Protection Agency (EPA) SW 846 Method 6010C
Mercury by EPA SW 846 Method 7470A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

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. 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.

III. ICP Interference Check Sample Analysis

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

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
ICB/CCB	Aluminum Magnesium Potassium Sodium	8.44 ug/L 17.70 ug/L 185 ug/L 120 ug/L	All samples in SDG 124775
PB (prep blank)	Aluminum Calcium Iron Magnesium Manganese Zinc Potassium	8.02 ug/L 65.10 ug/L 19.70 ug/L 13.20 ug/L 0.762 ug/L 2.29 ug/L 129 ug/L	All samples in SDG 124775

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 (>5X blank contaminants) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
49ADW01	Aluminum Manganese Zinc	27.8 ug/L 1.3 ug/L 5.7 ug/L	27.8U ug/L 2.0U ug/L 5.7U 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. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
49ADW01MS/MSD (49ADW01)	Mercury	175 (80-120)	190 (80-120)	NA	-
49ADW01MS/MSD (49ADW01)	Silver	79 (80-120)	-	UJ (all non-detects)	A

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. Serial Dilution

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

Diluted Sample	Analyte	%D (Limits)	Associated Samples	Flag	A or P
49ADW01	Calcium	42 (≤10)	49ADW01	J (all detects)	A

IX. Laboratory Control Samples

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

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Sample Result Verification

All analytes reported below the limit of quantitation (LOQ) and above the method detection limit (MDL) were qualified as follows:

Sample	Analyte	Flag	A or P
All samples in SDG 124775	All analytes reported below the LOQ and above the MDL.	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

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

Due to MS/MSD %R, serial dilution %D, and results below the LOQ and above the MDL, data were qualified as estimated in one sample.

Due to laboratory blank contamination, data were qualified as not detected in one sample.

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.

Radford Army Ammunition Plant, VA
Metals - Data Qualification Summary - SDG 124775

Sample	Analyte	Flag	A or P	Reason
49ADW01	Silver	UJ (all non-detects)	A	Matrix spike/Matrix spike duplicate (%R)
49ADW01	Calcium	J (all detects)	A	Serial dilution (%D)
49ADW01	All analytes reported below the LOQ and above the MDL.	J (all detects)	A	Sample result verification

Radford Army Ammunition Plant, VA
Metals - Laboratory Blank Data Qualification Summary - SDG 124775

Sample	Analyte	Modified Final Concentration	A or P
49ADW01	Aluminum Manganese Zinc	27.8U ug/L 2.0U ug/L 5.7U ug/L	A

Radford Army Ammunition Plant, VA
Metals - Field Blank Data Qualification Summary - SDG 124775

No Sample Data Qualified in this SDG

LDC #: 38427B4b
SDG #: 124775
Laboratory: CT Laboratories

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 04/19/17
Page: 1 of 1
Reviewer: ATL
2nd Reviewer:

METHOD: Metals (EPA SW 846 Method 6010C/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.	Instrument Calibration	A	
III.	ICP Interference Check Sample (ICS) Analysis	A	
IV.	Laboratory Blanks	SW	
V.	Field Blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	SW	
VII.	Duplicate sample analysis	~~SW~~ A	
VIII.	Serial Dilution	~~A~~ SW	
IX.	Laboratory control samples	A	LCS
X.	Field Duplicates	N	
XI.	Sample Result Verification	N	
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	49ADW01	827780	Water	01/13/17
2	49ADW01MS	827780MS	Water	01/13/17
3	49ADW01MSD	827780MSD	Water	01/13/17
4	49ADW01DUP	827780DUP	Water	01/13/17
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				

Notes:

LDC #: 38427B4b

VALIDATION FINDINGS WORKSHEET
Sample Specific Element Reference

Reviewer: ATL
2nd reviewer: C

All circled elements are applicable to each sample.

Sample ID	Matrix	Target Analyte List (TAL)
1	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, ___
2,3,4	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, ___
		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 #: 38427B4b

VALIDATION FINDINGS WORKSHEET
PB/ICB/CCB QUALIFIED SAMPLES

Reviewer: ATL
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

Analyte	Maximum PB[a] (mg/Kg)	Maximum PB[a] (ug/L)	Maximum ICB/CCB[a] (ug/L)	Action Level	1								
Al			8.44	42.2	27.8								
Mg			17.70	88.5									
K			185	925									
Na			120	600									

Sample Concentration units, unless otherwise noted: ug/L
Associated Samples: All

Analyte	Maximum PB[a] (mg/Kg)	Maximum PB[a] (ug/L)	Maximum ICB/CCB[a] (ug/L)	Action Level	1								
Al		8.02		40.1	27.8								
Ca		65.10		325.5									
Fe		19.70		98.5									
Mg		13.20		66									
Mn		0.762		3.81	1.3 /2.0 U								
Zn		2.29		11.45	5.7								
K		129		645									

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 #: 38427B4b

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Reviewer: ATL
2nd Reviewer:

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

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

Y N N/A Was a matrix spike analyzed for each matrix in this SDG?

Y N N/A Were matrix spike percent recoveries (%R) within the control limits of 75-125? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.

Y N N/A Were all duplicate sample relative percent differences (RPD) ≤ 20% for samples?

LEVEL IV ONLY:

Y N N/A Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	MS/MSD ID	Matrix	Analyte	MS %Recovery	MSD %Recovery	RPD (Limits)	Associated Samples	Qualifications
	2/3	W	Hg	175 (80-120)	190 (80-120)		1	~~J/UJ/A~~ (non-detect) ~~Jdet/A~~ ~~Jdet/A~~
	2/3	W	Ag	79 (80-120)			1	~~J/UJ/A~~ (non-detect) ~~J/UJ/A~~

Comments:

LDC #:38427B4b

VALIDATION FINDINGS WORKSHEET
ICP Serial Dilution

Reviewer: ATL
2nd Reviewer:

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

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

Y N N/A If analyte concentrations were > 50X the MDL (ICP) ,or >100X the MDL (ICP/MS), was a serial dilution analyzed?
Y N N/A Were ICP serial dilution percent differences (%D) ≤10%?
Y N N/A Is there evidence of negative interference? If yes, professional judgement will be used to qualify the data.

LEVEL IV ONLY:

Y N N/A Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	Diluted Sample ID	Matrix	Analyte	%D (Limits)	Associated Samples	Qualifications
	1	W	Ca	42 (10)	1	J/UJ/A (detect)

Comments:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Radford Army Ammunition Plant, VA

LDC Report Date: May 4, 2017

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: Curtis & Tompkins, Ltd.

Sample Delivery Group (SDG): 124775

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
48MW07	827098	Water	01/11/17
48MW07	827099	Water	01/11/17
49TM1	827101	Water	01/11/17
49TM1	827102	Water	01/11/17
48MW06	827103	Water	01/11/17
48MW06	827104	Water	01/11/17
48MW1	827105	Water	01/11/17
48MW1	827106	Water	01/11/17
49MW04	827107	Water	01/11/17
49MW04	827108	Water	01/11/17
49MW05	827109	Water	01/11/17
49MW05	827110	Water	01/11/17
49MW03	827474	Water	01/12/17
49MW03	827477	Water	01/12/17
49MW01	827481	Water	01/12/17
49MW01	827488	Water	01/12/17
50MW02	827490	Water	01/12/17
50MW02	827497	Water	01/12/17
011217R1	827498	Water	01/12/17
011217R1	827499	Water	01/12/17
48MW2	827762	Water	01/13/17
48MW2	827763	Water	01/13/17
48MW3	827764	Water	01/13/17
48MW3	827765	Water	01/13/17
49MW02	827766	Water	01/13/17
49MW02	827767	Water	01/13/17

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
13MW5	827768	Water	01/13/17
13MW5	827769	Water	01/13/17
13MW4	827770	Water	01/13/17
13MW4	827771	Water	01/13/17
13MW3	827772	Water	01/13/17
13MW3	827773	Water	01/13/17
13MW2	827776	Water	01/13/17
13MW2	827777	Water	01/13/17
49ADW01	827780	Water	01/13/17
49MW05MS	827110MS	Water	01/11/17
49MW05MSD	827110MSD	Water	01/11/17
49MW05DUP	827110DUP	Water	01/11/17
48MW2MS	827762MS	Water	01/13/17
48MW2MSD	827762MSD	Water	01/13/17
48MW2DUP	827762DUP	Water	01/13/17
48MW2MS	827763MS	Water	01/13/17
48MW2MSD	827763MSD	Water	01/13/17
48MW2DUP	827763DUP	Water	01/13/17
49ADW01DUP	827780DUP	Water	01/13/17

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 SWMU 49 Monitored Natural Attenuation Ground Monitoring Work Plan for Radford Army Ammunition Plant, Virginia (October 2014), 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:

Chloride, Sulfate, and Nitrate as Nitrogen by Environmental Protection Agency (EPA) SW 846 Method 9056A
Chemical Oxygen Demand by EPA Method 410.1
pH by EPA SW 846 Method 9040C
Total Organic Carbon by EPA SW 846 Method 9060A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

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
49ADW01	pH	7 days	48 hours	J (all detects)	P
49MW03 (827477) 48MW2 (827763) 48MW3 (827765) 49MW02 (827767) 13MW5 (827769) 13MW4 (827771) 13MW3 (827773) 13MW2 (827777)	Nitrate as N	5 days	48 hours	J (all detects)	P
49MW01 (827488) 50MW02 (827497)	Nitrate as N	6 days	48 hours	J (all detects)	P
011217R1 (827499)	Nitrate as N	6 days	48 hours	R (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	2.017 mg/L	48MW06 (827104) 49MW05 (827110)

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 (>5X blank contaminants) than the concentrations found in the associated laboratory blanks.

V. Field Blanks

Samples 011217R1 (827498) and 011217R1 (827499) were identified as rinsates. No contaminants were found.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. For 49MW05 (827110)MS/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) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples 48MW07 and 49TM1 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/L)		RPD (Limits)	Flag	A or P
	48MW07 (827098)	49TM1 (827101)			
Chloride	1.8	1.9	5 (≤25)	-	-
Nitrate as N	1.2	1.2	0 (≤25)	-	-
Sulfate	2.4	2.4	0 (≤25)	-	-

Analyte	Concentration (mg/L)		RPD (Limits)	Flag	A or P
	48MW07 (827099)	49TM1 (827102)			
Total organic carbon	6.0	0.96	145 (≤25)	J (all detects)	A

X. Sample Result Verification

All analytes reported below the limit of quantitation (LOQ) and above the method detection limit (MDL) were qualified as follows:

Sample	Analyte	Flag	A or P
All samples in SDG 124775	All analytes reported below the LOQ and above the MDL.	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods.

Due to technical holding time, data were rejected in one sample.

Due to technical holding time, field duplicate RPD, and results below the LOQ and above the MDL, data were qualified as estimated in thirty-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 rejected (R) are unusable for all purposes. 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.

Radford Army Ammunition Plant, VA
Wet Chemistry - Data Qualification Summary - SDG 124775

Sample	Analyte	Flag	A or P	Reason
49ADW01	pH	J (all detects)	P	Technical holding times
49MW03 (827477) 48MW2 (827763) 48MW3 (827765) 49MW02 (827767) 13MW5 (827769) 13MW4 (827771) 13MW3 (827773) 13MW2 (827777) 49MW01 (827488) 50MW02 (827497)	Nitrate as N	J (all detects)	P	Technical holding times
011217R1 (827499)	Nitrate as N	R (all non-detects)	P	Technical holding times
48MW07 (827099) 49TM1 (827102)	Total organic carbon	J (all detects)	A	Field duplicates (RPD)
48MW07 48MW07 49TM1 49TM1 48MW06 48MW06 48MW1 48MW1 49MW04 49MW04 49MW05 49MW05 49MW03 49MW03 49MW01 49MW01 50MW02 50MW02 011217R1 011217R1 48MW2 48MW2 48MW3 48MW3 49MW02 49MW02 13MW5 13MW5 13MW4 13MW4 13MW3 13MW3 13MW2 13MW2 49ADW01	All analytes reported below the LOQ and above the MDL.	J (all detects)	A	Sample result verification

Radford Army Ammunition Plant, VA
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 124775

No Sample Data Qualified in this SDG

Radford Army Ammunition Plant, VA
Wet Chemistry - Field Blank Data Qualification Summary - SDG 124775

No Sample Data Qualified in this SDG

LDC #: 38427B6
SDG #: 124775
Laboratory: CT Laboratories

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 04/19/17
Page: 1 of 2
Reviewer: ATL
2nd Reviewer: [signature]

METHOD: (Analyte) Chloride, Nitrate-N, Sulfate (EPA SW846 Method 9056A), COD (EPA Method 410.1), pH (EPA SW846 Method 9040C), TOC (EPA SW846 Method 9060A)

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	SW	19,20, ~~35~~ = rinsate ; ~~35 = purge water~~
VI.	Matrix Spike/Matrix Spike Duplicates	A	36,37 SO4 > 4X
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	(1,3) & (2,4)
X.	Sample result verification	N	
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 X	48MW07	827098	Water	01/11/17
2 X	48MW07	827099	Water	01/11/17
3 X	49TM1	827101	Water	01/11/17
4 X	49TM1	827102	Water	01/11/17
5	48MW06	827103	Water	01/11/17
6	48MW06	827104	Water	01/11/17
7	48MW1	827105	Water	01/11/17
8	48MW1	827106	Water	01/11/17
9	49MW04	827107	Water	01/11/17
10	49MW04	827108	Water	01/11/17
11	49MW05	827109	Water	01/11/17
12	49MW05	827110	Water	01/11/17
13	49MW03	827474	Water	01/12/17
14	49MW03	827477	Water	01/12/17
15	49MW01	827481	Water	01/12/17
16	49MW01	827488	Water	01/12/17

LDC #: 38427B6
SDG #: 124775
Laboratory: CT Laboratories

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 04/19/17

Reviewer: ATV
2nd Reviewer: CA

METHOD: (Analyte) Chloride, Nitrate-N, Sulfate (EPA SW846 Method 9056A), COD (EPA Method 410.1), pH (EPA SW846 Method 9040C), TOC (EPA SW846 Method 9060A)

	Client ID	Lab ID	Matrix	Date
17	50MW02	827490	Water	01/12/17
18	50MW02	827497	Water	01/12/17
19	011217R1	827498	Water	01/12/17
20	011217R1	827499	Water	01/12/17
21	48MW2	827762	Water	01/13/17
22	48MW2	827763	Water	01/13/17
23	48MW3	827764	Water	01/13/17
24	48MW3	827765	Water	01/13/17
25	49MW02	827766	Water	01/13/17
26	49MW02	827767	Water	01/13/17
27	13MW5	827768	Water	01/13/17
28	13MW5	827769	Water	01/13/17
29	13MW4	827770	Water	01/13/17
30	13MW4	827771	Water	01/13/17
31	13MW3	827772	Water	01/13/17
32	13MW3	827773	Water	01/13/17
33	13MW2	827776	Water	01/13/17
34	13MW2	827777	Water	01/13/17
35	49ADW01	827780	Water	01/13/17
36	49MW05MS	827110MS	Water	01/11/17
37	49MW05MSD	827110MSD	Water	01/11/17
38	49MW05DUP	827110DUP	Water	01/11/17
39	48MW2MS	827762MS	Water	01/13/17
40	48MW2MSD	827762MSD	Water	01/13/17
41	48MW2DUP	827762DUP	Water	01/13/17
42	48MW2MS	827763MS	Water	01/13/17
43	48MW2MSD	827763MSD	Water	01/13/17
44	48MW2DUP	827763DUP	Water	01/13/17
45	49ADW01	827780DUP		
46				
47				
48				

Notes:

LDC #: 38427B6

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Reviewer: ATL
2nd reviewer: Q

All circled methods are applicable to each sample.

Sample ID	Parameter
35	**pH** TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 **COD**
1,3,5,7,9,11	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN **TOC** Cr6+ ClO_4
13,15,17,19	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN **TOC** Cr6+ ClO_4
21,23,25	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN **TOC** Cr6+ ClO_4
27,29,31,33	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN **TOC** Cr6+ ClO_4
2,4,6,8,10	pH TDS **Cl** F **NO_3** NO_2 **SO_4** O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
12,14,16,18	pH TDS **Cl** F **NO_3** NO_2 **SO_4** O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
20,22,24	pH TDS **Cl** F **NO_3** NO_2 **SO_4** O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
26,28,30	pH TDS **Cl** F **NO_3** NO_2 **SO_4** O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
32,34	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
QC	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
36,37,38	pH TDS **Cl** F **NO_3** NO_2 **SO_4** O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
42,43,44	pH TDS **Cl** F **NO_3** NO_2 **SO_4** O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
39,40,41	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN **TOC** Cr6+ ClO_4
45	**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:

)C #: 384278G

VALIDATION FINDINGS WORKSHEET
Technical Holding Times

Reviewer: ATL
2nd reviewer: a

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

Method:	NO3-N Method 9056A				pH Method 9040C		
Parameters:	water				water		
Technical holding time:	~~2days~~ 48hrs				~~analyse ASAP~~ 48hrs		
Sample ID	Sampling date	Analysis date	Total Time	Qualifier	Analysis date	Total Time	Qualifier
35	01/13/17			J/R/P	01/20/17	7days	J/UJ/P (detect)
14	01/12/17	01/17/17	5days	J/R/P (detect)			
16	↓	01/18/17	6days	J/R/P (detect)			
18		↓	↓	J/R/P (detect)			
20	↓			J/R/P (non-detect)			
22	01/13/17		5days	J/R/P (detect)			
24	↓		↓	J/R/P (detect)			
26				J/R/P (detect)			
28				J/R/P (detect)			
30				J/R/P (detect)			
32				J/R/P (detect)			
34	↓	↓	↓	J/R/P (detect)			

LDC #: 38427B6

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: ATL
2nd Reviewer:

METHOD: Inorganics, Method See Cover

Conc. units: mg/L **Associated Samples:** 6, 12

Analyte	Blank ID	Blank ID	Blank Action Limit									
	PB mg/L	ICB/CCB (mg/L)										
SO4		2.017	10.085									

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# 38427B6

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: ATL
2nd Reviewer:

Inorganics: Method See Cover

Analyte	Concentration (mg/L)		RPD (~~≤20~~ ≤25)	QUALIFIER
	2	4		
Cl	1.8	1.9	5	
NO3-N	1.2	1.2	0	
SO4	2.4	2.4	0	

Analyte	Concentration (mg/L)		RPD (~~≤20~~ ≤25)	QUALIFIER
	1	3		
TOC	6.0	0.96	145	J/UJ/A

V:\FIELD DUPLICATES\FD_inorganic\38427B6.wpd

LDC Report# 38427B51

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Radford Army Ammunition Plant, VA

LDC Report Date: May 3, 2017

Parameters: Methane, Ethane, & Ethene

Validation Level: Stage 2B

Laboratory: Curtis & Tompkins, Ltd.

Sample Delivery Group (SDG): 124775

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
48MW07	827098	Water	01/11/17
49TM1	827101	Water	01/11/17
48MW06	827103	Water	01/11/17
48MW1	827105	Water	01/11/17
49MW04	827107	Water	01/11/17
49MW05	827109	Water	01/11/17
49MW03	827474	Water	01/12/17
49MW01	827481	Water	01/12/17
50MW02	827490	Water	01/12/17
011217R1	827498	Water	01/12/17
48MW2	827762	Water	01/13/17
48MW3	827764	Water	01/13/17
49MW02	827766	Water	01/13/17
13MW5	827768	Water	01/13/17
13MW4	827770	Water	01/13/17
13MW3	827772	Water	01/13/17
13MW2	827776	Water	01/13/17
48MW2MS	827762MS	Water	01/13/17
48MW2MSD	827762MSD	Water	01/13/17

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 SWMU 49 Monitored Natural Attenuation Ground Monitoring Work Plan for Radford Army Ammunition Plant, Virginia (October 2014), 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 (October 2013). 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:

Methane, Ethane, and Ethene by Method RSK-175

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

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.

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.

IV. Laboratory Blanks

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

V. Field Blanks

Sample 011217R1 was identified as a rinsate. No contaminants were found.

VI. 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.

VII. Laboratory Control Samples

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

VIII. Field Duplicates

Samples 48MW07 and 49TM1 were identified as field duplicates. No results were detected in any of the samples.

IX. Compound Quantitation

All compounds reported below the limit of quantitation (LOQ) and above the method detection limit (MDL) were qualified as follows:

Sample	Compound	Flag	A or P
All samples in SDG 124775	All compounds reported below the LOQ and above the MDL.	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

X. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

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

Due to results below the LOQ and above the MDL, data were qualified as estimated in seventeen 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.

Radford Army Ammunition Plant, VA
Methane, Ethane, & Ethene - Data Qualification Summary - SDG 124775

Sample	Analyte	Flag	A or P	Reason
48MW07 49TM1 48MW06 48MW1 49MW04 49MW05 49MW03 49MW01 50MW02 011217R1 48MW2 48MW3 49MW02 13MW5 13MW4 13MW3 13MW2	All compounds reported below the LOQ and above the MDL.	J (all detects)	A	Compound quantitation

Radford Army Ammunition Plant, VA
Methane, Ethane, & Ethene - Laboratory Blank Data Qualification Summary - SDG 124775

No Sample Data Qualified in this SDG

Radford Army Ammunition Plant, VA
Methane, Ethane, & Ethene - Field Blank Data Qualification Summary - SDG 124775

No Sample Data Qualified in this SDG

LDC #: 38427B51 **VALIDATION COMPLETENESS WORKSHEET** Date: 04/21/17
SDG #: 124775 Stage 2B Page: 1 of 2
Laboratory: CT Laboratories Reviewer: JVC
2nd Reviewer: CT

METHOD: GC Methane-Ethane-Ethene (Method RSK-175)

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 = r² ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	ND	~~FB~~ R = 10
VI.	Matrix spike/Matrix spike duplicates	A	
VII.	Laboratory control samples	A	
VIII.	Field duplicates	ND	D = 1/2
IX.	Compound quantitation RL/LOQ/LODs	N	
X.	Target compound identification	N	
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	48MW07	D	827098	Water	01/11/17
2	49TM1	b	827101	Water	01/11/17
3	48MW06		827103	Water	01/11/17
4	48MW1		827105	Water	01/11/17
5	49MW04		827107	Water	01/11/17
6	49MW05		827109	Water	01/11/17
7	49MW03		827474	Water	01/12/17
8	49MW01		827481	Water	01/12/17
9	50MW02		827490	Water	01/12/17
10	011217R1		827498	Water	01/12/17
11	48MW2		827762	Water	01/13/17
12	48MW3		827764	Water	01/13/17
13	49MW02		827766	Water	01/13/17
14	13MW5		827768	Water	01/13/17
15	13MW4		827770	Water	01/13/17
16	13MW3		827772	Water	01/13/17
17	13MW2		827776	Water	01/13/17
18	48MW2MS		827762MS	Water	01/13/17

LDC #: 38427B51 **VALIDATION COMPLETENESS WORKSHEET** Date: 04/21/17

SDG #: 124775 Stage 2B Page: 2 of 7

Laboratory: CT Laboratories Reviewer: JVC

2nd Reviewer:

METHOD: GC Methane-Ethane-Ethene (Method RSK-175)

	Client ID	Lab ID	Matrix	Date
19	48MW2MSD	827762MSD	Water	01/13/17
20				
21				
22				
23				
24				

Notes:

—	134544 MB						

LDC #: 38427

EDD POPULATION COMPLETENESS WORKSHEET

Date: 5/5/17
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?	y*	Js
IIb.	- Reason Codes used? If so, note which codes.	N	
IIc.	- Additional Information (QC Level, Validator, Validated Y/N, etc.)	y	highlight detects
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/NA	
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/NA	
IIIg.	-Are there any discrepancies between the data packet and the EDD?	N	

Notes: *see discrepancy sheet

LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

Bering Sea Environmental, LLC
ATTN: Ms. S. Julia Liu, P.E.

June 22, 2017

SUBJECT: Radford Army Ammunition Plant, VA, Data Validation

Dear Ms. Julia Liu,

Enclosed are the final validation reports for the fractions listed below. These SDGs were received on May 30, 2017. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #38805:

SDG #	Fraction
126485/126534/FA43019/FA43028 126533/12611/126555	Volatiles, Metals, Explosives, Methane, Ethane, & Ethene, Wet Chemistry, Perchlorate

The data validation was performed under Stage 2B validation guidelines. The analyses were validated using the following documents and variances, as applicable to each method:

- SWMU 54, RAAP-14, Monitored Natural Attenuation Interim Measures Work Plan for Radford Army Ammunition Plant, Virginia, April 2011
- 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, October 2013
- 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

3,108 pages SF

Attachment 1

EDD Stage 2B **LDC #38805 (Bering Sea Environmental-Anchorage, AK / Radford Army Ammunition Plant, VA)**

LDC	SDG#	DATE REC'D	(3) DATE DUE	VOA (8260C)		Metals (6010C /7470A)		Expl. (8330B)		Methane Ethane Ethene		CLO_4 (6850)		Cl,SO_4 NO_3-N (9056A)		Chlorate Chlorite (300.1)		COD (410.4)		pH (9040C)		TIC (9060A)		TOC (9060A)													
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	W	S
A	126485/126534 FA43019/FA43028	05/30/17	06/20/17	-	-	-	-	6	0	-	-	6	0	6	0	3	0	-	-	-	-	6	0	6	0												
B	126533/12611/ 126555	05/30/17	06/20/17	16	0	2	0	-	-	13	0	-	-	13	0	-	-	2	0	2	0	-	-	13	0												
Total	T/PG			16	0	2	0	6	0	13	0	6	0	19	0	3	0	2	0	2	0	6	0	19	0	0	0	0	0	0	0	0	0	0	0	0	94

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

L:\Bering Sea Group\Radford\38805ST.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Radford Army Ammunition Plant, VA

LDC Report Date: June 20, 2017

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: CT Laboratories/Eurofins

Sample Delivery Group (SDG): 126485/126534

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
54MW10	852429	Water	04/10/17
54MW10	852435	Water	04/10/17
54TM10	852439	Water	04/10/17
54TM10	852440	Water	04/10/17
54MW13	852441	Water	04/10/17
54MW13	852442	Water	04/10/17
54MW12	853081/3673421	Water	04/11/17
54MW12	853082	Water	04/11/17
54MW1	853083/3673422	Water	04/11/17
54MW1	853084	Water	04/11/17
041117R1	853085/3673423	Water	04/11/17
041117R1	853086	Water	04/11/17
54MW12MS	853081MS	Water	04/11/17
54MW12MSD	853081MSD	Water	04/11/17
54MW12DUP	853081DUP	Water	04/11/17
54MW12MS	853082MS	Water	04/11/17
54MW12MSD	853082MSD	Water	04/11/17
54MW12DUP	853082DUP	Water	04/11/17
54MW10MS	852435MS	Water	04/10/17
54MW10MSD	852435MSD	Water	04/10/17
54MW10DUP	852435DUP	Water	04/10/17

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 SWMU 54 (RAAP-14) Monitored Natural Attenuation Interim Measures Work Plan for Radford Army Ammunition Plant, Virginia (April 2011), 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:

Chloride, Sulfate, and Nitrate as Nitrogen by Environmental Protection Agency (EPA) SW 846 Method 9056A
Chlorate and Chlorite by EPA Method 300.1
Total Inorganic Carbon and Total Organic Carbon by EPA SW 846 Method 9060A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

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. 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.

V. Field Blanks

Samples 041117R1 (853085/3673423) and 041117R1 (853086) were identified as rinsates. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Analyte	Concentration	Associated Samples
041117R1 (853085/3673423)	04/11/17	Total organic carbon	0.54 mg/L	54MW12 (853081/3673421) 54MW1 (853083/3673422)

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated field blanks.

VI. 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 with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
54MW10 (852435)MS/MSD (54MW10 (852435) 54TM10 (852440) 54MW13 (852442))	Chloride	79 (80-120)	65 (80-120)	J (all detects)	A

For 54MW12 (853082)MS/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) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples 54MW10 and 54TM10 identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/L)		RPD (Limits)	Flag	A or P
	54MW10 (852429)	54TM10 (852439)			
Total organic carbon	6.9	5.5	23 (≤25)	-	-

Analyte	Concentration (mg/L)		RPD (Limits)	Flag	A or P
	54MW10 (852435)	54TM10 (852440)			
Chloride	6.4	6.3	2 (≤25)	-	-
Sulfate	65	65	0 (≤25)	-	-
Nitrate as N	0.30	0.29	3 (≤25)	-	-

X. Sample Result Verification

All analytes reported below the limit of quantitation (LOQ) and above the method detection limit (MDL) were qualified as follows:

Sample	Analyte	Flag	A or P
All samples in SDG 126485/126534	All analytes reported below the LOQ and above the MDL.	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

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

Due to MS/MSD %R and results below the LOQ and above the MDL, data were qualified as estimated in twelve 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.

Radford Army Ammunition Plant, VA
Wet Chemistry - Data Qualification Summary - SDG 126485/126534

Sample	Analyte	Flag	A or P	Reason
54MW10 (852435) 54TM10 (852440) 54MW13 (852442)	Chloride	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
54MW10 54MW10 54TM10 54TM10 54MW13 54MW13 54MW12 54MW12 54MW1 54MW1 041117R1 041117R1	All analytes reported below the LOQ and above the MDL.	J (all detects)	A	Sample result verification

Radford Army Ammunition Plant, VA
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 126485/126534

No Sample Data Qualified in this SDG

Radford Army Ammunition Plant, VA
Wet Chemistry - Field Blank Data Qualification Summary - SDG 126485/126534

No Sample Data Qualified in this SDG

LDC #: 38805A6 **VALIDATION COMPLETENESS WORKSHEET** Date: 06/14/17
SDG #: 126485/126534 Stage 2B Page: 1 of 2
Laboratory: CT Laboratories/Eurofins Reviewer: ATL
2nd Reviewer: [illegible]

METHOD: (Analyte) Chloride, Nitrate-N, Sulfate (EPA SW846 Method 9056A), Chlorate, Chlorite (EPA Method 300.1), TIC, TOC (EPA SW846 Method 9060A)

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	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	A	
V	Field blanks	SW	11/12 = rinsate
VI.	Matrix Spike/Matrix Spike Duplicates	SW	
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	(1,3), (2,4)
X.	Sample result verification	N	
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	54MW10	852429	Water	04/10/17
2	54MW10	852435	Water	04/10/17
3	54TM10	852439	Water	04/10/17
4	54TM10	852440	Water	04/10/17
5	54MW13	852441	Water	04/10/17
6	54MW13	852442	Water	04/10/17
7	54MW12	853081/3673421	Water	04/11/17
8	54MW12	853082	Water	04/11/17
9	54MW1	853083/3673422	Water	04/11/17
10	54MW1	853084	Water	04/11/17
11	041117R1	853085/3673423	Water	04/11/17
12	041117R1	853086	Water	04/11/17
13	~~54TM10MS~~	~~852440MS~~	Water	04/10/17
14	~~54TM10MSD~~	~~852440MSD~~	Water	04/10/17
15	~~54TM10DUP~~	~~852440DUP~~	Water	04/10/17
16	54MW12MS	853081MS	Water	04/11/17

LDC #: 38805A6
SDG #: 126485
Laboratory: CT Laboratories

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 06/14/17
Page: 2 of 2
Reviewer: ATL
2nd Reviewer:

METHOD: (Analyte) Chloride, Nitrate-N, Sulfate (EPA SW846 Method 9056A), Chlorate, Chlorite (EPA Method 300.1), TIC, TOC (EPA SW846 Method 9060A)

	Client ID	Lab ID	Matrix	Date
17	54MW12MSD	853081MSD	Water	04/11/17
18	54MW12DUP	853081DUP	Water	04/11/17
19	54MW12MS	853082MS	Water	04/11/17
20	54MW12MSD	853082MSD	Water	04/11/17
21	54MW12DUP	853082DUP	Water	04/11/17
22	54MW10MS	852435MS	↓	04/10/17
23	54MW10MSD	MSD ↓	↓	↓
24	54MW10DUP	↓	↓	↓
25				
26				

Notes:

LDC #: 38805A6

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

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

All circled methods are applicable to each sample.

Sample ID	Parameter
2,4,6,8,10	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
12	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
1,3,5,7,9,11	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 TIC
7,9,11,E	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 ClO_3, ClO_2
	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
QC	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 ClO_3 ClO_2
19,20,21	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
22,23,24	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
16,17,18	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
	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 #: 38805A6

VALIDATION FINDINGS WORKSHEET
Field Blanks

Reviewer: ATL
2nd Reviewer:

METHOD: Inorganics, EPA Method See Cover
Blank units: mg/L **Associated sample units:** mg/L
Sampling date: 04/11/17 Soil factor applied NA
Field blank type: (circle one) Field Blank / Rinsate / Other: Associated Samples: 7,9 ~~Qualify as B~~

Analyte	Blank ID	Action Limit	Sample Identification							
	11									
TOC	0.54	2.70								

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Samples with analyte concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as not detected, "U".

LDC #: 38805A6

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Reviewer: ATL
2nd Reviewer:

METHOD: Inorganics, EPA Method See cover

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

(Y) N N/A Was a matrix spike analyzed for each matrix in this SDG? 80-120

Y (N) N/A Were matrix spike percent recoveries (%R) within the control limits of 75-125? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.

(Y) N N/A Were all duplicate sample relative percent differences (RPD) ≤ 20% for water samples and ≤35% for soil samples?

LEVEL IV ONLY:

Y N (N/A) Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	MS/MSD ID	Matrix	Analyte	MS %Recovery	MSD %Recovery	RPD (Limits)	Associated Samples	Qualifications
	19/20 (ICAL#IC1074)	W	SO4	0 (80-120)	0 (80-120)			~~rerun with ICAL#IC1053~~ No Qual (re-analyzed)
	19/20 (ICAL#IC1074)	W	Cl	0 (80-120)	0 (80-120)			rerun with ICAL#IC1053
	19/20 (ICAL#IC1074)	W	NO3-N	0 (80-120)	0 (80-120)			~~rerun with ICAL#IC1053~~
	22/23	W	Cl	79 (80-120)	65 (80-120)		2,4,6	J/UJ/A (detect)

Comments: 19/20 (ICAL#IC1053): SO4>4x

LDC# 38805A6

VALIDATION FINDINGS WORKSHEET

Field Duplicates

Reviewer: ATL

2nd Reviewer:

Inorganics: Method See Cover

Analyte	Concentration (mg/L)		RPD (≤25)	
	2	4		
Chloride	6.4	6.3	2	
Sulfate	65	65	0	
Nitrate Nitrogen	0.30	0.29	3	

Analyte	Concentration (mg/L)		RPD (≤25)	
	1	3		
TOC	6.9	5.5	23	

\\LDCFILESERVER\Validation\FIELD DUPLICATES\FD_inorganic\38805A6.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Radford Army Ammunition Plant, VA

LDC Report Date: June 20, 2017

Parameters: Explosives

Validation Level: Stage 2B

Laboratory: CT Laboratories/Accutest Laboratories

Sample Delivery Group (SDG): 126485/FA43019/FA43028

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
54MW10	852429/FA43019-1	Water	04/10/17
54TM10	852439/FA43019-2	Water	04/10/17
54MW13	852441/FA43019-3	Water	04/10/17
54MW12	853081/FA43028-1	Water	04/11/17
54MW1	853083/FA43028-2	Water	04/11/17
041117R1	853085/FA43028-3	Water	04/11/17

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 SWMU 54 (RAAP-14) Monitored Natural Attenuation Interim Measures Work Plan for Radford Army Ammunition Plant, Virginia (April 2011), 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 (October 2013). 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 2B data validation, which comprises an evaluation of quality control (QC) summary results.

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.

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 with the following exceptions:

Date	Column	Compound	%D	Associated Samples	Flag	A or P
04/19/17	Signal 2	PETN	118.4	All samples in SDG 126485/FA43019/FA43028	UJ (all non-detects)	A

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 with the following exceptions:

Date	Column	Compound	%D	Associated Samples	Flag	A or P
04/20/17	Signal 2	PETN	114.2	54MW10 54TM10 54MW13 54MW1 041117R1	UJ (all non-detects)	A

IV. Laboratory Blanks

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

V. Field Blanks

Sample 041117R1 was identified as a rinsate. No contaminants were found.

VI. Surrogates

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

LCS ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
OP64666-BS	TNX	48 (60-126)	All samples in SDG 126485/FA43019/FA43028	UJ (all non-detects)	P
OP64666-BS	PETN	187 (50-150)	All samples in SDG 126485/FA43019/FA43028	NA	-

IX. Field Duplicates

Samples 54MW12 and 54TM12 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD (Limits)	Flag	A or P
	54MW10	54TM10			
HMX	2.8	2.9	4 (≤20)	-	-
3,5-Dinitroaniline	0.56	0.60	7 (≤20)	-	-
2-Amino-4,6-dinitrotoluene	1.4	1.4	0 (≤20)	-	-
4-Amino-2,6-dinitrotoluene	1.2	1.2	0 (≤20)	-	-
1,3,5-Trinitrobenzene	0.33	0.41	22 (≤20)	J (all detects)	A

Compound	Concentration (ug/L)		RPD (Limits)	Flag	A or P
	54MW10	54TM10			
2,4,6-Trinitrotoluene	1.0	1.1	10 (≤20)	-	-

X. Compound Quantitation

All compounds reported below the limit of quantitation (LOQ) and above the method detection limit (MDL) were qualified as follows:

Sample	Compound	Flag	A or P
All samples in SDG 126485/FA43019/FA43028	All compounds reported below the LOQ and above the MDL.	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

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

Due to ICV and continuing calibration %D, LCS %R, and results below the LOQ and above the MDL, data were qualified as estimated in six 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.

Radford Army Ammunition Plant, VA
Explosives - Data Qualification Summary - SDG 126485/FA43019/FA43028

Sample	Compound	Flag	A or P	Reason
54MW10 54TM10 54MW13 54MW12 54MW1 041117R1	PETN	UJ (all non-detects)	A	Initial calibration verification (%D)
54MW10 54TM10 54MW13 54MW1 041117R1	PETN	UJ (all non-detects)	A	Continuing calibration (%D)
54MW10 54TM10 54MW13 54MW12 54MW1 041117R1	TNX	UJ (all non-detects)	P	Laboratory control sample (%R)
54MW10 54TM10	1,3,5-Trinitrobenzene	J (all detects)	A	Field duplicates (RPD)
54MW10 54TM10 54MW13 54MW12 54MW1 041117R1	All compounds reported below the LOQ and above the MDL.	J (all detects)	A	Compound quantitation

Radford Army Ammunition Plant, VA
Explosives - Laboratory Blank Data Qualification Summary - SDG 126485/FA43019/FA43028

No Sample Data Qualified in this SDG

Radford Army Ammunition Plant, VA
Explosives - Field Blank Data Qualification Summary - SDG 126485/FA43019/FA43028

No Sample Data Qualified in this SDG

LDC #: 38805A40 **VALIDATION COMPLETENESS WORKSHEET** Date: 06/12/17

SDG #: 126485/FA43019/FA43028 Stage 2B Page: 1 of 1

Laboratory: CT Laboratories/Accutest Reviewer: JV

2nd Reviewer: Q

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 / SW	ICAL ≤ 15% r² ICV ≤ 20%
III.	Continuing calibration	SW	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	ND	R = 6
VI.	Surrogate spikes	A	
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples	SW	LCS
IX.	Field duplicates	SW	D = 1/2
X.	Compound quantitation RL/LOQ/LODs	N	
XI.	Target compound identification	N	
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 / Subcon ID	Matrix	Date
+ 1	54MW10	D	852429 / FA43019-1	Water	04/10/17
+ 2	54TM10	D	852439 / -2	Water	04/10/17
+ 3	54MW13		852441 / -3	Water	04/10/17
+ 4	54MW12		853081 / FA43028-1	Water	04/11/17
- 5	54MW1		853083 / -2	Water	04/11/17
6	041117R1		853085 / -3	Water	04/11/17
7					
8					
9					
10					
11					
12					

Notes:

-	OP64666-MB						

VALIDATION FINDINGS WORKSHEET

METHOD: ___GC ✓ ___HPLC

8310	8330	8151	8141	8141(Con't)	8021B
A. Acenaphthene	A. HMX	A. 2,4-D	A. Dichlorvos	CC. Trichlorinate	V. Benzene
B. Acenaphthylene	B. RDX	B. 2,4-DB	B. Mevinphos	DD. Trifluralin	CC. Toluene
C. Anthracene	C. 1,3,5-Trinitrobenzene	C. 2,4,5-T	C. Demeton-O	EE. Def	EE. Ethyl Benzene
D. Benzo(a)anthracene	D. 1,3-Dinitrobenzene	D. 2,4,5-TP	D. Demeton-S	FF. Prowl	SSS. O-Xylene
E. Benzo(a)pyrene	E. Tetryl	E. Dinoseb	E. Ethoprop	GG. Ethion	RRR. MP-Xylene
F. Benzo(b)fluoranthene	F. Nitrobenzene	F. Dichlorprop	F. Naled	HH. Famphur	GG. Total Xylene
G. Benzo(g,h,i)perylene	G. 2.4.6-Trinitrotoluene	G. Dicamba	G. Sulfotep	II. Phosmet	
H. Benzo(k)fluoranthene	H. 4-Amino-2,6-dinitrotoluene	H. Dalapon	H. Phorate	JJ. Tetrachlorvinphos	**VPH**
I. Chrysene	I. 2-Amino-4,6-dinitrotoluene	I. MCPP	I. Dimethoate	KK. Demeton (total)	A. C5-C6 Aliphatics
J. Dibenz(a,h)anthracene	J. 2,4-Dinitrotoluene	J. MCPA	J. Diazinon		B. C6-C8 Aliphatics
K. Fluoranthene	K. 2,6-Dinitrotoluene	K. Pentachlorophenol	K. Disulfoton		C. C8-C10 Aliphatics
L. Fluorene	L. 2-Nitrotoluene	L. 2,4,5-TP (silvex)	L. Parathion-methyl	**8315A**	D. C10-C12 Aliphatics
M. Indeno(1,2,3-cd)pyrene	M. 3-Nitrotoluene	M. Silvex	M. Ronnel	A. Formaldehyde	E. C8-C10 Aromatics
N. Naphthalene	N. 4-Nitrotoluene	N.	N. Malathion	B. Acetaldehyde	F. C10-C12 Aromatics
O. Phenanthrene	O. Nitroglycerin	O.	O. Chlorpyrifos	C. Benzaldehyde	G. Total VPH
P. Pyrene	P. Picric acid	P.	P. Fenthion	D. Butyraldehyde	
Q.	Q. 2,4-Dinitrophenol	Q.	Q. Parathion-ethyl	C. Benzaldehyde	**EPH**
R.	R. 3,5-Dinitroaniline		R. Trichlornate	D. Butyraldehyde	A. C10-C12 Aromatics
S.	S. 2-Nitrophenol		S. Merphos		B. C12-C16 Aromatics
	T. 4-Nitrophenol		T. Stirofos		C. C16-C21 Aromatics
	U. Picramic acid		U. Tokuthion	**Organic acids**	D. C21-C34 Aromatics
	V. PETN		V. Fensulfothion	A. Acetic acid	E. C10-C12 Aliphatics
	W. Hexahydro-1,3,5-trinitroso-1,3,5-triazine		W. Bolstar	B. Butyric acid	F. C12-C16 Aliphatics
	X. MNX		X. EPN	C. Lactic acid	G. C16-C21 Aliphatics
	Y. Hexahydro-1,3-dinitroso-5-nitro-1,3,5-triazine		Y. Azinphos-methyl	D. Propionic acid	H. C21-C34 Aliphatics
	Z. DNX		Z. Coumaphos	E. Pyruvic acid	
	AA. TNX		AA. Parathion		
			BB. Trichloronate		

LDC #: 38805 (180)

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

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

METHOD: __ GC __ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
What type of initial calibration verification calculation was performed? _%D or __%R
(Y) N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?
Y (N) N/A Did the initial calibration verification standards meet the %D / %R validation criteria of ≤20.0% / 80-120%?

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
	04/16/17	ICV IS78-500	Signal 2	V a)	118.4	All (ND)	J/UJ/A

LDC #: 38805 A4o

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

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".
What type of continuing calibration calculation was performed? __%D or __%R

(Y) N N/A — Were continuing calibration standards analyzed at the required frequencies?
Y (N) N/A — Did the continuing calibration standards meet the %D / %R validation criteria of ≤20.0% / 80-120%?

Level IV Only

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

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	RT (limit)	Associated Samples	Qualifications
	04/20/17	BB054283	Signal 2	V (+)	120.3	( )	OP64666-MB	J/UJ/A
						( )		
						( )		
	04/20/17	BB054295	↓	V (+)	114.2	( )	1-3, 5-6 (ND)	↓
						( )		
						( )		
						( )		
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LDC #: 38805A40

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: __ GC ✓ HPLC

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 an 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
	0P64666-BS	AA	48 (60-126)	( )	( )	All (ND)	J/UJ/P
		V	187 (50-150)	( )	( )	↓ ↓	J dets/P
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		

LDC#: 38805A40

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer:

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

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 (≤20%)	Qualifications (Parent only)
	1	2		
A	2.8	2.9	4	
R	0.56	0.60	7	
I	1.4	1.4	0	
H	1.2	1.2	0	
C	0.33	0.41	22	Jdets/A
G	1.0	1.1	10	

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LDC Report# 38805A87

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Radford Army Ammunition Plant, VA

LDC Report Date: June 20, 2017

Parameters: Perchlorate

Validation Level: Stage 2B

Laboratory: CT Laboratories/Accutest Laboratories

Sample Delivery Group (SDG): 126485/FA43019/FA43028

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
54MW10	852429/FA43019-1	Water	04/10/17
54TM10	852439/FA43019-2	Water	04/10/17
54MW13	852441/FA43019-3	Water	04/10/17
54MW12	853081/FA43028-1	Water	04/11/17
54MW1	853083/FA43028-2	Water	04/11/17
041117R1	853085/FA43028-3	Water	04/11/17

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 SWMU 54 (RAAP-14) Monitored Natural Attenuation Interim Measures Work Plan for Radford Army Ammunition Plant, Virginia (April 2011), 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 (October 2013). 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 6850

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

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 50.0%.

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

Sample 041117R1 was identified as a rinsate. No contaminants were found.

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 54MW10 and 54TM10 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD (Limits)	Flag	A or P
	54MW10	54TM10			
Perchlorate	0.24	0.24	0 (≤20)	-	-

X. Internal Standards

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

XI. Compound Quantitation

All compounds reported below the limit of quantitation (LOQ) and above the method detection limit (MDL) were qualified as follows:

Sample	Compound	Flag	A or P
All samples in SDG 126485/FA43019/FA43028	All compounds reported below the LOQ and above the MDL.	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

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

Due to results below the LOQ and above the MDL, data were qualified as estimated in six 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.

Radford Army Ammunition Plant, VA
Perchlorate - Data Qualification Summary - SDG 126485/FA43019/FA43028

Sample	Analyte	Flag	A or P	Reason
54MW10 54TM10 54MW13 54MW12 54MW1 041117R1	All compounds reported below the LOQ and above the MDL.	J (all detects)	A	Compound quantitation

Radford Army Ammunition Plant, VA
Perchlorate - Laboratory Blank Data Qualification Summary - SDG 126485/FA43019/FA43028

No Sample Data Qualified in this SDG

Radford Army Ammunition Plant, VA
Perchlorate - Field Blank Data Qualification Summary - SDG 126485/FA43019/FA43028

No Sample Data Qualified in this SDG

LDC #: 38805A87 **VALIDATION COMPLETENESS WORKSHEET** Date: 06/12/17

SDG #: 126485/FA43019/FA43028 Stage 2B Page: 1 of 1

Laboratory: CT Laboratories/Accutest Reviewer: [illegible]

2nd Reviewer: [illegible]

METHOD: LC/MS Perchlorate (EPA SW846 Method 6850)

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 ≤
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	R = 6
VII.	Surrogate spikes	N	Not reqd.
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	SW	D = 1/r
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
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/Subcon ID	Matrix	Date
1	54MW10	D	852429/FA43019-1	Water	04/10/17
2	54TM10	D	852439/-2	Water	04/10/17
3	54MW13		852441/-3	Water	04/10/17
4	54MW12		853081/FA43028-1	Water	04/11/17
5	54MW1		853083/-2	Water	04/11/17
6	041117R1		853085/-3	Water	04/11/17
7					
8					
9					

Notes:

	OP64744-MB						

LDC#: 38805A87

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer:

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

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 (~~≤50%~~) (≤70)	Qualifications (Parent only)
	1	2		
Perchlorate	0.24	0.24	0	

V:\Josephine\FIELD DUPLICATES\38805A87 bering radford.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Radford Army Ammunition Plant, VA

LDC Report Date: June 20, 2017

Parameters: Volatiles

Validation Level: Stage 2B

Laboratory: CT Laboratories

Sample Delivery Group (SDG): 126533/126611/126555

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
48MW06	853044	Water	04/11/17
49TM1	853050	Water	04/11/17
13MW4	853052	Water	04/11/17
13MW3	853054	Water	04/11/17
041117T1	853056	Water	04/11/17
48MW1	853670	Water	04/12/17
49MW01	853672	Water	04/12/17
50MW02	853674	Water	04/12/17
49MW04	853676	Water	04/12/17
041217T1	853678	Water	04/12/17
13MW2	853679	Water	04/12/17
49MW02	854484	Water	04/13/17
48MW3	854524	Water	04/13/17
48MW2	854530	Water	04/13/17
041317R1	854532	Water	04/13/17
041317T1	854535	Water	04/13/17
48MW3MS	854524MS	Water	04/13/17
48MW3MSD	854524MSD	Water	04/13/17

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 SWMU 49 Monitored Natural Attenuation Ground Monitoring Work Plan for Radford Army Ammunition Plant, Virginia (October 2014), 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 (October 2013). 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 8260C

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

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 with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
04/22/17	Bromomethane	25.84	All samples in SDG 126533/126611/126555	UJ (all non-detects)	A

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 041117T1, 041217T1, and 041317T1 were identified as trip blanks. No contaminants were found.

Sample 041317R1 was identified as a rinsate. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
041317R1	04/13/17	Acetone	13 ug/L	49MW02 48MW3 48MW2

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater (>10X for common contaminants, >5X for other contaminants) than the concentrations found in the associated field blanks.

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

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
48MW3MS/MSD (48MW3)	1,4-Dioxane	-	31 (59-139)	UJ (all non-detects)	A

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

Spike ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
48MW3MS/MSD (48MW3)	1,4-Dioxane	105 (≤30)	NA	-

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 48MW06 and 49TM1 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD (Limits)	Flag	A or P
	48MW06	49TM1			
1,1,1-Trichloroethane	0.41	0.45	9 (≤50)	-	-
1,1-Dichloroethane	0.27	3.0	11 (≤50)	-	-
1,1-Dichloroethene	0.50U	0.24	70 (≤50)	J (all detects) UJ (all non-detects)	A
cis-1,2-Dichloroethene	4.3	4.5	5 (≤50)	-	-
Tetrachloroethene	0.46	0.46	0 (≤50)	-	-
Trichloroethene	3.0	3.0	0 (≤50)	-	-

XI. Internal Standards

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

XII. Compound Quantitation

All compounds reported below the limit of quantitation (LOQ) and above the method detection limit (MDL) were qualified as follows:

Sample	Compound	Flag	A or P
All samples in SDG 126533/126611/126555	All compounds reported below the LOQ and above the MDL.	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. 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, MS/MSD %R, field duplicate RPD, and results below the LOQ and above the MDL, data were qualified as estimated in sixteen 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.

Radford Army Ammunition Plant, VA
Volatiles - Data Qualification Summary - SDG 126533/126611/126555

Sample	Compound	Flag	A or P	Reason
48MW06 49TM1 13MW4 13MW3 041117T1 48MW1 49MW01 50MW02 49MW04 041217T1 13MW2 49MW02 48MW3 48MW2 041317R1 041317T1	Bromomethane	UJ (all non-detects)	A	Continuing calibration (%D)
48MW3	1,4-Dioxane	UJ (all non-detects)	A	Matrix spike/Matrix spike duplicate (%R)
48MW06 49TM1	1,1-Dichloroethene	J (all detects) UJ (all non-detects)	A	Field duplicates (RPD)
48MW06 49TM1 13MW4 13MW3 041117T1 48MW1 49MW01 50MW02 49MW04 041217T1 13MW2 49MW02 48MW3 48MW2 041317R1 041317T1	All compounds reported below the LOQ and above the MDL.	J (all detects)	A	Compound quantitation

Radford Army Ammunition Plant, VA
Volatiles - Laboratory Blank Data Qualification Summary - SDG 126533/126611/126555

No Sample Data Qualified in this SDG

Radford Army Ammunition Plant, VA
Volatiles - Field Blank Data Qualification Summary - SDG 126533/126611/126555

No Sample Data Qualified in this SDG

LDC #: 38805B1 **VALIDATION COMPLETENESS WORKSHEET** Date: 06/12/17

SDG #: 126533 / 126611 / 126555 Stage 2B Page: 1 of 2

Laboratory: CT Laboratories Reviewer: [illegible]

2nd Reviewer: [illegible]

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

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% RF ICV ≤ 20%
IV.	Continuing calibration	SW	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	SW	*TB = 5, 10, 16 R = 15
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	SW	
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	SW	D = 1/2
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
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	48MW06	D	853044	Water	04/11/17
+ 2	49TM1	D	853050	Water	04/11/17
+ 3	13MW4		853052	Water	04/11/17
+ 4	13MW3		853054	Water	04/11/17
- 5	041117T1		853056	Water	04/11/17
+ 6	48MW1		853670	Water	04/12/17
+ 7	49MW01		853672	Water	04/12/17
+ 8	50MW02		853674	Water	04/12/17
+ 9	49MW04		853676	Water	04/12/17
- 10	041217T1		853678	Water	04/12/17
- 11	13MW2		853679	Water	04/12/17
- 12	49MW02		854484	Water	04/13/17
+ 13	48MW3		854524	Water	04/13/17

LDC #: 38805B1 **VALIDATION COMPLETENESS WORKSHEET** Date: 06/12/17
SDG #: 126533 Stage 2B Page: 2 of 2
Laboratory: CT Laboratories Reviewer: JB
2nd Reviewer: [illegible]

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

	Client ID	Lab ID	Matrix	Date
+ 14	48MW2	854530	Water	04/13/17
+ 15	041317R1	854532	Water	04/13/17
- 16	041317T1	854535	Water	04/13/17
17	48MW3MS	854524MS	Water	04/13/17
18	48MW3MSD	854524MSD	Water	04/13/17
19				
20				
21				
22				
23				

Notes:

-	136711 MB						

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 #: 38805 B1

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

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

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

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

Y N N/A Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?

Y N N/A Were percent differences (%D) ≤20 % and relative response factors (RRF) within the method criteria?

#	Date	Standard ID	Compound	Finding %D (Limit: <20.0%)	Finding RRF (Limit)	Associated Samples	Qualifications
	04/22/17	CCV-ICS1	B	25.84		All (ND)	J/UJ/A

Note: * = Ave RRF failed method criteria but within validation criteria

LDC #: 38805 B1

VALIDATION FINDINGS WORKSHEET
Field Blanks

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

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: 04/13/17

Field blank type: (circle one) Field Blank / Rinsate / Trip Blank / Other: R Associated Samples: 12-14 ~~All except 5, 10, 16, 15~~ (ND)

Compound	Blank ID	Sample Identification								
	15									
F	13									

Blank units: _____ **Associated sample units:** _____

Sampling date: _____

Field blank type: (circle one) Field Blank / Rinsate / Trip Blank / Other: _____ Associated Samples: _____

Compound	Blank ID	Sample Identification								

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 #: 38805 B1

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Reviewer: JVG
2nd Reviewer: [illegible]

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

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

(Y) N N/A 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.

(Y) N N/A Was a MS/MSD analyzed every 20 samples of each matrix?

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

#	Date	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		17/18	HHHH	( )	31 (59-139)	( )	13 (ND)	J/UJ A
			↓	( )	( )	105 (30)	↓ ↓	J dets A
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		

LDC#: 38805B1

VALIDATION FINDINGS WORKSHEET
Field Duplicates

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

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

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 (≤50%)	Qualifications (Parent only)
	1	2		
N	0.41	0.45	9	
I	2.7	3.0	11	
H	0.50U	0.24	70	J/UJ/A
QQQ	4.3	4.5	5	
AA	0.46	0.46	0	
S	3.0	3.0	0	

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LDC Report# 38805B4b

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Radford Army Ammunition Plant, VA

LDC Report Date: June 20, 2017

Parameters: Metals

Validation Level: Stage 2B

Laboratory: CT Laboratories

Sample Delivery Group (SDG): 126611

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
49ADW01	854534	Water	04/13/17
54ADW01	854536	Water	04/13/17
49ADW01MS	854534MS	Water	04/13/17
49ADW01MSD	854534MSD	Water	04/13/17
49ADW01DUP	854534DUP	Water	04/13/17
54ADW01MS	854536MS	Water	04/13/17
54ADW01MSD	854536MSD	Water	04/13/17
54ADW01DUP	854536DUP	Water	04/13/17

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 SWMU 49 Monitored Natural Attenuation Ground Monitoring Work Plan for Radford Army Ammunition Plant, Virginia (October 2014), 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, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, and Zinc by Environmental Protection Agency (EPA) SW 846 Method 6010C
Mercury by EPA SW 846 Method 7470A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

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. 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.

III. ICP Interference Check Sample Analysis

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

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
ICB/CCB	Silver Selenium Arsenic	1.39 ug/L 3.62 ug/L 5.67 ug/L	All samples in SDG 126611
ICB/CCB	Potassium	113 ug/L	49ADW01
ICB/CCB	Potassium	111 ug/L	54ADW01

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 (>5X blank contaminants) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
49ADW01	Selenium Arsenic	2.2 ug/L 6.5 ug/L	6.5U ug/L 12U ug/L
54ADW01	Selenium Arsenic	3.2 ug/L 4.2 ug/L	6.5U ug/L 12U 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. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
49ADW01MS/MSD (49ADW01)	Antimony Cadmium Thallium	- - -	62 (80-120) 53 (80-120) 64 (80-120)	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	A
49ADW01MS/MSD (49ADW01)	Copper	-	133 (80-120)	NA	-
49ADW01MS/MSD (49ADW01)	Zinc	-	122 (80-120)	J (all detects)	A

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

Spike ID (Associated Samples)	Analyte	RPD (Limits)	Flag	A or P
49ADW01MS/MSD (49ADW01)	Antimony Cadmium Copper Selenium Thallium Zinc	47 (≤15) 58 (≤15) 31 (≤15) 31 (≤15) 36 (≤15) 21 (≤15)	J (all detects) UJ (all non-detects)	A

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Analyte	RPD (Limits)	Flag	A or P
49ADW01DUP (49ADW01)	Iron	14 (≤10)	J (all detects)	A

VIII. Serial Dilution

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

Diluted Sample	Analyte	%D (Limits)	Associated Samples	Flag	A or P
49ADW01	Barium Calcium Magnesium	16 (≤10) 49 (≤10) 46 (≤10)	49ADW01	J (all detects) J (all detects) J (all detects)	A

IX. Laboratory Control Samples

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

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Sample Result Verification

All analytes reported below the limit of quantitation (LOQ) and above the method detection limit (MDL) were qualified as follows:

Sample	Analyte	Flag	A or P
All samples in SDG 126611	All analytes reported below the LOQ and above the MDL.	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

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

Due to MS/MSD %R and RPD, DUP RPD, serial dilution %D, and results below the LOQ and above the MDL, data were qualified as estimated in two samples.

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

Radford Army Ammunition Plant, VA
Metals - Data Qualification Summary - SDG 126611

Sample	Analyte	Flag	A or P	Reason
49ADW01	Antimony Cadmium Thallium Zinc	J (all detects) UJ (all non-detects)	A	Matrix spike/Matrix spike duplicate (%R)
49ADW01	Antimony Cadmium Copper Selenium Thallium Zinc	J (all detects) UJ (all non-detects)	A	Matrix spike/Matrix spike duplicate (RPD)
49ADW01	Iron	J (all detects)	A	Duplicate sample analysis (RPD)
49ADW01	Barium Calcium Magnesium	J (all detects) J (all detects) J (all detects)	A	Serial dilution (%D)
49ADW01 54ADW01	All analytes reported below the LOQ and above the MDL.	J (all detects)	A	Sample result verification

Radford Army Ammunition Plant, VA
Metals - Laboratory Blank Data Qualification Summary - SDG 126611

Sample	Analyte	Modified Final Concentration	A or P
49ADW01	Selenium Arsenic	6.5U ug/L 12U ug/L	A
54ADW01	Selenium Arsenic	6.5U ug/L 12U ug/L	A

Radford Army Ammunition Plant, VA
Metals - Field Blank Data Qualification Summary - SDG 126611

No Sample Data Qualified in this SDG

LDC #: 38805B4b
SDG #: ~~126533~~ 136611
Laboratory: CT Laboratories

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 06/13/17
Page: 1 of 1
Reviewer: ATL
2nd Reviewer:

METHOD: Metals (EPA SW 846 Method 6010C/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.	Instrument Calibration	A	
III.	ICP Interference Check Sample (ICS) Analysis	A	
IV.	Laboratory Blanks	SW	
V.	Field Blanks	~~SW~~ N	~~1,2=purge water~~
VI.	Matrix Spike/Matrix Spike Duplicates	SW	
VII.	Duplicate sample analysis	SW	
VIII.	Serial Dilution	SW	
IX.	Laboratory control samples	A	LCS
X.	Field Duplicates	N	
XI.	Sample Result Verification	N	
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	49ADW01	854534	Water	04/13/17
2	54ADW01	854536	Water	04/13/17
3	49ADW01MS	854534MS	Water	04/13/17
4	49ADW01MSD	854534MSD	Water	04/13/17
5	49ADW01DUP	854534DUP	Water	04/13/17
6	54ADW01MS	854536MS	Water	04/13/17
7	54ADW01MSD	854536MSD	Water	04/13/17
8	54ADW01DUP	854536DUP	Water	04/13/17
9				
10				
11				
12				
13				
14				
15				

Notes:

LDC #: 38805B4b

VALIDATION FINDINGS WORKSHEET
Sample Specific Element Reference

Reviewer: ATL
2nd reviewer: Q

All circled elements are applicable to each sample.

Sample ID	Matrix	Target Analyte List (TAL)
1, 2	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, ___
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, ___
6,7,8	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, ___
3,4,5	↓	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 #: 38805B4b

VALIDATION FINDINGS WORKSHEET
PB/ICB/CCB QUALIFIED SAMPLES

Reviewer: ATL
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

Analyte	Maximum PB[a] (mg/Kg)	Maximum PB[a] (ug/L)	Maximum ICB/CCB[a] (ug/L)	Action Level	1	2							
Ag			1.39	6.95									
Se			3.62	18.1	2.2/6.5	3.2/6.5							
As			5.67	28.35	6.5/12	4.2/12							

Sample Concentration units, unless otherwise noted: ug/L
Associated Samples: 1

Analyte	Maximum PB[a] (mg/Kg)	Maximum PB[a] (ug/L)	Maximum ICB/CCB[a] (ug/L)	Action Level									
K			113	565									

Sample Concentration units, unless otherwise noted: ug/L
Associated Samples: 2

Analyte	Maximum PB[a] (mg/Kg)	Maximum PB[a] (ug/L)	Maximum ICB/CCB[a] (ug/L)	Action Level									
K			111	555									

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 #: 38805B4b

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Reviewer: ATL
2nd Reviewer:

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

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

(Y) N N/A Was a matrix spike analyzed for each matrix in this SDG?

Y (N) N/A Were matrix spike percent recoveries (%R) within the control limits of ~~75~~ 80-125? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.

Y (N) N/A Were all duplicate sample relative percent differences (RPD) ≤ ~~20~~ 15% for samples?

LEVEL IV ONLY:

Y N (N/A) Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	MS/MSD ID	Matrix	Analyte	MS %Recovery	MSD %Recovery	RPD (Limits)	Associated Samples	Qualifications
	3/4	W	Sb		62 (80-120)		1	J/UJ/A (non-detect)
	3/4	W	Cd		53 (80-120)		1	J/UJ/A (non-detect)
	3/4	W	Cu		133 (80-120)		1	J/UJ/A (non-detect)
	3/4	W	Tl		64 (80-120)		1	J/UJ/A (non-detect)
	3/4	W	Zn		122 (80-120)		1	J/UJ/A (detect)
	3/4	W	Sb			47 (≤15)	1	J/UJ/A (non-detect)
	3/4	W	Cd			58 (≤15)	1	J/UJ/A (non-detect)
	3/4	W	Cu			31 (≤15)	1	J/UJ/A (non-detect)
	3/4	W	Se			31 (≤15)	1	J/UJ/A (detect)
	3/4	W	Tl			36 (≤15)	1	J/UJ/A (non-detect)
	3/4	W	Zn			21 (≤15)	1	J/UJ/A (detect)

Comments:

LDC #: 38805B4b

VALIDATION FINDINGS WORKSHEET
Duplicate Analysis

Reviewer: ATL
2nd Reviewer:

METHOD: Trace Metals (EPA SW 846 Method 6010/6020/7000)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a duplicate sample analyzed for each matrix in this SDG?
Y N N/A Were all duplicate sample relative percent differences (RPD) ≤ 20% for water samples and ≤ 35% for soil samples? If no, see qualifications below. A control limit of ±R.L. (±2X R.L. for soil) was used for sample values that were <5X the R.L., including the case when only one of the duplicate sample values was <5X R.L.. If field blanks were used for laboratory duplicates, note in the Overall Assessment.

LEVEL IV ONLY:
Y N N/A Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	Date	Duplicate ID	Matrix	Analyte	RPD (Limits)	Difference (Limits)	Associated Samples	Qualifications
	04/18/17	5	W	Fe	14 (0-10)		1	Jdet/A (detect)

Comments:

LDC #: 38805B4b

VALIDATION FINDINGS WORKSHEET
ICP Serial Dilution

Reviewer: ATL
2nd Reviewer: [signature]

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

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

Y (N) N/A If analyte concentrations were > 50X the MDL (ICP) ,or >100X the MDL (ICP/MS), was a serial dilution analyzed?
Y (N) N/A Were ICP serial dilution percent differences (%D) ≤10%?
Y (N) N/A Is there evidence of negative interference? If yes, professional judgement will be used to qualify the data.

LEVEL IV ONLY:

Y N (N/A) Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	Diluted Sample ID	Matrix	Analyte	%D (Limits)	Associated Samples	Qualifications
	1	W	Ba	16 (≤10)	1	J/UJ/A (detect)
	1	W	Ca	49 (≤10)	1	J/UJ/A (detect)
	1	W	Mg	46 (≤10)	1	J/UJ/A (detect)

Comments:

LDC Report# 38805B6

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Radford Army Ammunition Plant, VA

LDC Report Date: June 20, 2017

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: CT Laboratories

Sample Delivery Group (SDG): 126533/126611/126555

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
48MW06	853044	Water	04/11/17
48MW06	853049	Water	04/11/17
49TM1	853050	Water	04/11/17
49TM1	853051	Water	04/11/17
13MW4	853052	Water	04/11/17
13MW4	853053	Water	04/11/17
13MW3	853054	Water	04/11/17
13MW3	853055	Water	04/11/17
48MW1	853670	Water	04/12/17
48MW1	853671	Water	04/12/17
49MW01	853672	Water	04/12/17
49MW01	853673	Water	04/12/17
50MW02	853674	Water	04/12/17
50MW02	853675	Water	04/12/17
49MW04	853676	Water	04/12/17
49MW04	853677	Water	04/12/17
13MW2	853679	Water	04/12/17
13MW2	853680	Water	04/12/17
49MW02	854484	Water	04/13/17
49MW02	854522	Water	04/13/17
48MW3	854524	Water	04/13/17
48MW3	854527	Water	04/13/17
48MW2	854530	Water	04/13/17
48MW2	854531	Water	04/13/17
041317R1	854532	Water	04/13/17
041317R1	854533	Water	04/13/17

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
49ADW01	854534	Water	04/13/17
54ADW01	854536	Water	04/13/17
13MW2MS	853680MS	Water	04/12/17
13MW2MSD	853680MSD	Water	04/12/17
13MW2DUP	853680DUP	Water	04/12/17
48MW3MS	854524MS	Water	04/13/17
48MW3MSD	854524MSD	Water	04/13/17
48MW3DUP	854524DUP	Water	04/13/17
48MW3MS	854527MS	Water	04/13/17
48MW3MSD	854527MSD	Water	04/13/17
48MW3DUP	854527DUP	Water	04/13/17
49ADW01MS	854534MS	Water	04/13/17
49ADW01MSD	854534MSD	Water	04/13/17
49ADW01DUP	854534DUP	Water	04/13/17

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 SWMU 49 Monitored Natural Attenuation Ground Monitoring Work Plan for Radford Army Ammunition Plant, Virginia (October 2014), 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:

Chloride, Sulfate, and Nitrate as Nitrogen by Environmental Protection Agency (EPA) SW 846 Method 9056A
Chemical Oxygen Demand by EPA Method 410.1
pH by EPA SW 846 Method 9040C
Total Organic Carbon by EPA SW 846 Method 9060A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

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
49ADW01 54ADW01	pH	8 days	48 hours	J (all 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.

V. Field Blanks

Samples 041317R1 (854532) and 041317R1 (854533) were identified as rinsates. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Analyte	Concentration	Associated Samples
041317R1 (854532)	04/13/17	Total organic carbon	0.72 mg/L	49MW02 (854484) 48MW3 (854524) 48MW2 (854530)

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated field blanks.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. For 13MW2(853680)MS/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) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples 48MW06 and 49TM1 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/L)		RPD (Limits)	Flag	A or P
	48MW06 (853044)	49TM1 (853050)			
Total organic carbon	4.7	5	6 (≤25)	-	-

Analyte	Concentration (mg/L)		RPD (Limits)	Flag	A or P
	48MW06 (853049)	49TM1 (853051)			
Chloride	13	13	0 (≤25)	-	-
Sulfate	130	140	7 (≤25)	-	-
Nitrate as N	2.5	2.4	4 (≤25)	-	-

X. Sample Result Verification

All analytes reported below the limit of quantitation (LOQ) and above the method detection limit (MDL) were qualified as follows:

Sample	Analyte	Flag	A or P
All samples in SDG 126533/126611/126555	All analytes reported below the LOQ and above the MDL.	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

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 results below the LOQ and above the MDL, data were qualified as estimated in twenty-eight 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.

Radford Army Ammunition Plant, VA
Wet Chemistry - Data Qualification Summary - SDG 126533/126611/126555

Sample	Analyte	Flag	A or P	Reason
49ADW01 54ADW01	pH	J (all detects)	P	Technical holding times
48MW06 48MW06 49TM1 49TM1 13MW4 13MW4 13MW3 13MW3 48MW1 48MW1 49MW01 49MW01 50MW02 50MW02 49MW04 49MW04 13MW2 13MW2 49MW02 49MW02 48MW3 48MW3 48MW2 48MW2 041317R1 041317R1 49ADW01 54ADW01	All analytes reported below the LOQ and above the MDL.	J (all detects)	A	Sample result verification

Radford Army Ammunition Plant, VA
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 126533/126611/126555

No Sample Data Qualified in this SDG

Radford Army Ammunition Plant, VA
Wet Chemistry - Field Blank Data Qualification Summary - SDG 126533/126611/126555

No Sample Data Qualified in this SDG

LDC #: 38805B6 **VALIDATION COMPLETENESS WORKSHEET** Date: 06/13/17
SDG #: 126533 /~~12661~~/~~12665~~ Stage 2B Page: 1 of 2
Laboratory: CT Laboratories Reviewer: ATL
2nd Reviewer:

METHOD: (Analyte) Chloride, Nitrate-N, Sulfate (EPA SW846 Method 9056A), COD (EPA Method 410.1), pH (EPA SW846 Method 9040C), TOC (EPA SW846 Method 9060A)

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	A	
V	Field blanks	SW	25/26 = rinsate ; ~~27/28 = purge water~~
VI.	Matrix Spike/Matrix Spike Duplicates	~~SW~~ A	29/30: SO4 > 4X
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	(1,3), (2,4)
X.	Sample result verification	N	
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	48MW06	853044	Water	04/11/17
2	48MW06	853049	Water	04/11/17
3	49TM1	853050	Water	04/11/17
4	49TM1	853051	Water	04/11/17
5	13MW4	853052	Water	04/11/17
6	13MW4	853053	Water	04/11/17
7	13MW3	853054	Water	04/11/17
8	13MW3	853055	Water	04/11/17
9	48MW1	853670	Water	04/12/17
10	48MW1	853671	Water	04/12/17
11	49MW01	853672	Water	04/12/17
12	49MW01	853673	Water	04/12/17
13	50MW02	853674	Water	04/12/17
14	50MW02	853675	Water	04/12/17
15	49MW04	853676	Water	04/12/17
16	49MW04	853677	Water	04/12/17

LDC #: 38805B6
SDG #: 126533
Laboratory: CT Laboratories

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 06/13/17
Page: 2 of 2
Reviewer: ATL
2nd Reviewer:

METHOD: (Analyte) Chloride, Nitrate-N, Sulfate (EPA SW846 Method 9056A), COD (EPA Method 410.1), pH (EPA SW846 Method 9040C), TOC (EPA SW846 Method 9060A)

	Client ID	Lab ID	Matrix	Date
17	13MW2	853679	Water	04/12/17
18	13MW2	853680	Water	04/12/17
19	49MW02	854484	Water	04/13/17
20	49MW02	854522	Water	04/13/17
21	48MW3	854524	Water	04/13/17
22	48MW3	854527	Water	04/13/17
23	48MW2	854530	Water	04/13/17
24	48MW2	854531	Water	04/13/17
25	041317R1	854532	Water	04/13/17
26	041317R1	854533	Water	04/13/17
27	49ADW01	854534	Water	04/13/17
28	54ADW01	854536	Water	04/13/17
29	13MW2MS	853680MS	Water	04/12/17
30	13MW2MSD	853680MSD	Water	04/12/17
31	13MW2DUP	853680DUP	Water	04/12/17
32	48MW3MS	854524MS	Water	04/13/17
33	48MW3MSD	854524MSD	Water	04/13/17
34	48MW3DUP	854524DUP	Water	04/13/17
35	48MW3MS	854527MS	Water	04/13/17
36	48MW3MSD	854527MSD	Water	04/13/17
37	48MW3DUP	854527DUP	Water	04/13/17
38	49ADW01MS	854534MS	Water	04/13/17
39	49ADW01MSD	854534MSD	Water	04/13/17
40	49ADW01DUP	854534DUP	Water	04/13/17
41				
42				
43				
44				
45				

Notes:

LDC #: 38805B6

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Page: 1 of 1
Reviewer: ATL
2nd reviewer: Q

All circled methods are applicable to each sample.

Sample ID	Parameter
1,3,5,7,9	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN **TOC** Cr6+ ClO_4
11,13,15,17	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN **TOC** Cr6+ ClO_4
19,21,23	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN **TOC** Cr6+ ClO_4
25	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN **TOC** Cr6+ ClO_4
2,4,6,8,10	pH TDS **Cl** F **NO_3** N NO_2 **SO_4** O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
12,14,16,18	pH TDS **Cl** F **NO_3** N NO_2 **SO_4** O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
20,22,24	pH TDS **Cl** F **NO_3** N NO_2 **SO_4** O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
26	pH TDS **Cl** F **NO_3** N NO_2 **SO_4** O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
27,28	**pH** TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 **COD**
	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
QC	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
38,39,40	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 **COD**
32,33,34	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN **TOC** Cr6+ ClO_4
29,30,31	pH TDS **Cl** F **NO_3** N NO_2 **SO_4** O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
35,36,37	pH TDS **Cl** F **NO_3** N NO_2 **SO_4** O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
40	**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
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4

Comments:

LDC #: 38805B6

VALIDATION FINDINGS WORKSHEET
Technical Holding Times

Reviewer: ATL
2nd reviewer: CR

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:	pH EPA 9040C						
Parameters:	water						
Technical holding time:	~~analysis~~ ASAP 48hrs						
Sample ID	**Sampling date**	**Analysis date**	**Total Time**	**Qualifier**	**Analysis date**	**Total Time**	**Qualifier**
27, 28	04/13/17	04/21/17	8 days	J/UJ/P (detect)			

LDC #: 38805B6

VALIDATION FINDINGS WORKSHEET
Field Blanks

Reviewer: ATL
2nd Reviewer:

METHOD: Inorganics, EPA Method See Cover
Blank units: mg/L **Associated sample units:** mg/L
Sampling date: 04/13/17 Soil factor applied NA
Field blank type: (circle one) Field Blank / (Rinsate) / Other: Associated Samples: 19,21,23 ~~Qualify as B~~

Analyte	Blank ID	Action Limit	Sample Identification							
	25									
TOC	0.72	3.60								

Sampling date: 04/13/17 Soil factor applied NA
Field blank type: (circle one) Field Blank / Rinsate / Other: purge water Associated Samples: 28 ~~Qualify as B~~

Analyte	Blank ID	Action Limit	Sample Identification							
	27		28							
COD	59	295	230							

Sampling date: 04/13/17 Soil factor applied NA
Field blank type: (circle one) Field Blank / Rinsate / Other: purge water Associated Samples: 27 ~~Qualify as B~~

Analyte	Blank ID	Action Limit	Sample Identification							
	28		27							
COD	230	1150	59							

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Samples with analyte concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as not detected, "U".

LDC# 38805B6

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: ATL
2nd Reviewer:

Inorganics: Method See Cover

Analyte	Concentration (mg/L)		RPD (≤25)	
	2	4		
Chloride	13	13	0	
Sulfate	130	140	7	
Nitrate Nitrogen	2.5	2.4	4	

Analyte	Concentration (mg/L)		RPD (≤25)	
	1	3		
TOC	4.7	5	6	

\\LDCFILESERVER\Validation\FIELD DUPLICATES\FD_inorganic\38805B6.wpd

LDC Report# 38805B51

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Radford Army Ammunition Plant, VA

LDC Report Date: June 20, 2017

Parameters: Methane, Ethane, & Ethene

Validation Level: Stage 2B

Laboratory: CT Laboratories

Sample Delivery Group (SDG): 126533/126611/126555

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
48MW06	853044	Water	04/11/17
49TM1	853050	Water	04/11/17
13MW4	853052	Water	04/11/17
13MW3	853054	Water	04/11/17
48MW1	853670	Water	04/12/17
49MW01	853672	Water	04/12/17
50MW02	853674	Water	04/12/17
49MW04	853676	Water	04/12/17
13MW2	853679	Water	04/12/17
49MW02	854484	Water	04/13/17
48MW3	854524	Water	04/13/17
48MW2	854530	Water	04/13/17
041317R1	854532	Water	04/13/17
48MW3MS	854524MS	Water	04/13/17
48MW3MSD	854524MSD	Water	04/13/17

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 SWMU 49 Monitored Natural Attenuation Ground Monitoring Work Plan for Radford Army Ammunition Plant, Virginia (October 2014), 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 (October 2013). 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:

Methane, Ethane, and Ethene by Method RSK-175

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

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.

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.

IV. Laboratory Blanks

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

V. Field Blanks

Sample 041317R1 was identified as a rinsate. No contaminants were found.

VI. 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.

VII. Laboratory Control Samples

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

VIII. Field Duplicates

Samples 48MW06 and 49TM1 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD (Limits)	Flag	A or P
	48MW06	49TM1			
Ethane	0.70U	0.91	26 (≤35)	-	-

IX. Compound Quantitation

All compounds reported below the limit of quantitation (LOQ) and above the method detection limit (MDL) were qualified as follows:

Sample	Compound	Flag	A or P
All samples in SDG 126533/126611/126555	All compounds reported below the LOQ and above the MDL.	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

X. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

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

Due to results below the LOQ and above the MDL, data were qualified as estimated in thirteen 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.

Radford Army Ammunition Plant, VA
Methane, Ethane, & Ethene - Data Qualification Summary - SDG 126533/126611/126555

Sample	Analyte	Flag	A or P	Reason
48MW06 49TM1 13MW4 13MW3 48MW1 49MW01 50MW02 49MW04 13MW2 49MW02 48MW3 48MW2 041317R1	All compounds reported below the LOQ and above the MDL.	J (all detects)	A	Compound quantitation

Radford Army Ammunition Plant, VA
Methane, Ethane, & Ethene - Laboratory Blank Data Qualification Summary - SDG 126533/126611/126555

No Sample Data Qualified in this SDG

Radford Army Ammunition Plant, VA
Methane, Ethane, & Ethene - Field Blank Data Qualification Summary - SDG 126533/126611/126555

No Sample Data Qualified in this SDG

LDC #: 38805B51 **VALIDATION COMPLETENESS WORKSHEET** Date: 06/12/17
SDG #: 126533 / 126611 / 126555 Stage 2B Page: 1 of 1
Laboratory: CT Laboratories Reviewer: SVL
2nd Reviewer:

METHOD: GC Methane-Ethane-Ethene (Method RSK-175)

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	r² ICV ≤ 20
III.	Continuing calibration	A	CCV ≤ 20
IV.	Laboratory Blanks	A	
V.	Field blanks	ND	R = 13
VI.	Matrix spike/Matrix spike duplicates	A	
VII.	Laboratory control samples	A	LCS
VIII.	Field duplicates	SW	D = 1/2
IX.	Compound quantitation RL/LOQ/LODs	N	
X.	Target compound identification	N	
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	48MW06 D	853044	Water	04/11/17
2	49TM1 D	853050	Water	04/11/17
3	13MW4	853052	Water	04/11/17
4	13MW3	853054	Water	04/11/17
5	48MW1	853670	Water	04/12/17
6	49MW01	853672	Water	04/12/17
7	50MW02	853674	Water	04/12/17
8	49MW04	853676	Water	04/12/17
9	13MW2	853679	Water	04/12/17
10	49MW02	854484	Water	04/13/17
11	48MW3	854524	Water	04/13/17
12	48MW2	854530	Water	04/13/17
13	041317R1	854532	Water	04/13/17
14	48MW3MS	854524MS	Water	04/13/17
15	48MW3MSD	854524MSD	Water	04/13/17
16				
17				
18	136950 MB			

LDC #: 38805 B51

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd reviewer:

METHOD: ✓ GC ___ HPLC

Y N N/A Were field duplicate pairs identified in this SDG?

Y N N/A Were target compounds detected in the field duplicate pairs?

Compound	Concentration (ug/L)		%RPD Limit: (≤ 25 %)	Qualification Parent only / All Samples
	1	2		
Ethane	0.704	0.91	26	

Compound	Concentration ( )		%RPD Limit: (≤ %)	Qualification Parent only / All Samples

Compound	Concentration ( )		%RPD Limit: (≤ %)	Qualification Parent only / All Samples

Compound	Concentration ( )		%RPD Limit: (≤ %)	Qualification Parent only / All Samples

LDC #: 38805

EDD POPULATION COMPLETENESS WORKSHEET

Date: 06/27/17
Page: 1 of 1
2nd Reviewer:

The LDC job number listed above was entered by

	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.	N	
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/NA	
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/NA	
IIIg.	-Are there any discrepancies between the data packet and the EDD?	N	

Notes: *see discrepancy sheet

LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

Bering Sea Environmental
3601 C Street. Suite 1000-31
Anchorage, AK 99503
ATTN: Ms. S. Julia Liu, P.E.

August 25, 2017

SUBJECT: Radford Army Ammunition Plant, VA, Data Validation

Dear Ms. Julia Liu,

Enclosed are the final validation reports for the fractions listed below. This SDG was received on August 9, 2017. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #39239:

SDG #	Fraction
128820/FA45722/392672/392791	Volatiles, Metals, Explosives, Methane, Ethane, Ethene, Perchlorate, Wet Chemistry

The data validation was performed under Stage 2B validation guidelines. The analyses were validated using the following documents and variances, as applicable to each method:

- SWMU 49 Monitored Natural Attenuation Ground Monitoring Work Plan for Radford Army Ammunition Plant, Virginia, October 2014
- 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, October 2013
- 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

2,745 pages SF

Attachment 1

EDD Stage 2B **LDC #39239 (Bering Sea Environmental-Anchorage, AK / Radford Army Ammunition Plant, VA)**

LDC	SDG#	DATE REC'D	(3) DATE DUE	VOA (8260C)		Metals (6010C /7470A)		Expl. (8330B)		Methane Ethane Ethene		CLO_4 (6850)		Cl,SO_4 NO_3-N (9056A)		Chlorate Chlorite (300.1)		COD (410.4)		pH (9040C)		TIC (9060A)		TOC (9060A)													
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	W	S
A	128820/FA45722/ 392672/392791	08/09/17	08/30/17	16	0	2	0	6	0	14	0	6	0	20	0	6	0	2	0	2	0	6	0	20	0												
Total	T/PG			16	0	2	0	6	0	14	0	6	0	20	0	6	0	2	0	2	0	6	0	20	0	0	0	0	0	0	0	0	0	0	0	0	100

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

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Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Radford Army Ammunition Plant, VA

LDC Report Date: August 16, 2017

Parameters: Volatiles

Validation Level: Stage 2B

Laboratory: CT Laboratories

Sample Delivery Group (SDG): 128820

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
48MW06	891323	Water	07/12/17
49TM1	891325	Water	07/12/17
48MW1	891327	Water	07/12/17
49MW01	891329	Water	07/12/17
49MW02	891331	Water	07/12/17
49TM2	891333	Water	07/12/17
13MW4	891335	Water	07/12/17
13MW2	891337	Water	07/12/17
071217T1	891339	Water	07/12/17
50MW02	891495	Water	07/13/17
48MW3	891497	Water	07/13/17
48MW2	891502	Water	07/13/17
071317R1	891506	Water	07/13/17
13MW3	891508	Water	07/13/17
49MW04	891510	Water	07/13/17
071317T1	891512	Water	07/13/17
48MW3MS	891497MS	Water	07/13/17
48MW3MSD	891497MSD	Water	07/13/17

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 SWMU 49 Monitored Natural Attenuation Ground Monitoring Work Plan for Radford Army Ammunition Plant, Virginia (October 2014), 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 (October 2013). 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 8260C

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

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.

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	Analysis Date	Compound	Concentration	Associated Samples
139958MB	07/20/17	1,4-Dioxane	286 ug/L	All samples in SDG 128820

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater (>10X for common contaminants, >5X for other contaminants) than the concentrations found in the associated laboratory blanks.

VI. Field Blanks

Samples 071217T1 and 071317T1 were identified as trip blanks. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
071217T1	07/12/17	Chloromethane	0.42 ug/L	48MW06 49TM1 48MW1 49MW01 49MW02 49TM2 13MW4 13MW2
071317T1	07/13/17	Methylene chloride	0.58 ug/L	50MW02 48MW3 48MW2 071317R1 13MW3 49MW04

Sample 071317R1 was identified as a rinsate. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
071317R1	07/13/17	Acetone Methylene chloride Toluene	5.7 ug/L 0.55 ug/L 0.39 ug/L	50MW02 48MW3 48MW2 13MW3 49MW04

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater (>10X for common contaminants, >5X for other contaminants) than the concentrations found in the associated field blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
071317R1	Methylene chloride	0.55 ug/L	2.0U 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

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
48MW3MS/MSD (48MW3)	1,4-Dioxane	142 (59-139)	-	NA	-
48MW3MS/MSD (48MW3)	Carbon tetrachloride	-	38 (72-136)	J (all detects)	A

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

Spike ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
48MW3MS/MSD (48MW3)	1,4-Dioxane 2-Chlorotoluene	60 (≤20) 22 (≤20)	NA	-

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 48MW06 and 49TM1 and samples 49MW02 and 49TM2 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD (Limits)	Flag	A or P
	48MW06	49TM1			
1,1,1-Trichloroethane	0.71	0.75	5 (≤50)	-	-
1,1-Dichloroethane	5.0	5.1	2 (≤50)	-	-
1,1-Dichloroethene	0.43	0.39	10 (≤50)	-	-

Compound	Concentration (ug/L)		RPD (Limits)	Flag	A or P
	48MW06	49TM1			
Benzene	1.1	1.2	9 (≤50)	-	-
cis-1,2-Dichloroethene	9.7	9.8	1 (≤50)	-	-
Tetrachloroethene	0.87	0.91	4 (≤50)	-	-
Trichloroethene	6.1	6.1	0 (≤50)	-	-

Compound	Concentration (ug/L)		RPD (Limits)	Flag	A or P
	49MW02	49TM2			
cis-1,2-Dichloroethene	0.82	0.88	7 (≤50)	-	-
Trichloroethene	0.23	0.25	8 (≤50)	-	-

XI. Internal Standards

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

XII. Compound Quantitation

All compounds reported below the limit of quantitation (LOQ) and above the method detection limit (MDL) were qualified as follows:

Sample	Compound	Flag	A or P
All samples in SDG 128820	All compounds reported below the LOQ and above the MDL.	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XIII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

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

Due to MS/MSD %R and results below the LOQ and above the MDL, data were qualified as estimated in sixteen samples.

Due to trip blank contamination, data were qualified as not detected in one sample.

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.

Radford Army Ammunition Plant, VA
Volatiles - Data Qualification Summary - SDG 128820

Sample	Compound	Flag	A or P	Reason
48MW3	Carbon tetrachloride	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
48MW06 49TM1 48MW1 49MW01 49MW02 49TM2 13MW4 13MW2 071217T1 50MW02 48MW3 48MW2 071317R1 13MW3 49MW04 071317T1	All compounds reported below the LOQ and above the MDL.	J (all detects)	A	Compound quantitation

Radford Army Ammunition Plant, VA
Volatiles - Laboratory Blank Data Qualification Summary - SDG 128820

No Sample Data Qualified in this SDG

Radford Army Ammunition Plant, VA
Volatiles - Field Blank Data Qualification Summary - SDG 128820

Sample	Compound	Modified Final Concentration	A or P
071317R1	Methylene chloride	2.0U ug/L	A

LDC #: 39239A1 **VALIDATION COMPLETENESS WORKSHEET** Date: 08/15/17
SDG #: 128820 Stage 2B Page: 1 of 7
Laboratory: CT Laboratories Reviewer: JW
2nd Reviewer: CT

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

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%. r² ICV ≤ 20%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	SW	
VI.	Field blanks	SW	TB = 9, 16 R = 13
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	SW	
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	SW	b = 1/2, 5/6
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
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	48MW06 D1	891323	Water	07/12/17
2	49TM1 D1	891325	Water	07/12/17
3	48MW1	891327	Water	07/12/17
4	49MW01	891329	Water	07/12/17
5	49MW02 D2	891331	Water	07/12/17
6	49TM2 D2	891333	Water	07/12/17
7	13MW4	891335	Water	07/12/17
8	13MW2	891337	Water	07/12/17
9	071217T1	891339	Water	07/12/17
10	50MW02	891495	Water	07/13/17
11	48MW3	891497	Water	07/13/17
12	48MW2	891502	Water	07/13/17
13	071317R1	891506	Water	07/13/17

LDC #: 39239A1 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/15/17
SDG #: 128820 Stage 2B Page: 2 of 2
Laboratory: CT Laboratories Reviewer: SW
2nd Reviewer:

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

	Client ID	Lab ID	Matrix	Date
14	13MW3	891508	Water	07/13/17
15	49MW04	891510	Water	07/13/17
16	071317T1	891512	Water	07/13/17
17	48MW3MS	891497MS	Water	07/13/17
18	48MW3MSD	891497MSD	Water	07/13/17
19				
20				
21				
22				
23				

Notes:

+	139458-MB						

LDC #: 39239 A1

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: JVG
2nd Reviewer:

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

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 associated with every sample in this SDG?

Y N N/A Was a method blank analyzed at least once every 12 hours for each matrix and concentration?

Y N N/A Was there contamination in the method blanks? If yes, please see the qualifications below.

Blank analysis date: 07/20/17

Conc. units: ug/L Associated Samples: All (ND)

Compound	Blank ID	Sample Identification								
	139958 MB									
HHHH	286									

Blank analysis date:

Conc. units: Associated Samples:

Compound	Blank ID	Sample Identification								

LDC #: 39239 A1

VALIDATION FINDINGS WORKSHEET
Field Blanks

Reviewer: JVG
2nd Reviewer: [illegible]

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

(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: 07/12/17
Field blank type: (circle one) Field Blank / Rinsate / (Trip Blank) / Other: _____ Associated Samples: 1 - 8 (ND)

Compound	Blank ID	Sample Identification								
	9									
A	0.42									

Blank units: ug/L **Associated sample units:** ug/L
Sampling date: _____
Field blank type: (circle one) Field Blank / Rinsate / (Trip Blank) / Other: _____ Associated Samples: 10 - 15

Compound	Blank ID	Sample Identification								
	16		13							
E	0.58		0.55/2.04							

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 #: 39239A1

VALIDATION FINDINGS WORKSHEET
Field Blanks

Reviewer: JVG
2nd Reviewer:

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

(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: 07/13/17
Field blank type: (circle one) Field Blank / (Rinsate) / Trip Blank / Other: Associated Samples: 10 - 12, 14, 15 (ND)

Compound	Blank ID	Sample Identification								
	13									
F	5.7									
E	0.55									
CC	0.39									

Blank units: **Associated sample units:**
Sampling date:
Field blank type: (circle one) Field Blank / Rinsate / Trip Blank / Other: Associated Samples:

Compound	Blank ID	Sample Identification								

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 #: 39239A1

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Reviewer: JVG
2nd Reviewer: [illegible]

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

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

(Y) N N/A 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.

(Y) N N/A Was a MS/MSD analyzed every 20 samples of each matrix?

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

#	Date	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		17/18	HHHH	142 (59-139)	( )	( )	11 (ND)	J dets/A
			O	( )	38 (72-136)	( )	↓ (Det)	J/UJ/A
			HHHH	( )	( )	60 (20)	↓ (ND)	J dets/A
			Z	( )	( )	22 (↓)	↓ ↓	↓
				( )	( )	( )		
				( )	( )	( )		
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LDC#: 39239A1

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer:

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

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 (≤50%)	Qualifications (Parent only)
	1	2		
N	0.71	0.75	5	
I	5.0	5.1	2	
H	0.43	0.39	10	
V	1.1	1.2	9	
QQQ	9.7	9.8	1	
AA	0.87	0.91	4	
S	6.1	6.1	0	

Compound	Concentration (ug/L)		RPD (≤50%)	Qualifications (Parent only)
	5	6		
QQQ	0.82	0.88	7	
S	0.23	0.25	8	

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LDC Report# 39239A4b

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Radford Army Ammunition Plant, VA

LDC Report Date: August 23, 2017

Parameters: Metals

Validation Level: Stage 2B

Laboratory: CT Laboratories

Sample Delivery Group (SDG): 128820

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
54ADW01	890671	Water	07/11/17
49ADW1	891494	Water	07/13/17
54ADW01MS	890671MS	Water	07/11/17
54ADW01MSD	890671MSD	Water	07/11/17
54ADW01DUP	890671DUP	Water	07/11/17
49ADW1MS	891494MS	Water	07/13/17
49ADW1MSD	891494MSD	Water	07/13/17
49ADW1DUP	891494DUP	Water	07/13/17

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 SWMU 54 (RAAP-14) Monitored Natural Attenuation Interim Measures Work Plan for Radford Army Ammunition Plant, Virginia (April 2011), the SWMU 49 Monitored Natural Attenuation Ground Monitoring Work Plan for Radford Army Ammunition Plant, Virginia (October 2014), 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, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, and Zinc by Environmental Protection Agency (EPA) SW 846 Method 6010C
Mercury by EPA SW 846 Method 7470A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

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. 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.

III. ICP Interference Check Sample Analysis

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

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)	Calcium Chromium Magnesium	61.70 ug/L 0.809 ug/L 8.86 ug/L	54ADW01
ICB/CCB	Calcium Chromium Arsenic Barium Nickel Potassium	40.30 ug/L 1.86 ug/L 5.39 ug/L 1.19 ug/L 1.56 ug/L 148 ug/L	54ADW01
PB (prep blank)	Arsenic Silver	4.59 ug/L 2.39 ug/L	49ADW1
ICB/CCB	Thallium Magnesium Arsenic Barium Manganese Potassium Sodium	6.22 ug/L 10.60 ug/L 6.52 ug/L 0.919 ug/L 0.787 ug/L 167 ug/L 118 ug/L	49ADW1

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 (>5X blank contaminants) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
54ADW01	Chromium Arsenic Nickel	6.4 ug/L 5.4 ug/L 6.8 ug/L	6.4U ug/L 12U ug/L 6.8U ug/L
49ADW1	Arsenic	4.7 ug/L	12U 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. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
49ADW1MS/MSD (49ADW1)	Thallium	12 (80-120)	-	UJ (all non-detects)	A
49ADW1MS/MSD (49ADW1)	Aluminum	-	129 (80-120)	J (all detects)	A

For 49ADW1MS/MSD, although the percent recoveries were severely low for Thallium, the associated sample results were qualified as estimated (J/UJ) since the post spike recoveries were within the QC limits for this analyte.

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

Spike ID (Associated Samples)	Analyte	RPD (Limits)	Flag	A or P
49ADW1MS/MSD (49ADW1)	Thallium	149 (≤20)	UJ (all non-detects)	A

VII. Duplicate Sample Analysis

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

VIII. Serial Dilution

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

Diluted Sample	Analyte	%D (Limits)	Associated Samples	Flag	A or P
54ADW01	Calcium Magnesium	118 (≤10) 118 (≤10)	54ADW01	J (all detects) J (all detects)	A
49ADW1	Aluminum Calcium Magnesium	28 (≤10) 32 (≤10) 32 (≤10)	49ADW1	J (all detects) J (all detects) J (all detects)	A

IX. Laboratory Control Samples

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

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Sample Result Verification

All analytes reported below the limit of quantitation (LOQ) and above the method detection limit (MDL) were qualified as follows:

Sample	Analyte	Flag	A or P
All samples in SDG 128820	All analytes reported below the LOQ and above the MDL.	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

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

Due to MS/MSD %R and RPD, serial dilution %D, and results below the LOQ and above the MDL, data were qualified as estimated in two samples.

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

Radford Army Ammunition Plant, VA
Metals - Data Qualification Summary - SDG 128820

Sample	Analyte	Flag	A or P	Reason
49ADW1	Thallium	UJ (all non-detects)	A	Matrix spike/Matrix spike duplicate (%R)(RPD)
49ADW1	Aluminum	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
54ADW01	Calcium Magnesium	J (all detects) J (all detects)	A	Serial dilution (%D)
49ADW1	Aluminum Calcium Magnesium	J (all detects) J (all detects) J (all detects)	A	Serial dilution (%D)
54ADW01 49ADW1	All analytes reported below the LOQ and above the MDL.	J (all detects)	A	Sample result verification

Radford Army Ammunition Plant, VA
Metals - Laboratory Blank Data Qualification Summary - SDG 128820

Sample	Analyte	Modified Final Concentration	A or P
54ADW01	Chromium Arsenic Nickel	6.4U ug/L 12U ug/L 6.8U ug/L	A
49ADW1	Arsenic	12U ug/L	A

Radford Army Ammunition Plant, VA
Metals - Field Blank Data Qualification Summary - SDG 128820

No Sample Data Qualified in this SDG

LDC #: 39239A4b
SDG #: 128820
Laboratory: CT Laboratories

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 8/23/17
Page: 1 of 1
Reviewer: JB
2nd Reviewer: [illegible]

METHOD: Metals (EPA SW 846 Method 6010C/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.	Instrument Calibration	A	
III.	ICP Interference Check Sample (ICS) Analysis	A	
IV.	Laboratory Blanks	SW	
V.	Field Blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	SW	
VII.	Duplicate sample analysis	A	5; (As, Cd, Pb or by Diff) 8; (As, Cu, Se, V or by Diff)
VIII.	Serial Dilution	SW	
IX.	Laboratory control samples	A	LCS
X.	Field Duplicates	N	
XI.	Sample Result Verification	N	
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	54ADW01	890671	Water	07/11/17
2	49ADW1	891494	Water	07/13/17
3	54ADW01MS	890671MS	Water	07/11/17
4	54ADW01MSD	890671MSD	Water	07/11/17
5	54ADW01DUP	890671DUP	Water	07/11/17
6	49ADW1MS	891494MS	Water	07/13/17
7	49ADW1MSD	891494MSD	Water	07/13/17
8	49ADW1DUP	891494DUP	Water	07/13/17
9				
10				
11				
12				
13				
14				
15				

Notes:

LDC #: 39239A4b

VALIDATION FINDINGS WORKSHEET
Sample Specific Element Reference

Page: 1 of 1
Reviewer: JB
2nd reviewer: [illegible]

All circled elements are applicable to each sample.

Sample ID	Matrix	Target Analyte List (TAL)
1,2	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, ___
		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 #: 39239A4b

VALIDATION FINDINGS WORKSHEET
PB/ICB/CCB QUALIFIED SAMPLES

Reviewer: 3
2nd Reviewer: 4

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: 1

Analyte	Maximum PB[a] (mg/Kg)	Maximum PB[a] (ug/L)	Maximum ICB/CCB[a] (ug/L)	Action Level	1								
Ca		61.70	40.30	308.5									
Cr		0.809	1.86	9.3	6.4								
Mg		8.86		44.3									
As			5.39	26.95	5.4 / 12								
Ba			1.19	5.95									
Ni			1.56	7.8	6.8								
K			148	740									

Sample Concentration units, unless otherwise noted: ug/L
Associated Samples: 2

Analyte	Maximum PB[a] (mg/Kg)	Maximum PB[a] (ug/L)	Maximum ICB/CCB[a] (ug/L)	Action Level	2								
Tl			6.22	31.1									
Mg			10.60	53									
As		4.59	6.52	32.6	4.7 / 12								
Ba			0.919	4.595									
Mn			0.787	3.935									
Ag		2.39		11.95									
K			167	835									
Na			118	590									

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 #: 39239A46

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Reviewer: 13
2nd Reviewer:

METHOD: Inorganics, EPA Method See Cover

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

(Y) N N/A Was a matrix spike analyzed for each matrix in this SDG?

Y (N) N/A Were matrix spike percent recoveries (%R) within the control limits of 75-125? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.

Y (N) N/A Were all duplicate sample relative percent differences (RPD) ≤ 20% for water samples and ≤35% for soil samples?

LEVEL IV ONLY:

Y N (N/A) Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	MS/MSD ID	Matrix	Analyte	MS %Recovery	MSD %Recovery	RPD (Limits)	Associated Samples	Qualifications
	6,7	W	Tl	12 (80-120)			2	J/UJ/A (ND) (PSC 79%)
			Al		129 (80-120)		2	Jdet/A (Det)
			Tl			149 (20)	2	J/UJ/A (ND)

Comments:

LDC #: 39239A4b

VALIDATION FINDINGS WORKSHEET
ICP Serial Dilution

Reviewer: JB
2nd Reviewer:

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

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

(Y) N N/A If analyte concentrations were > 50X the MDL (ICP) ,or >100X the MDL (ICP/MS), was a serial dilution analyzed?
Y (N) N/A Were ICP serial dilution percent differences (%D) ≤10%?
Y (N) N/A Is there evidence of negative interference? If yes, professional judgement will be used to qualify the data.

LEVEL IV ONLY:

Y N (N/A) Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	Diluted Sample ID	Matrix	Analyte	~~RPD~~ %D (Limits)	Associated Samples	Qualifications
	1	W	Ca	118 (10)	1	J/UJ/A (Det)
			Mg	118 (10)	1	J/UJ/A (Det)
	2	W	Al	28 (10)	2	J/UJ/A (Det)
			Ca	32 (10)	2	J/UJ/A (Det)
			Mg	32 (10)	2	J/UJ/A (Det)

Comments:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Radford Army Ammunition Plant, VA

LDC Report Date: August 23, 2017

Parameters: Wet Chemistry

Validation Level: Stage 2B

Laboratory: CT Laboratories/Eurofins

Sample Delivery Group (SDG): 128820/392672/392791

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
54MW10	889901	Water	07/10/17
54MW10	889902	Water	07/10/17
54TM10	889903	Water	07/10/17
54TM10	889904	Water	07/10/17
54MW1	889905	Water	07/10/17
54MW1	889906	Water	07/10/17
071017R1	889907	Water	07/10/17
071017R1	889908	Water	07/10/17
54MW12	890666	Water	07/11/17
54MW12	890667	Water	07/11/17
54MW13	890669	Water	07/11/17
54MW13	890670	Water	07/11/17
54ADW01	890671	Water	07/11/17
48MW06	891323	Water	07/12/17
48MW06	891324	Water	07/12/17
49TM1	891325	Water	07/12/17
49TM1	891326	Water	07/12/17
48MW1	891327	Water	07/12/17
48MW1	891328	Water	07/12/17
49MW01	891329	Water	07/12/17
49MW01	891330	Water	07/12/17
49MW02	891331	Water	07/12/17
49MW02	891332	Water	07/12/17
49TM2	891333	Water	07/12/17
49TM2	891334	Water	07/12/17
13MW4	891335	Water	07/12/17

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
13MW4	891336	Water	07/12/17
13MW2	891337	Water	07/12/17
13MW2	891338	Water	07/12/17
49ADW1	891494	Water	07/13/17
50MW02	891495	Water	07/13/17
50MW02	891496	Water	07/13/17
48MW3	891497	Water	07/13/17
48MW3	891498	Water	07/13/17
48MW2	891502	Water	07/13/17
48MW2	891504	Water	07/13/17
071317R1	891506	Water	07/13/17
071317R1	891507	Water	07/13/17
13MW3	891508	Water	07/13/17
13MW3	891509	Water	07/13/17
49MW04	891510	Water	07/13/17
49MW04	891511	Water	07/13/17
54MW12MS	890666MS	Water	07/11/17
54MW12MSD	890666MSD	Water	07/11/17
54MW12DUP	890666DUP	Water	07/11/17
54MW12MS	890667MS	Water	07/11/17
54MW12MSD	890667MSD	Water	07/11/17
54MW12DUP	890667DUP	Water	07/11/17
54ADW01MS	890671MS	Water	07/11/17
54ADW01MSD	890671MSD	Water	07/11/17
54ADW01DUP	890671DUP	Water	07/11/17
48MW06MS	891324MS	Water	07/12/17
48MW06MSD	891324MSD	Water	07/12/17
48MW06DUP	891324DUP	Water	07/12/17
49ADW1DUP	891494DUP	Water	07/13/17
48MW3MS	891497MS	Water	07/13/17
48MW3MSD	891497MSD	Water	07/13/17
48MW3DUP	891497DUP	Water	07/13/17
48MW3MS	891498MS	Water	07/13/17
48MW3MSD	891498MSD	Water	07/13/17
48MW3DUP	891498DUP	Water	07/13/17

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 SWMU 49 Monitored Natural Attenuation Ground Monitoring Work Plan for Radford Army Ammunition Plant, Virginia (October 2014), the SWMU 54 (RAAP-14) Monitored Natural Attenuation Interim Measures Work Plan for Radford Army Ammunition Plant, Virginia (April 2011), 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:

Chloride, Sulfate, and Nitrate as Nitrogen by Environmental Protection Agency (EPA) SW 846 Method 9056A
Chlorate and Chlorite by EPA Method 300.0
Chemical Oxygen Demand by EPA Method 410.1
pH by EPA SW 846 Method 9040C
Total Inorganic Carbon and Total Organic Carbon by EPA SW 846 Method 9060A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

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
54ADW01	pH	71.00 hours	48 hours	J (all detects)	A
49ADW1	pH	187.67 hours	48 hours	J (all detects)	A

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
ICB/CCB	Chemical oxygen demand	3.0 mg/L	54ADW01 49ADW1

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 (>5X blank contaminants) than the concentrations found in the associated laboratory blanks.

V. Field Blanks

Samples 071017R1 and 071317R1 were identified as rinsates. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Analyte	Concentration	Associated Samples
071017R1 (889908)	07/10/17	Chloride	3.0 mg/L	54MW10 (889902) 54TM10 (889904) 54MW1 (889906)

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated field blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
54MW10 (889902)	Chloride	8.9 mg/L	8.9U mg/L
54TM10 (889904)	Chloride	5.6 mg/L	5.6U mg/L
54MW1 (889906)	Chloride	4.6 mg/L	4.6U mg/L

VI. 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 with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
54MW12 (890667)MS/MSD (54MW12 (890667))	Chloride	-	76 (80-120)	J (all detects)	A

For 48MW06 (891324)MS/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) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples 54MW10 and 54TM10, samples 48MW06 and 49TM1, and samples 49MW02 and 49TM2 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/L)		RPD (Limits)	Flag	A or P
	54MW10 (889901)	54TM10 (889903)			
Total organic carbon	2.6	2.2	17 (≤25)	-	-
Total inorganic carbon	70	68	3 (≤25)		

Analyte	Concentration (mg/L)		RPD (Limits)	Flag	A or P
	54MW10 (889902)	54TM10 (889904)			
Chloride	8.9	5.6	46 (≤25)	J (all detects)	A
Nitrate as N	0.10	0.21	71 (≤25)	J (all detects)	A
Sulfate	110	62	56 (≤25)	J (all detects)	A

Analyte	Concentration (mg/L)		RPD (Limits)	Flag	A or P
	48MW06 (891323)	49TM1 (891325)			
Total organic carbon	5.0	5.3	6 (≤25)	-	-

Analyte	Concentration (mg/L)		RPD (Limits)	Flag	A or P
	48MW06 (891324)	49TM1 (891326)			
Chloride	14	14	0 (≤25)	-	-
Nitrate as N	4.1	4.2	2 (≤25)	-	-
Sulfate	200	160	22 (≤25)	-	-

Analyte	Concentration (mg/L)		RPD (Limits)	Flag	A or P
	49MW02 (891331)	49TM2 (891333)			
Total organic carbon	3.2	4.0	22 (≤25)	-	-

Analyte	Concentration (mg/L)		RPD (Limits)	Flag	A or P
	49MW02 (891332)	49TM2 (891334)			
Chloride	2.0	2.1	5 (≤25)	-	-
Nitrate as N	0.14	0.14	0 (≤25)	-	-
Sulfate	18	18	0 (≤25)	-	-

X. Sample Result Verification

All analytes reported below the limit of quantitation (LOQ) and above the method detection limit (MDL) were qualified as follows:

Sample	Analyte	Flag	A or P
All samples in SDG 128820/392672/392791	All analytes reported below the LOQ and above the MDL.	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

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, MS/MSD %R, field duplicate RPD, and results below the LOQ and above the MDL, data were qualified as estimated in forty-two samples.

Due to rinsate 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.

Radford Army Ammunition Plant, VA
Wet Chemistry - Data Qualification Summary - SDG 128820/392672/392791

Sample	Analyte	Flag	A or P	Reason
54ADW01 49ADW1	pH	J (all detects)	A	Technical holding times
54MW12 (890667)	Chloride	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
54MW10 (889902) 54TM10 (889904)	Chloride Nitrate as N Sulfate	J (all detects) J (all detects) J (all detects)	A	Field duplicates (RPD)
54MW10 54MW10 54TM10 54TM10 54MW1 54MW1 071017R1 071017R1 54MW12 54MW12 54MW13 54MW13 54ADW01 48MW06 48MW06 49TM1 49TM1 48MW1 48MW1 49MW01 49MW01 49MW02 49MW02 49TM2 49TM2 13MW4 13MW4 13MW2 13MW2 49ADW1 50MW02 50MW02 48MW3 48MW3 48MW2 48MW2 071317R1 071317R1 13MW3 13MW3 49MW04 49MW04	All analytes reported below the LOQ and above the MDL.	J (all detects)	A	Sample result verification

Radford Army Ammunition Plant, VA
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 128820/392672/392791

No Sample Data Qualified in this SDG

Radford Army Ammunition Plant, VA
Wet Chemistry - Field Blank Data Qualification Summary - SDG 128820/392672/392791

Sample	Analyte	Modified Final Concentration	A or P
54MW10 (889902)	Chloride	8.9U mg/L	A
54TM10 (889904)	Chloride	5.6U mg/L	A
54MW1 (889906)	Chloride	4.6U mg/L	A

LDC #: 39239A6 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/23/17

SDG #: 128820/392672/392791 Stage 2B Page: 1 of 3

Laboratory: CT Laboratories/Eurofins Reviewer: VB

2nd Reviewer: O

METHOD: (Analyte) Chloride, Nitrate-N, Sulfate (EPA SW846 Method 9056A), Chlorate, Chlorite (EPA Method 300.1), COD (EPA Method 410.1), pH (EPA SW846 Method 9040C), TIC, TOC (EPA SW846 Method 9060A)

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	SW	R= 7, 8, 37-38
VI.	Matrix Spike/Matrix Spike Duplicates	SW	
VII.	Duplicate sample analysis	A	(58; RPD by Difference)
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	(2,3) (14,15,16,17) (22/23, 24/25)
X.	Sample result verification	N	
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	54MW10 T · TIC	889901	Water	07/10/17
2	54MW10 A	889902	Water	07/10/17
3	54TM10 T · TIC	889903	Water	07/10/17
4	54TM10 A	889904	Water	07/10/17
5	54MW1 T · TIC	889905	Water	07/10/17
6	54MW1 A	889906	Water	07/10/17
7	071017R1 TOC · TIC	889907	Water	07/10/17
8	071017R1 A	889908	Water	07/10/17
9	54MW12 T · TIC	890666	Water	07/11/17
10	54MW12 A	890667	Water	07/11/17
11	54MW13 T · TIC	890669	Water	07/11/17
12	54MW13 A	890670	Water	07/11/17
13	54ADW01 CT	890671	Water	07/11/17
14	48MW06 T	891323	Water	07/12/17
15	48MW06 A	891324	Water	07/12/17
16	49TM1 T	891325	Water	07/12/17

LDC #: 39239A6 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/23/17

SDG #: 128820/392672/392791 Stage 2B Page: 2 of 3

Laboratory: CT Laboratories/Eurofins Reviewer: JS

2nd Reviewer: A

METHOD: (Analyte) Chloride, Nitrate-N, Sulfate (EPA SW846 Method 9056A), Chlorate, Chlorite (EPA Method 300.1), COD (EPA Method 410.1), pH (EPA SW846 Method 9040C), TIC, TOC (EPA SW846 Method 9060A)

	Client ID	Lab ID	Matrix	Date
17	49TM1 A	891326	Water	07/12/17
18	48MW1 T	891327	Water	07/12/17
19	48MW1 A	891328	Water	07/12/17
20	49MW01 T	891329	Water	07/12/17
21	49MW01 A	891330	Water	07/12/17
22	49MW02 T	891331	Water	07/12/17
23	49MW02 A	891332	Water	07/12/17
24	49TM2 T	891333	Water	07/12/17
25	49TM2 A	891334	Water	07/12/17
26	13MW4 T	891335	Water	07/12/17
27	13MW4 A	891336	Water	07/12/17
28	13MW2 T	891337	Water	07/12/17
29	13MW2 A	891338	Water	07/12/17
30	49ADW1 C ?	891494	Water	07/13/17
31	50MW02 T	891495	Water	07/13/17
32	50MW02 A	891496	Water	07/13/17
33	48MW3 T	891497	Water	07/13/17
34	48MW3 A	891498	Water	07/13/17
35	48MW2 T	891502	Water	07/13/17
36	48MW2 A	891504	Water	07/13/17
37	071317R1 TOC	891506	Water	07/13/17
38	071317R1 A	891507	Water	07/13/17
39	13MW3 T	891508	Water	07/13/17
40	13MW3 A	891509	Water	07/13/17
41	49MW04 T	891510	Water	07/13/17
42	49MW04 A	891511	Water	07/13/17
43	54MW12MS T	890666MS	Water	07/11/17
44	54MW12MSD	890666MSD	Water	07/11/17
45	54MW12DUP	890666DUP	Water	07/11/17
46	54MW12MS A	890667MS	Water	07/11/17
47	54MW12MSD	890667MSD	Water	07/11/17
48	54MW12DUP	890667DUP	Water	07/11/17
49	54ADW01MS C	890671MS	Water	07/11/17

LDC #: 39239A6 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/23/17

SDG #: 128820/392672/392791 Stage 2B Page: 3 of 3

Laboratory: CT Laboratories/Eurofins Reviewer: JB

2nd Reviewer: CV

METHOD: (Analyte) Chloride, Nitrate-N, Sulfate (EPA SW846 Method 9056A), Chlorate, Chlorite (EPA Method 300.1), COD (EPA Method 410.1), pH (EPA SW846 Method 9040C), TIC, TOC (EPA SW846 Method 9060A)

	Client ID	Lab ID	Matrix	Date
50	54ADW01MSD	890671MSD	Water	07/11/17
51	54ADW01DUP pH COD	890671DUP	Water	07/11/17
52	48MW06MS *	891324MS	Water	07/12/17
53	48MW06MSD	891324MSD	Water	07/12/17
54	48MW06DUP	891324DUP	Water	07/12/17
55	49ADW1DUP pH	891494DUP	Water	07/13/17
56	48MW3MS T	891497MS	Water	07/13/17
57	48MW3MSD	891497MSD	Water	07/13/17
58	48MW3DUP T	891497DUP	Water	07/13/17
59	48MW3MS *	891498MS	Water	07/13/17
60	48MW3MSD	891498MSD	Water	07/13/17
61	48MW3DUP	891498DUP	Water	07/13/17
62				
63				
64				
65				
66				

Notes:

LDC #: 38239A4

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Reviewer: JB
2nd reviewer: [signature]

All circled methods are applicable to each sample.

Sample ID	Parameter
1,3,5,7,9 11	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN (TOC) Cr6+ ClO_4 (TIC) (Clorate) (Chlorite)
14,16,18,20,22 24,26,28,31	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN (TOC) Cr6+ ClO_4
33,35,37,39 41	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN (TOC) Cr6+ ClO_4
2,4,6,8,10, 12,15,17,19	pH TDS (Cl) F (NO_3) (NO_2) (SO_4) O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
21,23,25,27 29,~~30~~ 32,34	pH TDS (Cl) F (NO_3) NO_2 (SO_4) O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
36,38,40,42	pH TDS (Cl) F (NO_3) NO_2 (SO_4) O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
13, 30	(pH) TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 (COD)
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
QC	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
43-45 56-58	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN (TOC) Cr6+ ClO_4
46-48 52-54 59-61	pH TDS (Cl) F (NO_3) NO_2 (SO_4) O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
49,50	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 (COD)
51	(pH) TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4 (COD)
55	(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
	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 #: 39239A6

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 9040C						
Parameters:	pH						
Technical holding time:	48 hours						
Sample ID	Sampling date	Analysis date	Total Time	Qualifier	Analysis date	Total Time	Qualifier
13	7/11/17 11:50	7/14/17 10:50	71.00	J/UJ/A			
30	7/13/17 16:35	7/21/17 12:15	187.67	J/UJ/A			

LDC #: 39239A6

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: JS
2nd Reviewer: CJ

METHOD: Inorganics, Method See Cover

Conc. units: mg/L **Associated Samples:** 13, 30

Analyte	Blank ID	Blank ID	Blank Action Limit										
	PB	ICB/CCB (mg/L)											
COD		3.0	15										

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 #: 39239A6

VALIDATION FINDINGS WORKSHEET
Field Blanks

Reviewer: JB
2nd Reviewer: [signature]

METHOD: Inorganics, EPA Method See Cover
Blank units: mg/L **Associated sample units: mg/L**
Sampling date: 7/10/17 Soil factor applied NA
Field blank type: (circle one) Field Blank / Rinsate / Other: Rinsate Associated Samples: 2, 4, 6

Analyte	Blank ID	Action Limit	Sample Identification							
	8		2	4	6					
Chloride	3.0	15	8.9	5.6	4.6					

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Samples with analyte concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as not detected, "U".

LDC #: 39239A6

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Reviewer: JB
2nd Reviewer: CL

METHOD: Inorganics, EPA Method See Cover

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

Y N N/A Was a matrix spike analyzed for each matrix in this SDG?

Y N N/A Were matrix spike percent recoveries (%R) within the control limits of 75-125? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.

Y N N/A Were all duplicate sample relative percent differences (RPD) ≤ 20% for water samples and ≤35% for soil samples?

LEVEL IV ONLY:

Y N N/A Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	MS/MSD ID	Matrix	Analyte	MS %Recovery	MSD %Recovery	RPD (Limits)	Associated Samples	Qualifications
	46, 47	W	Cl		76 (80-120)		10	J / UJ / A (Det)

Comments: (52, 53); SO4 > 4x

LDC#: 39076W6 **VALIDATION FINDINGS WORKSHEET** Page: 1 of 2
Field Duplicates Reviewer: JB
2nd Reviewer:

Inorganics, Method See Cover

Analyte	Concentration (mg/L)		RPD (≤ 25)	Qualification (Parent only)
	1	3		
TOC	2.6	2.2	17	
TIC	70	68	3	

Analyte	Concentration (mg/L)		RPD (≤ 25)	Qualification (Parent only)
	2	4		
Chloride	8.9	5.6	46	Jdet/A
Nitrate as N	0.10	0.21	71	Jdet/A
Sulfate	110	62	56	Jdet/A

Analyte	Concentration (mg/L)		RPD (≤ 25)	Qualification (Parent only)
	14	16		
TOC	5.0	5.3	6	

Analyte	Concentration (mg/L)		RPD (≤ 25)	Qualification (Parent only)
	15	17		
Chloride	14	14	0	
Nitrate as N	4.1	4.2	2	
Sulfate	200	160	22	

Analyte	Concentration (mg/L)		RPD (≤ 25)	Qualification (Parent only)
	22	24		
TOC	3.2	4.0	22	

Analyte	Concentration (mg/L)		RPD (≤ 25)	Qualification (Parent only)
	23	25		
Chloride	2.0	2.1	5	
Nitrate as N	0.14	0.14	0	
Sulfate	18	18	0	

V:\FIELD DUPLICATES\Field Duplicates\FD_inorganic\2017\39239A6.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Radford Army Ammunition Plant, VA

LDC Report Date: August 16, 2017

Parameters: Explosives

Validation Level: Stage 2B

Laboratory: CT Laboratories/Accutest Laboratories

Sample Delivery Group (SDG): 128820/FA45722/FA95759

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
54MW10	889901/FA45722-1	Water	07/10/17
54TM10	889903/FA45722-2	Water	07/10/17
54MW1	889905/FA45722-3	Water	07/10/17
071017R1	889907/FA45722-4	Water	07/10/17
54MW12	890666/FA45759-1	Water	07/11/17
54MW13	890669/FA45759-2	Water	07/11/17
54MW12MS	890666/FA45759-1MS	Water	07/11/17
54MW12MSD	890666/FA45759-1MSD	Water	07/11/17

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 SWMU 54 (RAAP-14) Monitored Natural Attenuation Interim Measures Work Plan for Radford Army Ammunition Plant, Virginia (April 2011), 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 (October 2013). 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 2B data validation, which comprises an evaluation of quality control (QC) summary results.

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.

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 with the following exceptions:

Date	Column	Compound	%D	Associated Samples	Flag	A or P
06/29/17	Signal 2	Nitroglycerin	40.9	All samples in SDG 128820/FA45722/FA95759	UJ (all non-detects)	A

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.

IV. Laboratory Blanks

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

V. Field Blanks

Sample 071017R1 was identified as a rinsate. No contaminants were found.

VI. Surrogates

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

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 with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
54MW12MS/MSD (54MW12)	HMX	-	132 (80-115)	J (all detects)	A
54MW12MS/MSD (54MW12)	RDX DNX MNX	- 174 (66-127) 150 (71-137)	164 (50-160) 198 (66-127) 161 (71-137)	NA	-

Relative percent differences (RPD) were within QC limits.

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 54MW10 and 54TM10 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD (Limits)	Flag	A or P
	54MW10	54TM10			
HMX	0.35	1.8	135 (≤20)	J (all detects)	A
RDX	0.76	5.5	151 (≤20)	J (all detects)	A
2,4,6-Trinitrotoluene	0.44	4.5	164 (≤20)	J (all detects)	A
4-Amino-2,6-dinitrotoluene	0.10U	0.51	134 (≤20)	J (all detects) UJ (all non-detects)	A
1,3,5-Trinitrobenzene	0.10U	0.79	155 (≤20)	J (all detects) UJ (all non-detects)	A

X. Compound Quantitation

All compounds reported below the limit of quantitation (LOQ) and above the method detection limit (MDL) were qualified as follows:

Sample	Compound	Flag	A or P
All samples in SDG 128820/FA45722/FA95759	All compounds reported below the LOQ and above the MDL.	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XI. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

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

Due to ICV %D, MS/MSD %R, field duplicate RPD, and results below the LOQ and above the MDL, data were qualified as estimated in six 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.

Radford Army Ammunition Plant, VA
Explosives - Data Qualification Summary - SDG 128820/FA45722/FA95759

Sample	Compound	Flag	A or P	Reason
54MW10 54TM10 54MW1 071017R1 54MW12 54MW13	Nitroglycerin	UJ (all non-detects)	A	Initial calibration verification (%D)
54MW12	HMX	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)
54MW10 54TM10	HMX RDX 2,4,6-Trinitrotoluene	J (all detects) J (all detects) J (all detects)	A	Field duplicates (RPD)
54MW10 54TM10	4-Amino-2,6-dinitrotoluene 1,3,5-Trinitrobenzene	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	A	Field duplicates (RPD)
54MW10 54TM10 54MW1 071017R1 54MW12 54MW13	All compounds reported below the LOQ and above the MDL.	J (all detects)	A	Compound quantitation

Radford Army Ammunition Plant, VA
Explosives - Laboratory Blank Data Qualification Summary - SDG 128820/FA45722/FA95759

No Sample Data Qualified in this SDG

Radford Army Ammunition Plant, VA
Explosives - Field Blank Data Qualification Summary - SDG 128820/FA45722/FA95759

No Sample Data Qualified in this SDG

LDC #: 39239A40 **VALIDATION COMPLETENESS WORKSHEET** Date: 8/17/17
SDG #: 128820/FA45722 / FA 95759 Stage 2B Page: 1 of 1
Laboratory: CT Laboratories/Accutest Laboratories Reviewer: JVG
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 / D	
II.	Initial calibration/ICV	A / SW	ICAL ≤ 15% r² ICV ≤ 20%
III.	Continuing calibration	SW	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	ND	R = 4
VI.	Surrogate spikes	SW	
VII.	Matrix spike/Matrix spike duplicates	SW	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	D = 1/2
X.	Compound quantitation RL/LOQ/LODs	N	
XI.	Target compound identification	N	
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 / Subcon ID	Matrix	Date
1	54MW10	889901 / FA45722-1	Water	07/10/17
2	54TM10	889903 / -2	Water	07/10/17
3	54MW1	889905 / -3	Water	07/10/17
4	071017R1	889907 / -4	Water	07/10/17
5	54MW12	890666 / FA45759-1		07/11/17
6	54MW13	890669 / -2		
7	5MS	890666MS / -1	MS	
8	5MSD	MSD / -1	MSD	
9				
10				
11				
12				

Notes:

	OP65961-MB						

VALIDATION FINDINGS WORKSHEET

METHOD: ___GC ___HPLC

8310	8330	8151	8141	8141(Con't)	8021B
A. Acenaphthene	A. HMX	A. 2,4-D	A. Dichlorvos	CC. Trichlorinate	V. Benzene
B. Acenaphthylene	B. RDX	B. 2,4-DB	B. Mevinphos	DD. Trifluralin	CC. Toluene
C. Anthracene	C. 1,3,5-Trinitrobenzene	C. 2,4,5-T	C. Demeton-O	EE. Def	EE. Ethyl Benzene
D. Benzo(a)anthracene	D. 1,3-Dinitrobenzene	D. 2,4,5-TP	D. Demeton-S	FF. Prowl	SSS. O-Xylene
E. Benzo(a)pyrene	E. Tetryl	E. Dinoseb	E. Ethoprop	GG. Ethion	RRR. MP-Xylene
F. Benzo(b)fluoranthene	F. Nitrobenzene	F. Dichlorprop	F. Naled	HH. Famphur	GG. Total Xylene
G. Benzo(g,h,i)perylene	G. 2.4.6-Trinitrotoluene	G. Dicamba	G. Sulfotep	II. Phosmet	
H. Benzo(k)fluoranthene	H. 4-Amino-2,6-dinitrotoluene	H. Dalapon	H. Phorate	JJ. Tetrachlorvinphos	**VPH**
I. Chrysene	I. 2-Amino-4,6-dinitrotoluene	I. MCPP	I. Dimethoate	KK. Demeton (total)	A. C5-C6 Aliphatics
J. Dibenz(a,h)anthracene	J. 2,4-Dinitrotoluene	J. MCPA	J. Diazinon		B. C6-C8 Aliphatics
K. Fluoranthene	K. 2,6-Dinitrotoluene	K. Pentachlorophenol	K. Disulfoton		C. C8-C10 Aliphatics
L. Fluorene	L. 2-Nitrotoluene	L. 2,4,5-TP (silvex)	L. Parathion-methyl	**8315A**	D. C10-C12 Aliphatics
M. Indeno(1,2,3-cd)pyrene	M. 3-Nitrotoluene	M. Silvex	M. Ronnel	A. Formaldehyde	E. C8-C10 Aromatics
N. Naphthalene	N. 4-Nitrotoluene	N.	N. Malathion	B. Acetaldehyde	F. C10-C12 Aromatics
O. Phenanthrene	O. Nitroglycerin	O.	O. Chlorpyrifos	C. Benzaldehyde	G. Total VPH
P. Pyrene	P. Picric acid	P.	P. Fenthion	D. Butyraldehyde	
Q.	Q. 2,4-Dinitrophenol	Q.	Q. Parathion-ethyl	C. Benzaldehyde	**EPH**
R.	R. 3,5-Dinitroaniline		R. Trichlornate	D. Butyraldehyde	A. C10-C12 Aromatics
S.	S. 2-Nitrophenol		S. Merphos		B. C12-C16 Aromatics
	T. 4-Nitrophenol		T. Stirofos		C. C16-C21 Aromatics
	U. Picramic acid		U. Tokuthion	**Organic acids**	D. C21-C34 Aromatics
	V. PETN		V. Fensulfothion	A. Acetic acid	E. C10-C12 Aliphatics
	W. Hexahydro-1,3,5-trinitroso-1,3,5-triazine		W. Bolstar	B. Butyric acid	F. C12-C16 Aliphatics
	X. MNX		X. EPN	C. Lactic acid	G. C16-C21 Aliphatics
	Y. Hexahydro-1,3-dinitroso-5-nitro-1,3,5-triazine		Y. Azinphos-methyl	D. Propionic acid	H. C21-C34 Aliphatics
	Z. DNX		Z. Coumaphos	E. Pyruvic acid	
	AA. TNX		AA. Parathion		
			BB. Trichloronate		

LDC #: 39239A40

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

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

METHOD: __ GC / HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
What type of initial calibration verification calculation was performed? ___%D or ___%R
(Y) N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?
Y (N) N/A Did the initial calibration verification standards meet the %D / %R validation criteria of ≤20.0% / 80-120%?

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
	06/29/17	ICV 1615-500	Sig 2	O	40.9	All (ND)	J/UJ/A

LDC #: 39239 A4o

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: __ GC ✓ HPLC

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

What type of continuing calibration calculation was performed? __%D or __%R

(Y) N N/A Were continuing calibration standards analyzed at the required frequencies?

Y (N) N/A Did the continuing calibration standards meet the %D / %R validation criteria of ≤20.0% / 80-120%?

Level IV Only

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

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	RT (limit)	Associated Samples	Qualifications
	07/19/17	BB056490	Sig 2	E	26.3	( )	OP65961-MB	J/UJ/A
						( )		
						( )		
						( )		
						( )		
						( )		
						( )		
						( )		
						( )		
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						( )		

LDC #: 39239A4o

VALIDATION FINDINDS WORKSHEET
Surrogate Recovery

Reviewer: JVG
2nd Reviewer: 4

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
	OP65961-MB		T	61	(70-136)	J/UJ/P
					( )	
					( )	
					( )	
					( )	
					( )	
					( )	
					( )	
					( )	
					( )	
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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 #: 39239A4b

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

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".

(Y) N N/A — Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG?

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

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

#	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	7/8	A	( )	132 (80-115)	( )	5 (Det)	J dets /A
		B	( )	164 (50-160)	( )	↓ (ND)	↓
		Z	174 (66-127)	198 (66-127)	( )	↓ ↓	↓
		X	150 (71-137)	161 (71-137)	( )	↓ ↓	↓
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

LDC #: 39239A40

VALIDATION FINDINGS WORKSHEET
Field Duplicates

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

METHOD: ___ GC _/_ HPLC

Y N N/A Were field duplicate pairs identified in this SDG?
Y N N/A Were target compounds detected in the field duplicate pairs?

Compound	Concentration (ug/L)		%RPD Limit (≤ 30 %)	Qualification (Parent only)
	1	2		
A	0.35	1.8	135	J dets / A
B	0.76	5.5	151	
G	0.44	4.5	164	
H	0.10 U	0.51	134	J / UJ / A
C	0.10 U	0.79	155	

Compound	Concentration ( )		%RPD Limit (≤ %)	Qualification (Parent only)

Compound	Concentration ( )		%RPD Limit (≤ %)	Qualification (Parent only)

LDC Report# 39239A51

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Radford Army Ammunition Plant, VA

LDC Report Date: August 17, 2017

Parameters: Methane, Ethane, & Ethene

Validation Level: Stage 2B

Laboratory: CT Laboratories

Sample Delivery Group (SDG): 128820

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
48MW06	891323	Water	07/12/17
49TM1	891325	Water	07/12/17
48MW1	891327	Water	07/12/17
49MW01	891329	Water	07/12/17
49MW02	891331	Water	07/12/17
49TM2	891333	Water	07/12/17
13MW4	891335	Water	07/12/17
13MW2	891337	Water	07/12/17
50MW02	891495	Water	07/13/17
48MW3	891497	Water	07/13/17
48MW2	891502	Water	07/13/17
071317R1	891506	Water	07/13/17
13MW3	891508	Water	07/13/17
49MW04	891510	Water	07/13/17
48MW3MS	891497MS	Water	07/13/17
48MW3MSD	891497MSD	Water	07/13/17

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 SWMU 49 Monitored Natural Attenuation Ground Monitoring Work Plan for Radford Army Ammunition Plant, Virginia (October 2014), 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 (October 2013). 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:

Methane, Ethane, and Ethene by Method RSK-175

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

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.

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.

IV. Laboratory Blanks

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

V. Field Blanks

Sample 071317R1 was identified as a rinsate. No contaminants were found.

VI. 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.

VII. Laboratory Control Samples

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

VIII. Field Duplicates

Samples 48MW06 and 49TM1 and samples 49MW02 and 49TM2 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD (Limits)	Flag	A or P
	48MW06	49TM1			
Methane	0.42	0.42	0 (≤35)	-	-

IX. Compound Quantitation

All compounds reported below the limit of quantitation (LOQ) and above the method detection limit (MDL) were qualified as follows:

Sample	Compound	Flag	A or P
All samples in SDG 128820	All compounds reported below the LOQ and above the MDL.	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

X. Target Compound Identification

Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

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

Due to results below the LOQ and above the MDL, data were qualified as estimated in fourteen 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.

Radford Army Ammunition Plant, VA
Methane, Ethane, & Ethene - Data Qualification Summary - SDG 128820

Sample	Analyte	Flag	A or P	Reason
48MW06 49TM1 48MW1 49MW01 49MW02 49TM2 13MW4 13MW2 50MW02 48MW3 48MW2 071317R1 13MW3 49MW04	All compounds reported below the LOQ and above the MDL.	J (all detects)	A	Compound quantitation

Radford Army Ammunition Plant, VA
Methane, Ethane, & Ethene - Laboratory Blank Data Qualification Summary - SDG 128820

No Sample Data Qualified in this SDG

Radford Army Ammunition Plant, VA
Methane, Ethane, & Ethene - Field Blank Data Qualification Summary - SDG 128820

No Sample Data Qualified in this SDG

LDC #: 39239A51 **VALIDATION COMPLETENESS WORKSHEET** Date: 08/15/17
SDG #: 128820 Stage 2B Page: 1 of 1
Laboratory: CT Laboratories Reviewer:
2nd Reviewer:

METHOD: GC Methane-Ethane-Ethene (Method RSK-175)

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	r ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	ND	R = 1x
VI.	Matrix spike/Matrix spike duplicates	A	
VII.	Laboratory control samples	A	LCS *
VIII.	Field duplicates	SW	D = 1/2, 5/6
IX.	Compound quantitation RL/LOQ/LODs	N	
X.	Target compound identification	N	
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	48MW06 D1	891323	Water	07/12/17
2	49TM1 D1	891325	Water	07/12/17
3	48MW1	891327	Water	07/12/17
4	49MW01	891329	Water	07/12/17
5	49MW02 Dr	891331	Water	07/12/17
6	49TM2 Dr	891333	Water	07/12/17
7	13MW4	891335	Water	07/12/17
8	13MW2	891337	Water	07/12/17
9	50MW02	891495	Water	07/13/17
10	48MW3	891497	Water	07/13/17
11	48MW2	891502	Water	07/13/17
12	071317R1	891506	Water	07/13/17
13	13MW3	891508	Water	07/13/17
14	49MW04	891510	Water	07/13/17
15	48MW3MS	891497MS	Water	07/13/17
16	48MW3MSD	891497MSD	Water	07/13/17
17				
18	139901 MB			

LDC #: 39239A51

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd reviewer: 1

METHOD: / **GC** __ **HPLC**

Y N N/A Were field duplicate pairs identified in this SDG?
Y N N/A Were target compounds detected in the field duplicate pairs?

Compound	Concentration (ug/L)		%RPD Limit (≤ 35 %)	Qualification (Parent only)
	1	2		
Methane	0.42	0.42	0	

Compound	Concentration ( )		%RPD Limit (≤ %)	Qualification (Parent only)

Compound	Concentration ( )		%RPD Limit (≤ %)	Qualification (Parent only)

LDC Report# 39239A87

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Radford Army Ammunition Plant, VA

LDC Report Date: August 17, 2017

Parameters: Perchlorate

Validation Level: Stage 2B

Laboratory: CT Laboratories/Accutest Laboratories

Sample Delivery Group (SDG): 128820/FA45722/FA45759

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
54MW10	889901/FA45722-1	Water	07/10/17
54TM10	889903/FA45722-2	Water	07/10/17
54MW1	889905/FA45722-3	Water	07/10/17
071017R1	889907/FA45722-4	Water	07/10/17
54MW12	890666/FA45759-1	Water	07/11/17
54MW13	890669/FA45759-2	Water	07/11/17
54MW12MS	890666/FA45759-1MS	Water	07/11/17
54MW12MSD	890666/FA45759-1MSD	Water	07/11/17

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 SWMU 54 (RAAP-14) Monitored Natural Attenuation Interim Measures Work Plan for Radford Army Ammunition Plant, Virginia (April 2011), 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 (October 2013). 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 6850

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

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 50.0%.

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

Sample 071017R1 was identified as a rinsate. No contaminants were found.

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 not within the QC limits for 54MW12MS/MSD. No data were qualified since the parent sample results were greater than 4X the spiked concentration. Relative percent differences (RPD) were within QC limits.

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 54MW10 and 54TM10 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

	Concentration (ug/L)				
Compound	54MW10	54TM10	RPD (Limits)	Flag	A or P
Perchlorate	0.20	0.40	67 (≤20)	J (all detects)	A

X. Internal Standards

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

XI. Compound Quantitation

All compounds reported below the limit of quantitation (LOQ) and above the method detection limit (MDL) were qualified as follows:

Sample	Compound	Flag	A or P
All samples in SDG 128820/FA45722/FA45759	All compounds reported below the LOQ and above the MDL.	J (all detects)	A

Raw data were not reviewed for Stage 2B validation.

XII. Target Compound Identifications

Raw data were not reviewed for Stage 2B validation.

XIII. System Performance

Raw data were not reviewed for Stage 2B validation.

XIV. Overall Assessment of Data

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

Due to field duplicate RPD and results below the LOQ and above the MDL, data were qualified as estimated in six 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.

Radford Army Ammunition Plant, VA
Perchlorate - Data Qualification Summary - SDG 128820/FA45722/FA45759

Sample	Analyte	Flag	A or P	Reason
54MW10 54TM10	Perchlorate	J (all detects)	A	Field duplicates (RPD)
54MW10 54TM10 54MW1 071017R1 54MW12 54MW13	All compounds reported below the LOQ and above the MDL.	J (all detects)	A	Compound quantitation

Radford Army Ammunition Plant, VA
Perchlorate - Laboratory Blank Data Qualification Summary - SDG 128820/FA45722/FA45759

No Sample Data Qualified in this SDG

Radford Army Ammunition Plant, VA
Perchlorate - Field Blank Data Qualification Summary - SDG 128820/FA45722/FA45759

No Sample Data Qualified in this SDG

LDC #: 39239A87 **VALIDATION COMPLETENESS WORKSHEET** Date: 08/15/17

SDG #: 128820/FA45722 / FA45759 Stage 2B Page: 1 of 1

Laboratory: CT Laboratories/Accutest Laboratories Reviewer: JW

2nd Reviewer: CF

METHOD: LC/MS Perchlorate (EPA SW846 Method 6850)

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	r ICV ≤ 15%
IV.	Continuing calibration	A	CCV ≤ 15% LODV ≤ 50%
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	R = 4
VII.	Surrogate spikes	N	Not req'd.
VIII.	Matrix spike/Matrix spike duplicates	SW	
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	SW	D = 1/2
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
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 / Subcon ID	Matrix	Date
1	54MW10 D	889901/FA45722-1	Water	07/10/17
2	54TM10 D	889903/-2	Water	07/10/17
3	54MW1	889905/-3	Water	07/10/17
4	071017R1	889907/-4	Water	07/10/17
5	54MW12	890666/FA45759-1		07/11/17
6	54MW13	890669/-2		
7	5MS	/-1MS		
8	5MSD	/-1MSD		

Notes:

-	OP66151-MB						

LDC #: 39239A87

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates/Duplicates

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

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

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

Y N N/A Were a matrix spike (MS) and matrix spike duplicate (MSD) or duplicate sample analyzed for each matrix in this SDG?
Y N N/A Was a MS/MSD analyzed every 20 samples of each matrix?
Y N N/A Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?
Y N N/A Were all duplicate sample relative percent differences (RPD) or differences within QC limits?

#	Date	MS/MSD/DUP ID	Compound	MS %R	MSD %R	(%R Limits)	Difference (Limits)	Associated Samples	Qualifications
		7/8	Perchlorate	50	50	80-120		5 (Det)	No qual (parent conc. > 4X spike)

LDC #: 39239A87

VALIDATION FINDINGS WORKSHEET
Field Duplicates

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

METHOD: ___ GC ___ HPLC ✓ LCMS

Y N N/A Were field duplicate pairs identified in this SDG?
Y N N/A Were target compounds detected in the field duplicate pairs?

Compound	Concentration (ug/L)		%RPD Limit (≤ 20 %)	Qualification (Parent only)
	1	2		
Perchlorate	0.20	0.40	67	J dets / A

Compound	Concentration ( )		%RPD Limit (≤ %)	Qualification (Parent only)

Compound	Concentration ( )		%RPD Limit (≤ %)	Qualification (Parent only)

LDC #: 39239

EDD POPULATION COMPLETENESS WORKSHEET

Date: 8/24/17
Page: 1 of 1
2nd Reviewer:

The LDC job number listed above was entered by aj.

	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.	N	
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/NA	Highlight detect results.
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/NA	
IIIg.	-Are there any discrepancies between the data packet and the EDD?	N	

Notes: *see discrepancy sheet