Appendix B-1
Data Validation Reports

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DATA VALIDATION AND USABILITY REPORT

VOLATILES by USEPA SW-846 Method 8260C, 624 (Trip Blank)
EXPLOSIVES by USEPA SW-846 Method 8330B
MERCURY by USEPA SW-846 Method 7470A
METALS by USEPA SW-846 Method 6010C
CHEMICAL OXYGEN DEMAND by USEPA SW-846 Method 410.4
DISSOLVED GASES (MEE) by USEPA SW-846 Method RSK 175
TOTAL ORGANIC and INORGANIC CARBONS by USEPA SW-846 Method 9060A
ANIONS by USEPA SW-846 Method 9056A
pH by USEPA SW-846 Method 9040C
PERCHLORATES by USEPA SW-846 Method 6850
CHLORATES/CHLORITES by USEPA SW-846 Method 300.1

Project: Radford Army Ammunitions Plant, Virginia – Long Term Monitoring
Project/Task Number: 228-242801-003
Sample Data Package: 114433, 114442, 114475
Laboratory: CT Laboratories, Baraboo, Wisconsin
Microbac Laboratories, Marietta, Ohio (Perchlorate)
Summit Environmental Technologies, Cuyahoga Falls, Ohio (Chlorate/Chlorite)
Sample Matrix: Groundwater
Sampling Dates: 30 September, 1-2 October 2015
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), Stage 3VM (10% of data)
Data Reviewer: Jennifer Chandler, Chemist with HDR (Henningson, Durham, Richardson)

Sample ID	Matrix	Lab ID	Data Package	VOC	MEE	Chloride/Nitrate/ SO4/pH	PAH/EXP	Metals	TOC/ TIC COD	Chlorate/ Chlorite/ Perchlorates
54MW1	Groundwater	640106	114433	X		X	X			
54MW12	Groundwater	640109		X		X	X			
54MW13	Groundwater	640110		X		X	X			
54MW10	Groundwater	640111		X		X	X			
SWMU54TM	Groundwater	640112		X		X	X			
49MW04	Groundwater	640113				X				
54MW1	Groundwater	640118						X	X	X
54MW12	Groundwater	640119						X	X	X
54MW13	Groundwater	640120						X	X	X
54MW10	Groundwater	640121						X	X	X
SWMU54TM	Groundwater	640122						X	X	X
49MW04	Groundwater	640123		X	X					
48MW07	Groundwater	640251	114442			X				
48MW07	Groundwater	640252		X	X				X	
48MW06	Groundwater	640254				X				
48MW06	Groundwater	640255		X	X				X	
49TM01	Groundwater	640256				X				
49TM01	Groundwater	640257		X	X				X	
48MW2	Groundwater	640258				X				
48MW2	Groundwater	640259		X	X				X	
48MW1	Groundwater	640260				X				

Sample ID	Matrix	Lab ID	Data Package	VOC	MEE	Chloride/Nitrate/ SO4/pH	PAH/EXP	Metals	TOC/ TIC COD	Chlorate/ Chlorite/ Perchlorates
48MW1	Groundwater	640261	114442	X	X				X	
49MW01	Groundwater	640262				X				
49MW01	Groundwater	640263		X	X				X	
10115T1	TRIP BLANK	640297		X						
13MW3	Groundwater	640601	114475			X				
13MW3	Groundwater	640602		X	X				X	
13MW4	Groundwater	640603				X				
13MW4	Groundwater	640604		X	X				X	
13MW2	Groundwater	640605				X				
13MW2	Groundwater	640606		X	X				X	
100215R1	Groundwater	640607				X				
100215R1	Groundwater	640608		X	X				X	
48MW3	Groundwater	640609				X				
48MW3	Groundwater	640610		X	X				X	
ADW01	Groundwater	640611				X		X	X	
49MW02	Groundwater	640612				X				
49MW02	Groundwater	640613		X	X				X	
50MW02	Groundwater	640614				X				
50MW02	Groundwater	640615		X	X				X	
ADW02	Groundwater	640616				X		X	X	
TRIP BLANK	TRIP BLANK	640617		X	X					

Note: CT Laboratories confirmed that their LIMS system (Reporting System) reports the EDD as 8015 and the PDF as RSK-175. The lab confirmed that for reporting purposes with this report that these two are interchangeable. To be consistent between reports, the EDD label for 8015 was changed to RSK-175.

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 1.9°C and 2.5°C. The chains of custody (COCs) were filled out and signed. All samples had the proper preservation.

II. HOLDING TIMES

Holding time criteria were met. No qualification was required.

VOCs: Samples were analyzed within 14 days of collection.

Explosives: Samples were extracted within seven days of collection and analyzed within 40 days of extraction.

Perchlorates: Samples were analyzed within 28 days of collection.

Metals: Samples were analyzed within 180 days of collection. Mercury samples were analyzed within 28 days of collection.

Anions: Samples were not analyzed within 48 hours after collection for nitrate. All samples will be estimated with J or UJ, as they are within and Samples were analyzed within 28 days for sulfate and chloride.

MEE(Methane, Ethane, Ethene): Samples were analyzed within 14 days of collection.

COD: Samples were analyzed within 28 days of collection.

TOC/TIC: Samples were analyzed within 28 days of collection.

Chlorate: Samples were analyzed within 28 days of collection.

Chlorite: Samples were analyzed within 14 days of collection.

IV. INSTRUMENT PERFORMANCE

VOCs: GC/MS BFB tuning criteria were met. No qualification was required.

Explosives: Not applicable.

Perchlorates: Not applicable.

Metals: Not applicable.

Anions: Not applicable.

MEE: Not applicable.

COD: Not applicable.

TOC/TIC: Not applicable.

Chlorate: Not applicable.

Chlorite: Not applicable.

V. INSTRUMENT CALIBRATION
INITIAL CALIBRATIONS

VOCs: Initial calibration criteria were met. No qualification was required.

Explosives: Initial calibration criteria were met. No qualification was required.

Perchlorate: Initial calibration criteria were met. No qualification was required.

Metals: Initial calibration criteria were met. No qualification was required.

Anions: Initial calibration criteria were met. No qualification was required.

MEE: Initial calibration criteria were met. No qualification was required.

COD: Initial calibration criteria were met. No qualification was required.

TOC/TIC: Initial calibration criteria were met. No qualification was required.

Chlorate/Chlorite: Initial calibration criteria were met. No qualification was required.

SECOND SOURCE STANDARDS

VOCs: All target analytes had %D values less than 20%.

Explosives: All target analytes had %D values less than 20%.

Perchlorates: All target analytes had %D values less than 15%.

Metals: All target results had %D values less than 10%.

Anions: Not applicable.

MEE: All target *analytes had %D values less than 15%.*

COD: Not applicable.

TOC/TIC: Not applicable.

Chlorate/Chlorite: Not applicable.

CONTINUING CALIBRATIONS

VOCs: The Continuing Calibration Verification (CCV), analyzed on 10/13/15, was outside criteria for methyl acetate at 27%. The CCV, analyzed on 10/15/15, was outside criteria for Bromomethane at 32%. Methyl Acetate and Bromomethane in the associated samples were qualified as non-detect estimated (UJ) for associated samples.

Explosives: Nitrobenzene CCV, analyzed 10/14/15, failed outside the acceptable criteria (high). All samples were ND; therefore, no qualifications were required.

Perchlorate: All continuing calibration criteria were met.

Metals: All continuing calibration criteria were met.

Anions: All continuing calibration criteria were met.

MEE: All continuing calibration criteria were met.

COD: All continuing calibration criteria were met.

TOC/TIC: All continuing calibration criteria were met.

Chlorate/Chlorite: All continuing calibration criteria were met.

VI. BLANKS

METHOD BLANKS

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

VOCs: Target analytes were not detected in the method blanks.

Explosives: TNX was detected in the method blanks, but all sample results were non-detected. No qualification was required.

Perchlorate: Target analytes were not detected in the method blanks.

Metals: Calcium and Magnesium were detected in the method blank, but all sample results were greater than 10x the blank concentration. No qualification was required.

Anions: Anions were not detected in the method blanks.

MEE: Target analytes were not detected in the method blanks.

COD: Target analytes were not detected in the method blanks.

TOC/TIC: TOC analytes were not detected in the method blanks.

Chlorate/Chlorite: Target analytes were not detected in the method blanks.

TRIP BLANKS

VOCs: Acetone was detected in the TRIP BLANK (analyzed 10/13/15, 640617). Sample results less than two times the blank concentration have been qualified with a B for blank contamination.

Explosives: Not applicable.

Perchlorate: Not applicable.

Metals: Not applicable.

Anions: Not applicable.

MEE: Methane was detected in the TRIP BLANK (analyzed 10/6/15, 640617). All sample results were non-detected. No qualification was required.

COD: Not applicable.

TOC/TIC: Not applicable.

Chlorate/Chlorite: Not applicable.

INITIAL AND CONTINUING CALIBRATION BLANKS (ICB and CCB)

VOCs: 1,4-Dioxane and 2-Hexanone were detected in the ICB. Sample results were non-detected. No qualification was required.

Explosives: Explosives were not detected in the ICBs or CCBs. No qualification was required.

Perchlorate: Perchlorates were not detected in the ICBs or CCBs. No qualification was required.

Metals: Analytes were detected in the ICB and CCB. Samples were reanalyzed and reported at greater than LOD, or MDL. No qualification was required.

Anions: Anions were not detected in the ICBs or CCBs. No qualification was required.

MEE: Methane was detected in the ICB. Sample results less than two times the blank concentration have been qualified with a B for blank contamination.

COD: COD were not detected in the ICBs or CCBs. No qualification was required.

TOC/TIC: TIC analytes were detected in the CCBs. Sample results were greater than the method blank results, and no qualification was required.

Chlorate/Chlorite: Chlorate/chlorite were not detected in the ICBs or CCBs. No qualification was required.

RINSATE BLANKS

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

VOCs: Target analytes were detected in the rinsate blank (100215R1). Chloroform was detected in the RB; the compound results were considered estimated (B), at less than two times the blank concentration, in sample 50MW02. Methylene Chloride and Toluene were also detected in the rinsate blank. For these two compounds, the associated sample results were non-detect, or greater than two times the blank result; therefore, no qualification was required for these compounds.

Explosives: Not applicable.

Perchlorate: Not applicable.

Metals: Not applicable.

Anions: Nitrate/Nitrogen was detected in the rinsate blank (100215R1); this analytes results were considered estimated, at less than two times the blank results, in sample 49MW02, only.

MEE: Target analytes were not detected in the rinsate blanks.

COD: Not applicable.

TOC/TIC: TOC analytes were not detected in the rinsate blank.

Chlorate/Chlorite: Not applicable.

VII. LABORATORY CONTROL SAMPLES (LCS)

VOCs: LCS recoveries were within control limits.

Explosives: LCS recoveries were within control limits.

Perchlorate: LCS recoveries were within control limits.

Metals: LCS recoveries were within control limits.

Anions: LCS recoveries were within control limits.

MEE: LCS recoveries were within control limits.

COD: LCS recoveries were within control limits.

TOC/TIC: LCS recoveries were within control limits.

Chlorate/Chlorite: LCS recoveries were within control limits.

VIII. SURROGATES

All surrogate recoveries were within control limits except as noted below.

VOCs: Surrogate recoveries were within control limits.

Explosives: Surrogate recovery was not within control limits. Low surrogate recovery was acquired (primary and confirmation analysis) for samples 54MW13 and 54MW10. No remaining volume was available for re-extraction, so compounds were qualified as estimated (UJ, J).

Perchlorate: Not applicable.

Metals: Not applicable.

Anions: Not applicable.

MEE: Not applicable.

COD: Not applicable.

TOC/TIC: Not applicable.

Chlorate/Chlorite: Not applicable.

VIII. MATRIX SPIKE / MATRIX SPIKE DUPLICATE (MS/MSD)

VOCs: VOC spiked recoveries were within control limits.

Explosives: Nitroglycerin was above the control limits of 74-127%, for the MS analysis associated with sample 54MW12, at 179%. Nitroglycerin, for the MSD, was reanalyzed on the confirmation column and the low recoveries were confirmed to be out due to sample matrix. Due to >75% of the analytes failing low in the MSD, the %RPDs were also low. The associated failing analytes have been qualified as estimated (J).

Perchlorate: Perchlorate was below the control limits of 84-119%, at 82.5/72.0%, for the MS/D analysis associated with sample 54MW12. Perchlorate sample results were qualified as estimated (J).

Metals: Chromium was above the control limits of 90-113%, for the MS/MSD analysis associated with sample ADW01, at 131%/117%. Chromium was detected, in the parent sample and has been qualified as estimated (J). Iron in sample ADW01 was much greater than four times the spike concentration. No qualification was required.

Anions: Sulfate, at 54%, was below the control limit of 87-112%, for MS analysis associated with sample 13MW3. Sulfate was detected in the parent sample and has been qualified as estimated (J).

MEE: No qualification was required.

COD: No qualification was required.

TOC/TIC: TOC, at 73%, was below the control limit of 85-111%, for MS/MSD analysis associated with sample 48MW2. TOC was detected in the parent sample and has been qualified as estimated (J).

Chlorate/Chlorite: No qualification was required.

IX. DUPLICATES

FIELD DUPLICATES

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

Field Duplicate Sample	Parent Sample	Matrix	Analyses
NA	NA	NA	NA

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. If the analyte was undetected then the qualifier assigned was UJ.

VOCs: Not applicable.

Explosives: Not applicable.

Perchlorate: Not applicable.

Metals: Not applicable.

Anions: Not applicable.

MEE: Not applicable.

COD: Not applicable.

TOC/TIC: Not applicable.

Chlorate/Chlorite: Not applicable.

LABORATORY DUPLICATES

VOCs: Not applicable.

Explosives: Not applicable.

Perchlorate: Not applicable.

Metals: The RPDs between the parent and lab duplicate samples were not within control limits, for sample ADW01, for Chromium. Chromium (114%) results were qualified as estimated (J).

Anions: The RPDs between the parent and lab duplicate samples were within control limits. No qualification was required.

MEE: Not applicable.

COD: The RPDs between the parent and lab duplicate samples were within control limits. No qualification was required.

TOC/TIC: The RPD between the parent and lab duplicate samples were not within control limits for sample 54MW12, at 34%. Sample results were qualified as estimated with at J.

Chlorate/Chlorite: Not applicable.

X. INTERNAL STANDARDS (ISTD)
All ISTD criteria were met except as noted below.

VOCs: All ISTD criteria were met.

Explosives: Not applicable.

Perchlorate: All ISTD criteria were met.

Metals: Not applicable.

Anions: Not applicable.

MEE: Not applicable.

COD: Not applicable.

TOC/TIC: Not applicable.

Chlorate/Chlorite: Not applicable.

XI. 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.

VOCs: Not applicable.

Explosives: Not applicable.

Perchlorate: Not applicable.

Metals: The Serial Dilution result for sample ADW01, for iron, was less than 50 times the LOQ. A PDS was analyzed, but unacceptable for iron at 1208% recovery. The parent sample was reported and qualified as estimated (J).

Anions: Not applicable.

MEE: Not applicable.

COD: Not applicable.

TOC/TIC: Not applicable.

Chlorate/Chlorite: Not applicable.

XII. INTERFERENCE CHECK SAMPLES (ICS)
ICS results were applicable to the lead analysis. Results were within control limits of 80-120% except as noted below.

VOCs: Not applicable.

Explosives: Not applicable.

Perchlorate: Not applicable.

Metals: Recoveries were within control limits.

Anions: Not applicable.

MEE: Not applicable.

COD: Not applicable.

TOC/TIC: Not applicable.

Chlorate/Chlorite: Not applicable.

XIII. REPORTING LIMITS (RL) AND METHOD DETECTION LIMITS (MDL)
The required RLs as listed in the QAPP were met except as noted below.

VOCs: The required RLs as listed in the QAPP were met.

Explosives: The required RLs as listed in the QAPP were met.

Perchlorate: The required RLs as listed in the QAPP were met.

Metals: The required RLs as listed in the QAPP were met.

Anions: The required RLs as listed in the QAPP were met.

MEE: The required RLs as listed in the QAPP were met.

COD: The required RLs as listed in the QAPP were met.

TOC/TIC: The required RLs as listed in the QAPP were met.

Chlorate/Chlorite: The required RLs as listed in the QAPP were met.

XIV. 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).

VOCs: No issues.

Explosives: No issues.

Perchlorate: No issues.

Metals: No issues.

Anions: No issues.

MEE: No issues.

COD: No issues.

TOC/TIC: No issues.

Chlorate/Chlorite: No issues.

XV. DATA USABILITY

Data were usable as discussed below.

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

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

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

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

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

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

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

TOC/TIC: No data were rejected. Data required minimal qualification. All data are usable as qualified.

Chlorate/Chlorite: No data were rejected. Data required minimal qualification. All data are usable as qualified.

DATA VALIDATION AND USABILITY REPORT

VOLATILES by USEPA SW-846 Method 8260C
EXPLOSIVES by USEPA SW-846 Method 8330B
MERCURY by USEPA SW-846 Method 7470A
METALS by USEPA SW-846 Method 6010C
CHEMICAL OXYGEN DEMAND by USEPA SW-846 Method 410.4
DISSOLVED GASES (MEE) by USEPA SW-846 Method RSK 175
TOTAL ORGANIC and INORGANIC CARBONS by USEPA SW-846 Method 9060A
ANIONS by USEPA SW-846 Method 9056A
pH by USEPA SW-846 Method 9040C
PERCHLORATES by USEPA SW-846 Method 6850
CHLORATES/CHLORITES by USEPA SW-846 Method 300.1

Project:	Radford Army Ammunitions Plant, Virginia – Long Term Monitoring
Project/Task Number:	228-242801-003
Sample Data Package:	116426, 116448, 116472, 116472, 116508, 116524
Laboratory:	CT Laboratories, Baraboo, Wisconsin Microbac Laboratories, Marietta, Ohio (Perchlorate) Summit Environmental Technologies, Cuyahoga Falls, Ohio (Chlorate/Chlorite)
Sample Matrix:	Groundwater
Sampling Dates:	11-15 January 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), Stage 3VM (10% of data)
Data Reviewer:	Jennifer Chandler, Chemist with HDR (Henningson, Durham, Richardson)

Sample ID	Matrix	Lab ID	Data Package	VOC	MEE	Chloride/Nitrate/ SO4/pH	PAH/EXP	Metals	TOC/ TIC COD	Chlorate/ Chlorite/ Perchlorates
54MW10	GROUNDWATER	679480	116426			X				
54MW10	GROUNDWATER	679481	116426				X		X	X
54TM10	GROUNDWATER	679482	116426			X				
54TM10	GROUNDWATER	679483	116426				X		X	X
54MW12	GROUNDWATER	679978	116448			X				
54MW12	GROUNDWATER	679979	116448				X		X	X
54MW1	GROUNDWATER	679980	116448			X				
54MW1	GROUNDWATER	679981	116448						X	
54MW13	GROUNDWATER	679982	116448			X				
54MW13	GROUNDWATER	679983	116448				X		X	X
54ADW01	GROUNDWATER	679984	116448			X (pH)		X	X	
13MW3	GROUNDWATER	680615	116472			X				
13MW3	GROUNDWATER	680616	116472	X	X				X	
49TM01	GROUNDWATER	680617	116472			X				
49TM01	GROUNDWATER	680618	116472	X	X				X	
13MW4	GROUNDWATER	680619	116472			X				
13MW4	GROUNDWATER	680620	116472	X	X				X	
49MW04	GROUNDWATER	680621	116472			X				
49MW04	GROUNDWATER	680622	116472	X	X				X	

Sample ID	Matrix	Lab ID	Data Package	VOC	MEE	Chloride/Nitrate/ SO4/pH	PAH/EXP	Metals	TOC/ TIC COD	Chlorate/ Chlorite/ Perchlorates
13MW2	GROUNDWATER	680623	116472			X				
13MW2	GROUNDWATER	680624	116472	X	X				X	
49MW05	GROUNDWATER	680625	116472			X				
49MW05	GROUNDWATER	680626	116472	X	X				X	
011316T1	GROUNDWATER	680627	116472	X						
13MW5	GROUNDWATER	680628	116472			X				
13MW5	GROUNDWATER	680629	116472	X	X				X	
48MW07	GROUNDWATER	681413	116508			X				
48MW07	GROUNDWATER	681414	116508	X	X				X	
48MW06	GROUNDWATER	681415	116508			X				
48MW06	GROUNDWATER	681416	116508	X	X				X	
48MW1	GROUNDWATER	681417	116508			X				
48MW1	GROUNDWATER	681418	116508	X	X				X	
49MW03	GROUNDWATER	681419	116508			X				
49MW03	GROUNDWATER	681420	116508	X	X				X	
49MW01	GROUNDWATER	681421	116508			X				
49MW01	GROUNDWATER	681422	116508	X	X				X	
011416T1	GROUNDWATER	681423	116508	X						
49MW02	GROUNDWATER	681527	116524			X				
49MW02	GROUNDWATER	681528	116524	X	X				X	
48MW3	GROUNDWATER	681529	116524			X				
48MW3	GROUNDWATER	681531	116524	X	X				X	
48MW2	GROUNDWATER	681532	116524			X				
48MW2	GROUNDWATER	681533	116524	X	X				X	
50MW02	GROUNDWATER	681534	116524			X				
50MW02	GROUNDWATER	681535	116524	X	X				X	
011516R1	GROUNDWATER	681536	116524			X				
011516R1	GROUNDWATER	681537	116524	X	X			X	X	
49ADW01	GROUNDWATER	681538	116524			X (pH)		X	X	
011516T1	GROUNDWATER	681539	116524	X						

Note: CT Laboratories has confirmed that their LIMS Reporting System) reports the EDD as 8015 and the PDF as RSK-175. The lab confirmed that for reporting purposes with this report that these two are interchangeable. To be consistent between reports, the EDD label for 8015 was changed to RSK-175.

Note: According to the laboratory's case narrative, the standards for MNX, DNX, and TNX were not commercially available at the time of analysis. The primary source standard (used for initial and daily instrument calibrations) was expired when the samples arrived. The secondary source (used for QC purposes) was still valid until March, and was used for both daily calibrations and QC analysis. This is not technically a valid procedure, but the laboratory had no other options. The concentrations of the 2 standards were different, and therefore changed in the laboratory's LIMS reporting system. Due to this issue, all DNX, MNX, and TNX analysis will be considered estimated, with J, or UJ, validation qualifiers.

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 0.8°C and 4.9°C. The chains of custody (COCs) were filled out and signed. All samples had the proper preservation.

II. HOLDING TIMES
Holding time criteria were met. No qualification was required.

VOCs: Samples were analyzed within 14 days of collection.

Explosives: Samples were extracted within seven days of collection and analyzed within 40 days of extraction.

Perchlorates: Samples were analyzed within 28 days of collection.

Metals: Samples were analyzed within 180 days of collection. Mercury samples were analyzed within 28 days of collection.

Anions: Samples were analyzed within 48 hours after collection for nitrate.

MEE (Methane, Ethane, Ethene): Samples were analyzed within 14 days of collection.

COD: Samples were analyzed within 28 days of collection.

TOC/TIC: Samples were analyzed within 28 days of collection.

Chlorate: Samples were analyzed within 28 days of collection.

Chlorite: Samples were analyzed within 14 days of collection.

IV. INSTRUMENT PERFORMANCE

VOCs: GC/MS BFB tuning criteria were met. No qualification was required.

Explosives: Not applicable.

Perchlorates: Not applicable.

Metals: Not applicable.

Anions: Not applicable.

MEE: Not applicable.

COD: Not applicable.

TOC/TIC: Not applicable.

Chlorate: Not applicable.

Chlorite: Not applicable.

V. INSTRUMENT CALIBRATION
INITIAL CALIBRATIONS

VOCs: Initial calibration criteria were met. No qualification was required.

Explosives: Initial calibration %Recovery criteria were met.

Note: According to the laboratory's case narrative, the standards for MNX, DNX, and TNX were not commercially available at the time of analysis. The primary source standard (used for initial and daily instrument calibrations) was expired when the samples arrived. The secondary source (used for QC purposes) was still valid until March, and was used for both daily calibrations and QC analysis. This is not technically a valid procedure, but the laboratory had no other options. The concentrations of the 2 standards were different, and therefore changed in the laboratory's LIMS reporting system. Due to this issue, all DNX, MNX, and TNX analysis will be considered estimated, with J, or UJ, validation qualifiers.

Perchlorate: Initial calibration criteria were met. No qualification was required.

Metals: Initial calibration criteria were met. No qualification was required.

Anions: Initial calibration criteria were met. No qualification was required.

MEE: Initial calibration criteria were met. No qualification was required.

COD: Initial calibration criteria were met. No qualification was required.

TOC/TIC: Initial calibration criteria were met. No qualification was required.

Chlorate/Chlorite: Initial calibration criteria were met. No qualification was required.

SECOND SOURCE STANDARDS

VOCs: Bromomethane was outside the acceptable criteria for %D of 30%, on 012016. Any associated samples were qualified (UJ).

Explosives: All target analytes had %D values less than 20%. Note: the secondary source was not a true secondary source; therefore, all samples are reported as estimated.

Perchlorates: All target analytes had %D values less than 15%.

Metals: All target results had %D values less than 10%.

Anions: Not applicable.

MEE: All target *analytes had %D values less than 15%.*

COD: Not applicable.

TOC/TIC: Not applicable.

Chlorate/Chlorite: Not applicable.

CONTINUING CALIBRATIONS

VOCs: The Continuing Calibration Verification (CCV), analyzed on 01/21/16, was outside criteria for Bromomethane at 31%. The CCV, analyzed on 01/22/16, was outside criteria for Bromomethane at 32% and Dichlorofluoromethane at 23%. Dichlorofluoromethane and

Bromomethane in the associated samples were qualified as non-detect estimated (UJ) for associated samples.

Explosives: CCVs passed %Recovery criteria. See Note below.

Note: According to the laboratory's case narrative, the standards for MNX, DNX, and TNX were not commercially available at the time of analysis. The primary source standard (used for initial and daily instrument calibrations) was expired when the samples arrived. The secondary source (used for QC purposes) was still valid until March, and was used for both daily calibrations and QC analysis. This is not technically a valid procedure, but the laboratory had no other options. The concentrations of the 2 standards were different, and therefore changed in the laboratory's LIMS reporting system. Due to this issue, all DNX, MNX, and TNX analysis will be considered estimated, with J, or UJ, validation qualifiers.

Perchlorate: All continuing calibration criteria were met.

Metals: All continuing calibration criteria were met. Multiple elements exceeded the recovery limit in the CCV1 standard. The sample was reported using CCV2 wavelengths for the failing elements and was reanalyzed for magnesium using an acceptable CCV1 standard. Any samples, with the affected qualified analytes, were estimated (UJ/J).

Anions: All continuing calibration criteria were met.

MEE: All continuing calibration criteria were met.

COD: All continuing calibration criteria were met.

TOC/TIC: All continuing calibration criteria were not met. The CCV analyzed on 01/13/16, failed at 111%Recovery. All affected samples were qualified (UJ/J).

Chlorate/Chlorite: All continuing calibration criteria were met.

VI. BLANKS

METHOD BLANKS

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

VOCs: Target analytes were not detected in the method blanks.

Explosives: Target analytes were not detected in the method blanks.

Perchlorate: Target analytes were not detected in the method blanks.

Metals: Silver was detected in the MB greater than the MDL, but less than ½ the RL. Samples 011516R1, 54ADW01 and 49ADW01 were reported and qualified with a B flag for silver because the MB raw result was greater than criteria limits. Selenium was detected in the MB above the MDL and greater than ½ the RL. Samples 011516R1 and 54ADW01 were reported and qualified (B). Iron was also detected in 54ADW01 and qualified (B).

Anions: Anions were not detected in the method blanks.

MEE: Target analytes were not detected in the method blanks.

COD: Target analytes were not detected in the method blanks.

TOC/TIC: TOC analytes were not detected in the method blanks.

Chlorate/Chlorite: Target analytes were not detected in the method blanks.

TRIP BLANKS

VOCs: Target analytes were not detected in the trip blanks.

Explosives: Not applicable.

Perchlorate: Not applicable.

Metals: Not applicable.

Anions: Not applicable.

MEE: Not applicable.

COD: Not applicable.

TOC/TIC: Not applicable.

Chlorate/Chlorite: Not applicable.

INITIAL AND CONTINUING CALIBRATION BLANKS (ICB and CCB)

VOCs: Bromomethane and Chloroethane were detected in the ICB. Sample results were non-detected. No qualification was required.

Explosives: Explosives were not detected in the ICBs or CCBs. No qualification was required.

Perchlorate: Perchlorates were not detected in the ICBs or CCBs. No qualification was required.

Metals: Analytes were detected in the ICBs and CCBs. Samples were reanalyzed and reported at greater than LOD, or MDL. No further qualifications were required.

Anions: Anions were not detected in the ICBs or CCBs. No qualification was required.

MEE: Methane was detected in the ICB. The following sample results were qualified as estimated (B): 50MW02.

COD: COD were not detected in the ICBs or CCBs. No qualification was required.

TOC/TIC: TIC analytes were not detected in the ICBs and CCBs.

Chlorate/Chlorite: Chlorate/chlorite were not detected in the ICBs or CCBs. No qualification was required.

RINSATE BLANKS

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

VOCs: Methylene Chloride was detected in the rinsate blank (011516R1). All samples were non-detect; therefore no qualifications were needed.

Explosives: Not applicable.

Perchlorate: Not applicable.

Metals: Not applicable.

Anions: Nitrate/Nitrogen was detected in the rinsate blank (011516R1). The results were considered estimated (B), at greater than two times the blank results, in samples 13MW3, 54MW12, 48MW3, 49TM01, and 50MW02. Chloride was detected in rinsate blank (011516R1). The results were considered qualified as estimated (B), at greater than two times the blank results, in samples 13MW2, 48MW06, 49MW01, 49MW03, 49MW05, 50MW02, and 54MW12.

MEE: Target analytes were not detected in the rinsate blanks.

COD: Not applicable.

TOC/TIC: TOC analytes were detected in the rinsate blank. All samples were non-detect; therefore, no qualifications were needed.

Chlorate/Chlorite: Not applicable.

VII. LABORATORY CONTROL SAMPLES (LCS)

VOCs: LCS recoveries were within control limits.

Explosives: LCS recoveries were within control limits.

Perchlorate: LCS recoveries were within control limits.

Metals: LCS recoveries were within control limits.

Anions: LCS recoveries were within control limits.

MEE: LCS recoveries were within control limits.

COD: LCS recoveries were within control limits.

TOC/TIC: LCS recoveries were within control limits.

Chlorate/Chlorite: LCS recoveries were within control limits.

VIII. SURROGATES
All surrogate recoveries were within control limits except as noted below.

VOCs: Surrogate recoveries were within control limits.

Explosives: Surrogate recovery was not within control limits. 1, 2-Dinitrobenzene failed for the following samples: 54MW12. Compounds were qualified as estimated (UJ, J).

Perchlorate: Not applicable.

Metals: Not applicable.

Anions: Not applicable.

MEE: Not applicable.

COD: Not applicable.

TOC/TIC: Not applicable.

Chlorate/Chlorite: Not applicable.

VIII. MATRIX SPIKE / MATRIX SPIKE DUPLICATE (MS/MSD)

VOCs: VOC spiked recoveries were not within control limits. Sample 48MW2 failed for Bromomethane for MS %Recoveries (%R) (at 155%): Trichlorofluoromethane for MS/MSD %R (at 168%/ 171%); and Ethylbenzene for MSD %R (@123%). These compounds are qualified as estimated (UJ), for sample 48MW2. The %RPD failed for the following compounds, for sample 48MW2: 1,1,2,2-Tetrachloroethane; 1,2-Dibromoethane; 1,4-Dioxane; 2-Butanone; 2-Hexanone; 4-Methyl-2-pentanone; Acetone; Bromodichloromethane; Bromomethane; Methyl Acetate; and trans-1,3-Dichloropropene. All %RPDs failed at greater than 20%, and all the listed compounds were qualified as estimated (UJ).

Explosives: Multiple compounds were outside of the acceptable criteria for MS/MSD %recoveries and %RPD, due to dilution issues. All samples were qualified (UJ/J), for standard solution issues. The associated failing compounds were qualified as estimated (UJ/J).

Perchlorate: Perchlorate was outside the control limits of 84-119%, at 130%/ 70%%, for the MS/D analysis associated with sample 54MW12. Perchlorate sample results were qualified as estimated (J).

Metals: Several analytes were above the specified control limits, for the MS/MSD analysis associated with sample 54ADW01. The following analytes were reported and qualified as estimated (UJ/J): Aluminum, Cadmium, Chromium, Cobalt, Iron, Lead, Manganese, Nickel, Silver, Thallium, Vanadium, and Zinc. Manganese was also outside the %RPD limit criteria and was qualified as estimated (J).

Anions: Chloride, at 112%, was above the control limit of 87-111%, for MSD analysis associated with sample 54MW10, and has been qualified as estimated (J).

MEE: Target analytes were within control limits. No qualification was required.

COD: Target analytes were within control limits. No qualification was required.

TOC/TIC: Target analytes were within control limits. No qualification was required.

Chlorate/Chlorite: Target analytes were within control limits. No qualification was required.

IX. DUPLICATES

FIELD DUPLICATES

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

Field Duplicate Sample	Parent Sample	Matrix	Analyses (Method #)
54TM10	54MW10	GROUNDWATER	300.1, 6850, 8330, 9056, 9060
49TM01	13MW3	GROUNDWATER	8015, 8260, 9056, 9060

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. If the analyte was undetected then the qualifier assigned was UJ.

VOCs: All RPDs were within control limits. No qualification was required.

Explosives: All RPDs were within control limits. No qualification was required.

Perchlorate: All RPDs were within control limits. No qualification was required.

Metals: All RPDs were within control limits. No qualification was required.

Anions: All RPDs were within control limits. No qualification was required.

MEE: All RPDs were within control limits. No qualification was required.

COD: All RPDs were within control limits. No qualification was required.

TOC/TIC: All RPDs were within control limits. No qualification was required.

Chlorate/Chlorite: All RPDs were within control limits. No qualification was required.

LABORATORY DUPLICATES

VOCs: Not applicable.

Explosives: Not applicable.

Perchlorate: Not applicable.

Metals: The RPDs between the parent and lab duplicate samples were not within control limits, for sample 54ADW01, for Iron, and were qualified as estimated (J).

Anions: The RPDs between the parent and lab duplicate samples were within control limits. No qualification was required.

MEE: Not applicable.

COD: The RPDs between the parent and lab duplicate samples were within control limits. No qualification was required.

TOC/TIC: The RPD between the parent and lab duplicate samples were not within control limits for sample 54MW12, at 200%, and sample 48MW02, at 32%. Sample results were qualified as estimated (J).

Chlorate/Chlorite: The RPDs between the parent and lab duplicate samples were within control limits. No qualification was required.

X. INTERNAL STANDARDS (ISTD)
All ISTD criteria were met except as noted below.

VOCs: All ISTD criteria were met.

Explosives: Not applicable.

Perchlorate: All ISTD criteria were met.

Metals: Not applicable.

Anions: Not applicable.

MEE: Not applicable.

COD: Not applicable.

TOC/TIC: Not applicable.

Chlorate/Chlorite: Not applicable.

XI. 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.

VOCs: Not applicable.

Explosives: Not applicable.

Perchlorate: Not applicable.

Metals: The Serial Dilution (SD) results, for samples 54ADW01, for multiple elements, were less than 50 times the LOQ. A PDS was analyzed, but unacceptable for multiple elements. A separate PDS was analyzed and unacceptable for Calcium and Magnesium for %RPD. The parent sample was reported and qualified as estimated (UJ/J). The SD results, for 48MW3, were not acceptable for Barium and Calcium. The PDS was analyzed, acceptable, and reported.

Anions: Not applicable.

MEE: Not applicable.

COD: Not applicable.

TOC/TIC: Not applicable.

Chlorate/Chlorite: Not applicable.

XII. INTERFERENCE CHECK SAMPLES (ICS)
ICS results were applicable to the lead analysis. Results were within control limits of 80-120% except as noted below.

VOCs: Not applicable.

Explosives: Not applicable.

Perchlorate: Not applicable.

Metals: Recoveries were within control limits.

Anions: Not applicable.

MEE: Not applicable.

COD: Not applicable.

TOC/TIC: Not applicable.

Chlorate/Chlorite: Not applicable.

XIII. REPORTING LIMITS (RL) AND METHOD DETECTION LIMITS (MDL)
The required RLs as listed in the QAPP were met except as noted below.

VOCs: The required RLs as listed in the QAPP were met.

Explosives: The required RLs as listed in the QAPP were met.

Perchlorate: The required RLs as listed in the QAPP were met.

Metals: The required RLs as listed in the QAPP were met.

Anions: The required RLs as listed in the QAPP were met.

MEE: The required RLs as listed in the QAPP were met.

COD: The required RLs as listed in the QAPP were met.

TOC/TIC: The required RLs as listed in the QAPP were met.

Chlorate/Chlorite: The required RLs as listed in the QAPP were met.

XIV. 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).

VOCs: No issues.

Explosives: No issues.

Perchlorate: No issues.

Metals: No issues.

Anions: No issues.

MEE: No issues.

COD: No issues.

TOC/TIC: No issues.

Chlorate/Chlorite: No issues.

XV. DATA USABILITY

Data were usable as discussed below.

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

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

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

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

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

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

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

TOC/TIC: No data were rejected. Data required minimal qualification. All data are usable as qualified.

Chlorate/Chlorite: No data were rejected. Data required minimal qualification. All data are usable as qualified.

DATA VALIDATION AND USABILITY REPORT

VOLATILES by USEPA SW-846 Method 8260C
EXPLOSIVES by USEPA SW-846 Method 8330B
MERCURY by USEPA SW-846 Method 7470A
METALS by USEPA SW-846 Method 6010C
CHEMICAL OXYGEN DEMAND by USEPA SW-846 Method 410.4
DISSOLVED GASES (MEE) by USEPA SW-846 Method RSK 175
TOTAL ORGANIC and INORGANIC CARBONS by USEPA SW-846 Method 9060A
ANIONS by USEPA SW-846 Method 9056A
pH by USEPA SW-846 Method 9040C
PERCHLORATES by USEPA SW-846 Method 6850
CHLORATES/CHLORITES by USEPA SW-846 Method 300.1

Project:	Radford Army Ammunitions Plant, Virginia – Long Term Monitoring
Project/Task Number:	228-242801-003
Sample Data Package:	118236, 118280, 118319
Laboratory:	CT Laboratories, Baraboo, Wisconsin;SGS Accutest, Orlando, Florida;Erofins/Eaton Analytical, South Bend, Indiana
Sample Matrix:	Groundwater
Sampling Dates:	12-14 April 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), Stage 3VM (10% of data)
Data Reviewer:	Jennifer Chandler, Chemist with HDR (Henningson, Durham, Richardson)

Sample ID	Matrix	Lab ID	Data Package	VOC	MEE	Chloride/Nitrate/ SO4/pH	PAH/EXP	Metals	TOC/ TIC COD	Chlorate/ Chlorite/ Perchlorates
50MW02	GW	707495	118236	X	X	X			X	
49MW02	GW	707512	118236	X	X	X			X	
48MW3	GW	707513	118236	X	X	X			X	
48MW2	GW	707514	118236	X	X	X			X	
48MW06	GW	707515	118236	X	X	X			X	
49TM01	GW	707516	118236	X	X	X			X	
041216T1	GW	707517	118236	X	X	X			X	
49MW01	GW	708692	118280	X	X	X			X	
48MW1	GW	708694	118280	X	X	X			X	
13MW3	GW	708696	118280	X	X	X			X	
041316R1	GW	708698	118280	X	X	X			X	
13MW4	GW	708700	118280	X	X	X			X	
13MW2	GW	708707	118280	X	X	X			X	
49MW04	GW	708709	118280	X	X	X			X	
49ADW01	GW	708711	118280			X		X	X	
041316T1	GW	708713	118280	X						
54MW12	GW	709222	118319			X	X		X	X

Sample ID	Matrix	Lab ID	Data Package	VOC	MEE	Chloride/Nitrate/ SO4/pH	PAH/EXP	Metals	TOC/ TIC COD	Chlorate/ Chlorite/ Perchlorates
54MW10	GW	709258	118319			X	X		X	X
041416R1	GW	709260	118319			X	X		X	X
54ADW01	GW	709262	118319			X		X	X	
54MW1	GW	709272	118319			X	X		X	X
54TM1	GW	709274	118319			X	X		X	X
54MW13	GW	709276	118319			X	X		X	X

Note: CT Laboratories has confirmed that their LIMS Reporting System) reports the EDD as 8015 and the PDF as RSK-175. The lab confirmed that for reporting purposes with this report that these two are interchangeable. To be consistent between reports, the EDD label for 8015 was changed to RSK-175.

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 0.8°C and 1.2°C. The chains of custody (COCs) were filled out and signed. All samples had the proper preservation.

II. HOLDING TIMES

Holding time criteria were met. No qualification was required.

VOCs: Samples were analyzed within 14 days of collection.

Explosives: Samples were extracted within seven days of collection and analyzed within 40 days of extraction.

Perchlorates: Samples were analyzed within 28 days of collection.

Metals: Samples were analyzed within 180 days of collection. Mercury samples were analyzed within 28 days of collection.

Anions: Samples were analyzed within 48 hours after collection for nitrate. Sulfate and Chloride were analyzed within 28 days after collection.

MEE (Methane, Ethane, Ethene): Samples were analyzed within 14 days of collection.

COD: Samples were analyzed within 28 days of collection.

TOC/TIC: Samples were analyzed within 28 days of collection.

Chlorate: Samples were analyzed within 28 days of collection.

Chlorite: Samples were analyzed within 14 days of collection.

IV. INSTRUMENT PERFORMANCE

VOCs: GC/MS BFB tuning criteria were met. No qualification was required.

Explosives: Not applicable.

Perchlorates: Not applicable.

Metals: Not applicable.

Anions: Not applicable.

MEE: Not applicable.

COD: Not applicable.

TOC/TIC: Not applicable.

Chlorate: Not applicable.

Chlorite: Not applicable.

V. INSTRUMENT CALIBRATION

INITIAL CALIBRATIONS

VOCs: Initial calibration criteria were met. No qualification was required.

Explosives: Initial calibration criteria were met. No qualification was required.

Perchlorate: Initial calibration criteria were met. No qualification was required.

Metals: Initial calibration criteria were met. No qualification was required.

Anions: Initial calibration criteria were met. No qualification was required.

MEE: Initial calibration criteria were met. No qualification was required.

COD: Initial calibration criteria were met. No qualification was required.

TOC/TIC: Initial calibration criteria were met. No qualification was required.

Chlorate/Chlorite: Initial calibration criteria were met. No qualification was required.

SECOND SOURCE STANDARDS

VOCs: All target analytes had %D values less than 20%.

Explosives: All target analytes had %D values less than 20%.

Perchlorates: All target analytes had %D values less than 15%.

Metals: All target results had %D values less than 10%.

Anions: Not applicable.

MEE: All target *analytes had %D values less than 15%.*

COD: Not applicable.

TOC/TIC: Not applicable.

Chlorate/Chlorite: Not applicable.

CONTINUING CALIBRATIONS

VOCs: All continuing calibration criteria were met.

Explosives: All continuing calibration criteria were met.

Perchlorate: All continuing calibration criteria were met.

Metals: All continuing calibration criteria were met.

Anions: All continuing calibration criteria were met.

MEE: All continuing calibration criteria were met.

COD: All continuing calibration criteria were met.

TOC/TIC: All continuing calibration criteria were met.

Chlorate/Chlorite: All continuing calibration criteria were met.

VI. BLANKS

METHOD BLANKS

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

VOCs: Target analytes were not detected in the method blanks.

Explosives: Target analytes were not detected in the method blanks.

Perchlorate: Target analytes were not detected in the method blanks.

Metals: Calcium, selenium, silver, copper were detected in the MB. Sample results were qualified as estimated (B). No further qualification was necessary.

Anions: Anions were not detected in the method blanks.

MEE: Target analytes were not detected in the method blanks.

COD: Target analytes were not detected in the method blanks.

TOC/TIC: TOC analytes were not detected in the method blanks.

Chlorate/Chlorite: Target analytes were not detected in the method blanks.

TRIP BLANKS

VOCs: Target analytes were not detected in the trip blanks.

Explosives: Not applicable.

Perchlorate: Not applicable.

Metals: Not applicable.

Anions: Not applicable.

MEE: Not applicable.

COD: Not applicable.

TOC/TIC: Not applicable.

Chlorate/Chlorite: Not applicable.

INITIAL AND CONTINUING CALIBRATION BLANKS (ICB and CCB)

VOCs: Volatiles were not detected in the ICBs or CCBs. No qualification was required.

Explosives: Explosives were not detected in the ICBs or CCBs. No qualification was required.

Perchlorate: Perchlorates were not detected in the ICBs or CCBs. No qualification was required.

Metals: Selenium, silver, beryllium, antimony, copper, and potassium were detected in the ICBs and CCBs. Sample results were qualified as estimated (B). No further qualification was necessary.

Anions: Anions were not detected in the ICBs or CCBs. No qualification was required.

MEE: MEEs were not detected in the ICBs or CCBs. No qualification was required.

COD: COD were not detected in the ICBs or CCBs. No qualification was required.

TOC/TIC: TIC analytes were not detected in the ICBs and CCBs.

Chlorate/Chlorite: Chlorate/chlorite were not detected in the ICBs or CCBs. No qualification was required.

RINSATE BLANKS

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

VOCs: Methylene Chloride and acetone were detected in the rinsate blank (041316R1). All samples were non-detect; therefore no qualifications were needed.

Explosives: Not applicable.

Perchlorate: Not applicable.

Metals: Not applicable.

Anions: Target analytes were not detected in the rinsate blanks.

MEE: Target analytes were not detected in the rinsate blanks.

COD: Not applicable.

TOC/TIC: TOC analytes were detected in the rinsate blank. All samples were non-detect; therefore, no qualifications were needed.

Chlorate/Chlorite: Not applicable.

VII. LABORATORY CONTROL SAMPLES (LCS)

VOCs: LCS recoveries were within control limits.

Explosives: LCS recoveries were within control limits.

Perchlorate: LCS recoveries were within control limits.

Metals: LCS recoveries were within control limits.

Anions: LCS recoveries were within control limits.

MEE: LCS recoveries were within control limits.

COD: LCS recoveries were within control limits.

TOC/TIC: LCS recoveries were within control limits.

Chlorate/Chlorite: LCS recoveries were within control limits.

VIII. SURROGATES

All surrogate recoveries were within control limits except as noted below.

VOCs: Surrogate recoveries were within control limits.

Explosives: Surrogate recoveries were not within control limits. On the initial analysis, surrogate recoveries were high in the MB and multiple samples, but the confirmation analysis of each of these had surrogate recoveries within the acceptable QC limits. Some type of contaminant co-elution on the primary analysis that does not occur on the confirmation analysis. The Surrogate values were reported from the primary analysis and the sample surrogate value was qualified, by the lab, with an "S". Compounds were qualified as estimated (UJ, J).

Perchlorate: Not applicable.

Metals: Not applicable.

Anions: Not applicable.

MEE: Not applicable.

COD: Not applicable.

TOC/TIC: Not applicable.

Chlorate/Chlorite: Not applicable.

VIII. MATRIX SPIKE / MATRIX SPIKE DUPLICATE (MS/MSD)

VOCs: Target analytes were within control limits. No qualification was required.

Explosives: Explosives were above the control limits, for the MS/MSD analysis associated with sample 54MW12. Perchlorate sample results were qualified as estimated (J).

Perchlorate: Perchlorate was below the control limits, for the MS analysis associated with sample 54MW12. Perchlorate sample results were qualified as estimated (J).

Metals: Several analytes were above the specified control limits, for the MS/MSD analysis associated with sample 49ADW01. The following analytes were reported and qualified as estimated (UJ/J): Barium, copper, antimony, arsenic, and selenium. The sample was qualified as estimated (J).

Anions: Chloride failed above the control limit for the MS analysis associated with sample 48MW3; chloride and nitrate nitrogen failed for MSD analysis with sample 49MW01; and sulfate was below the control limit for the MS analysis associated with sample 54MW12. Sample results were qualified (UJ/J).

MEE: Target analytes were within control limits. No qualification was required.

COD: Target analytes were within control limits. No qualification was required.

TOC/TIC: Target analytes were within control limits. No qualification was required.

Chlorate/Chlorite: Chlorite was below the control limits, for the MS analysis associated with sample 54MW12. Sample result was qualified as estimated (UJ).

IX. DUPLICATES

FIELD DUPLICATES

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

Field Duplicate Sample	Parent Sample	Matrix	Analyses (Method #)
48MW06	49TM01	GROUNDWATER	8260, 9056, 9060, 9040, RSK175, 410.4

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. If the analyte was undetected then the qualifier assigned was UJ.

VOCs: All RPDs were within control limits. No qualification was required.

Explosives: All RPDs were within control limits. No qualification was required.

Perchlorate: All RPDs were within control limits. No qualification was required.

Metals: All RPDs were within control limits. No qualification was required.

Anions: All RPDs were within control limits. No qualification was required.

MEE: All RPDs were within control limits. No qualification was required.

COD: All RPDs were within control limits. No qualification was required.

TOC/TIC: TOC %RPD was not within control limits. The RPD was greater than 20%, therefore both the parent and field duplicate samples were qualified (J).

Chlorate/Chlorite: All RPDs were within control limits. No qualification was required.

LABORATORY DUPLICATES

VOCs: Not applicable.

Explosives: Not applicable.

Perchlorate: Not applicable.

Metals: The RPDs between the parent and lab duplicate samples were not within control limits, for sample 49ADW01, for manganese, failed and were qualified as estimated (J).

Anions: The RPDs between the parent and lab duplicate samples were within control limits. No qualification was required.

MEE: Not applicable.

COD: The RPDs between the parent and lab duplicate samples were within control limits. No qualification was required.

TOC/TIC: The RPD between the parent and lab duplicate samples were not within control limits for sample 48MW3. Sample results were qualified as estimated (UJ).

Chlorate/Chlorite: The RPDs between the parent and lab duplicate samples were within control limits. No qualification was required.

X. INTERNAL STANDARDS (ISTD)
All ISTD criteria were met except as noted below.

VOCs: All ISTD criteria were met.

Explosives: Not applicable.

Perchlorate: All ISTD criteria were met.

Metals: Not applicable.

Anions: Not applicable.

MEE: Not applicable.

COD: Not applicable.

TOC/TIC: Not applicable.

Chlorate/Chlorite: Not applicable.

XI. 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.

VOCs: Not applicable.

Explosives: Not applicable.

Perchlorate: Not applicable.

Metals: The Serial Dilution (SD) results, for sample 49ADW01, for multiple elements, were less than 50 times the LOQ. A PDS was analyzed, but unacceptable RPD, for barium, copper, and manganese. The parent sample was reported and qualified as estimated (UJ/J). The SD results, for 49ADW01 and 54ADW01, were not acceptable for calcium and magnesium.

Anions: Not applicable.

MEE: Not applicable.

COD: Not applicable.

TOC/TIC: Not applicable.

Chlorate/Chlorite: Not applicable.

XII. INTERFERENCE CHECK SAMPLES (ICS)

ICS results were applicable to the lead analysis. Results were within control limits of 80-120% except as noted below.

VOCs: Not applicable.

Explosives: Not applicable.

Perchlorate: Not applicable.

Metals: Recoveries were within control limits.

Anions: Not applicable.

MEE: Not applicable.

COD: Not applicable.

TOC/TIC: Not applicable.

Chlorate/Chlorite: Not applicable.

XIII. REPORTING LIMITS (RL) AND METHOD DETECTION LIMITS (MDL)
The required RLs as listed in the QAPP were met except as noted below.

VOCs: The required RLs as listed in the QAPP were met.

Explosives: The required RLs as listed in the QAPP were met.

Perchlorate: The required RLs as listed in the QAPP were met.

Metals: The required RLs as listed in the QAPP were met.

Anions: The required RLs as listed in the QAPP were met.

MEE: The required RLs as listed in the QAPP were met.

COD: The required RLs as listed in the QAPP were met.

TOC/TIC: The required RLs as listed in the QAPP were met.

Chlorate/Chlorite: The required RLs as listed in the QAPP were met.

XIV. 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).

VOCs: No issues.

Explosives: No issues.

Perchlorate: No issues.

Metals: No issues.

Anions: No issues.

MEE: No issues.

COD: No issues.

TOC/TIC: No issues.

Chlorate/Chlorite: No issues.

XV. DATA USABILITY
Data were usable as discussed below.

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

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

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

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

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

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

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

TOC/TIC: No data were rejected. Data required minimal qualification. All data are usable as qualified.

Chlorate/Chlorite: No data were rejected. Data required minimal qualification. All data are usable as qualified.

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 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: 120408, 120462
Laboratory: CT Laboratories, Baraboo, Wisconsin
Sample Matrix: Groundwater

Sampling Dates: 12-13 July 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	pH/Metals/COD
48MW6	GW	744395	120408	X	X	X	X	
49TM01	GW	744398	120408	X	X	X	X	
48MW1	GW	744400	120408	X	X	X	X	
49MW01	GW	744408	120408	X	X	X	X	
50MW02	GW	744411	120408	X	X	X	X	
49TM02	GW	744414	120408	X	X	X	X	
071216R1	GW	744416	120408	X	X	X	X	
13MW3	GW	744418	120408	X	X	X	X	
13MW4	GW	744420	120408	X	X	X	X	
071216T1	QC	744422	120408	X				
49MW02	GW	744939	120462	X	X	X	X	
48MW3	GW	744970	120462	X	X	X	X	
48MW2	GW	744972	120462	X	X	X	X	
13MW2	GW	744974	120462	X	X	X	X	
49MW04	GW	744976	120462	X	X	X	X	
49ADW01	GW	744978	120462					X
071316T1	QC	744980	120462	X				

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 0.7°C and 4.6°C. The chains of custody (COCs) were filled out and signed. All samples had the proper preservation.

Note: One sample was analyzed for pH (49ADW01). The Holding Time (HT) for pH analysis is considered a field test parameter and should be analyzed immediately. Any analysis performed at a laboratory is considered outside of method criteria; therefore, analysis will be considered estimated (J).

II. HOLDING TIMES

Holding time criteria were met. No qualification was required.

VOCs: Samples were analyzed within 14 days of collection.

Metals: Samples were analyzed within 180 days of collection. Mercury samples were analyzed within 28 days of collection.

Anions: Samples were analyzed within 48 hours after collection for nitrate. Sulfate and Chloride were analyzed within 28 days after collection.

MEE (Methane, Ethane, Ethene): Samples were analyzed within 14 days of collection.

COD: Samples were analyzed within 28 days of collection.

TOC: Samples were analyzed within 28 days of collection.

III. BLANKS

METHOD BLANKS (MB)

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

VOCs: Target analytes were not detected in the method blanks.

Metals: Target analytes were not detected in the method blanks.

Anions: Anions were not detected in the method blanks.

MEE: Target analytes were not detected in the method blanks.

COD: Target analytes were not detected in the method blanks.

TOC: TOC analytes were not detected in the method blanks.

TRIP BLANKS (TB)

VOCs: 1,4-Dioxane was detected in TB 071316T1. Sample results were qualified as estimated (B). No further qualification was necessary.

RINSATE BLANKS (RB)

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

VOCs: Styrene, Toluene, and Chloromethane were detected in the RB (071216R1). Sample results less than two times the blank concentration have been qualified with a B for blank contamination.

Metals: Not applicable.

Anions: Target analytes were not detected in the rinsate blanks.

MEE: Target analytes were not detected in the rinsate blanks.

COD: Not applicable.

TOC: Target analytes were not detected in the rinsate blanks.

IV. LABORATORY CONTROL SAMPLES (LCS)

VOCs: LCS recoveries were within control limits.

Metals: LCS recoveries were within control limits.

Anions: LCS recoveries were within control limits.

MEE: LCS recoveries were within control limits.

COD: LCS recoveries were within control limits.

TOC: LCS recoveries were within control limits.

V. SURROGATES

All surrogate recoveries were within control limits except as noted below.

VOCs: Surrogate recoveries were within control limits.

VI. MATRIX SPIKE / MATRIX SPIKE DUPLICATE (MS/MSD)

VOCs: 1,4-Dioxane was above the specified control limits, for the MSD analysis associated with sample 48MW2. Sample results were qualified as estimated (J). 1,4-Dioxane, Bromoform, Chloromethane, cis-1,2-Dichloroethene, and Trichloroethene were outside the specified control limits, for the MS/MSD analysis associated to sample 48MW6. Samples were qualified as estimated (J).

Metals: Mercury was below the specified control limits, for the MS analysis associated with sample 49ADW01. Samples were qualified as estimated (J).

Anions: Chloride was above the specified control limits, for the MS analysis associated with sample 48MW1. Samples were qualified as estimated (J).

MEE: Target analytes were within control limits. No qualification was required.

COD: Target analytes were within control limits. No qualification was required.

TOC: Target analytes were within control limits. No qualification was required.

XII. DUPLICATES

FIELD DUPLICATES

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

Field Duplicate Sample	Parent Sample	Matrix	Analyses (Method #)
49TM01	48MW6	GROUNDWATER	8260, 9056, 9060, RSK175
50MW02	49TM02	GROUNDWATER	8260, 9056, 9060, RSK175

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: 1,1,1-Trichlorethane; cis-1,2-Dichloroethene;%RPD was not within control limits in sample pairing 48MW6-49TM01. 1,4-Dioxane %RPD was not within control limits in sample pairing 50MW02-49TM02. The RPD was greater than 20%, therefore both the parent and field duplicate samples were qualified (J).

Metals: Not applicable.

Anions: All RPDs were within control limits. No qualification was required.

MEE: Methane %RPD was not within control limits in sample pairing 50MW02-49TM02. The RPD was greater than 20%, therefore both the parent and field duplicate samples were qualified (J).

COD: Not applicable.

TOC: All RPDs were within control limits. No qualification was required.

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. Results were within control limits of 80-120% except as noted below.

Metals: None were reported.

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

The required RLs as listed in the QAPP were met except as noted below.

VOCs: The required RLs as listed in the QAPP were met.

Metals: The required RLs as listed in the QAPP were met.

Anions: The required RLs as listed in the QAPP were met.

MEE: The required RLs as listed in the QAPP were met.

COD: The required RLs as listed in the QAPP were met.

TOC: 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).

VOCs: No issues.

Metals: No issues.

Anions: No issues.

MEE: No issues.

COD: No issues.

TOC: No issues.

XII. DATA USABILITY

Data were usable as discussed below.

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

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

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

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

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

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