FINAL
ENHANCED BIOREMEDIATION FIELD TEST REPORT
OPERABLE UNIT 2
SITE ST012 – LIQUID FUELS STORAGE AREA
FORMER WILLIAMS AIR FORCE BASE
MESA, ARIZONA

Prepared for:
Air Force Civil Engineer Center
AFCEC/CIBW
2261 Hughes Avenue, Suite 155
Lackland AFB, Texas 78236-9851

Prepared by:
Amec Foster Wheeler Environment & Infrastructure, Inc.
4600 East Washington Street, Suite 600
Phoenix, Arizona 85034

05 April 2018

Contract Number: FA8903-09-D-8572 - 0002
Project No. 9101110001
CDRL No. A001

SIGNATURE PAGE

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ED_005025_00007837-00002

TABLE OF CONTENTS

1.0 INTRODUCTION 1-1
1.1 Purpose and Organization of Report 1-1
1.2 Background 1-1
1.3 Field Test Procedure 1-2
2.0 EBR FIELD TEST IMPLEMENTATION 2-1
2.1 Site Preparation 2-1
2.2 Baseline Sampling and Well Preparation 2-1
2.2.1 Analytical Data from TestAmerica 2-2
2.2.2 Microbial Data from Microbial Insights 2-4
2.3 Solution Mixing and Injection (Injection Phase) 2-6
2.4 Shut-In Period 2-6
2.5 Extraction Phase 2-7
2.6 Post-Extraction Sampling 2-9
2.7 Waste Management 2-9
2.8 Deviations from the Work Plan 2-10
3.0 EVALUATION OF RESULTS AND RECOMMENDATIONS 3-1
3.1 Evaluation of Laboratory Analytical Results 3-1
3.2 Evaluation of Microbial Analytical Results 3-1
3.3 Estimation of Hydraulic Parameters 3-2
3.4 Estimation of Sulfate Utilization Rate 3-4
3.5 Recommendations 3-6
4.0 REFERENCES 4-1

LIST OF TABLES

Table 2-1 Analytical Data for ST012-W11 2-3
Table 2-2 Analytical Data for ST012-W30 2-4
Table 2-3 Microbial Data for ST012-W11 2-5
Table 2-4 Microbial Data for ST012-W30 2-5
Table 2-5 Concentrations of Solution Used for Injection 2-6
Table 2-6 Bromide and Sulfate Concentrations during Shut-In Period 2-7
Table 2-7 Bromide and Sulfate Concentrations for ST012-W11 during Extraction Phase 2-8
Table 2-8 Bromide and Sulfate Concentrations for ST012-W30 during Extraction Phase 2-9
Table 3-1 Dispersivity Values Used in Groundwater Model Calibrations 3-3

ED_005025_00007837-00003

LIST OF GRAPHS

Graph 3-1 ST012-W30 Injection-Phase Elevations 3-2
Graph 3-2 ST012-W11 Dispersivity Calibration Runs 3-3
Graph 3-3 ST012-W30 Dispersivity Calibration Runs 3-4
Graph 3-4 ST012-W11 Shut-In Phase Bromide and Sulfate 3-5
Graph 3-5 ST012-W30 Shut-In Phase Bromide and Sulfate 3-6

LIST OF FIGURES

Figure 1-1 Location of Former Williams Air Force Base
Figure 1-2 ST012 Site Location Map
Figure 1-3 EBR Field Test Locations

LIST OF APPENDICES

Appendix A Sample Collection Records
Appendix B Analytical Laboratory Data
Appendix C Data Validation Narratives
Appendix D Microbial Analytical Reports
Appendix E Microbial Kinetics Estimation

ED_005025_00007837-00004

LIST OF ACRONYMS AND ABBREVIATIONS

µg/L	micrograms per liter
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AMEC	AMEC Environment & Infrastructure, Inc.
Amec Foster Wheeler	Amec Foster Wheeler Environment & Infrastructure, Inc.
BEM	Balanced Environmental Management System, Inc.
COC	Contaminant of concern
DNF	denitrifying bacteria
EBR	enhanced bioremediation
frac tank	fractionation tank
ft amsl	feet above mean sea level
GEO	geobacter
gpm	gallons per minute
JP-4	jet propulsion fuel grade 4
LNAPL	light non-aqueous phased liquid
LSZ	Lower Saturated Zone
mg/L	milligram per liter
MGN	methanogenic bacteria
Microbial Insights	Microbial Insights, Inc.
OU-2	Operable Unit 2
qPCR	quantified polymerase chain reaction
PLFA	phospholipid fatty acid
RD/RAWP	Remedial Design/Remedial Action Work Plan
RODA 2	Record of Decision Amendment 2
SEE	Steam Enhanced Extraction
SRB	sulfate reducing bacteria
ST012	Site ST012 Liquid Fuel Storage Area
TEA	terminal electron acceptor
TestAmerica	TestAmerica Laboratories, Inc.
TPH	total petroleum hydrocarbons
TTZs	Thermal Treatment Zones
USAR	United States Army Reserve
VOC	volatile organic compound

ED_005025_00007837-00005

1.0 INTRODUCTION

Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) prepared this Enhanced Bioremediation (EBR) Field Test Report for the Air Force Civil Engineer Center (AFCEC) to provide details related to EBR field activities conducted for Operable Unit 2 (OU-2) at the former Williams Air Force Base (AFB) in Mesa, Arizona (Figure 1-1). OU-2 is composed of the Installation Restoration Program Site ST012, the former Liquid Fuels Storage Area (ST012) (Figure 1-2), where historic releases of jet propulsion fuel grade 4 (JP-4) and/or aviation gasoline have resulted in contaminated soil and groundwater.

An OU-2 Record of Decision Amendment 2 (RODA 2) (AFCEC, 2013) revised the groundwater remedy to implement steam enhanced extraction (SEE) followed by EBR. The purpose of the EBR Field Test was to obtain data to support EBR design.

1.1 Purpose and Organization of Report

The purpose of this EBR Field Test Completion Report is to document the field activities and associated results related to the EBR Field Test Plan (AMEC Environment & Infrastructure, Inc. [AMEC], 2014b), including interpretation of results.

This report consists of five sections, plus appendices. Section 1.0 presents an introduction and background information. Section 2.0 describes the field activities including deviations from the Final EBR Field Test Plan (AMEC, 2014b) and laboratory results. Section 3.0 discusses results and estimates parameters for use in EBR design. Appendix A presents low-flow sample collection records. Appendix B includes analytical laboratory results. Data validation narratives are included in Appendix C and microbial results are in Appendix D. Appendix E presents calculations for the estimate of microbial degradation kinetics.

1.2 Background

As part of the ST012 Remedial Design and Remedial Action Work Plan (RD/RAWP) (AMEC, 2014a) for implementing the OU-2 RODA 2, the selected remedial action includes an initial period of SEE for mass removal of dissolved contaminants and light non-aqueous phased liquid (LNAPL) within established thermal treatment zones (TTZs), followed by EBR to address LNAPL and dissolved phase contaminants within and outside the TTZs. Amec Foster Wheeler conducted this EBR Field Test in support of the design for the EBR portion of the approved groundwater remedy for the site. The EBR and SEE modeling report prepared as part of the ST012 RD/RAWP described EBR modeling results using both aerobic and anaerobic processes for remediation. Modeling results for both processes indicated that the remediation goals could be met; however, there were significant assumptions made for both approaches. The major assumptions made in screening the anaerobic approach considered that the anaerobic terminal electron acceptor (TEA) sulfate could be utilized and groundwater contaminants of concern (COCs) would be partitioned from the liquid to dissolved phase at significant enough rates that the added TEA as sulfate would cause biodegradation of petroleum contamination based on stoichiometry alone (AMEC, 2014a). Therefore, this EBR Field Test included two single well tracer tests, herein also referred to as push-pull tests, using sulfate as a TEA to evaluate appropriate delivery and dosing for EBR at

ED_005025_00007837-00006

ST012 under the anaerobic scenario. Due to the prevalence of existing aerobic EBR data that can adequately support a future design, this field test only investigated anaerobic EBR to provide data to support evaluation of strategies for aerobic and/or anaerobic EBR and for design of anaerobic methods if this approach is implemented.

Monitoring wells ST012-W11 and ST012-W30 were selected for the single-well tracer tests because they are both located outside of the SEE TTZs and both have historical evidence of LNAPL contamination. Both wells are screened in the Lower Saturation Zone (LSZ) and are located on the United States Army Reserve (USAR) Property to the west of the SEE TTZs (see Figure 1-3). Figure 1-3 also shows the extent of residual LNAPL within each hydrostratigraphic zone as estimated in the RD/RAWP (AMEC, 2014a).

1.3 Field Test Procedure

The EBR field test was conducted as two separate push-pull tests at well locations ST012-W11 and ST012-W30. The field test was conducted in general conformance with the EBR Field Test Plan (AMEC, 2014b) which included the following steps:

1. Baseline Sampling and Well Preparation
2. TEA and tracer (solution) mixing and injection
3. Monitoring during shut-in period
4. Groundwater/solution extraction and sampling during extraction
5. Post-extraction sampling
6. Review and interpretation of laboratory data

Each of the above steps is discussed in detail in Sections 2.0 through 4.0.

ED_005025_00007837-00007

2.0 EBR FIELD TEST IMPLEMENTATION

The EBR Field Test was conducted in general accordance with the Final EBR Field Test Plan (AMEC, 2014b). This section describes implementation activities.

2.1 Site Preparation

Coordination with the USAR Center occurred to gain access to the site for the test and agree on locations for staging of equipment and tanks. Equipment required for implementation was temporarily located within the USAR Center during the push and pull phases of the EBR test except for the fractionation tank (frac tank) which was used to store extracted groundwater during the pull phase and was located on Avoca Street (which was closed for SEE construction activities).

2.2 Baseline Sampling and Well Preparation

Prior to initiating the field test, baseline samples were collected. On 16 July 2014, low-flow procedures were followed to collect samples for baseline analysis from monitoring wells ST012-W11 and ST012-W30. Once field readings of temperature, pH, specific conductance, dissolved oxygen, and oxidation-reduction potential stabilized (see Appendix A), samples were collected and submitted to TestAmerica Laboratories (TestAmerica) and Microbial Insights, Inc. (Microbial Insights) for the following analyses:

- Chemical Analysis (TestAmerica):
  - sulfate
  - bromide
  - cation/anion balance
    - Inductively Coupled Plasma Metals
    - Ion Chromatography
  - Total Petroleum Hydrocarbons (TPH)
  - Volatile Organic Compounds (VOCs)
- Microbial Population Analysis (Microbial Insights):
  - quantified polymerase chain reaction (qPCR) analysis to enumerate the following bacterial groups:
    - denitrifying bacteria (DNF, nirK and nirS functional genes)
    - geobacter (GEO)
    - sulfate reducing bacteria (SRB; APS)
    - methanogenic bacteria (MGN)
  - phospholipid fatty acid (PLFA) analysis to quantify total biomass and assess microbial population activity

ED_005025_00007837-00008

On 16 July 2014, attempts were made to use an in-line bio-flo™ filter provided by Microbial Insights to collect samples for microbial population analysis; however, the filters clogged before the required amount of water was collected. Microbial Insights indicated prior to the field test that this is a common occurrence and provided glass bottles to fill with water instead of using the filters if this problem arose. When the samples arrived at Microbial Insights, the laboratory indicated that there was not enough sample to run both sets of tests, so additional samples were collected from each well on 17 July 2014 to conduct the PLFA analysis.

Prior to beginning the field tests, an oil-water interface probe was used to check for LNAPL in the wells. A trace of LNAPL was detected in ST012-W11 but there was not enough to remove with a bailer. A pressure transducer and AquiStar® TempHion™ Smart Sensor (an in-situ bromide probe and data logger) were then placed inside each well to monitor changes in groundwater elevation and bromide concentrations, respectively, during the testing.

2.2.1 Analytical Data from TestAmerica

Tables 2-1 and 2-2 present analytical data from TestAmerica for the full suite of analyses performed during baseline, post-shut-in, and post-extraction sampling at ST012-W11 and ST012-W30, respectively. Analytical reports are included in Appendix B and data validation narratives are provided in Appendix C. Sections 2.4 and 2.5 provide additional details on sample collection activities during the post-shut-in and post-extraction periods, respectively.

ED_005025_00007837-00009

Table 2-1 Analytical Data for ST012-W11

Sample Location:		ST012 - W11					
Sample Type: Sample Date:		Baseline 7/16/2014		Post-Shut-In 9/2/2014		Post-Extraction 9/8/2014	
Parameter	Units						
JP-4 (Total Petroleum Hydrocarbons)							
Diesel Range Organics [C10-C28]	mg/L	0.45	B	0.56		0.095	U
Gasoline Range Organics [C6-C10]	µg/L	3000		2700	Q	73	Q
Total Petroleum Hydrocarbons	*mg/L*	*3.5*		*3.3*		*0.17*	
Volatile Organic Compounds							
1,2-Dichloroethane	µg/L	0.4	U	0.4	UQ	0.4	U
Benzene	µg/L	51		45	Q	0.37	J
Ethylbenzene	µg/L	310		230		2.4	
Methylene Chloride	µg/L	0.8	U	1.1	J	0.8	U
m-Xylene & p-Xylene	µg/L	0.8	U	74	D	2.2	
Naphthalene	µg/L	38	B	43		0.4	
o-Xylene	µg/L	0.4	U	4	U	0.4	U
Toluene	µg/L	0.38	J	1.2	Q	0.4	U
Trichloroethene	µg/L	0.21	J	0.2	UQ	0.2	U
Trichlorofluoromethane	µg/L	0.8	U	0.8	U	0.8	U
Xylenes, Total	µg/L	1.6	U	74	D	2.2	
Total Volatile Organic Compounds	*mg/L*	*0.40*		*0.47*		*0.011*	
Other							
Bromide	mg/L	1.6	J	2.6		2.5	
Sulfate	mg/L	5.4		6.4		280	
Calcium	mg/L	310		300		770	
Chloride	mg/L	800		780		1600	
Iron	mg/L	0.063	J	0.14		0.03	U
Manganese	mg/L	2.2	Q	2	Q	0.067	Q
Magnesium	mg/L	67		67		140	
Sodium	mg/L	79		76		92	
Potassium	mg/L	7.7		16		21	

Notes:
JP-4 – jet propulsion fuel grade 4
µg/L – micrograms per liter
mg/L – milligrams per liter
B – The analyte was detected above one-half the reporting limit in an associated blank
J – The analyte was positively identified; the quantitation is an estimation
U – The analyte was not detected above the reporting limit
Q – One or more quality control criteria failed

ED_005025_00007837-00010

Table 2-2 Analytical Data for ST012-W30

Sample Location:		ST012 - W30					
Sample Type: Sample Date:		Baseline 7/16/2014		Post-Shut-In 9/2/2014		Post-Extraction 9/10/2014	
Parameter	Units						
JP-4 (Via Petroleum Hydrocarbons)							
Diesel Range Organics [C10-C28]	mg/L	0.47	B	1.2		11	
Gasoline Range Organics [C6-C10]	µg/L	3900		13000		14000	
Total Petroleum Hydrocarbons	*mg/L*	*4.37*		*14.2*		*25*	
Volatile Organic Compounds							
1,2-Dichloroethane	µg/L	4	U	4	U	2	U
Benzene	µg/L	1200		2700		1900	
Ethylbenzene	µg/L	290		920		740	
Methylene Chloride	µg/L	8	U	12	J	4	U
m-Xylene & p-Xylene	µg/L	8	U	570		950	
Naphthalene	µg/L	32	B	110		84	
o-Xylene	µg/L	4	U	130		85	
Toluene	µg/L	4	U	160		160	
Trichloroethene	µg/L	2	U	2	U	1	U
Trichlorofluoromethane	µg/L	8	U	8	U	4	U
Xylenes, Total	µg/L	16	U	700		1000	
Total Volatile Organic Compounds	*mg/L*	*1.576*		*5.316*		*4.93*	
Other							
Bromide	mg/L	1.3		3.5	J	2.3	
Sulfate	mg/L	11		18		13	
Calcium	mg/L	240		190		200	
Chloride	mg/L	600		580		510	
Iron	mg/L	0.65		1.2		2.7	
Manganese	mg/L	2.6	Q	3.3	Q	3.2	Q
Magnesium	mg/L	52		43		43	
Sodium	mg/L	67		62		60	
Potassium	mg/L	6.7		91		55	

Notes:
JP-4 – jet propulsion fuel grade 4
µg/L – micrograms per liter
mg/L – milligrams per liter

Data Validation Flags:
B – The analyte was detected above one-half the reporting limit in an associated blank
J – The analyte was positively identified; the quantitation is an estimation
U – The analyte was not detected above the reporting limit
Q – One or more quality control criteria failed

2.2.2 Microbial Data from Microbial Insights

Tables 2-3 and 2-4 present microbial data from Microbial Insights for the testing conducted during baseline, post-shut-in, and post-extraction sampling at ST012-W11 and ST012-W30, respectively. Microbial Analytical Reports are included in Appendix D.

ED_005025_00007837-00011

Table 2-3 Microbial Data for ST012-W11

Sample Location:		ST012 - W11		
Sample Type:		Baseline 7/16/2014 7/17/2014[1]	Post-Shut-In 9/2/2014	Post-Extraction 9/8/2014
Parameter	Units			
qPCR				
Denitrifying Bacteria (nirK)	cells/ml	2.26E+06	4.52E+05	5.93E+05
Denitrifying Bacteria (nirS)	cells/ml	1.34E+05	1.93E+04	4.78E+04
Geobacter (GEO)	cells/ml	8.94E+01	1.53E+04	7.88E+02
Sulfate Reducing Bacteria (APS)	cells/ml	3.76E+04	6.49E+05	2.76E+06
Methanogens (MGN)	cells/ml	5.73E+05	7.00E+04	4.41E+03
PLFA				
Total Biomass	cells/ml	2.82E+04	4.39E+04	4.60E+04
Firmicutes	% of Total	34.68	20.44	0.52
Proteobacteria	% of Total	33.82	45.98	76.03
Anaerobic Metal Reducers	% of Total	1.68	1.91	0
SRB/Actinomycetes	% of Total	2.77	3.21	0.48
General	% of Total	27.06	27.09	22.42
Eukaryotes	% of Total	0	1.37	0.55
Slowed Growth		0.97	0.78	0.05
Decreased Permeability		0	0.16	0

Notes:
% - percent
ml – milliliter
PLFA – Phospholipid Fatty Acid Analysis
qPCR – quantified polymerase chain reaction
SRB – sulfate reducing bacteria
[1]Insufficient sample volume was collected on 16 July 2014 for the full baseline sampling round, so additional sample volume was collected and submitted on 17 July 2014.

Table 2-4 Microbial Data for ST012-W30

Sample Location:		ST012 – W30		
Sample Type:		Baseline 7/16/2014 7/17/2014[1]	Post-Shut-In 9/2/2014	Post-Extraction 9/10/2014
Parameter	Units			
qPCR				
Denitrifying Bacteria (nirK)	cells/ml	8.06E+05	4.89E+05	3.87E+05
Denitrifying Bacteria (nirS)	cells/ml	4.25E+05	3.20E+04	1.16E+04
Geobacter spp. (GEO)	cells/ml	2.33E+01	1.06E+04	1.17E+05
Sulfate Reducing Bacteria (APS)	cells/ml	4.45E+04	4.37E+04	2.00E+05
Methanogens (MGN)	cells/ml	5.05E+04	6.42E+04	4.68E+04
PLFA				
Total Biomass	cells/ml	5.75E+04	1.02E+04	4.15E+04
Firmicutes	% of Total	48.44	24.57	14.07
Proteobacteria	% of Total	22.59	26.93	50.65
Anaerobic Metal Reducers	% of Total	5.4	1.54	1.55
SRB/Actinomycetes	% of Total	3.99	4.13	0.9
General	% of Total	19.6	32.08	30.95

Table 2-4 Microbial Data for ST012-W30

Sample Location:		ST012 – W30		
Sample Type:		Baseline 7/16/2014 7/17/2014[1]	Post-Shut-In 9/2/2014	Post-Extraction 9/10/2014
Parameter	Units			
Eukaryotes	% of Total	0	0.75	1.89
Slowed Growth		0.9	0.75	0.25
Decreased Permeability		0.12	0	0.07

Notes:
% - percent
ml – milliliter
PLFA – Phospholipid Fatty Acid Analysis
qPCR – Quantified Polymerase Chain Reaction Analysis
SRB – sulfate reducing bacteria
[1]Insufficient sample volume was collected on 16 July 2014 for the full baseline sampling round, so addition sample volume was collected and submitted on 17 July 2014.

2.3 Solution Mixing and Injection (Injection Phase)

Groundwater extraction, solution mixing and injection took place on 18 July 2014 for ST012-W30 and on 21 July 2014 for ST012-W11. First a submersible Grundfos Redi-Flo pump was used to extract 400 gallons from each of the test wells. Extracted water was stored in a 500-gallon tank. The extracted water was then de-oxygenated by purging with nitrogen and mixed by placing submersible pumps in the tank and recirculating the water for 30 minutes. Following de-oxygenation, 12 kilograms of potassium sulfate, the terminal electron acceptor being tested, and 300 grams of sodium bromide, the conservative tracer, were added to each of the tanks and were thoroughly mixed. A sample from each batch of solution was collected and submitted to TestAmerica for laboratory analysis of bromide and sulfate. Table 2-5 provides the calculated concentrations of bromide and sulfate compared to the laboratory results.

Table 2-5 Concentrations of Solution Used for Injection

Location	Bromide Concentration (mg/L)		Sulfate Concentration (mg/L)	
	Calculated	Lab Result	Calculated	Lab Result
ST012-W11	150	150	4,300	2,300
ST012-W30	150	220	4,300	3,800

Notes:
mg/L – milligrams per liter

Once the test solution was mixed, the solution was gravity fed into the associated test well. A water level indicator was used to monitor groundwater levels during solution injection to make sure an overflow condition did not occur.

2.4 Shut-In Period

Following the push phase of the field test, samples were collected twice per week from each monitoring well using low-flow procedures and were sent to TestAmerica for bromide and sulfate analysis. Additionally, readings were collected from the bromide meters to provide instantaneous data to enable decision making with regards to how long to wait prior to conducting the pull-phase

ED_005025_00007837-00013

of the test. The data from the bromide probes, however, were deemed unreliable early on in the shut-in period. The bromide probes were removed from the wells, re-calibrated, and replaced inside the wells, but the data continued to be unreliable. On 16 August 2014, the bromide probes were removed from the wells and sent back to the supplier. Given that the bromide probes could not be used, the bi-weekly sample results were compiled and evaluated as soon as data became available so that decisions could be made on when to conduct the pull phase.

As indicated in the EBR Field Test Plan, it was anticipated that the shut-in period would last between two and four weeks. The actual duration was dependent on how long it would take for the conservative tracer, bromide, to reach ambient (baseline) conditions. The shut-in period would last no more than twice the duration that it took to reach baseline conditions. Based on laboratory data through 19 August 2014, approximately four weeks into the shut-in period, with concentrations approaching baseline conditions (Table 2-6), a decision was made to schedule the extraction phase for the week of 1 September 2014.

Table 2-6 Bromide and Sulfate Concentrations during Shut-In Period

Sample Type	Date	ST012–W11		ST012–W30	
		Bromide (mg/L)	Sulfate (mg/L)	Bromide (mg/L)	Sulfate (mg/L)
Baseline	7/16/2012	1.6	5.4	1.3	11
Shut-in	7/22/2014	55	1,000	99	1,900
Shut-in	7/24/2014	39	2,000	92	1,600
Shut-in	7/29/2014	18	940	47	840
Shut-in	7/31/2014	12	610	35	660
Shut-in	8/5/2014	6.2	300	20	320
Shut-in	8/7/2014	4.9	230	16	240
Shut-in	8/12/2014	3.0	110	11	140
Shut-in	8/15/2014	2.4	73	8.7	100
Shut-in	8/19/2014	1.9	42	6.5	67
Shut-in	8/21/2014	1.8	31	5.2	49
Shut-in	8/26/2014	1.6	18	4.5	34
Shut-in	8/29/2014	1.5	14	3.9	24
Post-Shut-In	9/2/2014	2.6	6.4	3.5 J	18

Notes:
mg/L – milligrams per liter
J = The analyte was positively identified; the quantitation is an estimation

Prior to conducting extraction, low flow samples were collected from each monitoring well, and were submitted to Test America and Microbial Insights to be tested for the full suite of analysis that was conducted during baseline sampling. The results of these samples are presented in Tables 2-1 through 2-4 and discussed in Section 3.

2.5 Extraction Phase

For the extraction phase of the field test, a submersible Grundfos Redi-Flo pump was installed sequentially in ST012-W11 and ST012-W30 at 248 and 216 feet below top of casing, respectively.

ED_005025_00007837-00014

The pump extracted groundwater at a rate of up to 20 gallons per minute (gpm) to extract as much of the solution that was introduced to the groundwater as possible.

Extraction started at ST012-W11 on 4 September 2014. 1,000 gallons of water were extracted from ST012-W11 on 4 September 2014 and 9,000 gallons were extracted during a continuous period from 6 September through 7 September 2014. A pumping rate of 5 to 6 gpm was maintained during extraction. Extracted water was pumped into a 21,000-gallon frac tank and a slip line from the main conveyance line was used to collect a sample at intervals of approximately 500 gallons. The collected samples were shipped to TestAmerica for bromide and sulfate analysis. Bromide and Sulfate results during the pull phase in ST012-W11 are tabulated in Table 2-7.

Table 2-7 Bromide and Sulfate Concentrations for ST012-W11 during Extraction Phase

Date / Time	Quantity Pumped (gallons)	Bromide (mg/L)	Sulfate (mg/L)	Date / Time	Quantity Pumped (gallons)	Bromide (mg/L)	Sulfate (mg/L)
9/4/14 15:05	500	2.9	260	9/7/14 9:57	5,500	2.60	280
9/4/14 16:41	1,000	2.8	260	9/7/14 11:29	6,000	2.50	280
9/6/14 21:47	1,674	2.6	320	9/7/2014 13:43	6,500	2.50	280
9/6/14 22:48	2,004	2.6	260	9/7/2014 15:25	7,000	2.50	280
9/7/14 0:23	2,500	2.6	270	9/7/2014 17:00	7,500	2.50	280
9/7/14 1:55	3,000	2.6	270	9/7/2014 18:33	8,000	2.80	290
9/7/14 3:30	3,500	2.6	270	9/7/2014 20:18	8,500	2.70	280
9/7/14 5:03	4,000	2.6	280	9/7/2014 21:54	9,000	2.70	280
9/7/14 6:35	4,500	2.6	280	9/7/2014 23:33	9,500	2.70	280
9/7/14 8:26	5,000	2.6	280	9/8/14 01:10	10,000	2.70	280

Notes:
mg/L – milligrams per liter.

Initial results from TestAmerica for the pull-phase of ST012-W11 were used to calculate the total amount of sulfate that was extracted from the groundwater. The results of this calculation indicated that more sulfate was extracted from the groundwater than was introduced during the push-phase of the field test. A request was made that the laboratory re-analyze a select number of samples, and the reported results were confirmed. During re-analysis, Amec Foster Wheeler determined that the high sulfate concentrations reported by the laboratory were within range of background concentrations at the site.

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On 7 September 2014, groundwater extraction began at ST012-W30 using the same techniques as at ST012-W11. Extraction of the first 500 gallons removed from this well occurred over a 14-hour period. Pumping rates from this well could not be sustained at a constant rate and required personnel to toggle the pump on and off. Due to the low yield of the well, the target volume of water to be extracted during the pull-phase was reduced to 1,000 gallons. During extraction of the remaining 500 gallons of water to be pumped from the well, three rounds of samples were collected. Extraction of this volume of water occurred over an approximate 25-hour period. The collected samples were shipped to Test America for bromide and sulfate analysis. Bromide and Sulfate results for samples collected during the pull phase in ST012-W30 are tabulated in Table 2-8. Historical groundwater monitoring upgradient of site contamination has shown background sulfate concentrations generally range from 250 to 300 milligrams per liter (mg/L) (Balanced Environmental Management System, Inc. [BEM], 1998). Sulfate concentrations in ST012-W30 below typical background concentrations indicate potential LNAPL-influenced conditions.

Table 2-8 Bromide and Sulfate Concentrations for ST012-W30 during Extraction Phase

Date / Time	Quantity Pumped (gallons)	Bromide (mg/L)	Sulfate (mg/L)
9/7/14 6:05	500	2.7	18
9/9/14 8:03	500	2.3	15
9/9/14 10:49	667	2.6	15
9/9/14 13:45	834	2.6	19
9/10/14 10:56	1,000	2.4	16

Notes:
mg/L – milligrams per liter

2.6 Post-Extraction Sampling

At the conclusion of the extraction phase for each well, post-extraction samples were collected and submitted to Test America and Microbial Insights to be tested for the full suite of analysis that was conducted during baseline sampling. The results of these samples are presented in Tables 2-1 through 2-4 and discussed in Section 3.

2.7 Waste Management

The groundwater purged for low flow sampling during the shut-in period and the water purged from the test wells during the pull phase of the EBR field tests were contained in a single 21,000-gallon frac tank. The groundwater was treated in the SEE groundwater treatment system.

ED_005025_00007837-00016

2.8 Deviations from the Work Plan

Based on unforeseen conditions, the following deviations from the work plan were implemented:

1. The in-line bio-flo™ filters were not used to collect samples for microbial analysis because they clogged before the required amount of water was collected. Microbial Insights indicated that this situation occurs frequently and that collecting bottles of water that the lab will process through a filter prior to testing provides the same level of confidence with the data. Therefore, this is not a significant deviation.
2. The in-situ bromide probes did not provide reliable data and were removed from the wells within the early stages of the shut-in period. Amec Foster Wheeler relied upon laboratory data to make field decisions during the shut-in period, which required a few additional days for results to be available; trend predictions were used to schedule a time to conduct the extraction phase. Based on the results of laboratory testing, the extraction phase was conducted within the appropriate timeframe; therefore, the suspension of the use of the in-situ bromide probes is not considered a significant deviation from the work plan.
3. Due to the slow extraction rates achievable from ST012-W30, only 1,000 gallons of water was removed during the extraction phase compared to the 10,000 gallons targeted in the EBR Field Test Plan. This may be due to fouling of the well over time. Well fouling limits evaluation of hydraulic conductivity for the well. Extraction of a smaller volume of water than planned results in only partial extraction of the injected fluids. This limits evaluation of degradation kinetics; however, data from the shut-in phase is available for calculation of kinetic parameters.

ED_005025_00007837-00017

3.0 EVALUATION OF RESULTS AND RECOMMENDATIONS

Evaluation of the analytical data obtained during the EBR Field Test and estimation of hydraulic and biological degradation parameters are presented in this section.

3.1 Evaluation of Laboratory Analytical Results

Analytical concentration data for ST012-W11 presented in Table 2-1 show no significant change between the baseline and the post-shut-in period for most of the analytes evaluated. However, there is a decrease in total TPH and total VOC concentrations observed between these monitoring periods and the post-extraction sampling round. Additionally, sulfate, calcium and chloride concentrations for the post-shut-in period increased as well. These conditions were not expected and are interpreted to be a result of cleaner/background groundwater within part of the screened interval being drawn into the well rather than pulling only injected water back into the well. Historical groundwater monitoring upgradient of site contamination has shown background sulfate concentrations generally range from 250 to 300 mg/L (BEM, 1998) which is similar to the concentrations observed in ST012-W11 during the pull phase.

Results for ST012-W30 presented in Table 2-2 indicate an increase in concentration for total TPH and total VOCs in both the post-shut-in sample and post-extraction sample in comparison with the baseline sample results.

3.2 Evaluation of Microbial Analytical Results

Microbial results for samples collected from ST012-W11 (Table 2-3) show an increase in the quantity of sulfate reducing bacteria between the baseline and post-shut-in sampling events. Another increase in these bacteria was observed during the post-extraction sampling event, for an overall increase in density of two orders of magnitude. Geobacter (which is implicated in biological metals reduction) increased by three orders of magnitude between baseline and post-shut-in sampling rounds and then decreased by two orders of magnitude during the post-extraction sampling event. Methanogenic bacterial densities decreased by two orders of magnitude between the baseline and post-extraction sampling events.

Although increases in total biomass were modest over the course of the test, the percentages of Firmicutes and Proteobacteria were approximately equal during baseline sampling and shifted such that Proteobacteria was more prevalent in the post-shut-in sample and even more prevalent in the post-extraction sample. An increase in the proportion of Proteobacteria present coupled with an increase in biomass suggests metabolism of a readily available growth substrate. The decline in Firmicutes suggests a transition to a more aerobic environment over the course of the test and/or the extraction of more oxygenated water from upgradient of contamination (see Section 3.1).

Microbial results for samples collected from ST012-W30 (Table 2-4) show no change in sulfate-reducing bacteria between the baseline and post-shut-in sampling events; however, the density of these organisms increased by an order of magnitude between the post-shut-in and the post-extraction sampling events. Geobacter densities increased by three orders of magnitude between baseline and post-shut-in sampling rounds and increased by another order of magnitude during the post-extraction sampling event. Methanogenic bacterial densities decreased by two orders of magnitude between the baseline and post-extraction sampling events.

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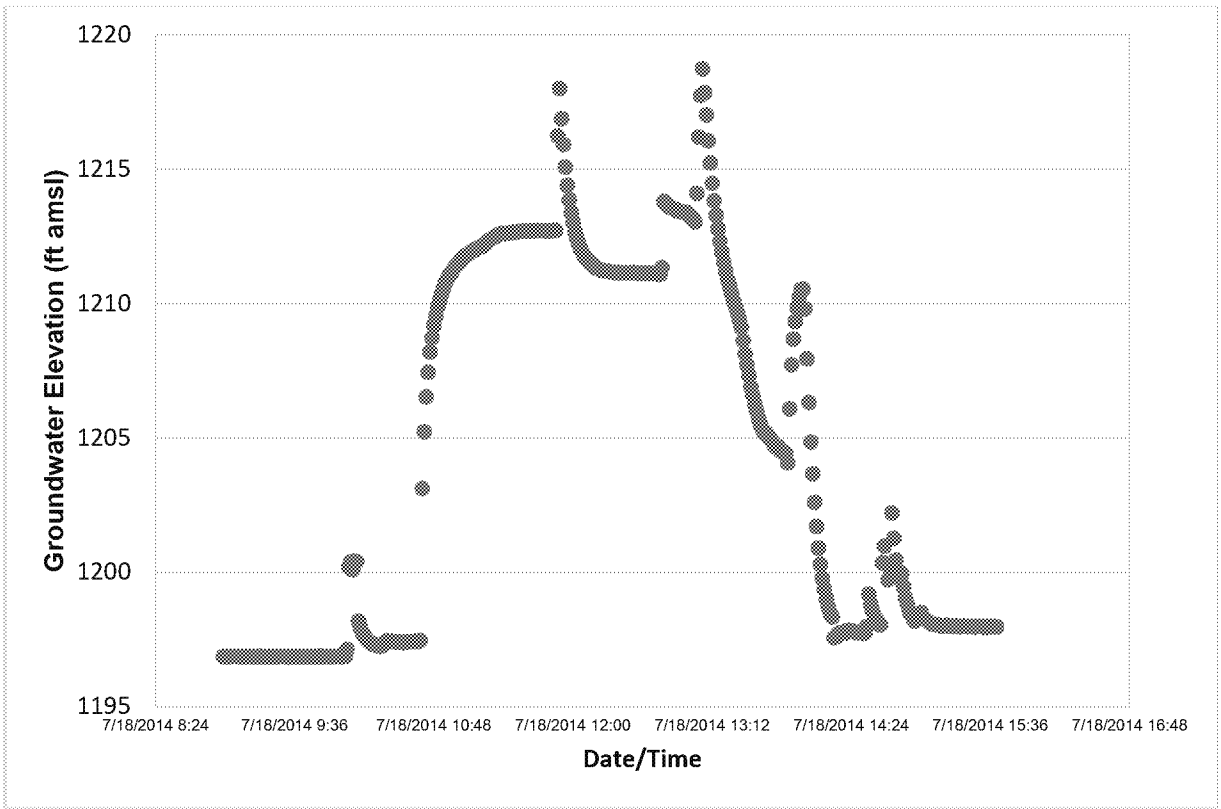
The percentage of Firmicutes was higher than the percentage of Proteobacteria in the baseline sample but shifted such that percentages of these groups were relatively the same in the post-shut-in sample; Proteobacteria were more prevalent in the post-extraction sample.

3.3 Estimation of Hydraulic Parameters

Water elevations from transducer data collected throughout the field test were evaluated for estimation of hydraulic parameters. However, groundwater elevation data from the transducers generally showed rapid and abrupt changes during the pull phases which was likely related to fouling of the well screens; this limited analysis of pull phase data for estimation of hydraulic conductivity. Transducer data was not recorded for the ST012-W11 push phase so only groundwater elevation data collected during the push phase in ST012-W30 provides potentially useable data. The push phase in ST012-W30 was analyzed using the groundwater model from the RD/RAWP. The purpose was to calibrate the model to the observed elevation increases associated with the ST012-W30 push phase by varying the hydraulic conductivity. The push-phase liquid injection was modeled and the predicted groundwater elevations were compared to the observed elevations from the transducer. Unfortunately, the groundwater elevation data corresponding to the push phase included about four elevation spikes related to increases in solution addition rates (see Graph 3-1) and the model could not be effectively calibrated to this data. Therefore, no refinement to the model hydraulic conductivity values are recommended based on EBR Field Test results.

Graph 3-1 ST012-W30 Injection-Phase Elevations



Note:
ft amsl – feet above mean sea level

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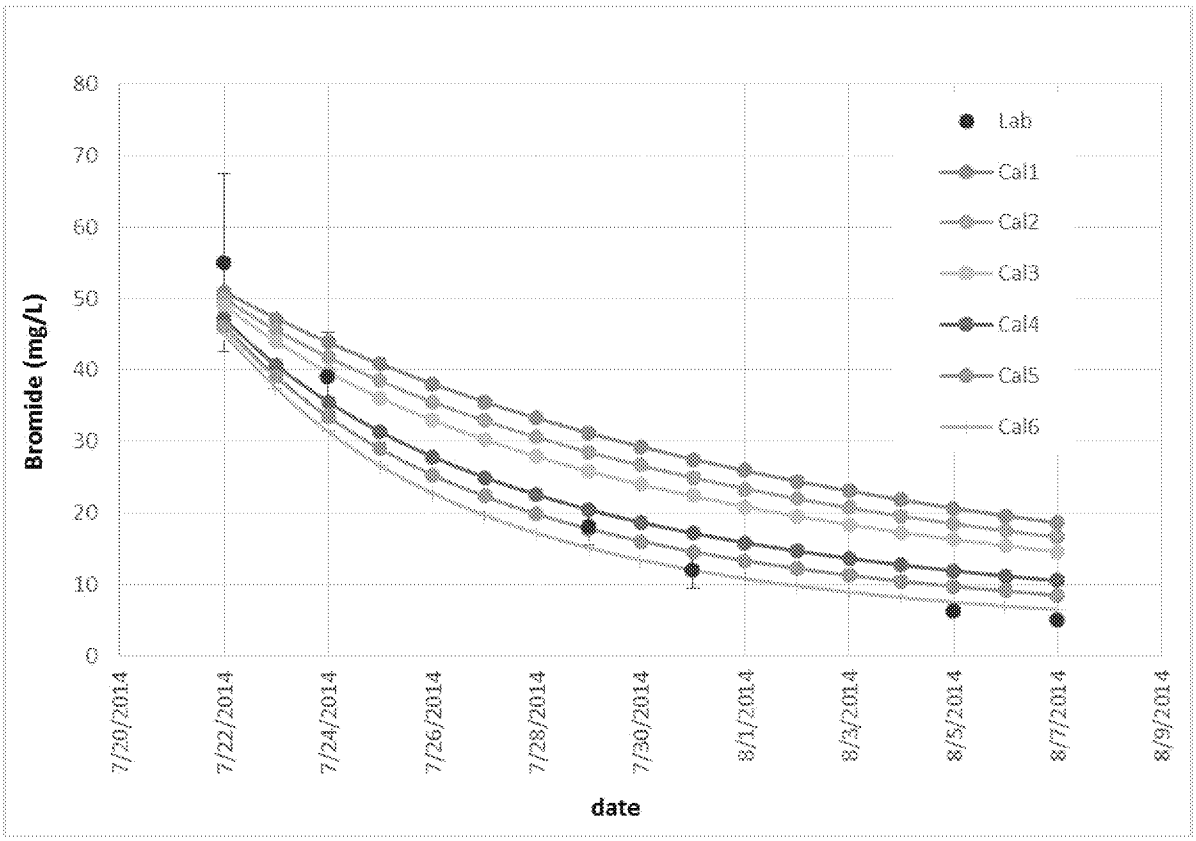
A similar approach was used to evaluate dispersivity at ST012 by varying dispersivity in the groundwater model to generate predicted bromide concentrations over time that compare well to the laboratory analytical results for bromide. The groundwater model uses a single set of longitudinal, horizontal, and vertical dispersivities throughout the model domain so the objective was to obtain the best calibration to both the ST012-W11 and ST012-W30 data with the same dispersivity values. Table 3-1 shows the dispersivity values for the six calibration runs and Graphs 3-2 and 3-3 show the calibration model run predicted bromide results compared to the analytical data.

Table 3-1 Dispersivity Values Used in Groundwater Model Calibrations

Calibration Run	Longitudinal	Horizontal	Vertical
1	20.00	6.66	1.00
2	17.50	5.57	0.88
3	15.00	4.64	0.75
4	10.00	3.05	0.50
5	7.50	2.27	0.38
6	5.00	1.50	0.25

Graph 3-2 ST012-W11 Dispersivity Calibration Runs



Note:
mg/L – milligrams per liter

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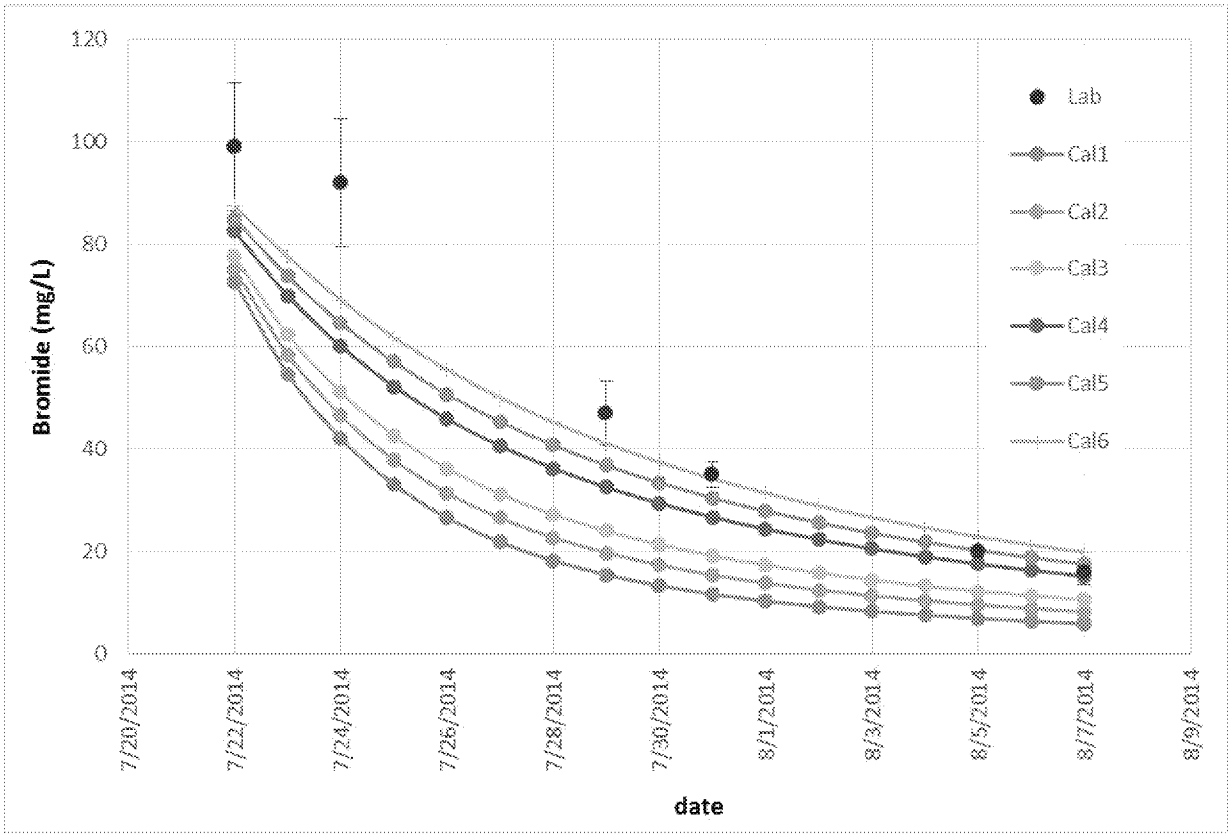
Graph 3-3 ST012-W30 Dispersivity Calibration Runs



Note:
mg/L – milligrams per liter

Based on this analysis, the recommended dispersivity values for future EBR modeling are from Calibration Run 6 (5.00 ft, 1.50 ft, and 0.25 ft). These compare to values of 10, 1, and 0.1 used in previous RD/RAWP modeling for the LSZ.

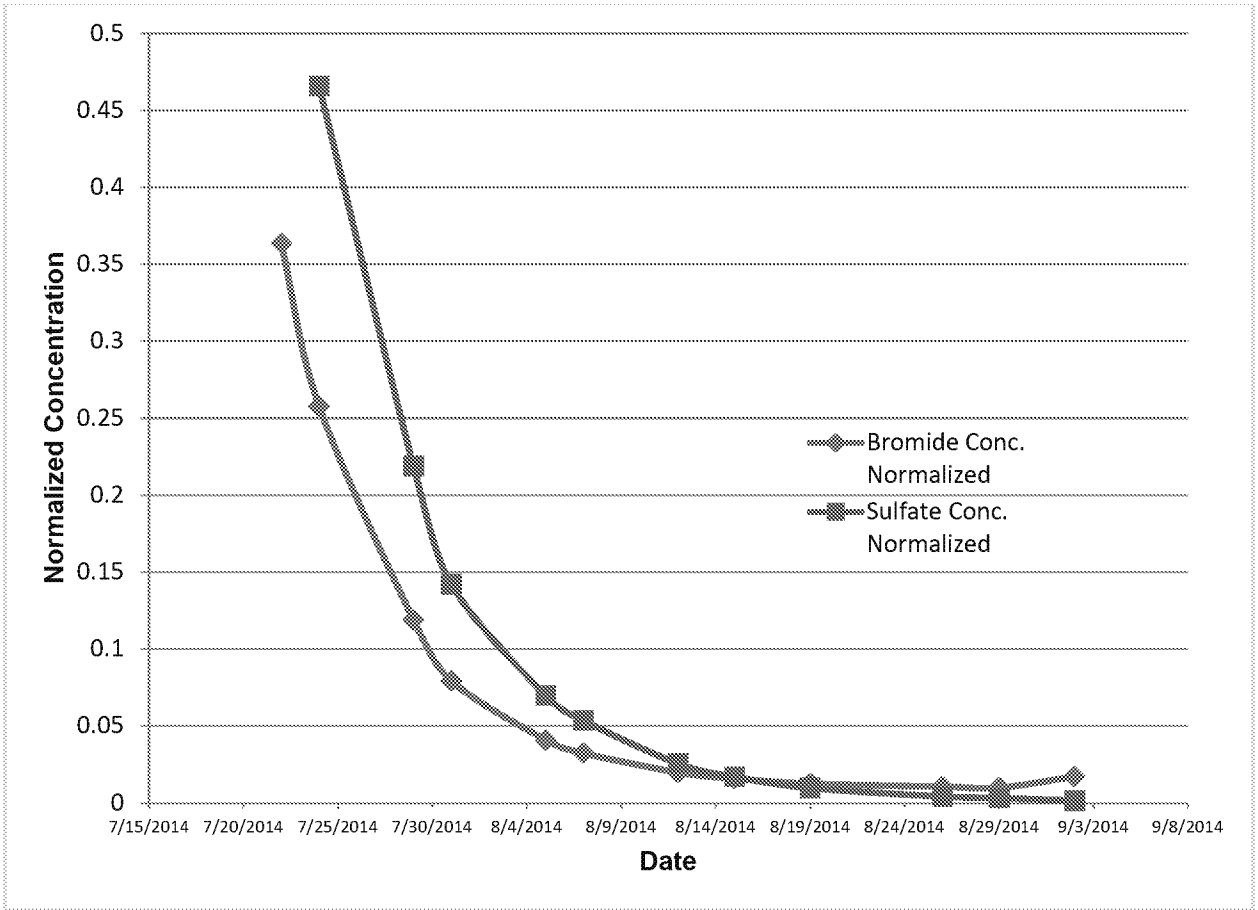
3.4 Estimation of Sulfate Utilization Rate

Sulfate utilization has been estimated from the shut-in period of ST012-W11 and ST012-W30. Well fouling in ST012-W30 limited the extraction volume during the extraction-phase of the test. The limited volume extracted did not provide a sufficient data set to estimate sulfate utilization during the pull phase. As discussed in Section 3.1, the increasing sulfate concentrations in ST012-W11 during the pull phase of the test indicate that background groundwater sulfate concentrations were being pulled into the well and prevent the accurate estimation of sulfate utilization during the pull phase.

Instead, sulfate utilization was estimated from sulfate concentration collected during the shut-in period. Graph 3-4 shows normalized concentrations of bromide and sulfate (measured concentration divided by initial calculated concentration) for ST012-W11 during the shut-in period. The normalized sulfate concentration is higher than the normalized bromide concentration for the majority of the shut-in period; however, after the initial 24 July 2014 sample, sulfate decreased faster than bromide and the data after this date are useful for evaluating the sulfate utilization rate.

ED_005025_00007837-00021

Graph 3-4 ST012-W11 Shut-In Phase Bromide and Sulfate



The data collected during the shut-in period for ST012-W30 also provides a useful data set for estimation of the sulfate utilization rate. Graph 3-5 shows the normalized concentrations for ST012-W30. Normalized sulfate concentrations are lower than normalized bromide concentrations throughout the shut-in period which is expected where sulfate is being consumed. Using the data from the ST012-W11 and ST012-W30 shut-in periods, a Lineweaver-Burk analysis was performed. In this analysis, the half saturation coefficient and the maximum substrate utilization rate were estimated from a graph of the inverse utilization rate and the inverse sulfate concentration. Using this method (see calculations in Appendix E), the maximum sulfate utilization rate ranges from 33 to 75 mg/L-day for ST012-W11 and ST012-W30, respectively. The half saturation coefficient, which represents the sulfate concentration at which reaction rate is ½ of the maximum rate, ranges from 4,100 to 4,200 mg/L of sulfate for ST012-W30 and ST012-W11 respectively.

These kinetic values were then used to model the sulfate consumption and TPH degradation using Monod-type kinetics. Initial sulfate and TPH concentrations used in the model were selected to represent background influx and LNAPL influenced conditions, respectively. A first-order degradation curve was fitted to these modeled values to graphically approximate a first-order maximum TPH degradation rate with a coefficient of 0.03 day^{-1} (see Appendix E). This value compares to a value of 0.0125 day^{-1} for the maximum utilization rate of hydrocarbons other than benzene in the RD/RAWP modeling indicating that the maximum degradation rate under sulfate reducing conditions in the EBR field test was approximately 2.4 times greater than previously

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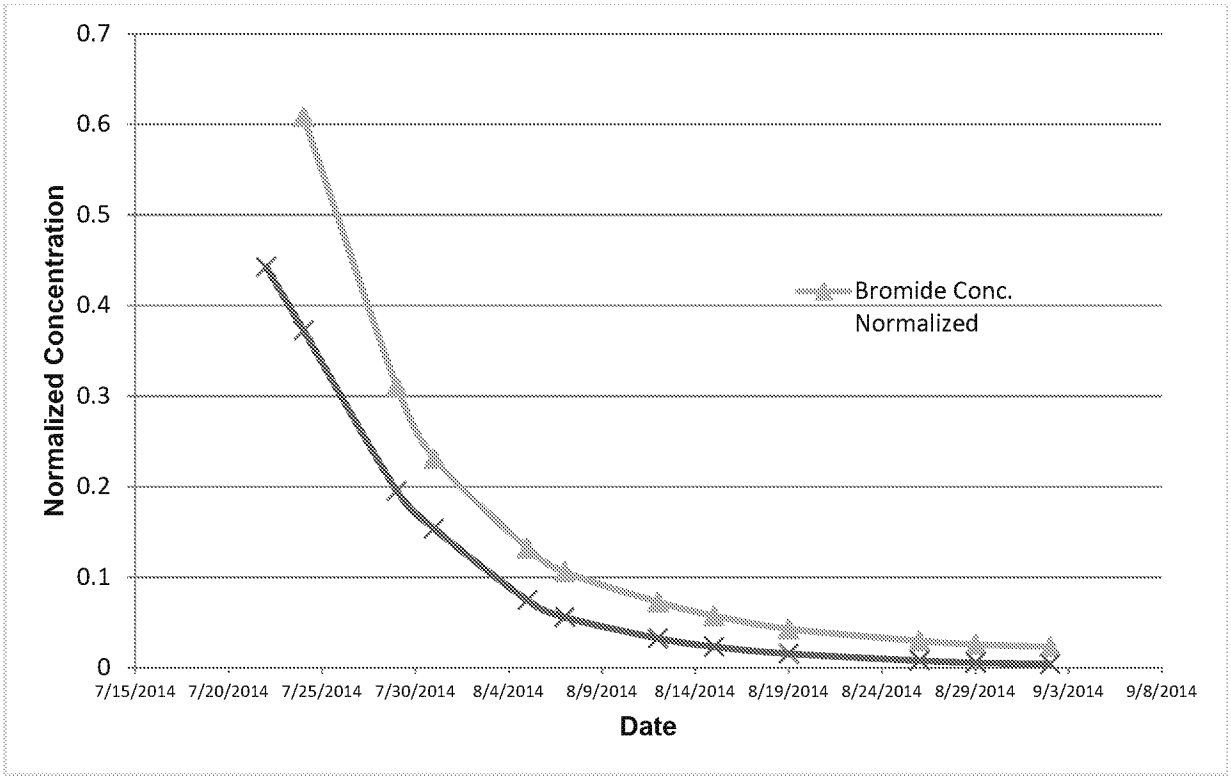
modeled. First order kinetics are a reasonable representation of Monod degradation kinetics when the sulfate concentration is much less than the half saturation coefficient. This is the case for background sulfate concentrations; therefore, the RD/RAWP model is based on reasonable but conservative kinetic values. Future updates to the model should incorporate the estimated Monod-type kinetic values to evaluate TPH degradation rates for sulfate concentrations approaching and greater than the half saturation coefficient.

Graph 3-5 ST012-W30 Shut-In Phase Bromide and Sulfate



3.5 Recommendations

The data collected for decreases in sulfate concentration from the EBR Field Test indicates that sulfate-reducing bacterial populations increased and that dispersivity values and sulfate utilization rates were more favorable than the assumed values used in the RD/RAWP EBR modeling. These findings, in combination with previous studies that concluded sulfate reduction was the dominant naturally occurring process for contaminant assimilation (BEM, 1998), indicate that sulfate amendment should be included in the EBR strategy. Sulfate amendment could either be used solely or in combination with aerobic methods to achieve remediation goals.

The next step will be to develop a refined EBR approach using the new parameters developed in this study and to prepare an RD/RAWP addendum to document the revised approach and implementation strategy.

ED_005025_00007837-00023

4.0 REFERENCES

Air Force Civil Engineer Center (AFCEC), 2013. *Record of Decision Amendment 2, Groundwater, Operable Unit 2 (OU-2), Site ST012, Former Williams Air Force Base, Mesa, Arizona*. 28 September 2013. [AR#1633]

AMEC Environment & Infrastructure, Inc. (AMEC), 2014a. *Final Remedial Design and Remedial Action Work Plan for Operable Unit 2, Revised Groundwater Remedy, Site ST012, Former Williams Air Force Base, Mesa, Arizona*. 20 May 2014. [AR#301162]

AMEC, 2014b. *Final Uniform Federal Policy Quality Assurance Project Plan (Enhanced Bioremediation Field Test Plan), Operable Unit 2, Site ST012, Liquid Fuels Storage Area, Former Williams Air Force Base, Mesa, Arizona*. 20 May 2014. [AR#421651]

BEM, 1998. *Final Consolidated Treatability Study Report (TSR) Liquid Fuel Storage Area (Site ST-12), Williams AFB, Arizona*. September 1998. [AR#947]

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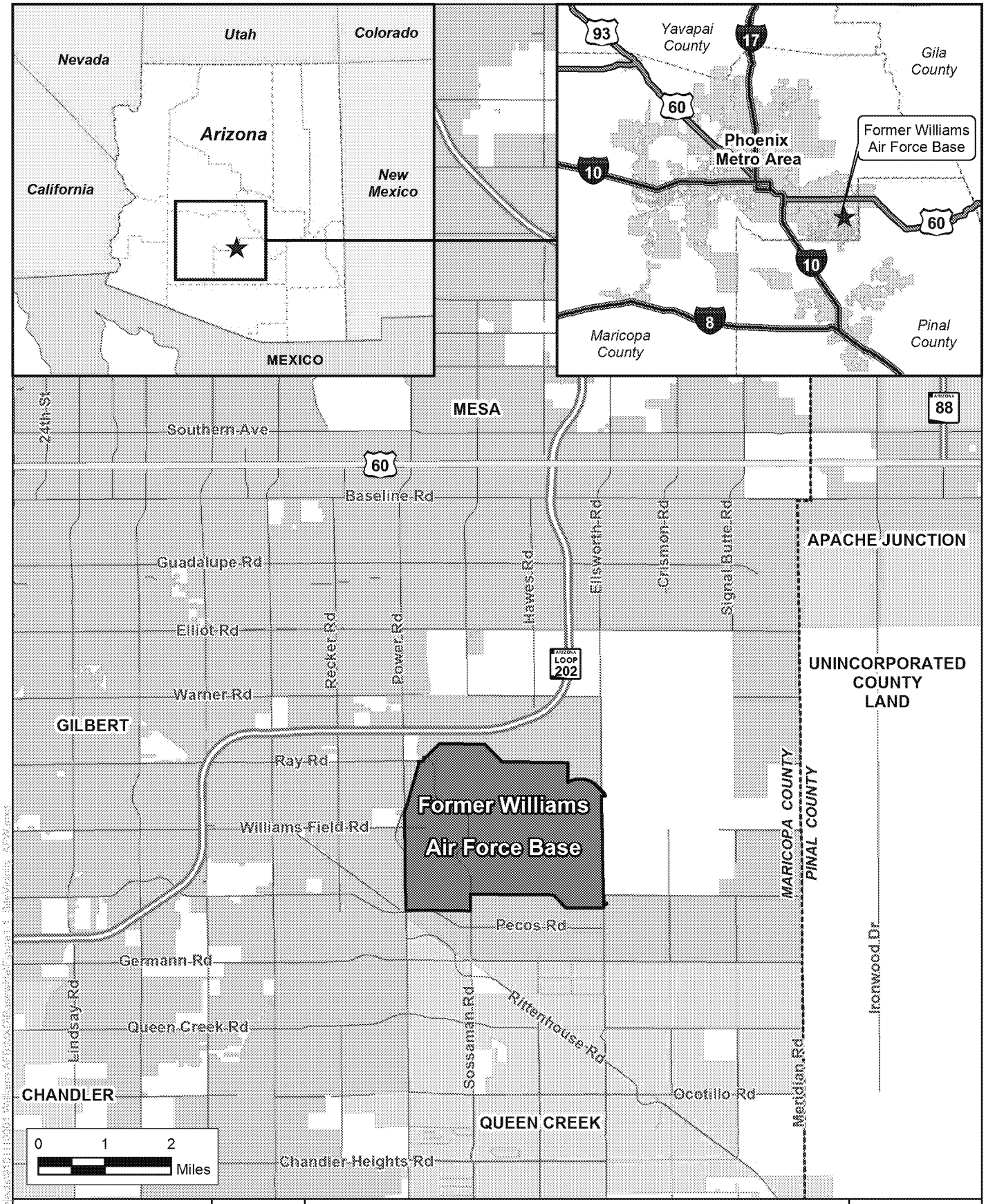
FIGURES



Job No.:	9101110001
PM:	EW
Date:	1/28/2015
Scale:	1" = 2 miles

N

Former Williams Air Force Base
Mesa, Arizona

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Location of Former Williams Air Force Base

FIGURE **1-1**

amec foster wheeler

Job No.:	9101110001
PM:	EW
Date:	2/4/2015
Scale:	1" = 0.5 mile

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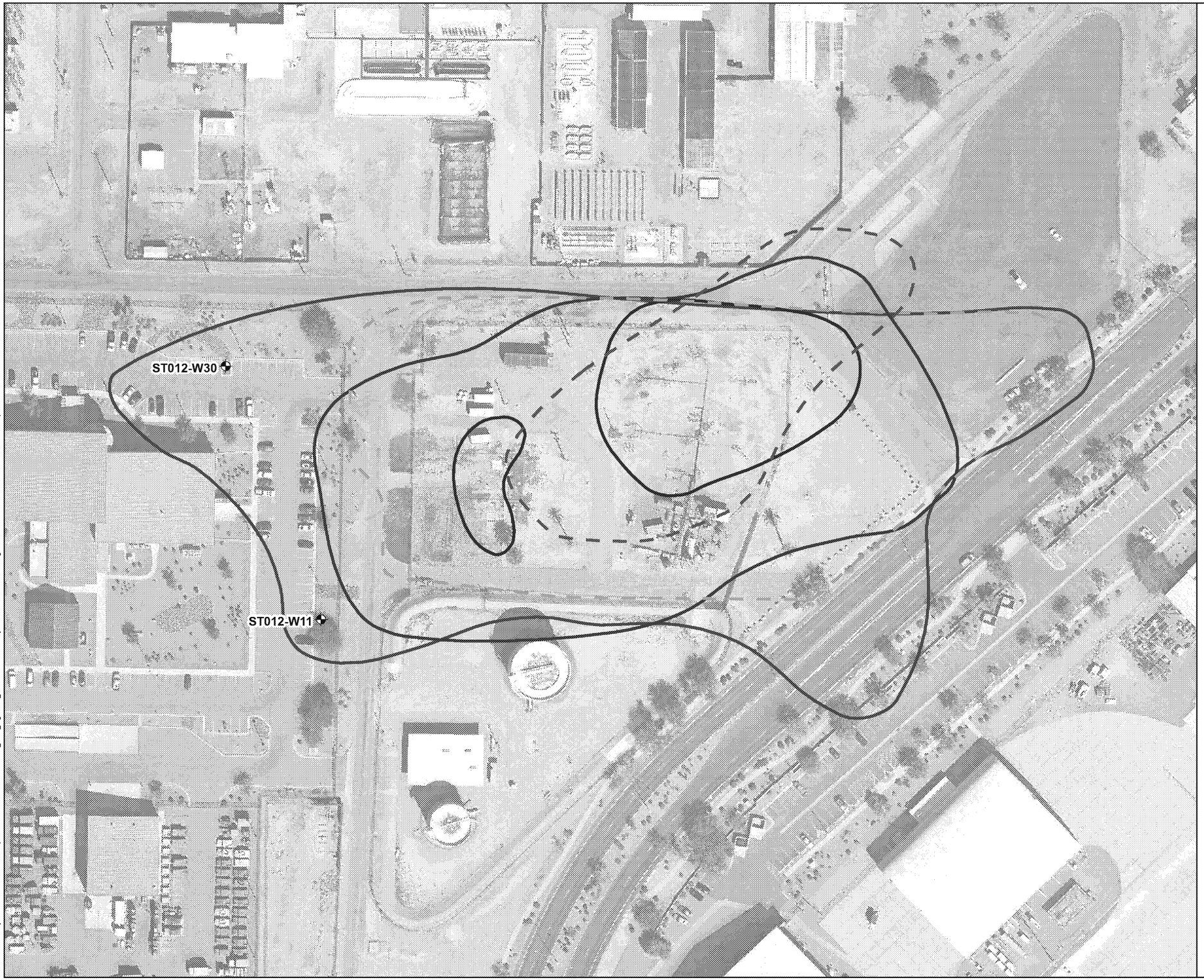
Former Williams Air Force Base
Mesa, Arizona

ST012 Site Location Map

FIGURE
1-2

amec foster wheeler



Legend

- Push-Pull Test Well
- CZ RD/RAWP LNAPL extent
- UWBZ RD/RAWP LNAPL extent
- LSZ RD/RAWP LNAPL extent
- LSZ SEE Treatment Zone
- CZ/UWBZ SEE Treatment Zone

Notes: SEE - Steam Enhanced Extraction
CZ - Cobble Zone
LSZ - Lower Saturated Zone
UWBZ - Upper Water Bearing Zone
LNAPL - Light Non-Aqueous Phase Liquid
EBR - Enhanced Bioremediation
RD/RAWP - Remedial Design/Remedial Action Work Plan

0 50 100 Feet

N

Revised Draft Final
Enhanced Bioremediation Field Test Report
Former Williams Air Force Base
Mesa, Arizona

EBR FIELD TEST LOCATIONS

FIGURE **1-3**

Job No.
PM: 9101110001
Date: 4/22/2015
Scale: 1" = 100 feet

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Document: P:\Projects\Williams AFB\GIS\MapDocuments\ST012\EBR\WAFB_EBR_FigureE4_1.mxd PDF: P:\Projects\Williams AFB\GIS\Figures\ST012\ST012 EBR Field Test Locations.pdf 4/21/2015 10:27 AM michael.washburn

APPENDIX A

SAMPLE COLLECTION RECORDS

GROUNDWATER SAMPLING FIELD DATA

PROJECT NAME: Former Williams AFB

PROJECT #: 9101110001.5300.5301

WELL ID: ST012-W30

SAMPLED BY: S.W. & K.C.

DATE: 7/16/14

WELL INFORMATION

TD Casing: 252.7 feet BTOC

Screened Interval: 210.7 to 250.7 feet BTOC

Discharge Rate: 100 mLpm (est.)

Sampling Method: MP-10

Time Pump On: 14:00 hours

Time Pump Off: 15:40 hours

Total Time Pumped: 100 minutes

Static Depth to Water: 146.91 feet (TOC El. ____ ft)

Feet Water in Casing: - 106.79 feet

Casing Capacity: - gallons (____ gal/ft)

Sand Pack Volume - gallons (____ gal/ft)

Total Purge Volume: 4000 ~~mLiters~~ mL

Water Level at Sampling: 146.21 feet

Pump Depth: 2.16 feet btoc

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mL/min)	Purge Volume (Liters) mL	WL	Comments
14:20										CPM2/155/110
13:58	34.44	7.11	2137	5.38	7.26	16.0	100	initial	146.20	Turned on pump → CPM2; 1415 water @
14:25	33.17	6.70	2390	8.32	6.29	-105.4	100	500	146.20	surface
14:30	33.03	6.69	2448	5.28	4.86	-122.8	100	1000	146.20	
14:35	32.57	6.70	2463	3.26	4.50	-145.9	100	1500	146.20	DO = 7.4 %
14:40	32.50	6.70	2454	2.39	4.61	-162.2	100	2000	146.21	DO = 2.4 %
14:45	31.98	6.69	2433	2.15	4.54	-176.3	100	2500	146.21	DO = 1.5 % ORP = 14
14:50	31.56	6.69	2425	3.07	4.45	-185.3	100	3000	146.20	DO = 1.9 % ORP = 9
14:55	31.55	6.69	2410	3.00	4.56	-192.4	100	3500	146.21	DO = ✓ ORP = 7
15:00	31.46	6.70	2417	2.36	4.47	-196.9	100	4000	146.21	DO = ✓ ORP = 4
										NOTE: Baseline Sampling

Sample ID: ST012-W30-WG-071614 Sample Time: 15:15 Duplicate (ID = ST012-DUP01-WG-071614, Time 15:30)

Analyses requested: 8260B, 8015GRO, 8015DRO, 9056A, 6010C

Water Quality Meter: YSI 556 - #12E102103 Turbidity Meter: 2100Q TURB #12050C17737

Water Level Meter/Interface Probe: Solinst

c:\users\shanda.wagner\desktop\walb_st012_fldshts.docx

amec

GROUNDWATER SAMPLING FIELD DATA

PROJECT NAME: Former Williams AFB ST012 EBR

PROJECT #: 9101110001.5300.5301

WELL ID: ST012-W11

SAMPLED BY: S.W. & E.M.

DATE: 7/16/14

WELL INFORMATION

TD Casing:	250	feet	Static Depth to Water:	147.60	feet (TOC El. ____ ft)
Screened Interval:	208 – 248	feet	Feet Water in Casing:	102.40	feet
Discharge Rate:	~200	mLpm (est.)	Casing Capacity:	—	gallons (____ gal/ft)
Sampling Method:	Low-Flow Bladder		Sand Pack Volume	—	gallons (____ gal/ft)
Time Pump On:	11:03	hours	Total Purge Volume:	9.9	Liters
Time Pump Off:	12:50	hours	Water Level at Sampling:	147.65	feet
Total Time Pumped:	73	minutes	Pump Depth:	213	feet btoc

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mL/min)	Purge Volume ~~(Liters)~~ mL		Comments
11:03									kL	Start pump CMP2; 11:17 water
11:31	33.41	7.00	2678	2.65	7.91	84.5	100mL/min	—	147.61	at surface
11:36	32.97	7.16	2686	4.77	6.22	75.7	100	500	147.61	Note: water has faint sheen and
11:41	34.17	7.15	2697	3.09	5.75	75.7	100	1000	147.61	faint hydrocarbon odor.
11:46	34.46	7.11	2715	4.48	5.46	71.8	75	1375	147.61	
11:51	34.80	7.07	2744	3.83	5.34	66.8	75	1750	147.61	
11:56	35.02	7.02	2758	2.82	4.99	59.4	75	2125	147.61	
12:01	31.44	6.51	2919	3.05	5.95	-67.4	150	2875	147.57	Increase psi to 110 psi.
12:06	29.31	6.43	2911	~~4.49~~ 2.31	4.44	-106.8	150	3625	147.65	
12:11	28.83	6.46	2883	1.95	4.26	-118.3	250	4375	147.65	
12:16	28.80	6.48	2872	1.99	4.37	-130.0	250	6125	147.65	ΔDO=2.5% ; ΔORP=9%
12:21	28.63	6.48	2898	2.31	4.32	-153.9	250	7375	147.66	ΔDO=1.2% ; ΔORP=15.5%
12:26	28.91	6.48	2899	2.22	4.31	-159.2	250	8625	147.66	ΔDO=0.2% ; ΔORP=3.3%
12:31	28.93	6.47	2898	1.53	4.46	-163.1	250	9875	147.65	ΔDO=3.4% ; ΔORP=2.4%
										NOTE: Baseline Sampling

Sample ID: ST012-W11-WG-0714 Sample Time: 12:45 Duplicate (ID = N/A, Time N/A)

Analyses requested: 8260B, 8015GRO, 8015DRO, 9056A, 6010C

Water Quality Meter: YSI 556 MPS #12E102103 Turbidity Meter: HACH 2100Q #12050C17737

Water Level Meter/Interface Probe: Solinst Interface Probe

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amec

GROUNDWATER SAMPLING FIELD DATA

PROJECT NAME: Former Williams AFB

PROJECT #: 9101110001.5300.5301

WELL ID: ST012-W30

SAMPLED BY: S.W.

DATE: 7/22/14

WELL INFORMATION

TD Casing: 252.7 feet BTOC

Screened Interval: 210.7 to 250.7 feet BTOC

Discharge Rate: ~200 mLpm (est.)

Sampling Method: Low Flow Bladder Pump

Time Pump On: ~~0700~~ 0752 hours

Time Pump Off: 0925 hours

Total Time Pumped: 93 minutes

Static Depth to Water: 145.87 74 feet (TOC El. ____ ft)

Feet Water in Casing: ____ feet

Casing Capacity: — gallons (____ gal/ft)

Sand Pack Volume — gallons (____ gal/ft)

Total Purge Volume: — 9.8 Liters

Water Level at Sampling: 145.88 feet BTOC

Pump Depth: 216 feet btoc

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mL/min)	Purge Volume (Liters) mL	WL	Comments
0705										Start pump CPU2-15; water at
0732	28.37	5.17	3538	96.9	3.31	25.4	125	—	145.87	Surface @ 07:24
										Replaced bladder @ 752 - start pump
805	30.35	4.96	4996	26.6	1.20	30.3	170	—	145.85	
810	29.34	5.29	4958	26.1	3.12	21.5	170	850	145.89	
815	29.18	5.30	4805	20.6	1.29	4.2	180	1750	145.89	
820	29.13	5.31	4770	17.0	1.33	-7.7	175	2625	145.87	
825	29.16	5.32	4774	16.1	0.95	-10.9	175	3500	145.85	
830	29.20	5.30	4773	14.9	1.02	-13.0	180	4400	145.86	ΔDO = 7%; ΔORP = 16%
835	29.19	5.23	4807	15.4	1.13	-11.4	180	5300	145.86	ΔDO = 9.7%; ΔORP = 14%
840	29.25	5.21	4807	13.8	1.08	-10.3	220	6400	145.86	ΔDO = 4.6%; ΔORP = 10.7%
845	28.90	5.17	4796	14.9	0.93	-10.3	230	7550	145.87	ΔDO = 16%; ΔORP = —
850	28.92	5.15	4793	14.1	0.88	-10.2	220	8650	145.88	ΔDO = 6%; ΔORP = 1%
855	29.06	5.13	4820	12.8	0.90	-9.9	200	9750	145.88	ΔDO = 2%; ΔORP = 3%
										Shut-in Week 1

Sample ID: ST012-W30-WG-0714 22 Sample Time: 09:26 Duplicate (ID = ST012-DUP01-0722 14 Time 1030)

Analyses requested: 300 Bromide & Sulfate

Water Quality Meter: YSI 556 MPS 12E102103 Turbidity Meter: HACH 2100Q 12050C017737

Water Level Meter/Interface Probe: ____

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GROUNDWATER SAMPLING FIELD DATA

PROJECT NAME: Former Williams AFB ST012 EBR

PROJECT #: 9101110001.5300.5301

WELL ID: ST012-W11

SAMPLED BY: S.W.

DATE: 7/22/14

WELL INFORMATION

TD Casing: 250 feet

Screened Interval: 208 – 248 feet

Discharge Rate: ~200 mLpm (est.)

Sampling Method: Low Flow Bladder Pump

Time Pump On: 1140 hours

Time Pump Off: 1243 hours

Total Time Pumped: 63 minutes

Static Depth to Water: 148.00 feet (TOC El. ____ ft)

Feet Water in Casing: 102 feet

Casing Capacity: — gallons (____ gal/ft)

Sand Pack Volume — gallons (____ gal/ft)

Total Purge Volume: (SW) 7380 7.3 Liters

Water Level at Sampling: 148.08 feet

Pump Depth: 213 feet btoc

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mL/min)	Purge Volume ~~(Liters)~~ mL	WL	Comments
1140									148	Start pump : CPM2 15
1158	30.64	6.39	2324	3.09	10.34	29.9	190	—	148.08	
1203	30.34	5.95	2663	12.0	10.13	40.3	190	950	148.07	
1208	30.06	6.51	5421	9.10	7.13	43.8	195	1925	148.08	
1213	30.23	6.54	5265	7.75	6.81	38.2	200	2925	148.07	
1218	30.06	6.55	5108	8.03	7.41	34.9	210	3975	148.08	
1223	29.83	6.56	5138	7.78	7.20	32.9	215	5050	148.08	ΔDO = 3% ; ΔORP = 6%
1228	30.15	6.57	5149	7.45	6.95	31.6	220	6150	148.08	ΔDO = 3.5% ; ΔORP = 4%
1233	29.90	6.57	5152	8.16	7.17	32.4	225	7275	148.08	ΔDO = 3% ΔORP = 2.5%
										NOTE: Shut-in week 1

Sample ID: ST012-W11-WG-072214 Sample Time: 12:41 Duplicate (ID = N/A, Time N/A)

Analyses requested: 300 Bromide & Sulfate

Water Quality Meter: YSI 556 MPS Turbidity Meter: HACH 2100Q

Water Level Meter/Interface Probe: Solinst Interface Probe

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GROUNDWATER SAMPLING FIELD DATA

PROJECT NAME: Former Williams AFB ST012 EBR

PROJECT #: 9101110001.5300.5301

WELL ID: ST012-W30

SAMPLED BY: S.W. & K.K.

DATE: 7/24/14

WELL INFORMATION

TD Casing: 252.7 feet BTOC

Screened Interval: 210.7 to 250.7 feet BTOC

Discharge Rate: ~150 mLpm (est.)

Sampling Method: Low Flow Bladder Pump

Time Pump On: 832 hours

Time Pump Off: 927 hours

Total Time Pumped: 55 minutes

Static Depth to Water: 145.62 feet (TOC El. ____ ft)

Feet Water in Casing: 107.08 feet

Casing Capacity: — gallons (____ gal/ft)

Sand Pack Volume — gallons (____ gal/ft)

Total Purge Volume: 4.5 Liters

Water Level at Sampling: 145.78 feet

Pump Depth: 216 feet btoc

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mL/min)	Purge Volume ~~(Liters)~~ Liters	mL	Comments
832										Start pump; CPM2 - 55/15
855	32.24	5.36	6094	21.4	7.82	53.4	151	145.8	—	
900	30.37	5.41	6154	11.9	1.66	-17.2	125	145.8	755	
905	30.26	5.51	5834	8.54	0.95	-40.8	180	145.76	1655	
910	30.56	5.52	5800	8.72	1.02	-42.2	180	145.78	2555	
915	30.61	5.62	5754	7.9	0.80	-47.6	115	145.81	3130	
920	30.42	5.61	5723	8.23	0.78	-47.4	125	145.82	3755	ΔDO = 2.5% ; ΔORP = 0.4%
925	30.55	5.57	5722	9.56	0.80	-44.8	150	145.80	4505	ΔDO = 2% ; ΔORP = 6%
										NOTE: Shut-in week 1

Sample ID: ST012-W30-WG-072414 Sample Time: 0927 Duplicate (ID = N/A, Time N/A)

Analyses requested: 9056A / 300 ~~Sodium and~~ Bromide and Sulfate

Water Quality Meter: YSI 556 MPS Turbidity Meter: HACH 2100Q

Water Level Meter/Interface Probe: Solinst

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GROUNDWATER SAMPLING FIELD DATA

PROJECT NAME: Former Williams AFB ST012 EBR

PROJECT #: 9101110001.5300.5301

WELL ID: ST012-W11

SAMPLED BY: S.W & K.K

DATE: 7-24-14

WELL INFORMATION

TD Casing: 207.5 - 247.5 ~~250~~ feet BTOC

Screened Interval: 249.5 ~~208 - 248~~ feet BTOC

Discharge Rate: mLpm (est.)

Sampling Method: Low Flow Bladder pump

Time Pump On: 0930 hours

Time Pump Off: 1041 hours

Total Time Pumped: 65 minutes

Static Depth to Water: 147.88 feet (TOC El. ____ ft)

Feet Water in Casing: 101.62 feet

Casing Capacity: — gallons (____ gal/ft)

Sand Pack Volume — gallons (____ gal/ft)

Total Purge Volume: 6.4 Liters

Water Level at Sampling: 147.98 feet

Pump Depth: 213 feet btoc

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mL/min)	~~Purge Volume (Liters)~~ wl	Comments	Purge (mL)
0936									START PUMP CM2/55	—
1006	29.68	6.18	6776	6.70	2.90	45.5	260	147.97	Faint sheen and odor	—
1011	28.97	6.19	8095	6.32	0.86	26.4	260	148.05		1300
1016	29.12	6.18	8346	6.97	0.40	1.3	170	147.96		2150
1021	29.14	6.24	8265	6.04	0.37	-8.8	175	148.02		3025
1026	29.20	6.26	8252	4.92	0.47	-14.5	250	147.97		4275
1031	29.06	6.32	8238	6.60	0.43	-14.6	200	147.99	ΔDO = 93% ; ΔORP = 0.7%	5275
1036	29.05	6.32	8239	5.16	0.39	-14.3	215	147.98	ΔDO = 10% ; ΔORP ~ 2%	6350
									NOTE: Shut in week 21	

Sample ID: ST012-W11-WG-072414 Sample Time: 1041 Duplicate (ID = N/A, Time N/A)

Analyses requested: 9056A / 300 ~~Sodium and~~ Bromide and Sulfate

Water Quality Meter: YSI 556 MPS Turbidity Meter: HACH 2100 Q

Water Level Meter/Interface Probe: Solinst

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GROUNDWATER SAMPLING FIELD DATA 770.7

PROJECT NAME: Former Williams AFB

PROJECT #: 9101110001.5300.5301

WELL ID: ST012-W30

SAMPLED BY: S.W. & B.C.

DATE: 7/29/14

WELL INFORMATION

TD Casing:	252.7	feet	Static Depth to Water:	145.69	feet (TOC El. ____ ft)
Screened Interval:	210.7 to 250.2	feet	Feet Water in Casing:	107.01	feet
Discharge Rate:	~180	mLpm (est.)	Casing Capacity:	—	gallons (____ gal/ft)
Sampling Method:	Low Flow		Sand Pack Volume	—	gallons (____ gal/ft)
Time Pump On:	0730	hours	Total Purge Volume:	11.6	Liters
Time Pump Off:	0917	hours	Water Level at Sampling:	145.96	feet
Total Time Pumped:	103	minutes	Pump Depth:	216	feet btoc

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mL/min)	Purge Volume ~~(Liters)~~ mL	ABTOC WL	Comments
806	3080	6.54	5731	—	8.23	-146.5	170	—		NOTE: Faint sheen and odor
0811	29.53	6.34	4820	43.4	4.00	-203.6	170	850	145.81	
0816	29.64	6.39	4173	38.6	3.86	-209.7	170	1700	145.81	
0821	29.61	6.39	4089	48.2	4.45	-203.1	170	2550	145.83	
0826	29.41	6.36	4062	47.1	4.59	-203.8	170	3400	145.83	
0831	29.52	6.35	4066	48.0	4.56	-213.6	170	4250	145.83	
0836	29.69	6.36	4048	37.8	4.42	-206.4	170	5100	145.88	
0841	29.61	6.41	4026	37.4	4.24	-207.3	170	5950	145.93	
0846	29.70	6.42	4028	41.0	3.92	-214.4	170	6800	145.93	
0851	29.69	6.36	4013	32.5	3.64	-204.1	190	7750	145.93	
0856	29.61	6.29	4010	38.3	3.43	-186.8	190	8700	145.96	
0901	29.57	6.27	4025	33.2	3.16	-198.7	190	9650	145.96	
0906	29.71	6.28	4006	28.4	3.19	-194.2	190	10,600	145.96	
0911	29.63	6.28	4012	25.5	3.17	-199.4	190	11,550	145.96	
										NOTE: Shut-in Week 2

Sample ID: ST012-W30-WG-072914 Sample Time: 9:17 Duplicate (ID = N/A, Time N/A)

Analyses requested: 300 (Bromide and Sulfate)

Water Quality Meter: YSI 556 MPS Turbidity Meter: HACH 2100Q

Water Level Meter/Interface Probe: Solinst

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GROUNDWATER SAMPLING FIELD DATA

PROJECT NAME: Former Williams AFB ST012 EBR

PROJECT #: 9101110001.5300.5301

WELL ID: ST012-W11

SAMPLED BY: S.W. & B.C.

DATE: 7/29/14

WELL INFORMATION

TD Casing: 250 feet

Screened Interval: 208 – 248 feet

Discharge Rate: – mLpm (est.)

Sampling Method: Low Flow Bladder Pump

Time Pump On: 945 hours

Time Pump Off: ~~945~~ 1052 hours

Total Time Pumped: 67 minutes

Static Depth to Water: 148.76 feet (TOC El. ____ ft)

Feet Water in Casing: 102.24 feet

Casing Capacity: — gallons (____ gal/ft)

Sand Pack Volume — gallons (____ gal/ft)

Total Purge Volume: 3.5 Liters

Water Level at Sampling: 147. feet

Pump Depth: 213 feet btoc

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mL/min)	Purge Volume ~~(Liters)~~ mL	ftBTOC WL	Comments
1016	30.54	6.66	8191	9.02	8.09	-138.2	100	—	147.90	Faint sheen and odor
1021	29.99	6.60	6281	5.17	3.18	-199.3	100	500	147.91	
1026	29.79	6.61	5806	4.19	3.12	-199.2	120	1100	147.94	
1031	29.47	6.63	5380	3.91	3.61	-192.3	120	1700	147.89	ΔDO = 13%; QR = 3.5%
1036	29.35	6.64	5313	3.68	3.89	-210.8	120	2300	147.86	
1041	29.52	6.64	5305	4.59	3.97	[redacted]	120	2900	147.87	ORP: -210.2
1046	29.21	6.65	5274	3.57	3.98	-201.5	120	3500	147.85	
										NOTE: Shut-in week 2

Sample ID: ST012-W11-WG-072914 Sample Time: 10:52 Duplicate (ID = N/A, Time N/A)

Analyses requested: 300 (Bromide + Sulfate)

Water Quality Meter: YSI 556 MPS 13J100674 Turbidity Meter: HACH 2100Q 12050C017737

Water Level Meter/Interface Probe: Solinist Interface Probe

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GROUNDWATER SAMPLING FIELD DATA

PROJECT NAME: Former Williams AFB

PROJECT #: 9101110001.5300.5301

WELL ID: ST012-W11

SAMPLED BY: Camas

DATE: 7/31/14

WELL INFORMATION

TD Casing: 250 feet

Screened Interval: 208 – 248 feet

Discharge Rate: mLpm (est.)

Sampling Method: Low Flow Bladder Pump

Time Pump On: 1140 hours

Time Pump Off: 1240 hours

Total Time Pumped: 60 minutes

TOTAL PURGE VOL: 8400

Static Depth to Water: 147.95 feet (TOC El.)

Feet Water in Casing: 102.40 feet

Casing Capacity: — gallons ( )

Sand Pack Volume — gallons ( )

Total Purge Volume: 8.4 Liters

Water Level at Sampling: 147.74 feet

Pump Depth: 213 feet btoc

SAMPLE TIME: 1238

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mL/min)	Purge Volume (Liters)	WATER DEPTH	Comments
1220	30.09	6.58	5128	5.90	5.82	-216.8	140	—	147.71	
1225	29.62	6.57	4836	5.23	5.76	-226.4	140	700	147.79	
1230	29.66	6.59	4609	2.70	5.42	-228.0	140	1400	147.87	
1235	29.54	6.60	4561	3.10	5.42	-225.4	140	2100	147.74	

Sample ID: ST012-W11-WG-073114 Sample Time: 1238 Duplicate (ID = _____, Time _____)

Analyses requested: _____

Water Quality Meter: _____ Turbidity Meter: _____

Water Level Meter/Interface Probe: _____

GROUNDWATER SAMPLING FIELD DATA

PROJECT NAME: Former Williams AFB

PROJECT #: 9101110001.5300.5301

WELL ID: ST012-W30

SAMPLED BY: Combs

DATE: 7/31/14

WELL INFORMATION

TD Casing: 252.7 feet

Screened Interval: 210.7 - 250.7 feet

Discharge Rate: mLpm (est.)

Sampling Method: Low Flow Bladder Pump

Time Pump On: 0945 hours

Time Pump Off: 1055 hours

Total Time Pumped: 70 minutes

Static Depth to Water: 145.64 feet (TOC El. ____ ft)

Feet Water in Casing: — feet

Casing Capacity: — gallons (____ gal/ft)

Sand Pack Volume — gallons (____ gal/ft)

Total Purge Volume: 6.65 Liters

Water Level at Sampling: 145.76 feet

Pump Depth: 216 feet btoc

SAMPLE TIME: 1043 TOTAL PURGE VOL: 6650

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mL/min)	Purge Volume (Liters)	WATER LEVEL	Comments
1025	32.44	6.48	4038	6.71	4.30	-194.7	95	—	145.71	
1030	32.37	6.47	3985	4.44	3.15	-214.4	95	475	145.76	
1035	32.64	6.43	3997	3.58	3.18	-208.5	95	950	145.76	
1040	32.05	6.41	4000	9.08	3.24	-212.8	95	1425	145.76	

Sample ID: ST012-W30-WG-073114 Sample Time: 1043 Duplicate (ID = _____, Time _____)

Analyses requested: _____

Water Quality Meter: _____ Turbidity Meter: _____

Water Level Meter/Interface Probe: _____

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GROUNDWATER SAMPLING FIELD DATA FORM – ~~ST035~~ ST012

PROJECT: Former Williams AFB

PROJECT #: 9101110001

Phase/Task: ~~7160.7170~~ 5300.5301

SITE NAME: ~~ST035~~ ST012

WELL ID: ST012-W11 ~~B760-MW10~~

SAMPLED BY: Eric Miller

DATE: 8-5-14

TD Casing:	~~155~~	ft	Static Depth to Water:	147.71	ft BTOC
Screened Interval:	~~114.8-154.8~~	ft BTOC	Depth to Product:	147.60	ft BTOC
Pump Set Depth		ft BTOC	Water Level at Sampling:	147.72	ft BTOC
Time Pump On:	8:33	hours	Total Purge Volume:	2500	mL
Time Pump Off:	9:20	hours			
Total Time Pumped:	48	minutes			

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mLpm)	Purge Volume (mL)	Water Level (ft BTOC)	Comments
8:50	31.63	7.27	4007	5.10	6.34	4.5	100	initial	147.70	cpm2155/100
8:55	28.34	7.07	3757	4.51	1.20	-185.6	100	500	147.70	
9:00	28.65	7.10	3461	4.00	.78	-204.8	100	1000	147.71	
9:05	28.65	7.12	3403	3.63	.81	-209.3	100	1500	147.71	Δ: 3.7%
9:10	28.63	7.16	3380	3.05	.80	-211.2	100	2000	147.72	Δ = 1.2%
9:15	28.58	7.18	3366	2.36	.84	-212.0	100	2500	147.72	Δ = 4.7%

Sample ID: ~~760-MW10-WG~~ ST012-W11-GW-080514

Sample Time: 9:18

Duplicate ID: NA

Duplicate Time: N/A

Water Quality Meter Information: YSI 556 - 12E102103

Turbidity Meter Information: HACH 2100Q - 12050C137737

Water Level / Interface Probe Information: SOLINST - 223540

Sample Pump Information: MP10 - AMEC

Additional Notes:

GROUNDWATER SAMPLING FIELD DATA FORM – ~~ST035~~ ST012

PROJECT: Former Williams AFB

PROJECT #: 9101110001

Phase/Task: ~~7160.7170~~ 5300.5301

SITE NAME: ~~ST035~~ ST012

WELL ID: ~~B760-MW10~~ ST012-W30

SAMPLED BY: Eric Miller

DATE: 8.5.14

TD Casing: ~~155~~ ft

Screened Interval: ~~114.8-154.8~~ ft BTOC

Pump Set Depth ft BTCC

Time Pump On: 7:10 hours

Time Pump Off: 8:15 hours

Total Time Pumped: 65 minutes

Static Depth to Water: 145.55 ft BTOC

Depth to Product: 145.50 ft BTOC

Water Level at Sampling: 145.71 ft BTOC

Total Purge Volume: 6750 mL

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mLpm)	Purge Volume (mL)	Water Level (ft BTOC)	Comments
7:25	28.74	6.69	3360	9.73	2.14	-167.3	150	initial	145.70	CMP2/55/95
7:30	28.81	6.79	2796	3.43	1.80	-205.7	150	750	145.74	
7:35	28.28	6.82	2805	3.07	2.15	-206.7	150	1500	145.71	
7:40	28.59	6.84	2826	2.53	1.51	-208.0	150	2250	145.70	
7:45	28.76	6.86	2839	2.19	.87	-209.2	150	3000	145.70	
7:50	28.92	6.88	2851	2.37	.76	-210.5	150	3750	145.70	
7:55	29.09	6.89	2861	4.18	.67	-210.9	150	4500	145.71	
8:00	29.13	6.88	2863	2.58	.61	-211.8	150	5250	145.70	8.9% (DO)
8:05	29.40	6.87	2872	2.56	.58	-211.6	150	6000	145.70	DO = 4.9%
8:10	29.46	6.87	2877	2.07	.52	-210.3	150	6750	145.71	DO = 10%

Sample ID: ~~760-MW10-WG~~ ST012-W30-WG-080514

Sample Time: 8:13

Duplicate ID: NA

Duplicate Time: NA

Water Quality Meter Information: YSI 555 - 12E102103

Turbidity Meter Information: HACH 2100Q - 12050C17737

Water Level / Interface Probe Information: SOLINST - 223540

Sample Pump Information: MP10 - AMEC

Additional Notes:

GROUNDWATER SAMPLING FIELD DATA FORM – ~~ST035~~ ST012

PROJECT: Former Williams AFB

PROJECT #: 9101110001

Phase/Task: ~~7100.7170~~ 5300.5301

SITE NAME: ~~ST035~~ ST012

WELL ID: ~~8700-MW10~~ ST012-U30

SAMPLED BY: Eric Miller

DATE: 8-7-14

TD Casing:	~~155~~	ft
Screened Interval:	~~114.8-154.8~~	ft BTOC
Pump Set Depth		ft BTOC
Time Pump On:	7:35	hours
Time Pump Off:	8:40	hours
Total Time Pumped:	65	minutes

Static Depth to Water:	145.63	ft BTOC
Depth to Product:	145.45	ft BTOC
Water Level at Sampling:	145.66	ft BTOC
Total Purge Volume:	6750	mL

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mLpm)	Purge Volume (mL)	Water Level (ft BTOC)	Comments
7:50	28.90	6.20	2687	8.82	3.62	-29.9	150	Initial	145.69	CPMZ 155/95
7:55	28.77	6.26	2606	6.97	1.87	-195.0	150	750	145.65	
8:00	28.81	6.36	2568	3.86	2.22	-209.9	150	1500	145.65	
8:05	28.95	6.43	2576	3.22	1.20	-220.1	150	2250	145.65	
8:10	28.99	6.45	2753	3.79	.52	-223.3	150	3000	145.66	
8:15	28.96	6.47	2568	4.15	.46	-225.8	150	3750	145.66	DO = 11.5%
8:20	29.14	6.48	2584	3.84	.31	-228.3	150	4500	145.66	DO = —
8:25	29.29	6.48	2595	3.14	.29	-228.9	150	5250	145.66	DO = 6.5%
8:30	29.30	6.47	2601	2.40	.30	-229.2	150	6000	145.66	DO = 3.3%
8:35	29.35	6.47	2587	2.28	.27	-228.7	150	6750	145.66	DO = 10%

Sample ID:	~~760-MW10-WG~~ ST012-U30-W6-080714	Sample Time:	8:37
Duplicate ID:	—	Duplicate Time:	—
Water Quality Meter Information:	YSI 556 - 12E102103	Turbidity Meter Information:	HACH 2100Q - 12050C177337
Water Level / Interface Probe Information:	SOLINST - 223540	Sample Pump Information:	MP10 - AMEC

Additional Notes:

GROUNDWATER SAMPLING FIELD DATA FORM – ~~ST035~~ ST012

PROJECT: Former Williams AFB

PROJECT #: 9101110001

Phase/Task: ~~7100.7170~~ 5300.5301

SITE NAME: ~~ST035~~ ST012

WELL ID: ~~B760-MW10~~ ST012-611

SAMPLED BY: Eric Miner

DATE: 8-7-14

TD Casing:	~~155~~	ft
Screened Interval:	~~114.8-154.8~~	ft BTOC
Pump Set Depth		ft BTOC
Time Pump On:	9:30	hours
Time Pump Off:	10:41	hours
Total Time Pumped:	71	minutes

Static Depth to Water:	147.60	ft BTOC
Depth to Product:	147.56	ft BTOC
Water Level at Sampling:	147.61	ft BTOC
Total Purge Volume:	3500	mL

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mLpm)	Purge Volume (mL)	Water Level (ft BTOC)	Comments
9:50	31.22	7.05	3387	458	4.98	48.8	100	initial	147.60	cpm2155 / 100
9:55	28.92	6.83	3150	3.92	.60	-221.1	100	500	147.61	
10:00	29.01	6.81	3100	2.16	.44	-234.5	100	1000	147.61	
10:05	28.96	6.83	3063	1.98	.41	-235.6	100	1500	147.62	DO = 6.8%
10:10	28.90	6.84	3069	1.65	.38	-236.8	100	2000	147.62	DO = 7.3%
10:15	28.95	6.84	3054	2.42	.45	-236.8	100	2500	147.62	DO = —
10:20	29.17	6.84	3081	2.34	.48	-237.1	100	3000	147.61	DO = 6.2%
10:25	29.36	6.84	3093	1.93	.52	-237.6	100	3500	147.61	DO = 7.6%

Sample ID:	~~760-MW10-WG~~ ST012-611-106-080714	Sample Time:	10:30
Duplicate ID:	—	Duplicate Time:	—
Water Quality Meter Information:	YSI 556 12E102103	Turbidity Meter Information:	HACH 2100Q 22350
Water Level / Interface Probe Information:	SOLINST 1205GC17337	Sample Pump Information:	MP10 - AMEC

Additional Notes:

GROUNDWATER SAMPLING FIELD DATA

PROJECT NAME: Former Williams AFB

PROJECT #: 9101110001.5300.5301

WELL ID: ST012-W30

SAMPLED BY: Eric Miller

DATE: 8-12-14

WELL INFORMATION

TD Casing: - feet

Screened Interval: - feet

Discharge Rate: - mLpm (est.)

Sampling Method: Bladder Pump

Time Pump On: 803 hours

Time Pump Off: 910 hours

Total Time Pumped: 67 minutes

Static Depth to Water: 145.76 feet (TOC El. ____ ft)

Feet Water in Casing: - feet

Casing Capacity: - gallons (____ gal/ft)

Sand Pack Volume - gallons (____ gal/ft)

Total Purge Volume: 8000 mLiters

Water Level at Sampling: 145.81 feet

Pump Depth: 216 feet btoc

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mL/min)	Purge Volume (Liters) mL	Comments
820	31.61	6.28	2851	7.51	2.51	-49.3	200	initial	CPMZ 155 100 Product = 145.71
825	31.43	6.27	2810	5.39	1.22	-119.5	200	1000	DTW = 145.76
830	31.21	6.28	2744	6.86	.66	-127.0	200	2000	145.76
835	30.80	6.27	2640	5.72	.49	-152.1	200	3000	145.77
8:40	30.44	6.29	2579	4.65	.44	-169.9	200	4000	145.78 DO = 10%
8:45	30.28	6.29	2551	9.43	.46	-183.3	200	5000	145.78 DO = 4%
8:50	30.37	6.29	2546	4.56	.55	-191.9	200	6000	145.80 DO = —
8:55	30.51	6.30	2548	3.98	.60	-195.5	200	7000	145.81 DO = 8%
9:00	30.27	6.28	2542	2.54	.64	-198.2	200	8000	145.81 DO = 6%

Sample ID: ST012-W30-GW-081214 Sample Time: 9:02 Duplicate (ID = - , Time -)

Analyses requested: 300 - BROMIDE SULFITE

Water Quality Meter: YSI 556 - 08F100726 Turbidity Meter: Hach 2100Q - 12050C17737

Water Level Meter/Interface Probe: 128

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GROUNDWATER SAMPLING FIELD DATA

PROJECT NAME: Former Williams AFB

PROJECT #: 9101110001.5300.5301

WELL ID: ST012-W11

SAMPLED BY: Eric Miller

DATE: 8-12-14

WELL INFORMATION

TD Casing: 250 feet

Screened Interval: 208 – 248 feet

Discharge Rate: 100 mLpm (est.)

Sampling Method: Bladder Pump

Time Pump On: 9:20 hours

Time Pump Off: 10:30 hours

Total Time Pumped: 70 minutes

Static Depth to Water: 147.78 feet (TOC El. ____ ft)

Feet Water in Casing: – feet

Casing Capacity: – gallons (____ gal/ft)

Sand Pack Volume – gallons (____ gal/ft)

Total Purge Volume: 4000 Liters

Water Level at Sampling: 147.85 feet

Pump Depth: 213 feet btoc

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mL/min)	Purge Volume (Liters)	Comments
									GPM2/55/100
9:40	29.83	5.94	3003	678	1.39	-155.7	100	initial	DTW = 147.78 Reduce = 147.75
9:45	29.06	5.99	2975	3.09	.36	-164.6	100	500	147.80
9:50	28.96	6.05	2972	2.34	.37	-173.8	100	1000	147.81
9:55	28.83	6.06	2961	2.02	.39	-179.8	100	1500	147.82
10:00	28.81	6.08	2957	1.49	.44	-184.1	100	2000	147.84 DO = 11%
10:05	28.63	6.09	2950	1.41	.49	-189.8	100	2500	147.84 DO = 10%
10:10	28.61	6.10	2950	1.43	.54	-192.8	100	3000	147.84 DO = 9%
10:15	28.60	6.11	2947	2.42	.59	-196.7	100	3500	147.85 DO = 8%
10:20	28.69	6.12	2957	3.57	.63	-197.8	100	4000	147.85 DO = 6%

Sample ID: ST012-W11-WG-081214 Sample Time: 10:24 Duplicate (ID = – , Time –)

Analyses requested: 300

Water Quality Meter: YSI556 - 08F100726 Turbidity Meter: Hach 2100Q - 12050C17737

Water Level Meter/Interface Probe: 122

GROUNDWATER SAMPLING FIELD DATA

PROJECT NAME: Former Williams AFB

PROJECT #: 9101110001.5300.5301

WELL ID: ST012-W30

SAMPLED BY: Eric Miller

DATE: 8-15-14

WELL INFORMATION

TD Casing: – feet

Screened Interval: – feet

Discharge Rate: 150 mLpm (est.)

Sampling Method: Bladder Pump

Time Pump On: 8:35 hours

Time Pump Off: 9:20 hours

Total Time Pumped: 45 minutes

Static Depth to Water: 145.67 feet (TOC El. ____ ft)

Feet Water in Casing: – feet

Casing Capacity: – gallons (____ gal/ft)

Sand Pack Volume – gallons (____ gal/ft)

Total Purge Volume: 3,750 mLiters

Water Level at Sampling: 145.90 feet

Pump Depth: – feet btoc

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mL/min)	Purge Volume (Liters)	Comments
									CPM2 155190
8:45	29.67	6.56	2549	15.2	2.98	-45.3	150	initial	DTW = 145.78 PRODUCT = 145.65
8:50	29.31	6.58	2515	23.1	1.49	-130.9	150	750	145.79
8:55	29.10	6.63	2451	18.6	1.12	-166.2	150	1500	145.89
9:00	29.09	6.64	2433	5.7	1.02	-170.2	150	2250	145.88 DO = 8.9 %
9:05	29.17	6.66	2425	5.81	.97	-177.9	150	3000	145.90 DO = 4.9 %
9:10	29.11	6.67	2421	2.82	.91	-182.4	150	3750	145.90 DO = 6.1 %

Sample ID: ST012-W30-06-081514 Sample Time: 9:12 Duplicate (ID = –, Time –)

Analyses requested: 300

Water Quality Meter: U-51556 - 12E102103 Turbidity Meter: Hach 2100Q - 13000C02891

Water Level Meter/Interface Probe: Solinst 122 - 300'

GROUNDWATER SAMPLING FIELD DATA

PROJECT NAME: Former Williams AFB

PROJECT #: 9101110001.5300.5301

WELL ID: ST012-W11

SAMPLED BY: Eric Miller

DATE: 8.15.14

WELL INFORMATION

TD Casing:	250	feet	Static Depth to Water:	147.74	feet (TOC El.
Screened Interval:	208 – 248	feet	Feet Water in Casing:	–	feet
Discharge Rate:	150	mLpm (est.)	Casing Capacity:	–	gallons (
Sampling Method:	Bladder Pump		Sand Pack Volume	–	gallons (
Time Pump On:	9:35	hours	Total Purge Volume:	4500	m Liters
Time Pump Off:	10:25	hours	Water Level at Sampling:	147.85	feet
Total Time Pumped:	50	minutes	Pump Depth:	–	feet btoc

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mL/min)	Purge Volume (Liters)	Comments
									CPM2155/100
9:50	29.02	6.69	2956	15.1	3.49	41.3	~~100~~ 150	initial	DTW = 147.84 PRODUCT = 147.70
9:55	27.90	6.71	2860	9.55	.78	-170.8	150	750	147.84
10:00	27.89	6.80	2799	19.1	.45	-191.7	150	1500	147.85
1005	27.82	6.87	2767	18.8	.76	-206.6	150	2250	147.85
1010	27.77	6.89	2751	16.7	.70	-210.7	150	3000	147.84 DO = 7.8%
1015	27.87	6.90	2759	14.9	.74	-208.3	150	3750	147.84 DO = 5.4%
1020	27.82	6.91	2753	15.5	.77	-214.3	150	4500	147.85 DO = 3.8%

Sample ID: ST012-W11-WG- 081514 Sample Time: 10:21 Duplicate (ID = – , Time –)

Analyses requested: 300

Water Quality Meter: YSI 556 - 12E102103 Turbidity Meter: Hach 2100Q - 1300C02891

Water Level Meter/Interface Probe: Solinst 122 - 300'

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GROUNDWATER SAMPLING FIELD DATA

PROJECT NAME: Former Williams AFB

PROJECT #: 9101110001.5300.5301

WELL ID: ST012-W11

SAMPLED BY: S.W.

DATE: 8/19/14

WELL INFORMATION

TD Casing: 250 (249.5) feet

Screened Interval: 208 – 248 feet

Discharge Rate: mLpm (est.)

Sampling Method: Low Flow

Time Pump On: 8:29 hours

Time Pump Off: 9:03 hours

Total Time Pumped: 34 minutes

Static Depth to Water: 147.55 / 147.65 feet (TOC El. ____ft)

Feet Water in Casing: feet

Casing Capacity: gallons (____gal/ft)

Sand Pack Volume gallons (____gal/ft)

Total Purge Volume: Liters

Water Level at Sampling: feet

Pump Depth: 213 feet btoc

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mL/min)	Purge Volume ~~(Liters)~~ mL	Comments: Water Level ft BTOC	
835	27.30	6.77	3003	8.07	6.24	-200.5	300	—	147.80	Faint odor and sheen
840	27.01	6.62	2980	11.5	6.36	-254.4	300	1500	147.80	
845	26.92	6.75	2961	7.84	6.40	-267.2	300	3000	147.81	
850	26.93	6.79	2961	6.25	6.39	-263.5	300	4500	147.80	ΔDO = 0.15% ; ΔORP = 1.4%
855	26.95	6.80	2961	4.83	6.38	-270.5	300	6000	147.80	ΔDO = 0.15% ; ΔORP = 2.6%
900	26.98	6.81	2962	4.50	6.37	-271.5	300			

Sample ID: ST012-W11-WG- 081914 Sample Time: 903 Duplicate (ID = N/A, Time N/A)

Analyses requested: 300 (Sulfate & Bromide)

Water Quality Meter: YSI 556 MPS 13J100674 Turbidity Meter: HACH 2100Q 12050C017757

Water Level Meter/Interface Probe: Solinst Interface Meter Model 122 #201387

GROUNDWATER SAMPLING FIELD DATA

PROJECT NAME: Former Williams AFB

PROJECT #: 9101110001.5300.5301

WELL ID: ST012-W30

SAMPLED BY: S. W.

DATE: 8/19/14

WELL INFORMATION

TD Casing: 252.7 feet BTOC

Screened Interval: 210.7 to 250.7 feet BTOC

Discharge Rate: ~175 mLpm (est.)

Sampling Method: Low Flow

Time Pump On: 0714 hours

Time Pump Off: 801 hours

Total Time Pumped: 45 minutes

Static Depth to Water: 145.44 / 145.51 feet (TOC El. ____ ft)

Feet Water in Casing: ____ feet

Casing Capacity: — gallons (____ gal/ft)

Sand Pack Volume — gallons (____ gal/ft)

Total Purge Volume: — Liters

Water Level at Sampling: 145.88 feet

Pump Depth: 216 ~~mbgs~~ feet btoc

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mL/min)	Purge Volume ~~(Liters)~~ mL	Comments WL
0714									145.44
0736	27.54	6.76	2514	4.87	6.15	-242.6	150	—	145.88 Start pump; Faint odor and sheen
0741	27.44	6.73	2515	3.99	6.17	-274.5	150	750	145.88
0746	27.48	6.71	2513	3.09	6.17	-268.8	150	1500	145.87 ΔDO = 0.0% ΔORP = 2.1%
0751	27.52	6.70	2507	3.00	6.15	-276.6	200	2500	145.87 ΔDO = 0.3% ΔORP = 2.8%
0756	27.54	6.66	2515	2.65	6.15	-272.5	200	3500	145.88

Sample ID: ST012-W30-WG-08/19/14 Sample Time: 0800 Duplicate (ID = N/A, Time N/A)

Analyses requested: 300 (Bromide & Sulfate)

Water Quality Meter: YSI 556 MPS 13J100679 Turbidity Meter: HACH 2100Q 12050C017737

Water Level Meter/Interface Probe: Solinst Interface meter Model 122 # 201387

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GROUND WATER SAMPLING FIELD DATA

PROJECT NAME: Former Williams AFB

PROJECT #: 9101110001.5300.5301

WELL ID: ST012-W30

SAMPLED BY: S.W.

DATE: 8/22/14

WELL INFORMATION

TD Casing:	252.7	feet BTOC	Static Depth to Water:	145.53 / 145.59	feet (TOC El. ____ ft)
Screened Interval:	210.7 - 250.7	feet BTOC	Feet Water in Casing:	107.11	feet
Discharge Rate:	~300	mLpm (est.)	Casing Capacity:	—	gallons (____ gal/ft)
Sampling Method:	Low Flow		Sand Pack Volume	—	gallons (____ gal/ft)
Time Pump On:	10:20	hours	Total Purge Volume:	—	Liters
Time Pump Off:		hours	Water Level at Sampling:	145.63	feet
Total Time Pumped:		minutes	Pump Depth:	216	feet btoc

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mL/min)	Purge Volume (~~Liters~~) mL	WL ft BTOC	Comments
1031	29.40	6.77	2602	5.90	69.5	97.4	300	—	145.59	Faint odor & sheen
1036	28.47	6.66	2549	6.30	9.2	-177.6	300	1500	145.59	
1041	28.25	6.67	2513	4.93	3.2	-193.9	300	3000	145.61	
1046	28.20	6.61	2494	2.83	~~[illegible]~~ 0.83	-196.2	300	4500	145.62	
1051	28.24	6.59	2506	2.41	0.63	-196.8	300	6000	145.62	ΔDO=48% ; ΔORP=0.3%
1056	28.29	6.59	2501	2.11	1.19	-197.9	300	7500	145.62	
1101	28.53	6.58	2517	2.04	0.75	-199.1	300	9000	145.63	
1106	28.69	6.57	2520	1.78	0.51	-201.4	300	10500	145.63	
1111	28.63	6.58	2518	1.55	0.43	-202.0	300	12000	145.63	
1116	28.65	6.55	2517	1.58	0.40	-202.5	300	13500	145.63	

Sample ID: ST012-W30-WG-082214 Sample Time: 11:19 Duplicate (ID = N/A, Time N/A)

Analyses requested: 300 (Bromide & Sulfate)

Water Quality Meter: YSI 556 MPS 12E102103 Turbidity Meter: HACH 2100Q 1300C028901

Water Level Meter/Interface Probe: Solinst Interface Meter

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GROUNDWATER SAMPLING FIELD DATA

PROJECT NAME: Former Williams AFB

PROJECT #: 9101110001.5300.5301

WELL ID: ST012-W11

SAMPLED BY: S.W.

DATE: 8/22/14

WELL INFORMATION

TD Casing: 250 feet

Screened Interval: 208 – 248 feet

Discharge Rate: ~350 mLpm (est.)

Sampling Method: Micro purge

Time Pump On: 11:35 hours

Time Pump Off: ~~11:34~~ 1235 hours

Total Time Pumped: minutes

Static Depth to Water: 147.61/147.67 feet (TOC El.)

Feet Water in Casing: 102.33 feet

Casing Capacity: — gallons ( )

Sand Pack Volume — gallons ( )

Total Purge Volume: — Liters

Water Level at Sampling: feet

Pump Depth: 213 feet btoc

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mL/min)	Purge Volume ~~(Liters)~~ mL	Water Level ft BTOC	Comments
1147	28.48	6.93	3059	3.65	3.04	-44.9	350	—	147.70	Faint odor + sheen
1152	27.51	6.82	3008	4.32	0.28	-200.2	350	1750	147.71	
1157	27.40	6.90	2981	3.45	0.13	-215.4	350	3500	147.71	
1202	27.43	6.94	2976	3.17	0.15	-220.0	350	5250	147.72	
1207	27.37	6.96	2975	2.70	0.30	-222.4	350	7000	147.72	
1212	27.38	6.97	2975	2.65	0.66	-224.0	350	8750	147.73	
1217	27.58	6.98	2989	2.36	0.61	-227.6	350	10,500	147.73	ΔDO = 8.2%; ΔORP = 1.6%
1222	27.43	6.99	2979	2.13	0.29	-228.6	350	12,250	147.73	
1227	27.56	6.99	2987	2.12	0.17	-228.7	350	14,000	147.73	
1232	27.60	7.00	2988	1.87	0.13	-228.0	350			

Sample ID: ST012-W11-WG-082214 Sample Time: 1235 Duplicate (ID = N/A, Time N/A)

Analyses requested: 300/Bromide + Sulfate

Water Quality Meter: YSI 556 MPS 12E102103 Turbidity Meter: HACH 2100Q 13060028901

Water Level Meter/Interface Probe: Solinst Interface Meter

GROUNDWATER SAMPLING FIELD DATA

PROJECT NAME: Former Williams AFB

PROJECT #: 9101110001.5300.5301

WELL ID: ST012-W30

SAMPLED BY: Matt Cambo

DATE: 8/26/14

WELL INFORMATION

TD Casing: 252.7 feet BTOC

Screened Interval: 210.7 – 250.7 feet BTOC

Discharge Rate: 100 mLpm (est.)

Sampling Method: low flow

Time Pump On: 08:25 hours

Time Pump Off: 09:50 hours

Total Time Pumped: 85 minutes

Static Depth to Water: 145.56 feet (TOC El. ____ ft)

Feet Water in Casing: 107.14 feet

Casing Capacity: ____ gallons (____ gal/ft)

Sand Pack Volume ____ gallons (____ gal/ft)

Total Purge Volume: 9500 Liters

Water Level at Sampling: 145.7 feet

Pump Depth: 216 feet btoc

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mL/min)	Purge Volume (Liters)	Water Level (ft BTOC)	Comments
0845	29.81	6.60	2249	11.3	6.93	-141.0	100	–	145.52 145.56	CPM 3 ID82 ps190
0850	29.72	6.69	2232	8.3	0.45	-159.1	100	500	145.68 145.69	
0855	29.73	6.76	2224	5.7	0.24	-166.1	100	1000	145.66 145.70	Sulfur smell, clear water
0900	29.82	6.81	2222	5.0	0.30	-166.8	100	1500	145.65 145.70	sheen
0905	29.89	6.84	2225	5.3	0.29	-172.3	100	2000	145.65 145.70	
0910	29.94	6.85	2227	5.3	1.29	-175.8	100	2500	145.67 145.70	
0915	30.01	6.87	2227	5.3	0.20	-176.5	100	3000	145.66 145.70	GOC
0920	30.18	6.88	2229	5.3	0.36	-178.3	100	3500	145.67 145.70	product - water
0925	30.52	6.88	2246	5.2	0.20	-180.5	100	4000	145.66 145.70	
0930	30.58	6.88	2251	5.3	0.17	-184.6	100	4500	145.65 145.70	
0935	30.66	6.89	2257	5.3	0.16	-188.4	100	5000	145.65 145.70	
0940	30.77	6.88	2256	5.3	0.16	-188.2	100	5500	145.66 145.70	

Sample ID: ST012-W30-WG-082614 Sample Time: 0945 Duplicate (ID = N/A, Time N/A)

Analyses requested: ____

Water Quality Meter: YSI 556 MPS

Turbidity Meter: Hach 2100Q

Water Level Meter/Interface Probe: Solonist

GROUNDWATER SAMPLING FIELD DATA

PROJECT NAME: Former Williams AFB

PROJECT #: 9101110001.5300.5301

WELL ID: ST012-W11

SAMPLED BY: Matt Camba

DATE: 8/26/14

WELL INFORMATION

TD Casing: 250 feet BTOC

Screened Interval: 208 – 248 feet BTOC

Discharge Rate: 100 mLpm (est.)

Sampling Method: Low Flow

Time Pump On: 1030 hours

Time Pump Off: 12:00 hours

Total Time Pumped: 90 minutes

Static Depth to Water: 147.55 - 147.57 feet (TOC El. ____ ft)

Feet Water in Casing: 102.43 feet

Casing Capacity: ____ gallons (____ gal/ft)

Sand Pack Volume ____ gallons (____ gal/ft)

Total Purge Volume: 5500 Liters

Water Level at Sampling: 147.65 feet

Pump Depth: 213 feet btoc

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mL/min)	Purge Volume (Liters)	Water Level (ft BTOC)	Comments
~~0845~~	~~29.81~~	~~6.60~~	~~2249~~	~~11.3~~	~~0.93~~	~~-191.0~~	~~100~~			
1055	29.79	7.06	2729	7.45	1.04	-190.6	100	100	147.6 - 147.75	CPM 3 ID 82 PSI 90
1100	29.16	7.08	2702	6.14	0.26	-179.8	100	500	147.6 - 147.70	Sheen, clear water, tint
1105	29.13	7.08	2699	5.8	0.05	-184.9	100	1000	147.6 - 147.65	of grey
1110	29.19	7.09	2696	5.69	0.03	-195.1	100	1500	147.6 - 147.65	
1115	29.38	7.11	2703	6.02	0.13	-209.8	100	2000	147.6 - 147.65	
1120	29.50	7.14	2702	6.17	0.37	-211.4	100	2500	147.6 - 147.65	LOC
1125	29.64	7.15	2706	6.3	0.58	-212.2	100	3000	147.6 - 147.65	product - water
1130	29.68	7.16	2709	5.84	0.94	-216.5	100	3500	147.6 - 147.65	
1135	29.75	7.17	2718	5.62	0.89	-217.0	100	4000	147.6 - 147.65	
1140	29.71	7.18	2712	5.86	0.67	-218.4	100	4500	147.6 - 147.65	
1145	29.85	7.19	2711	5.73	0.51	-219.9	100	5000	147.6 - 147.65	
1150	30.04	7.20	2731	5.68	0.41	-221.3	100	5500	147.6 - 147.65	

Sample ID: ST012-W11-WG-082614 Sample Time: 11:55 Duplicate (ID = N/A, Time N/A)

Analyses requested:

Water Quality Meter: YSI 556 MPS Turbidity Meter: Hach 2100Q

Water Level Meter/Interface Probe: Solinist

GROUNDWATER SAMPLING FIELD DATA

PROJECT NAME: Former Williams AFB

PROJECT #: 9101110001.5300.5301

WELL ID: ST012-W11

SAMPLED BY: Matt Cassba

DATE: 8/29/14

WELL INFORMATION

TD Casing: 250 feet

Screened Interval: 208 – 248 feet

Discharge Rate: 150 mLpm (est.)

Sampling Method: Low Flow

Time Pump On: 12 05 hours

Time Pump Off: 13 15 hours

Total Time Pumped: 60 minutes

Static Depth to Water: 147.35 feet (TOC El. ____ ft)

Feet Water in Casing: 102.65 feet

Casing Capacity: ____ gallons (____ gal/ft)

Sand Pack Volume ____ gallons (____ gal/ft)

Total Purge Volume: 4500 Liters

Water Level at Sampling: 147.45 feet

Pump Depth: 213 feet btoc

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mL/min)	Purge Volume (Liters)	Comments: Product Level	Comments: WL BTOC	Comments:
1240	31.25	6.94	3195	4.07	1.95	-80.5	150	150	147.40	147.45	CPM3 ED82 PSI
1245	30.36	7.07	3087	2.46	0.45	-149.4	150	750	147.40	147.45	
1250	29.48	7.14	3039	2.33	0.15	-177.7	150	1500	147.40	147.45	Pump off 1228-
1255	29.36	7.15	3024	2.58	0.09	-183.6	150	2250	147.40	147.45	1238
1300	29.24	7.15	3022	2.28	0.02	-185.9	150	3000	147.40	147.45	
1305	29.43	7.15	3031	2.97	0.04	-188.0	150	3750	147.40	147.45	Sheen, sed odor
1310	29.25	7.17	3024	2.82	0.14	-190.1	150	4500	147.40	147.45	

Sample ID: ST012-W11-WG- 082914 Sample Time: 1312 Duplicate (ID = N/A, Time N/A)

Analyses requested: 300 Sulfate Bromide

Water Quality Meter: YSI 556 MPS 12E102103 Turbidity Meter: Hach 2100 Q

Water Level Meter/Interface Probe: Solinist 201387

GROUNDWATER SAMPLING FIELD DATA

PROJECT NAME: Former Williams AFB

PROJECT #: 9101110001.5300.5301

WELL ID: ST012-W30

SAMPLED BY: Matt Camba

DATE: 8/29/14

WELL INFORMATION

TD Casing: 252.7 feet

Screened Interval: 210.7-250.7 feet

Discharge Rate: 150 mLpm (est.)

Sampling Method: Low Flow

Time Pump On: 1035 hours

Time Pump Off: 1145 hours

Total Time Pumped: 70 minutes

Static Depth to Water: 145.40 feet (TOC El. ____ ft)

Feet Water in Casing: 107.3 feet

Casing Capacity: ____ gallons (____ gal/ft)

Sand Pack Volume ____ gallons (____ gal/ft)

Total Purge Volume: 4750 Liters

Water Level at Sampling: 145.55 feet

Pump Depth: 216 feet btoc

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mL/min)	Purge Volume (Liters)	WL BTOC	product level	Comments
1055	31.75	6.86	2597	5.37	0.25	-159.0	150	150	145.48	145.40	CPM3 ID82 A91 90
1100	31.70	6.97	2580	2.56	0.05	-162.1	150	750	145.56	145.50	
1105	31.75	7.01	2579	2.36	0.03	-164.2	150	1500	145.56	145.50	sheen bead after
1110	31.65	7.04	2576	2.44	0.10	-171.2	150	2250	145.56	145.50	
1115	32.08	7.05	2597	2.40	0.52	-172.7	150	3000	145.56	145.50	
1120	31.91	7.04	2584	2.42	0.66	-171.1	150	3750	145.55	145.50	
1125	31.78	7.04	2578	2.34	0.29	-175.0	150	4500	145.55	145.50	
1130	31.88	7.02	2583	1.98	0.24	-176.6	150	3250	145.55	145.50	
1135	32.08	7.82	2687		0.17	-177.4	150	4000	145.55	145.50	
1140	32.01	7.00	2588	1.55	0.15	-173.1	150	4750	145.55	145.50	

Sample ID: ST012-W30-WG-082914 Sample Time: 1143 Duplicate (ID = NA, Time NA)

Analyses requested: 300 Sulfate Bromide

Water Quality Meter: YSI 556 MPS 12E102103 Turbidity Meter: Hach 2100Q

Water Level Meter/Interface Probe: Solinist 201387

GROUNDWATER SAMPLING FIELD DATA

PROJECT NAME: Former Williams AFB

PROJECT #: 9101110001.5300.5301

WELL ID: ST012-W30 ~~ST012-W30-WB~~

SAMPLED BY: MILLER/COMBS

DATE: 9/2/14

WELL INFORMATION

TD Casing: — feet

Screened Interval: — feet

Discharge Rate: 150 mLpm (est.)

Sampling Method: Bladder Pump

Time Pump On: 0930 hours

Time Pump Off: 1120 hours

Total Time Pumped: 110 minutes

Static Depth to Water: 145.39 feet (TOC El. ____ ft)

Feet Water in Casing: — feet

Casing Capacity: — gallons (____ gal/ft)

Sand Pack Volume — gallons (____ gal/ft)

Total Purge Volume: 6750 mLiters

Water Level at Sampling: 145.71 feet

Pump Depth: — feet btoc

DEPTH TO PRODUCT 145.35 FT

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mL/min)	Purge Volume (Liters)	Comments
									CMP2/55/100
0950	30.58	6.71	2494	6.11	4.03	-48.2	150	initial	
955	29.60	6.84	2449	5.03	3.08	-86.2	150	750	145.65
1000	29.46	6.87	2431	3.03	1.84	-113.8	150	1500	145.69
1005	29.52	6.87	2426	1.92	1.07	-121.5	150	2250	145.70
1010	29.77	6.87	2433	2.15	0.40	-123.1	150	3000	145.70
1015	29.73	6.84	2434	1.70	0.29	-125.31	150	3750	145.70
1020	29.64	6.82	2432	1.71	0.25	-127.9	150	4500	145.71
1025	29.84	6.81	2440	1.39	0.20	-130.5	150	5250	145.71
1030	29.85	6.79	2438	1.14	0.17	-131.2	150	6000	145.71
1035	29.99	6.76	2440	1.82	0.15	-132.9	150	6750	145.71

Sample ID: ST012-W30-WB-090214 Sample Time: 10:37 Duplicate (ID = —, Time —)

Analyses requested: Multiple

Water Quality Meter: YSI 556 MPS - 12610210 3 Turbidity Meter: Hach 2100Q - 13060028901

Water Level Meter/Interface Probe: Solinst Interface Probe

GROUNDWATER SAMPLING FIELD DATA

PROJECT NAME: Former Williams AFB

PROJECT #: 9101110001.5300.5301

WELL ID: ST012-W11

SAMPLED BY: Mike/Combs

DATE: 9.2.14

WELL INFORMATION

TD Casing: 250 feet

Screened Interval: 208 – 248 feet

Discharge Rate: 150 mLpm (est.)

Sampling Method: Bladder Pump

Time Pump On: 12.15 hours

Time Pump Off: 14.45 hours

Total Time Pumped: 150 minutes

Static Depth to Water: 147.53 feet (TOC El. ____ ft)

Feet Water in Casing: — feet

Casing Capacity: — gallons (____ gal/ft)

Sand Pack Volume — gallons (____ gal/ft)

Total Purge Volume: ~8250 ~Liters

Water Level at Sampling: 147.61 feet

Pump Depth: — feet btoc

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mL/min)	Purge Volume (Liters)	Comments WATER DEPTH
1235	29.96	6.86	3063	5.18	2.10	-31.5		—	147.63 DTP = 147.36
1240	29.00	6.88	2992	3.23	0.19	-121.2	150	750	147.59
1245	28.70	6.95	2965	3.57	0.03	-144.9	150	1500	147.57
1250	28.60	7.00	2960	4.18	0.25	-159.3	150	2250	147.57
1255	28.62	7.02	2964	7.92	0.49	-164.8	150	3000	147.57
1300	28.85	7.03	2967	3.55	1.04	-165.3	150	3750	147.60
1305	28.80	7.03	2975	2.07	0.95	-165.4	150	4500	147.60
1310	28.71	7.05	2966	2.09	0.50	-167.3	150	5250	147.59
1315	28.80	7.05	2969	1.43	0.33	-167.9	150	6000	147.60
1320	28.90	7.06	2973	1.69	0.24	-170.8	150	6750	147.60
1325	28.94	7.06	2977		0.18	-174.4	150	7500	147.61
1330	28.64	7.07	2966	1.60	0.16	-172.9	150	8250	147.61

Sample ID: ST012-W11-WG-090214 Sample Time: 1340 Duplicate (ID = ST012-DUP01-090214, Time 1350)

Analyses requested: Multiple

Water Quality Meter: YSI 556 MPS - 12E 102 103 Turbidity Meter: Hach 2100Q - 13060028901

Water Level Meter/Interface Probe: Solinst Interface Probe

GROUNDWATER SAMPLING FIELD DATA

PROJECT NAME: Former Williams AFB

PROJECT #: 9101110001.5300.5301

WELL ID: ST012-W11

SAMPLED BY: B.C. / S.W. / D.F.

DATE: 9/4/14 to 9/8/14

WELL INFORMATION

TD Casing: 250 feet

Screened Interval: 208 – 248 feet

Discharge Rate: 5 GPM ~~mLpm (est.)~~

Sampling Method: GRAB

Time Pump On: ~~1300~~ 1508 hours 9/6/14

Time Pump Off: 0110 hours 9/8/14

Total Time Pumped: 34 ~~minutes~~ Hours

Static Depth to Water: 147.6 feet (TOC El. ____ ft)

Feet Water in Casing: ____ feet

Casing Capacity: ____ gallons (____ gal/ft)

Sand Pack Volume ____ gallons (____ gal/ft)

Total Purge Volume: ____ ~~Liters~~ GAL

Water Level at Sampling: ____ feet

Pump Depth: 248 feet btoc

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q ~~(mL/min)~~ GPM	Purge Volume ~~(Liters)~~ GAL	Comments
1730							5		START; already pumped 50 gallons
1508	27.38	7.13	5399	Too High	4.34	31.3	5.5	505	ST012-W11-WG-500 GAL
1641	33.27	7.23	6111	Too High	2.75	59.4	5.5	1000	
21:47	27.34	7.29	5400		7.86	62.8	5	1674	ST012-W11-EBR-X-
22:48	26.98	7.21	5578		3.59	68.1	5	2,004	ST012-W11-EBR-X-
00:23	27.00	7.17	5686		4.53	67.3	5	2,502	ST012-W11-EBR-X-
01:55	26.83	7.14	5685		4.09	68.2	5	3,000	ST012-W11-EBR-X-3000
03:30	26.79	7.14	5717		4.11	68.7	5	3,500	ST012-W11-EBR-X-3500
05:03	26.65	7.00	5702		4.22	71.1	5	4,000	ST012-W11-EBR-X-4000
06:35	26.60	7.10	5686		4.07	70.5	5	4,500	ST012-W11-EBR-X-4500
0826	27.45	7.16	5813	clear	4.89	59.0	5	5,000	ST012-W11-EBR-X-5000
0957	27.81	7.10	5837	clear	4.71	58.3	5	5,500	ST012-W11-EBR-X-5500
1129	27.20	7.10	5796	clear	4.97	56.3	5	6,000	ST012-W11-EBR-X-6000
1343	27.66	7.07	5797	clear	4.65	57.4	5	6,500	ST012-W11-EBR-X-6500
1525	27.47	7.11	5750	clear	4.88	56.7	5	7,000	ST012-W11-EBR-X-7000
1700	27.49	7.11	5773	clear	5.15	59.3	5	7,500	ST012-W11-EBR-X-7500
1833	27.19	7.12	5752	clear	5.03	58.5	5	8,000	ST012-W11-EBR-X-8000

Sample ID: ST012-W11-WG- ~~W11-WG-500 GAL~~ 500 GAL Sample Time: See Above Duplicate (ID = N/A, Time N/A)

Analyses requested: 300 (Bromide & Sulfate)

Water Quality Meter: YSI 556 MPS Turbidity Meter: HACH 2100Q

Water Level Meter/Interface Probe: ____

GROUNDWATER SAMPLING FIELD DATA

PROJECT NAME: Former Williams AFB

PROJECT #: 9101110001.5300.5301

WELL ID: ST012-W11

SAMPLED BY: B.C/S.W/D.F

DATE: 9/4/14 - 9/8/14

WELL INFORMATION

TD Casing: 250 feet

Screened Interval: 208 – 248 feet

Discharge Rate: 5 gpm mLpm (est.)

Sampling Method: GRAB

Time Pump On: ~~1200~~ 1508 hours 9/6/14

Time Pump Off: 0110 hours 9/8/14

Total Time Pumped: 34 ~~minutes~~ HOURS

Static Depth to Water: feet (TOC El. ft)

Feet Water in Casing: feet

Casing Capacity: gallons (gal/ft)

Sand Pack Volume gallons (gal/ft)

Total Purge Volume: Liters

Water Level at Sampling: feet

Pump Depth: 248 feet btoc

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mL/min)	Purge Volume (Liters)	Comments
2018	27.86	7.19	6880	clear	4.89	59.5	5	8506	ST012-W11-EBR-X-8500
2154	27.20	7.17	5712	clear	4.87	58.0	5	9002	ST012-W11-EBR-X-9000
2333	26.90	7.17	5708	clear	4.89	61.6	5	9505	ST012-W11-EBR-X-9500
0110	27.06	7.18	5714	clear	4.77	66.0	5	10000	ST012-W11-EBR-X-10000

Sample ID: ST012-W11-WG- Sample Time: SEE ABOVE Duplicate (ID = NA, Time NA)

Analyses requested: 300 (BROMIDE + SULFATE

Water Quality Meter: YSI 556 MPS Turbidity Meter: NA

Water Level Meter/Interface Probe:

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GROUNDWATER SAMPLING FIELD DATA

PROJECT NAME: Former Williams AFB

PROJECT #: 9101110001.5300.5301

WELL ID: **ST012-W11**

SAMPLED BY: Combs

DATE: 9/8/14

WELL INFORMATION

TD Casing: 250 feet

Screened Interval: 208 – 248 feet

Discharge Rate: 5 gpm mLpm (est.)

Sampling Method: grab

Time Pump On: 1300 1352 hours 9/8/14

Time Pump Off: 0110 hours 9/8/14

Total Time Pumped: 31 ~~minutes~~ Hours

Static Depth to Water: _____ feet (TOC El. _____ft)

Feet Water in Casing: _____ feet

Casing Capacity: _____ gallons (____gal/ft)

Sand Pack Volume _____ gallons (____gal/ft)

Total Purge Volume: _____ Liters

Water Level at Sampling: _____ feet

Pump Depth: 248 feet btoc

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mL/min)	Purge Volume (Liters)	Comments
0117	26.93	7.13	5688	clear	5.04	69.0	5	10049	FINAL SAMPLES FOR DENVER/KNOXVILLE

Sample ID: **ST012-W11-WG-** Sample Time: SEE ABOVE Duplicate (ID = N A, Time N A)

Analyses requested: 8260B VOC, 8015B (JP-4), 90569 SO4, Cl, Bromide, O-PO4, 6010C Metals

Water Quality Meter: YSI 556 MPS Turbidity Meter: N A

Water Level Meter/Interface Probe: _____

GROUNDWATER SAMPLING FIELD DATA

PROJECT NAME: Former Williams AFB

PROJECT #: 9101110001.5300.5301

WELL ID: ST012-~~W11~~ W30

SAMPLED BY: (CMS)

DATE: 9/9/14 – 9/10/14

WELL INFORMATION

TD Casing: ~~ST(250~~ 252.7 feet BTOC

Screened Interval: ~~ST(208-240~~ feet 210.7 to 250.7 BTOC

Discharge Rate: ~7 gpm ~~ml/pm (est.)~~

Sampling Method: Grab

Time Pump On: 0735 9/9/14 hours

Time Pump Off: 1111 9/10/14 hours

Total Time Pumped: — minutes

Static Depth to Water: 145.91 feet (TOC El. ____ ft)

Feet Water in Casing: — feet

Casing Capacity: — gallons (____ gal/ft)

Sand Pack Volume — gallons (____ gal/ft)

Total Purge Volume: 300 ~~Liters~~ Gal

Water Level at Sampling: ____ feet

Pump Depth: 216 feet btoc

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mL/min) SEE NOTES	Purge Volume ~~(Liters)~~ Gal	Comments
									initial flow at turn on: 8.4 gpm
*0803	27.46	5.13	2646	clear	1.15	45.5	8.28	~40	and dropping. NOT STEADY
1049	28.31	5.34	2157	clear	1.69	52.5		167	* initial sample after 5 min of
1318	31.15	6.48	2318	clear	1.75	5.5		344	pumping taken
EOD									ST012-W30-EBR-X-INT
1056	29.02	6.66	2000	clear	2.49	65.4		500	ST012-W30-EBR-X-167
									STOP PUMPING FOR DAY AT 369 gal
									@ 1357
									ST012-W30-EBR-X-344
									ST012-W30-EBR-X-600

Sample ID: ST012-~~W11~~-WG- W30 Sample Time: SEE ABOVE Duplicate (ID = NA, Time NA)

Analyses requested: 300 Bromide, SULFATE

Water Quality Meter: YSI 556 MPS Turbidity Meter: NA

Water Level Meter/Interface Probe: —

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GROUNDWATER SAMPLING FIELD DATA

PROJECT NAME: Former Williams AFB

PROJECT #: 9101110001.5300.5301

WELL ID: ST012-~~W11~~W30

SAMPLED BY: COMAS

DATE: 9/10/14

WELL INFORMATION

TD Casing: ~~250~~ 252.7 feet BTOC

Screened Interval: ~~208–248~~ feet 210.7 to 250.7 BTOC

Discharge Rate: ~7 gpm mLpm (est.)

Sampling Method: Grab

Time Pump On: 0735 9/9/14 hours

Time Pump Off: 1111 9/10/14 hours

Total Time Pumped: — minutes

Static Depth to Water: 145.91 feet (TOC El. ____ ft)

Feet Water in Casing: — feet

Casing Capacity: — gallons (____ gal/ft)

Sand Pack Volume — gallons (____ gal/ft)

Total Purge Volume: 500 ~~Liters~~ Gal

Water Level at Sampling: — feet

Pump Depth: 211 feet btoc

Time	Temp (°C)	pH	EC (µS/cm)	Turbidity (NTU)	DO mg/L	ORP mV	Q (mL/min)	Purge Volume (Liters)	Comments
1056	29.02	6.66	2000	Clear	2.49	65.4	—	500	SAMPLES SENT TO DENVER

Sample ID: ST012-W11-WG- 30 Sample Time: SEE ABOVE Duplicate (ID = NA Time NA)

Analyses requested: Denver sample 8260B VOC's, 8015B(SP-4), 9056A SO4, Cl, Bromide, ~~Br~~ oPO4, 6010C Metals

Water Quality Meter: YSI 556 MPS Turbidity Meter: NA

Water Level Meter/Interface Probe: —

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W-30

Time	gallons	pH	Temp (°C)	cond (us/cm)	DO (mg/L)	ORP
0605	500	6.92	26.04	2250	1.31	-153.9

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APPENDIX B

ANALYTICAL LABORATORY DATA
(INCLUDED ON CD ONLY)

This appendix is a separate file included with this submittal.

APPENDIX C

DATA VALIDATION NARRATIVES
(INCLUDED ON CD ONLY)

Data Evaluation Narrative
AMEC Project: Former Williams AFB
AMEC Project Number: 9101110001.5300.5301
Site: ST012 – Enhanced Bioremediation Field Test
Sampling Event: July 2014
Matrix: Groundwater

SDG: 280-57958-1

1.0 INTRODUCTION

A data quality evaluation (DQE) was performed on the data reported for the Enhanced Bioremediation Field Test conducted at Site ST012 in July 2014, at the former Williams Air Force Base (AFB), Mesa, Arizona. The following sections provide summary discussions of the required data qualifications for each site and analytical methods for samples collected at the former WAFB. Data validation was conducted on 100% of the primary samples and field quality control samples (trip blanks, rinsate blanks, sample duplicates, and matrix spike/matrix spike duplicate [MS/MSD] samples). A Level III (Step IIB) data validation was performed using supplemental checklists to review the following quality control elements: laboratory case narrative, sample documentation, chain-of-custody, holding time protocols, method-specific calibration information, mass tunes, method blank results, laboratory control sample (LCS) results, surrogate recoveries (where applicable), MS/MSD recoveries and relative percent differences (RPDs), field duplicate RPDs, trip and equipment/rinsate blanks, method-specific QC elements (such as interelement check standards (ICS), serial dilutions, post digestion spikes (PDS), column breakdown, etc.), method sensitivity, and completeness.

Data were reviewed using precision and accuracy control limits presented in The Department of Defense (DoD) Quality Systems Manual (QSM) Version 4.2 (DoD, 2010). DQE data qualifications were applied if necessary in accordance with procedures in Air Force Center for Environmental Excellence (AFCEE) Quality Assurance Project Plan (QAPP), Version 4.0.01 (AFCEE, 2005), the method, and professional judgment using the following qualifiers:

- J = The reported concentration is considered an estimated value due to discrepancies in meeting certain analyte-specific quality control criteria.
- F = The reported concentration is between the limit of quantitation/reporting limit (LOQ/RL) and method detection limit (MDL) and is considered an estimated value
- UJ = The target compound was not detected and the reporting limit is considered imprecise due to discrepancies in meeting certain analyte-specific quality control criteria.
- B = The result may be biased high or a false positive based on blank data.
- M = The reported concentration is estimated due to matrix effects.
- R = The data are considered unusable due to discrepancies in meeting certain quality control criteria and may not be used in decision making.

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2.0 DELIVERABLES

The data packages as submitted to AMEC Environment and Infrastructure, Inc. (AMEC) are complete as stipulated in the Draft Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) for Site ST012 Enhanced Bioremediation Field Test Plan (AMEC, 2014), and the applicable guidelines described in the former Williams AFB Performance Based Remediation Program QAPP and standard operating procedures (SOPs) (collectively referred to as the QAPP/SOP [AMEC, 2012]) for U.S. States Environmental Protection Agency (EPA) Methods SW9056A, and SW6010C.

3.0 SAMPLE INTEGRITY

Samples within this sample delivery group (SDG) collected from ST012 were submitted to TestAmerica Laboratories (TAL) in Denver, Colorado for anions by Method SW9056A and select metals by Method SW6010C.

Based on the information provided on the cooler receipt forms, samples arrived at the laboratory within the recommended temperature and preservation requirements.

Completed Chain-of-Custody (COC) documents are included in the data package.

4.0 SAMPLE IDENTIFICATION

This SDG contains the following water and quality control (QC) samples:

Site: ST012	QC Samples
ST012-W30-NABRSOL	

These samples were collected on 17July 2014. The laboratory performed matrix spike/matrix spike duplicate analysis on sample ST-W30-NABRSOL.

5.0 SAMPLE QUALIFICATION

Only those components that required qualification of the data are presented in this narrative. All Level III components were within the DoD QSM QC limits, with the following exceptions:

- Constituents were present in the associated blanks (no qualification required).
- Metals were detected in the Interference Check Solution A (ICSA) (no qualification required).
- MS/MSD recoveries were outside QC limits (no flags applied).
- PDS recoveries were outside QC limits for metals (no flags applied).

6.0 ANIONS (SW9056A)

Samples collected from site ST012 were submitted for Anions by Method SW9056A. A Level III validation was performed on this method and only those components that exceeded the QAPP/SOP criteria are presented below. Each of the Level III components was within the QAPP/SOP QC criteria.

6.1 Limits of Quantitation

The LOQs as specified in the QAPP/SOP (AMEC, 2012) were met for samples submitted for the analysis of Anions by USEPA Method SW 9056A with the exception of analytes that required dilution. The sample in this SDG required dilution for chloride, bromide and sulfate resulting in elevated LOQs. The laboratory indicated a dilution with a "D" qualifier which was subsequently removed during the validation process.

7.0 METALS (SW6010C)

Samples collected from Site ST012 were submitted for the major metal cations by EPA Method SW6010C. Samples were analyzed for calcium, iron, magnesium, manganese, potassium, and sodium. A Level III validation was performed on this method and only those components that required qualification of the data are presented in this narrative. All Level III validation was performed on this method and only those components that exceeded the SAP/TAL SOP criteria are presented below. The following components exceeded the QC criteria or were noted:

- Constituents were present in the associated blanks and flagged "B" (no flags applied).
- Metals were detected in the Interference Check Solution A (ICSA) (no qualification required).
- PDS recoveries were outside QC limits for two metals (no flags applied).

7.1 Method Blanks

One method blank showed the presence of calcium (106 J µg/L). Associated sample results less than 5x the blank value were qualified as estimated and flagged "B".

Action: No qualification was required because the associated calcium results in the sample were greater than 5 x the blank value.

7.2 Interference Check Solution A (ICSA)

Manganese was detected in the ICSA solution associated with prep batch 280-236485. The vendor verified that the ICSA contained these trace impurities.

Action: No qualification is required for impurities verified by the vendor.

7.3 Matrix Spike/Matrix Spike Duplicate

The laboratory performed MS/MSD on the sample ST012-W30-NABRSOL for metals. The MS recovery for calcium, iron, and manganese recovered below the QC limit and potassium

recovered above the QC limits. No qualification is required if the recoveries were high and the samples were non-detect or the analyte was present in the sample at concentrations greater than 4x the spike amount.

Action: No qualification was required for any of the metals in sample ST012-W30-NABRSOL because they were present in the sample at greater than 4x the spike amount.

7.4 Post Digestion Spike

The laboratory performed a PDS on sample ST012-W30-NABRSOL and the recovery for calcium, magnesium, manganese, and potassium in sample recovered below the QC limit. No qualification is required if the recoveries were high and the samples were non-detect or the analyte was present in the sample at concentrations greater than 4x the spike amount.

Action: No qualification was required for calcium and manganese results in sample ST012-W30-NABRSOL because the metals were present in the sample at greater than 4x the spike amount or the MS/MSD recovery was within control.

7.5 Limits of Quantitation

The LOQs as specified in the QAPP/SOP (AMEC, 2012) were met for samples submitted for the analysis of metals by USEPA Method SW6010C except where dilutions were required to place the constituent concentration within the calibration range. Dilutions were required for the sample in this SDG resulting in elevated LOQs. The laboratory indicated a dilution with a "D" qualifier which was subsequently removed during the validation process.

8.0 OVERALL SITE EVALUATION AND PROFESSIONAL JUDGMENT

Edits to the DQE qualifiers by professional judgment were not required.

9.0 SUMMARY OF DATA QUALITY INDICATORS

This section provides an assessment of the data based on project data quality indicators (DQIs) described on QAPP Worksheet #37 of the Program Document QAPP/SOP (AMEC, 2012). The DQIs consist of precision, accuracy, representativeness, comparability, completeness, and sensitivity.

9.1 Precision

An assessment of precision of analytical data is accomplished via review of field duplicate and MS/MSD analyses. Field duplicate and MS/MSD analyses are used to assess field variability, which includes sample collection/handling as well as matrix homogeneity. Precision is expressed as the relative percent difference (RPD) between results for duplicate pairs.

Field duplicate samples were not submitted with this SDG. A MS/MSD was performed on the project sample for metals and the RPDs were within QC limits. Precision for metals and anions was additionally evaluated through the analysis of the LCS/LCSD and the RPDs were compliant

with the QAPP/SOP. Therefore, the overall method and sample matrix precision are acceptable and achieve project objectives.

9.2 Accuracy (Bias)

An assessment of accuracy of analytical data is accomplished via evaluation of the spike recoveries in the MS/MSD, LCS, post digestion spike samples, and surrogate spike compounds, in addition to calibration criteria. Accuracy is expressed as percent recovery. Accuracy data were compliant with the QAPP/SOP with the exception of MS/MSD and/or PDS recoveries for the metals; however, no qualification was applied because the metals were present in concentrations greater than 4x the spike amount. Therefore, the data results indicate method and matrix accuracy is acceptable to achieve project objectives.

9.3 Representativeness

Representativeness for the analytical data is determined through evaluation of the associated blank data and evaluation of appropriate sample handling procedures. All samples were properly stored and preserved in the field and at TestAmerica. Method blanks contained low-levels of calcium which did not result in qualification; therefore, the data is representative of the Site conditions.

9.4 Comparability

Comparability addresses the confidence with which one data set can be compared to another. Use of appropriate sampling methods, COC procedures, and EPA-approved analytical methods, as well as adherence to strict QA/QC procedures, provide the basis for uniformity in sample collection and analysis. Analytical data were generated by TestAmerica using standard reporting units of micrograms per liter for metals and milligrams per liter for anions. In addition, sample collection and analytical method protocols were implemented in accordance with approved, documented procedures. Analytical data are determined to be comparable to previous Site results; however, due to shipping delays may be biased low.

9.5 Completeness

Completeness of the field sampling activities were assessed in terms of the actual number and type of sample results received from the field and laboratory, as compared with the planned number and type of sample results. All samples planned were collected which meets a field completeness of 100%.

Analytical completeness of data is a measure of the number of valid project-specific data results obtained in comparison to the total number of data results projected to achieve project DQOs. Valid data are defined as data that meet the project-specific DQOs. No data were rejected as a result of the data validation. The completeness goals met the 90 percent goal for field and laboratory data expected for this project.

9.6 Sensitivity

Analytical methods and RLs were implemented in accordance with the QAPP/SOP and EPA promulgated methodologies. Method RLs were achieved for the event except when sample

dilutions were required to bring target compounds within the linear range of the instrument calibration. As previously mentioned, the sample within this SDG required dilutions formetals and anions to place the results within the calibration range. These include modified RLs for selected detections; therefore, sensitivity requirements were met for non-diluted constituents.

9.7 Usability Summary

The data generated during the July 2014 sampling event meet the project DQOs. The DQOs for the Enhanced Bioremediation Field Test is to produce data to support design of anaerobic methods for the ST012 remedy if selected.

10.0 REFERENCES

AFCEE, 2005. Quality Assurance Project Plan, Version 4.0.01, May, 2005.

AMEC, August 11, 2014. *Draft Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) (Enhanced Bioremediation Field Test Plan) Operable Unit 2 Site ST012 - Liquid Fuels Storage Area, Former Williams Air Force Base, Mesa, Arizona*.

AMEC, February 23, 2012. *Performance Based Remediation Program Quality Assurance Project Plan (QAPP) and Standard Operating Procedures (SOPs) (QAP/SOP), Former Williams Air Force Base, Mesa, Arizona*.

DoD, 2010. Department of Defense Quality System Manual, Version 4.2 Final, October 2010.

Prepared/Date: JAH 9/22/2014
Checked/Date: DWK 9/22/2014

ED_005025_00007837-00072

Flagged Data Reports

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-57958-1

9-22-14

Client Sample ID: **ST012-W30-NABRSOL**

Lab Sample ID: 280-57958-1
Client Matrix: Water

Date Sampled: 07/18/2014 0947
Date Received: 07/19/2014 0850

6010C Metals (ICP)

Analysis Method:	6010C	Analysis Batch:	280-238102	Instrument ID:	MT_026
Prep Method:	3010A	Prep Batch:	280-236485	Lab File ID:	26A080714B.asc
Dilution:	1.0			Initial Weight/Volume:	50 mL
Analysis Date:	08/07/2014 2006			Final Weight/Volume:	50 mL
Prep Date:	07/30/2014 1230				

Analyte	Result (ug/L)	Qualifier	DL	LOQ
Calcium	220000	J	35	1000
Iron	7300	J	22	100
Magnesium	46000		11	500
Manganese	3600	QJ	0.25	10
Sodium	120000		92	5000

Analysis Method:	6010C	Analysis Batch:	280-238726	Instrument ID:	MT_026
Prep Method:	3010A	Prep Batch:	280-236485	Lab File ID:	26A081214A.asc
Dilution:	50			Initial Weight/Volume:	50 mL
Analysis Date:	08/12/2014 1855			Final Weight/Volume:	50 mL
Prep Date:	07/30/2014 1230				

Analyte	Result (ug/L)	Qualifier	DL	LOQ
Potassium	4300000	J-D	12000	150000

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-57958-1

General Chemistry

Client Sample ID: **ST012-W30-NABRSOL**

Lab Sample ID: 280-57958-1
Client Matrix: Water

9-22-14

Date Sampled: 07/18/2014 0947
Date Received: 07/19/2014 0850

Analyte	Result	Qual	Units	DL	LOQ	Dil	Method
Bromide	220	~~B~~	mg/L	5.7	25	50	9056A
Analysis Batch: 280-237574	Analysis Date: 08/05/2014 2359						
Orthophosphate as P	1.0	U	mg/L	0.94	2.5	5.0	9056A
Analysis Batch: 280-235057	Analysis Date: 07/19/2014 1513						
Chloride	510	~~B~~	mg/L	1.3	15	5.0	9056A
Analysis Batch: 280-235056	Analysis Date: 07/19/2014 1750						
Sulfate	3800	~~B~~	mg/L	4.6	100	20	9056A
Analysis Batch: 280-235058	Analysis Date: 07/19/2014 2349						

Data Quality Evaluation Checklists

Method Validated: 9056A

Initial Review by: J. Hartness Date: 9/22/14
Senior Review by: D. Knaub Date: 9/22/14

SDG#: 280-57958-1
Matrix: Groundwater

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C)	QC acceptance criteria published by DoD, if available; otherwise method- specified criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	Not applicable (NA)	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	ok
Limit of Detection Determination and Verification (LOD) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly LOD verification checks shall be performed (see box D-13)	See 40 CFR 1368. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL / LOD verification check at higher level and set MDL higher or reconduct MDL study (see box D-13).	NA	Samples cannot be analyzed without a valid MDL.	Pg. 93-98 6/16/2013
Limit of Quantitation Establishment and Verification (LOQ) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly LOQ verification checks shall be performed (see box D-14)	Within calibration range including low standard; within method precision and accuracy.	Re-run LOQ	NA	Samples cannot be analyzed without a valid LOQ	MRL check: Level 3 Package Pg. 92 (7/19/14) = OK

Method Validated: 9056A

Initial Review by: J. Hartness Date: 9/22/14
Senior Review by: D. Knaub Date: 9/22/14

SDG#: 280-57958-1
Matrix: Groundwater

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Retention Time (RT) Window Width Calculated for Each Analyte and Surrogate	At method set-up and after major maintenance (e.g., column change)	RT width is ± 3 times standard deviation for each analyte RT from 24-hour study.	NA	NA		OK
Container, Preservation, and Holding Time	All field samples	500 ml poly, Cool to 4°C Nitrate – 48 hours Nitrite, sulfate, chloride – 28 days	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collected: 7/18/14 Temp: Analyzed: 7/19/14
ICAL for All Analytes (Minimum Three Standards and One Calibration Blank)	Initial calibration prior to sample analysis	R ≥ 0.995	Correct problem then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed.	Level 4 Package Pg. 873 Inst IC_6 8/01/14(Br) OK Pg 878 Inst: WC_IonChrom10 - 7/15/14 (o-PO4, SO4) OK Pg -875 Inst: WC_IonChrom8 – 7/15/14(Cl) OK
Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 10% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	Pg. 85-87 Level 3 Package OK

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Retention Time Window Position Establishment for Each Analyte and Surrogate	Once per ICAL and at the beginning of the analytical shift	Position shall be set using the midpoint standard of the calibration curve or the value in the CCV run at the beginning of the analytical shift.	NA	NA		Ok
Midrange Continuing Calibration Verification (CCV)	After every 10 field samples and at end of the analysis sequence.	All analytes within established retention time windows and within ± 10% of true value	Correct problem then repeat CCV. If that fails, then repeat ICAL. Reanalyze all samples since last successful calibration verification.	Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification, if . reanalysis is not possible.	No samples may be analyzed until the problem has been corrected.	Pg. 85-88 Level 3 Package OK
Method Blank	One per preparatory batch	No analytes detected > ½ RL. See box D-1.	Correct problem, then see criteria in box D-1; if required, reprep then reanalyze method blank and all samples processed with the contaminated blank.	Lab: Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch. Validator; Apply "B" flag if result is less than 5x method blank.		Pg 18 (Cl), 20 (oPO4), 22 (SO4), 24 (Br), 89 All MBs = ND See ADR

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Laboratory Control Sample (LCS) Containing All Analytes Required to be Reported, Including Surrogates	One LCS per preparatory batch	Use laboratory in-house LCS acceptance criteria (not to exceed 20%).See Box D-3.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix G)	If corrective action fails apply J-flag to specific analyte(s) in all samples in the associated preparatory batch		Pg 18 (Cl), 20 (oPO4), 22 (SO4), 24 (Br), 90,91 LCS/LCSD = OK See ADR
Matrix Spike (MS)	One MS per preparatory batch per matrix (see box D- 7)	For matrix evaluation, use laboratory in-house LCS acceptance criteria (not to exceed 20%).	Examine the project-specific 000s. Contact the client as to additional measures to be taken,	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	None in this SDG
Matrix Spike Duplicate (MSD) or Sample Duplicate	One per preparatory batch per matrix	RPD ≤15% (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	NA
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD ≤10%	Qualify sample	For the specific analyte(s) in the parent & dup samples, apply J- flag if acceptance criteria are not met.		No field duplicate collected

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Results Reported Between LOD and LOQ	NA	NA	NA	Apply J-flag to all results between LOD and LOQ. Validator flags: If using AFCEE; Apply "F" flag		No detections between LOD and LOQ
QC Blanks (Equipment Blanks and Field Blanks)	Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value (10x for common lab contaminants) are qualified as estimated and flagged "B".		Not collected

ED_005025_00007837-00081

Method Validated: 6010 | Initial Review by: J. Hartness | Date: 9/22/14 | SDG#:280-57958-1
Senior Review by: D. Knaub | Date: 9/22/14 | Matrix: Groundwater

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C)	QC acceptance criteria published by DoD, if available; otherwise method- specified criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	Not applicable (NA)	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	Ok
Instrument Detection Limit (IDL) Study	At initial set-up and after significant change in instrument type, personnel, test method, or sample matrix	IDL shall be ≤ Limit of Detection (LOD)	NA	NA		p. 67-68 6/11/13
Container, Preservation, and Holding Time	All field samples	Water: 500 ml Poly, HNO_3 to pH < 2, Cool to 6°C, Soil: 4 oz glass or poly jar, Cool to 6°C 180 days to analysis	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collection date: 7/18/14 Prep; 7/30/14 Analysis date: 8/07/14, 8/12/14 Temp: 2.6°C OK

Method Validated: 6010 | Initial Review by: J. Hartness | Date: 9/22/14 | SDG#:280-57958-1
Senior Review by: D. Knaub | Date: 9/22/14 | Matrix: Groundwater

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Initial calibration (ICAL) for all analytes (minimum one high standard and a calibration blank)	Daily ICAL prior to sample analysis	If more than one calibration standard is used, r ≥ 0.995.	Correct problem then repeat ICAL.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed.	p. 77 run log ICIS analyzed 8/07/2014 16:03 IC analyzed 8/07/2014 16:07 and 16:11 ICVH 8/07/2014 16:20 p. 79 run log ICIS analyzed 8/12/2014 17:11 IC analyzed 8/12/2014 17:14 and 17:17 ICVH 8/12/2014 17:28
Second Source Calibration Verification (ICV)	Once after each ICAL, prior to beginning sample run	Value of second source for all analytes within ± 10% of true value	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	p. 45 ICVH 280-238102/6 8/7/2014 All OK p. 46,47 ICV 280-238102/7,8 8/7/2014 All OK p. 48 ICV 280-238726/6 8/12/2014 All OK p. 49-51ICV 280-238726/8,10 8/12/2014 All OK
Continuing Calibration Verification (CCV)	After every 10 field samples and at the end of the analysis sequence	All analytes within ± 10% of true value	Correct problem, rerun CCV. If that fails, then repeat ICAL. Reanalyze all samples since last successful calibration verification	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) of interest in all samples since the last acceptable CCV. Validator flags: If using AFCEE; Apply "J" flag only if reanalysis cannot be performed	Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	p. 45-47 CCV 280-238102 8/7/2014 All OK p. 47 CCVL 280-238102/60 8/7/2014 NA=120% ***No flag: samples high level*** p. 48-51 CCV 280-238726 8/12/2014 All OK

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Low-level calibration check standard	Daily, after one-point ICAL	Within ± 20% of true value	Correct problem, then reanalyze	Flagging criteria are not appropriate.	No samples may be analyzed without a valid low-level calibration check standard. Low-level calibration check standard should be less than or equal to the reporting limit.	p. 52 ***All OK***
Linear dynamic range or high-level check standard	Every 6 months	Within ±10% of expected value	NA	NA		p. 75 7/21/2014
Method Blank	One per preparatory batch	No analytes detected > ½ RL and greater than 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1).	Correct problem, then see criteria in box D-1; if required, reprep then reanalyze method blank and all samples processed with the contaminated blank.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch	Problem must be corrected. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where samples cannot be reanalyzed.	p. 12 & 55, 56 MB-280-2336485/1-A Ca = 106J x 5 =530 ug/L **Calcium was detected in samples at 5x greater than MB: No qualification required** ***See ADR***
Calibration blank	Before beginning a sample run, after every 10 samples, and at end of the analysis sequence	No analytes detected > LOD	Correct problem. Reprep and reanalyze calibration blank. All samples following the last acceptable calibration blank must be reanalyzed	Apply B-flag to all results for specific analyte(s) in all samples associated with the blank.		p. 53(Ca, Fe, Mg, Mn, NA) CCB 280-238102/59 Na = 229J x 5 = 1145 ug/L **Sodium was detected in samples at 5x greater than ICB: No qualification required** p. 54 (K) ICB, CCBs 280-238726 All ND

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Interference check solutions (ICS-A and ICS-AB)	At the beginning of an analytical run and every 12 hours	ICS-A: Absolute value of concentration for all non-spiked analytes < LOD (unless they are a verified trace impurity from one of the spiked analytes) ICS-AB: Within ±20% of expected value	Terminate analysis, locate and correct problem, reanalyze ICS, reanalyze all samples.	If corrective action fails, apply Q-flag to all results for specific analyte(s) in all samples associated with the ICS. Validator flags: If using AFCEE; Apply "M" flag		p. 57 ICS-A Mn & Na >LOD ***No qualification- vendor verified trace impurities and samples do not have Al, Ca, Fe, or Mg at levels > ICS*** p. 58 ICS-AB :All OK
Laboratory Control Sample (LCS) Containing All Analytes to be Reported	One per preparatory batch	QC acceptance criteria specified by DoD, if available; see box D-3 and Appendix G.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix G)	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch Validator flags: If using AFCEE; Apply "J" flag	Problem must be corrected. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	p. 13 LCS-280-2336485/2-A ***All OK*** ***See ADR***
Matrix Spike (MS)	One per preparatory batch per matrix (see box D-7)	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS.	Examine the project-specific DQOs. If the matrix spike falls outside of DoD criteria, additional quality control test (dilution test and post-digestion spike addition) are required to evaluate matrix effects.	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	p. 15-16 ST012-W30-NABRSOL Ca = 64%, 86% Fe = 63%, 92% Mn = 57%, 79% K = 280%, 85% ***No qualification: sample result is greater than 4x spike amount or MS/MSD was within QC limits*** ***See ADR***

Method Validated: 6010 | Initial Review by: J. Hartness | Date: 9/22/14 | SDG#:280-57958-1
Senior Review by: D. Knaub | Date: 9/22/14 | Matrix: Groundwater

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Matrix Spike Duplicate (MSD)	One per preparatory batch per matrix (see Box D-7)	MSD: For matrix evaluation use QC acceptance criteria specified by DoD for LCS MSD RPD < 20%	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	Pg. 15 ST012-W30-NABRSOL ***RPDs are ok*** ***See ADR***
Dilution test	Once per preparatory batch	Five-fold dilution must agree within ± 10% of the original measurement	Perform post-digestion spike addition.	Flagging criteria are not appropriate.	Only applicable for samples with concentrations > 50 x LOQ.	Pg. 17 ST012-W30-NABRSOL ***OK***
Post digestion spike addition	When dilution test fails or analyte concentration for all samples < 50 x LOQ	Recovery within 75-125% of (see Table B-1)	Run all associated samples in the preparatory batch by method of standard additions (MSA) or see flagging criteria.	For specific analyte(s) in the parent sample, apply J-flag of acceptance criteria are not met.	Spike addition should produce a concentration of 10 - 100 x LOQ	Pg. 14 Ca = 55% Mg = 73% Mn = -424% K = -275% ***No qualification: sample result is greater than 4x spike amount or MS/MSD was within QC limits***
Method of standard additions (MSA)	When matrix interference is suspected	NA	NA	NA	Document use of MSA in the case narrative.	NA
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD 20%	Qualify samples	For the specific analyte(s) in the parent & dup samples, apply J-flag if acceptance criteria are not met.		No field dups analyzed for metals
Results Reported Between LOD and LOQ	NA	NA	NA	Apply J-flag to all results between DL and LOQ. Validator flags: If using AFCEE; Apply "F" flag		No results reported between MDL and RL.
QC Blanks (Equipment Blanks, and Field Blanks)	Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value are qualified as estimated and flagged "B".		No EB blanks

Data Evaluation Narrative
AMEC Project: Former Williams AFB
AMEC Project Number: 9101110001.5300.5301
Site: ST012 – Enhanced Bioremediation Field Test
Sampling Event: July 2014
Matrix: Groundwater

SDG: 280-58001-1

1.0 INTRODUCTION

A data quality evaluation (DQE) was performed on the data reported for the Enhanced Bioremediation field test conducted at Site ST012 in July 2014, at the former Williams Air Force Base (AFB), Mesa, Arizona. The following sections provide summary discussions of the required data qualifications for each site and analytical methods for samples collected at the former WAFB. Data validation was conducted on 100% of the primary samples and field quality control samples (trip blanks, rinsate blanks, sample duplicates, and matrix spike/matrix spike duplicate [MS/MSD] samples). A Level III (Step IIB) data validation was performed using supplemental checklists to review the following quality control elements: laboratory case narrative, sample documentation, chain-of-custody, holding time protocols, method-specific calibration information, mass tunes, method blank results, laboratory control sample (LCS) results, surrogate recoveries (where applicable), MS/MSD recoveries and relative percent differences (RPDs), field duplicate RPDs, trip and equipment/rinsate blanks, method-specific QC elements (such as interelement check standards (ICS), serial dilutions, post digestion spikes (PDS), column breakdown, etc.), method sensitivity, and completeness.

Data were reviewed using precision and accuracy control limits presented in The Department of Defense (DoD) Quality Systems Manual (QSM) Version 4.2 (DoD, 2010). DQE data qualifications were applied if necessary in accordance with procedures in Air Force Center for Environmental Excellence (AFCEE) Quality Assurance Project Plan (QAPP), Version 4.0.01 (AFCEE, 2005), the method, and professional judgment using the following qualifiers:

- J = The reported concentration is considered an estimated value due to discrepancies in meeting certain analyte-specific quality control criteria.
- F = The reported concentration is between the limit of quantitation/reporting limit (LOQ/RL) and method detection limit (MDL) and is considered an estimated value
- UJ = The target compound was not detected and the reporting limit is considered imprecise due to discrepancies in meeting certain analyte-specific quality control criteria.
- B = The result may be biased high or a false positive based on blank data.
- M = The reported concentration is estimated due to matrix effects.
- R = The data are considered unusable due to discrepancies in meeting certain quality control criteria and may not be used in decision making.

ED_005025_00007837-00087

2.0 DELIVERABLES

The data packages as submitted to AMEC Environment and Infrastructure, Inc. (AMEC) are complete as stipulated in the Draft Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) for Site ST012 Enhanced Bioremediation Field Test Plan (AMEC, 2014), and the applicable guidelines described in the former Williams AFB Performance Based Remediation Program QAPP and standard operating procedures (SOPs) (collectively referred to as the QAPP/SOP [AMEC, 2012]) for U.S. States Environmental Protection Agency (EPA) Methods SW8260B, SW8015B, SW9056A, and SW6010C.

3.0 SAMPLE INTEGRITY

Samples within this sample delivery group (SDG) collected from ST012 were submitted to TestAmerica Laboratories (TAL) in Denver, Colorado for select volatile organic compounds (VOCs) analysis by USEPA Method SW8260B, total petroleum hydrocarbons-gasoline range organics (TPH-GRO) and diesel range organics (TPH-DRO) by Method SW8015B, anions by Method SW9056A and select metals by Method SW6010C.

Based on the information provided on the cooler receipt forms, samples arrived at the laboratory outside the recommended temperature requirements (17.6°C) due to a delay in shipment to the laboratory by Federal Express.

Action: The VOC, TPH-GRO, and TPH-DRO results reported for the samples were qualified as estimated, with a possible low bias and flagged "J/UJ". The metals and anions data were not qualified for temperature exceedence.

Completed Chain-of-Custody (COC) documents are included in the data package.

4.0 SAMPLE IDENTIFICATION

This SDG contains the following water and quality control (QC) samples:

Site: ST012	QC Samples
ST012-W11-WG-0714	ST012-DUP01-071614
ST012-W30-WG-0714	TB01-071614

These samples were collected on 16 July 2014. Sample ST012-DUP01-071614 is a field duplicate of sample ST012-W30-WG-0714.

5.0 SAMPLE QUALIFICATION

Only those components that required qualification of the data are presented in this narrative. All Level III components were within the DoD QSM QC limits, with the following exceptions:

- Samples were received outside the recommended temperature range and VOC, TPH-GRO and TPH-DRO results were flagged "J/UJ".
- Samples were received outside the holding time for orthophosphate and flagged "UJ".
- Constituents were present in the associated blanks and flagged "B".
- Surrogate recoveries were outside QC limits (no flags applied).
- Metals were detected in the Interference Check Solution A (ICSA) (no qualification required).
- MS/MSD recoveries were outside QC limits resulting in "J" flags.
- PDS recoveries were outside QC limits for two metals (no flags applied).
- Field and laboratory duplicate precision was outside QC limits and results were flagged "J".
- Results were present between the MDL and LOQ and flagged "F".

6.0 VOCS (SW8260B)

Samples collected from site ST012 were submitted for VOCs by EPA Method SW8260B and analyzed for site-specific VOC compounds of interest (COIs).

A Level III validation was performed on this method and only those components that exceeded the QAPP/SOP criteria are presented below. Each of the Level III components was within the QAPP/SOP QC criteria; however the following qualification was noted:

- Samples were received outside the recommended temperature range and VOCs were flagged "J/UJ".
- Constituents were present in the associated blanks and flagged "B".
- Field duplicate precision was outside QC limits and results were flagged "J".
- Results were present between the MDL and RL and flagged "F".

6.1 Receipt Condition

The samples were received out of temperature requirements and qualified as estimated (J/UJ) with a possible low bias. See Section 3.0 *Sample Integrity* for details.

6.2 Method Blank and Trip Blank

The method blanks for this SDG contained naphthalene (0.507 J micrograms per liter [µg/L]) and methylene chloride (0.489 J µg/L), and the trip blank contained naphthalene (0.43 J µg/L). Any associated sample with results less than 5x (10x for common contaminants) the method or trip blank results were considered as possibly biased high or false positive and flagged "B". The 5x/10x rule was applied to the raw response in the sample prior to dilution and sample volume calculations.

Action: The naphthalene results in the trip blank sample TB01-071614 and the methylene chloride results in groundwater sample ST012-DUP01-071614 were qualified as estimated with a possible high bias and flagged "B".

6.3 Field Duplicates

One duplicate pair was collected and analyzed for VOCs: ST012-DUP01-071614/ST012-W30-WG-0714. The relative percent difference (RPD) between the parent and duplicate was exceeded for naphthalene. Positive sample results above the LOQ were qualified.

Action: The naphthalene results for the primary sample and the duplicate were qualified as estimated and flagged "J". As mentioned above, results were previously flagged for temperature exceedence and no additional qualification was necessary.

6.4 Limits of Quantitation

The LOQs as specified in the QAPP/SOP (AMEC, 2012) were met for samples submitted for the analysis of VOCs by USEPA Method SW 8260B except where dilutions were required to place the constituent within the calibration range. Dilutions were required. The laboratory indicated a dilution with a "D" qualifier which was subsequently removed during the validation process.

Any result reported between the LOQ and MDL is considered a quantitative estimate. The results reported between the RL and MDL are presented in the attached data report.

Action: The associated results reported between the LOQ and MDL were qualified as estimated and flagged "F" unless overridden by other QC criteria.

7.0 TPH-GRO (8015B)

Samples collected from Site ST012 were submitted for TPH-GRO analysis by EPA Method SW8015B. A Level III validation was performed on this method and only those components that exceeded the program document QAPP/SOP criteria are presented below. Qualification was required for the following:

- Samples were received outside the recommended temperature range and results were flagged "J/UJ".
- Surrogate recoveries were outside QC limits (no flags applied).

7.1 Receipt Condition

The samples were received out of temperature requirements and qualified as estimated (J/UJ) with a possible low bias. See Section 3.0 *Sample Integrity* for details.

7.2 Surrogate Recoveries

Surrogate a,a,a-trifluorotoluene recovered above the QC limits in samples ST012-W11-WG-0714 and ST012-W30-WG-0714. No qualification is required if the samples were diluted or the surrogate recoveries were high and the samples were non-detect.

Action: No qualification was required because the samples were diluted.

7.3 Limits of Quantitation

The LOQ as specified in the QAPP/SOP (AMEC, 2012) was met for samples submitted for the analysis of TPH-GRO by EPA Method SW8015B except where dilutions were required to place the constituent within the calibration range. Samples reported with this SDG required dilution due to high levels of TPH-GRO. The laboratory indicated a dilution with a "D" qualifier which was subsequently removed during the validation process.

8.0 TPH-DRO (8015B)

Samples collected from Site ST012 were submitted for TPH-DRO analysis by EPA Method SW8015B. A Level III validation was performed on this method and only those components that exceeded the program document QAPP/SOP criteria are presented below. Qualification was required for the following:

- Samples were received outside the recommended temperature range and results were flagged "J/UJ".
- Constituents were present in associated blanks and flagged "B".

8.1 Receipt Condition

The samples were received out of temperature requirements and qualified as estimated (J/UJ) with a possible low bias. See Section 3.0 *Sample Integrity* for details.

8.2 Method Blank

The method blanks for this SDG contained TPH-DRO (0.174 J milligrams per liter [mg/L], respectively). Any associated sample with results less than 5x the method blank results were considered as possibly biased high or false positive and flagged "B". The 5x rule was applied to the raw response in the sample prior to dilution and sample volume calculations.

Action: The TPH-DRO results in both the groundwater samples were qualified as estimated with a possible high bias and flagged "B".

8.3 Limits of Quantitation

The LOQ as specified in the QAPP/SOP (AMEC, 2012) was met for samples submitted for the analysis of TPH-DRO by EPA Method SW8015B. Dilutions were not required for TPH-DRO.

9.0 ANIONS (SW9056A)

Samples collected from site ST012 were submitted for Anions by Method SW9056A. A Level III validation was performed on this method and only those components that exceeded the QAPP/SOP criteria are presented below. Each of the Level III components was within the QAPP/SOP QC criteria; however the following qualification was noted:

- Samples were received outside the holding time for orthophosphate and flagged "UJ".

- MS/MSD recoveries were outside QC limits for bromide resulting in "J" flags.
- Laboratory duplicate RPD exceeded Qc limits and results were flagged "J".

9.1 Holding Times

The samples were received at the laboratory after the holding time for orthophosphate had expired due to a Federal Express delay in shipping.

Action: The orthophosphate results were considered estimated with a possible low bias and flagged "UJ".

9.2 Matrix Spike/Matrix Spike Duplicate

The laboratory performed MS/MSD on both samples in this SDG for anions. The recovery for bromide in sample ST012-W11-WG-0714 recovered above the QC limit and the recovery for chloride in sample ST012-W30-WG-0714 recovered below the QC limit in the MS/MSD samples. No qualification is required if the recoveries were high and the samples were non-detect or the analyte was present in the sample at concentrations greater than 4x the spike amount.

Action: The bromide results in sample ST012-W11-WG-0714 were qualified as estimated with a possible high bias and flagged "J". No qualification was required for chloride in sample ST012-W30-WG-0714 because it was present in the sample at greater than 4x the spike amount.

9.3 Laboratory Duplicate

The laboratory performed duplicate analyses on both samples in this SDG. The RPD between sample ST012-W11-WG-0714 and the laboratory duplicate was exceeded for sulfate. Positive sample results above the LOQ were qualified.

Action: The sulfate results in sample ST012-W11-WG-0714 were qualified as estimated and flagged "J".

9.4 Limits of Quantitation

The LOQs as specified in the QAPP/SOP (AMEC, 2012) were met for samples submitted for the analysis of Anions by USEPA Method SW 9056A with the exception of analytes that required dilution. Both samples in this SDG required dilution for chloride resulting in elevated LOQs. The laboratory indicated a dilution with a "D" qualifier which was subsequently removed during the validation process.

10.0 METALS (SW6010C)

Samples collected from Site ST012 were submitted for the major metal cations by EPA Method SW6010C. Samples were analyzed for calcium, iron, magnesium, manganese, potassium, and sodium. A Level III validation was performed on this method and only those components that required qualification of the data are presented in this narrative. All Level III validation was

performed on this method and only those components that exceeded the SAP/TAL SOP criteria are presented below. The following components exceeded the QC criteria or were noted:

- Constituents were present in the associated blanks and flagged "B" (no flags applied).
- Metals were detected in the Interference Check Solution A (ICSA) (no qualification required).
- PDS recoveries were outside QC limits for two metals (no flags applied).
- Results were present between the MDL and LOQ and flagged "F".

10.1 Method Blanks

One method blank showed the presence of calcium (113 J µg/L) and sodium (111 J µg/L). Associated sample results less than 5x the blank value were qualified as estimated and flagged "B".

Action: No qualification was required because the associated calcium and sodium results in the samples were greater than 5 x the blank value.

10.2 Interference Check Solution A (ICSA)

Manganese was detected in the ICSA solution associated with prep batch 280-235312. The vendor verified that the ICSA contained these trace impurities.

Action: No qualification is required for impurities verified by the vendor.

10.3 Post Digestion Spike

The laboratory performed a PDS on sample ST012-W11-WG-0714 and the recovery for calcium and manganese in sample recovered below the QC limit. No qualification is required if the recoveries were high and the samples were non-detect or the analyte was present in the sample at concentrations greater than 4x the spike amount.

Action: No qualification was required for calcium and manganese results in sample ST012-W11-WG-0714 because the metals were present in the sample at greater than 4x the spike amount.

10.4 Limits of Quantitation

The LOQs as specified in the QAPP/SOP (AMEC, 2012) were met for samples submitted for the analysis of metals by USEPA Method SW6010C except where dilutions were required to place the constituent concentration within the calibration range. No Dilutions were required.

Any result reported between the LOQ and MDL is considered a quantitative estimate. The results reported between the RL and MDL are presented in the attached data report.

Action: The associated results reported between the LOQ and MDL were qualified as estimated and flagged "F" unless overridden by other QC criteria.

11.0 OVERALL SITE EVALUATION AND PROFESSIONAL JUDGMENT

Edits to the DQE qualifiers by professional judgment were not required.

12.0 SUMMARY OF DATA QUALITY INDICATORS

This section provides an assessment of the data based on project data quality indicators (DQIs) described on QAPP Worksheet #37 of the Program Document QAPP/SOP (AMEC, 2012). The DQIs consist of precision, accuracy, representativeness, comparability, completeness, and sensitivity.

12.1 Precision

An assessment of precision of analytical data is accomplished via review of field duplicate and MS/MSD analyses. Field duplicate and MS/MSD analyses are used to assess field variability, which includes sample collection/handling as well as matrix homogeneity. Precision is expressed as the relative percent difference (RPD) between results for duplicate pairs.

Field duplicate sample samples were submitted for VOCs and the RPD was exceeded for naphthalene most likely due to the different dilutions applied to the samples; therefore, impacts to DQOs are minimal. A MS/MSD was performed on project samples for anions and metals and the RPDs were within QC limits. Additionally, the laboratory performed a duplicate analysis for anions and the RPD was exceeded for sulfate resulting in qualification for sulfate in one sample. Precision for TPH-GRO and TPH-DRO was evaluated through the analysis of the LCS/LCSD and the RPDs were compliant with the QAPP/SOP. Even though two naphthalene results and one sulfate result were qualified as estimated, the overall method and sample matrix precision are acceptable and achieve project objectives.

12.2 Accuracy (Bias)

An assessment of accuracy of analytical data is accomplished via evaluation of the spike recoveries in the MS/MSD, LCS, post digestion spike samples, and surrogate spike compounds, in addition to calibration criteria. Accuracy is expressed as percent recovery. Accuracy data were compliant with the QAPP/SOP with the exception TPH-GRO surrogates and MS/MSD recoveries for bromide in one sample. The DQE resulted in the qualification of bromide results as estimated in one sample. Estimated data is usable data and all remaining accuracy data for the other anions, VOCs, TPH-GRO, TPH-DRO, and metals were within QC limits or did not require qualification. Therefore, the data results indicate method and matrix accuracy is acceptable to achieve project objectives.

12.3 Representativeness

Representativeness for the analytical data is determined through evaluation of the associated blank data and evaluation of appropriate sample handling procedures. All samples were properly stored and preserved in the field and at TestAmerica; however, due to a Federal Express shipping delay samples were received at the laboratory above temperature requirements and the holding time was exceeded for orthophosphate. The temperature exceedence resulted in the qualification of the VOC, TPH-GRO and TPH-DRO results with a

possible low bias and the orthophosphate results were qualified as possibly low due to the holding time exceedence.

Method blanks and trip blanks contained low-levels of naphthalene, methylene chloride, TPH-DRO and/or metals which resulted in the qualification of low-level naphthalene, methylene chloride and TPH-DRO results in one or more of the samples. The targets qualified in the groundwater samples are at such low levels, that the impact to DQOs is minimal. Due to the qualifications, the analytical results indicate sample data for VOCs, TPH-GRO, TPH-DRO, and orthophosphate may be biased low and may not be truly representative of the Site conditions.

12.4 Comparability

Comparability addresses the confidence with which one data set can be compared to another. Use of appropriate sampling methods, COC procedures, and EPA-approved analytical methods, as well as adherence to strict QA/QC procedures, provide the basis for uniformity in sample collection and analysis. Analytical data were generated by TestAmerica using standard reporting units of micrograms per liter for VOCs, TPH-GRO, and metals and milligrams per liter for TPH-DRO and anions. In addition, sample collection and analytical method protocols were implemented in accordance with approved, documented procedures. Analytical data are determined to be comparable to previous Site results; however, due to shipping delays may be biased low.

12.5 Completeness

Completeness of the field sampling activities were assessed in terms of the actual number and type of sample results received from the field and laboratory, as compared with the planned number and type of sample results. All samples planned were collected which meets a field completeness of 100%.

Analytical completeness of data is a measure of the number of valid project-specific data results obtained in comparison to the total number of data results projected to achieve project DQOs. Valid data are defined as data that meet the project-specific DQOs. No data were rejected as a result of the data validation; however, some of the results were qualified as estimated. Estimated data is usable data. The completeness goals met the 90 percent goal for field and laboratory data expected for this project.

12.6 Sensitivity

Analytical methods and RLs were implemented in accordance with the QAPP/SOP and EPA promulgated methodologies. Method RLs were achieved for the event except when sample dilutions were required to bring target compounds within the linear range of the instrument calibration. As previously mentioned, the samples within this SDG required dilutions for VOCs, TPH-GRO, and chloride to place the results within the calibration range. These include modified RLs for selected detections; therefore, sensitivity requirements were met for non-diluted constituents.

12.7 Usability Summary

The data generated during the July 2014 sampling event required qualification and the analytical results indicate sample data for VOCs, TPH-GRO, TPH-DRO, and orthophosphate may be biased low and may not be truly representative of the Site conditions. The DQOs for the Enhanced Bioremediation Field Test is to produce data to support design of anaerobic methods for the ST012 remedy if selected.

13.0 REFERENCES

AFCEE, 2005. Quality Assurance Project Plan, Version 4.0.01, May, 2005.

AMEC, August 11, 2014. *Draft Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) (Enhanced Bioremediation Field Test Plan) Operable Unit 2 Site ST012 - Liquid Fuels Storage Area, Former Williams Air Force Base, Mesa, Arizona.*

AMEC, February 23, 2012. *Performance Based Remediation Program Quality Assurance Project Plan (QAPP) and Standard Operating Procedures (SOPs) (QAP/SOP), Former Williams Air Force Base, Mesa, Arizona.*

DoD, 2010. Department of Defense Quality System Manual, Version 4.2 Final, October 2010.

Prepared/Date: JAH 8/27/2014
Checked/Date: DWK 8/29/2014

ED_005025_00007837-00096

Flagged Data Reports

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-58001-1

Client Sample ID: **ST012-W11-WG-0714**

Lab Sample ID: 280-58001-1

Client Matrix: Water

Date Sampled: 07/16/2014 1245

Date Received: 07/21/2014 0845

8260B Volatile Organic Compounds (GC/MS)

Analysis Method:	8260B	Analysis Batch:	280-236589	Instrument ID:	VMS_Z
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	Z8841.D
Dilution:	1.0			Initial Weight/Volume:	20 mL
Analysis Date:	07/30/2014 1744			Final Weight/Volume:	20 mL
Prep Date:	07/30/2014 1744				

Analyte	Result (ug/L)	Qualifier	DL	LOQ
1,2-Dichloroethane	0.40	U J	0.13	1.0
Benzene	51	J	0.16	1.0
Methylene Chloride	0.80	U J	0.32	5.0
m-Xylene & p-Xylene	0.80	U	0.34	2.0
Naphthalene	38	B J	0.22	1.0
o-Xylene	0.40	U J	0.19	1.0
Toluene	0.38	J F	0.17	1.0
Trichloroethene (TCE)	0.21	J F	0.16	1.0
Trichlorofluoromethane	0.80	U J	0.29	2.0
Xylenes, Total	1.6	U J	0.19	2.0

Surrogate	%Rec	Qualifier	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	116		70 - 120
4-Bromofluorobenzene (Surr)	98		75 - 120
Dibromofluoromethane (Surr)	88		85 - 115
Toluene-d8 (Surr)	100		85 - 120

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-58001-1

Client Sample ID: **ST012-W11-WG-0714**

Lab Sample ID: 280-58001-1
Client Matrix: Water

Date Sampled: 07/16/2014 1245
Date Received: 07/21/2014 0845

8260B Volatile Organic Compounds (GC/MS)

Analysis Method:	8260B	Analysis Batch:	280-236589	Instrument ID:	VMS_Z
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	Z8842.D
Dilution:	10			Initial Weight/Volume:	20 mL
Analysis Date:	07/30/2014 1807	Run Type:	DL	Final Weight/Volume:	20 mL
Prep Date:	07/30/2014 1807				

8-26-14

Analyte	Result (ug/L)	Qualifier	DL	LOQ
Ethylbenzene	310	~~D~~ J	1.6	10

Surrogate	%Rec	Qualifier	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	81		70 - 120
4-Bromofluorobenzene (Surr)	100		75 - 120
Dibromofluoromethane (Surr)	90		85 - 115
Toluene-d8 (Surr)	97		85 - 120

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-58001-1

Client Sample ID: **ST012-W30-WG-0714**

Lab Sample ID: 280-58001-2

Client Matrix: Water

Date Sampled: 07/16/2014 1515

Date Received: 07/21/2014 0845

8260B Volatile Organic Compounds (GC/MS)

Analysis Method:	8260B	Analysis Batch:	280-236589	Instrument ID:	VMS_Z
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	Z8843.D
Dilution:	10			Initial Weight/Volume:	20 mL
Analysis Date:	07/30/2014 1830			Final Weight/Volume:	20 mL
Prep Date:	07/30/2014 1830				

8/26/14

Analyte	Result (ug/L)	Qualifier	DL	LOQ
1,2-Dichloroethane	4.0	U J	1.3	10
Ethylbenzene	290	~~D~~ J	1.6	10
Methylene Chloride	8.0	U J	3.2	50
m-Xylene & p-Xylene	8.0	U	3.4	20
Naphthalene	32	~~B D~~ J	2.2	10
o-Xylene	4.0	U J	1.9	10
Toluene	4.0	U	1.7	10
Trichloroethene (TCE)	2.0	U	1.6	10
Trichlorofluoromethane	8.0	U	2.9	20
Xylenes, Total	16	U	1.9	20

Surrogate	%Rec	Qualifier	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	84		70 - 120
4-Bromofluorobenzene (Surr)	100		75 - 120
Dibromofluoromethane (Surr)	91		85 - 115
Toluene-d8 (Surr)	99		85 - 120

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-58001-1

Client Sample ID: **ST012-W30-WG-0714**

Lab Sample ID: 280-58001-2

Client Matrix: Water

Date Sampled: 07/16/2014 1515

Date Received: 07/21/2014 0845

8260B Volatile Organic Compounds (GC/MS)

Analysis Method:	8260B	Analysis Batch:	280-236589	Instrument ID:	VMS_Z
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	Z8844.D
Dilution:	100			Initial Weight/Volume:	20 mL
Analysis Date:	07/30/2014 1853	Run Type:	DL	Final Weight/Volume:	20 mL
Prep Date:	07/30/2014 1853				

9/8 8-16-14

Analyte	Result (ug/L)	Qualifier	DL	LOQ
Benzene	1200	~~D~~ J	16	100

Surrogate	%Rec	Qualifier	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	79		70 - 120
4-Bromofluorobenzene (Surr)	95		75 - 120
Dibromofluoromethane (Surr)	88		85 - 115
Toluene-d8 (Surr)	95		85 - 120

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-58001-1

Client Sample ID: **ST012-DUP01-WG-071614**

Lab Sample ID: 280-58001-3FD

Client Matrix: Water

Date Sampled: 07/16/2014 1530

Date Received: 07/21/2014 0845

8260B Volatile Organic Compounds (GC/MS)

Analysis Method:	8260B	Analysis Batch:	280-236704	Instrument ID:	VMS_G2
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	G2_3444.D
Dilution:	4.0			Initial Weight/Volume:	20 mL
Analysis Date:	07/30/2014 2302			Final Weight/Volume:	20 mL
Prep Date:	07/30/2014 2302				

8-26-14

Analyte	Result (ug/L)	Qualifier	DL	LOQ
1,2-Dichloroethane	1.6	U J	0.52	4.0
Ethylbenzene	210	~~D~~ J	0.64	4.0
Methylene Chloride	2.1	~~J D~~ B	1.3	20
m-Xylene & p-Xylene	3.2	U J	1.4	8.0
Naphthalene	20	~~D~~ J	0.88	4.0
o-Xylene	1.6	U J	0.76	4.0
Toluene	1.6	U	0.68	4.0
Trichloroethene (TCE)	0.80	U	0.64	4.0
Trichlorofluoromethane	3.2	U	1.2	8.0
Xylenes, Total	6.4	U	0.76	8.0

Surrogate	%Rec	Qualifier	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	88		70 - 120
4-Bromofluorobenzene (Surr)	92		75 - 120
Dibromofluoromethane (Surr)	86		85 - 115
Toluene-d8 (Surr)	93		85 - 120

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-58001-1

Client Sample ID: **ST012-DUP01-WG-071614**

Lab Sample ID: 280-58001-3FD

Client Matrix: Water

Date Sampled: 07/16/2014 1530

Date Received: 07/21/2014 0845

8260B Volatile Organic Compounds (GC/MS)

Analysis Method:	8260B	Analysis Batch:	280-236589	Instrument ID:	VMS_Z
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	Z8846.D
Dilution:	40			Initial Weight/Volume:	20 mL
Analysis Date:	07/30/2014 1939	Run Type:	DL	Final Weight/Volume:	20 mL
Prep Date:	07/30/2014 1939				

gpk 8-26-14

Analyte	Result (ug/L)	Qualifier	DL	LOQ
Benzene	1200	~~D~~ J	6.4	40

Surrogate	%Rec	Qualifier	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	79		70 - 120
4-Bromofluorobenzene (Surr)	95		75 - 120
Dibromofluoromethane (Surr)	87		85 - 115
Toluene-d8 (Surr)	95		85 - 120

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-58001-1

Client Sample ID: **TB01-071614**

Lab Sample ID: 280-58001-4TB

Client Matrix: Water

Date Sampled: 07/16/2014 0000

Date Received: 07/21/2014 0845

8260B Volatile Organic Compounds (GC/MS)

Analysis Method:	8260B	Analysis Batch:	280-236589	Instrument ID:	VMS_Z
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	Z8835.D
Dilution:	1.0			Initial Weight/Volume:	20 mL
Analysis Date:	07/30/2014 1526			Final Weight/Volume:	20 mL
Prep Date:	07/30/2014 1526				

9-26-14

Analyte	Result (ug/L)	Qualifier	DL	LOQ
1,2-Dichloroethane	0.40	U J	0.13	1.0
Benzene	0.20	U	0.16	1.0
Ethylbenzene	0.20	U	0.16	1.0
Methylene Chloride	0.80	U	0.32	5.0
m-Xylene & p-Xylene	0.80	U	0.34	2.0
Naphthalene	0.43	B	0.22	1.0
o-Xylene	0.40	U J	0.19	1.0
Toluene	0.40	U	0.17	1.0
Trichloroethene (TCE)	0.20	U	0.16	1.0
Trichlorofluoromethane	0.80	U	0.29	2.0
Xylenes, Total	1.6	U	0.19	2.0

Surrogate	%Rec	Qualifier	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	74		70 - 120
4-Bromofluorobenzene (Surr)	93		75 - 120
Dibromofluoromethane (Surr)	85		85 - 115
Toluene-d8 (Surr)	96		85 - 120

Client: AMEC Environment & Infrastructure, Inc. Job Number: 280-58001-1

Client Sample ID: **ST012-W11-WG-0714**

Lab Sample ID: 280-58001-1 Date Sampled: 07/16/2014 1245
Client Matrix: Water Date Received: 07/21/2014 0845

8015B_GRO Gasoline Range Organics (GRO)

Analysis Method:	8015B_GRO	Analysis Batch:	280-235828	Instrument ID:	VGC_Q
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	010F1001.D
Dilution:	5.0			Initial Weight/Volume:	5 mL
Analysis Date:	07/24/2014 1658			Final Weight/Volume:	5 mL
Prep Date:	07/24/2014 1658			Injection Volume:	5 mL

8-26-14

Analyte	Result (ug/L)	Qualifier	DL	LOQ
Gasoline Range Organics (GRO)-C6-C10	3000	~~D M~~ J	50	130

Surrogate	%Rec	Qualifier	Acceptance Limits
a,a,a-Trifluorotoluene	243	~~Q~~ *	82 - 110

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-58001-1

Client Sample ID: **ST012-W30-WG-0714**

Lab Sample ID: 280-58001-2

Client Matrix: Water

Date Sampled: 07/16/2014 1515

Date Received: 07/21/2014 0845

8015B_GRO Gasoline Range Organics (GRO)

Analysis Method:	8015B_GRO	Analysis Batch:	280-235828	Instrument ID:	VGC_Q
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	011F1101.D
Dilution:	5.0			Initial Weight/Volume:	5 mL
Analysis Date:	07/24/2014 1725			Final Weight/Volume:	5 mL
Prep Date:	07/24/2014 1725			Injection Volume:	5 mL

8-26-14

Analyte	Result (ug/L)	Qualifier	DL	LOQ
Gasoline Range Organics (GRO)-C6-C10	3900	~~D M~~ J	50	130

Surrogate	%Rec	Qualifier	Acceptance Limits
a,a,a-Trifluorotoluene	119	~~Q~~	82 - 110

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-58001-1

Client Sample ID: **TB01-071614**

Lab Sample ID: 280-58001-4TB

Client Matrix: Water

Date Sampled: 07/16/2014 0000

Date Received: 07/21/2014 0845

8015B_GRO Gasoline Range Organics (GRO)

Analysis Method:	8015B_GRO	Analysis Batch:	280-235828	Instrument ID:	VGC_Q
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	012F1201.D
Dilution:	1.0			Initial Weight/Volume:	5 mL
Analysis Date:	07/24/2014 1752			Final Weight/Volume:	5 mL
Prep Date:	07/24/2014 1752			Injection Volume:	5 mL

8-26-14

Analyte	Result (ug/L)	Qualifier	DL	LOQ
Gasoline Range Organics (GRO)-C6-C10	20	U J	10	25

Surrogate	%Rec	Qualifier	Acceptance Limits
a,a,a-Trifluorotoluene	102		82 - 110

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-58001-1

Client Sample ID: **ST012-W11-WG-0714**

Lab Sample ID: 280-58001-1

Client Matrix: Water

Date Sampled: 07/16/2014 1245

Date Received: 07/21/2014 0845

8015B_DRO Diesel Range Organics (DRO) (GC)

Analysis Method:	8015B_DRO	Analysis Batch:	280-236144	Instrument ID:	SGC_U
Prep Method:	3510C	Prep Batch:	280-235611	Initial Weight/Volume:	1053.2 mL
Dilution:	1.0			Final Weight/Volume:	1 mL
Analysis Date:	07/29/2014 0200			Injection Volume:	1 uL
Prep Date:	07/23/2014 1226			Result Type:	PRIMARY

8-26-14

Analyte	Result (mg/L)	Qualifier	DL	LOQ
Diesel Range Organics [C10-C28]	0.45	MB	0.031	0.24

Surrogate	%Rec	Qualifier	Acceptance Limits
o-Terphenyl	79	M	50 - 115

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-58001-1

Client Sample ID: **ST012-W30-WG-0714**

Lab Sample ID: 280-58001-2
Client Matrix: Water

Date Sampled: 07/16/2014 1515
Date Received: 07/21/2014 0845

8015B_DRO Diesel Range Organics (DRO) (GC)

Analysis Method:	8015B_DRO	Analysis Batch:	280-236144	Instrument ID:	SGC_U
Prep Method:	3510C	Prep Batch:	280-235611	Initial Weight/Volume:	1046.3 mL
Dilution:	1.0			Final Weight/Volume:	1 mL
Analysis Date:	07/29/2014 0228			Injection Volume:	1 uL
Prep Date:	07/23/2014 1226			Result Type:	PRIMARY

8-26-14

Analyte	Result (mg/L)	Qualifier	DL	LOQ
Diesel Range Organics [C10-C28]	0.47	~~M~~B	0.031	0.24

Surrogate	%Rec	Qualifier	Acceptance Limits
o-Terphenyl	78		50 - 115

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-58001-1

Client Sample ID: **ST012-W11-WG-0714**

Lab Sample ID: 280-58001-1
Client Matrix: Water

Date Sampled: 07/16/2014 1245
Date Received: 07/21/2014 0845

6010C Metals (ICP)

Analysis Method:	6010C	Analysis Batch:	280-237882	Instrument ID:	MT_026
Prep Method:	3010A	Prep Batch:	280-235312	Lab File ID:	26A080614D.asc
Dilution:	1.0			Initial Weight/Volume:	50 mL
Analysis Date:	08/06/2014 2317			Final Weight/Volume:	50 mL
Prep Date:	07/28/2014 0730				

gp 8-27-14

Analyte	Result (ug/L)	Qualifier	DL	LOQ
Calcium	310000		35	1000
Iron	63	F	22	100
Magnesium	67000		11	500
Manganese	2200		0.25	10
Potassium	7700		240	3000
Sodium	79000		92	5000

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-58001-1

Client Sample ID: **ST012-W30-WG-0714**

Lab Sample ID: 280-58001-2

Client Matrix: Water

Date Sampled: 07/16/2014 1515

Date Received: 07/21/2014 0845

6010C Metals (ICP)

Analysis Method:	6010C	Analysis Batch:	280-237882	Instrument ID:	MT_026
Prep Method:	3010A	Prep Batch:	280-235312	Lab File ID:	26A080814D.asc
Dilution:	1.0			Initial Weight/Volume:	50 mL
Analysis Date:	08/06/2014 2333			Final Weight/Volume:	50 mL
Prep Date:	07/28/2014 0730				

8-27-14

Analyte	Result (ug/L)	Qualifier	DL	LOQ
Calcium	240000		35	1000
Iron	650		22	100
Magnesium	52000		11	500
Manganese	2600		0.25	10
Potassium	6700		240	3000
Sodium	67000		92	5000

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-58001-1

General Chemistry

Client Sample ID: **ST012-W11-WG-0714**

Lab Sample ID: 280-58001-1

Client Matrix: Water

Date Sampled: 07/16/2014 1245

Date Received: 07/21/2014 0845

8-26-14

Analyte	Result	Qual	Units	DL	LOQ	Dil	Method
Bromide	1.6	J	mg/L	0.11	0.50	1.0	9056A
Analysis Batch: 280-237437	Analysis Date: 08/05/2014 1811						
Orthophosphate as P	0.20	U ~~H~~ J	mg/L	0.19	0.50	1.0	9056A
Analysis Batch: 280-237432	Analysis Date: 08/05/2014 1721						
Chloride	800	~~D~~	mg/L	5.1	60	20	9056A
Analysis Batch: 280-237437	Analysis Date: 08/06/2014 0042						
Sulfate	5.4	J	mg/L	0.23	5.0	1.0	9056A
Analysis Batch: 280-237433	Analysis Date: 08/05/2014 1721						

General Chemistry

Client Sample ID: **ST012-W30-WG-0714**

Lab Sample ID: 280-58001-2 Date Sampled: 07/16/2014 1515
Client Matrix: Water Date Received: 07/21/2014 0845

Analyte	Result	Qual	Units	DL	LOQ	Dil	Method
Bromide	1.3		mg/L	0.11	0.50	1.0	9056A
Analysis Batch: 280-237437	Analysis Date: 08/05/2014 1922						
Orthophosphate as P	0.20	U	mg/L	0.19	0.50	1.0	9056A
Analysis Batch: 280-237432	Analysis Date: 08/05/2014 1738						
Chloride	600	D	mg/L	5.1	60	20	9056A
Analysis Batch: 280-237437	Analysis Date: 08/06/2014 0100						
Sulfate	11		mg/L	0.23	5.0	1.0	9056A
Analysis Batch: 280-237433	Analysis Date: 08/05/2014 1738						

Data Quality Evaluation Checklists

Method Validated: 8260B

Initial Review by: J. Hartness Date: 8/28/14 SDG#: 280-58001-1
Senior Review by: D. Knaub Date: 8/29/14 Matrix: Groundwater

ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (METHODS 8260 AND 8270)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C).	QC acceptance criteria published by DoD, if available; otherwise method- specific criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	NA	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	Ok
MDL Study	At initial set-up and subsequently once per 12-month period; otherwise quarterly MDL verification checks shall be performed (see box D-18)	See 40 CFR 136B. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL verification check at higher level and set MDL higher or reconduct MDL study (see box D-18)	NA	Samples cannot be analyzed without a valid MDL.	Ok
Tuning	Prior to calibration and every 12 hours during sample analysis	Refer to method for specific ion criteria.	Retune instrument and verify. Rerun affected samples.	Flagging criteria are not appropriate	Problem must be corrected. No samples may be accepted without a valid tune.	Pg. 98-102 level III package VMS_G2, ICAL/ICV, 7/28/2014 VMS_G2, CCV, 7/30/2014 VMS_Z, ICAL/ICV/ 7/09/2014 VMS_Z, ICAL/ICV/ 5/29/2014 VMS_Z, ICAL/ICV/CCV, 7/30/2014 All ok

ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (METHODS 8260 AND 8270)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Breakdown Check (DDT Method 8270C Only)	Daily prior to analysis of samples	Degradation ≤ 20% for DDT	Correct problem then repeat breakdown check	Flagging criteria are not appropriate	No samples shall be run until degradation ≤ 20%. Benzidine and pentachlorophenol should be present at their normal responses and no peak tailing should be observed.	NA
Container, Preservation, and Holding Time	All field samples	8260 – 40 ml VOA vial HCl to pH < 2, Cool to 4°C 14 days to analysis 8270 – 1 L Amber glass, Cool to 4°C 7 days to extraction 40 days to analysis	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collection date: 7/16/2014 Analysis date: 7/30/14 Temp 17.6°C Received out of temp due to FED-X shipping delay. ***Flag results "J/UJ"***

ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (METHODS 8260 AND 8270)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Minimum Five-Point Initial Calibration For All Analytes (ICAL)	Initial calibration prior to sample analysis	Average response factor (RF) for SPCCs: VOCs - 0.30 for Chlorobenzene and 1,1,2,2-tetrachlorolethane. a 0.1 for chloromethane, bromoform, and 1,1-dicbloroethane. SVOCs - a 0.050. RSD for RFs for CCCs: The CCCs are vinyl chloride, 1,1-dichlorethene, chloroform, 1,2-dichloropropane, toluene, and ethylbenzene. VOCs and SVOCs - 30% and one option below; **Option 1**: RSD for each analyte ≤ 15% **Option 2**: linear least squares regression r a 0.995 **Option 3**: non-linear regression - coefficient of determination (COD) e a 0.99 (6 points shall be used for second order, 7 points shall be used for third order)	Correct problem then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed.	Pg. 114 -127 OK VMS_G2, 7/28/2014 Pg. 128- 132 OK VMS_Z, 5/29/2014 Pg. 133-134 OK VMS_Z, 7/09/2014 Pg. 135-143 OK VMS_Z, 7/30/2014
Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 25% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	Pg.144, VMS_G2 ICV 280-236135/22 (7/28/14) Pg.150 -151, VMS_Z ICV 280-227817/22 (5/29/14) Pg.155 -157, VMS_Z ICV 280-227817/22 (7/30/14) All COIs OK

ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (METHODS 8260 AND 8270)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Retention Time Window Position Establishment for Each Analyte and Surrogate	Once per ICAL	Position shall be set using the midpoint standard of the initial calibration curve.	NA			All OK
Evaluation of Relative Retention Times (RRT)	With each sample	RRT of each target analyte in each calibration standard within ± 0.06 RRT units.	Correct problem, then rerun ICAL.			Pg. 103-106 All ok
Calibration Verification (CV)	Daily, before sample analysis, and every 12 hours of analysis time	Average RF for SPCCs: VOCs 0.30 for Chlorobenzene and 1,1,2,2-tetrachlorolethane, 0.1 for chloromethane, bromoform, and 1,1-dichloroethane. SVOCs 0.050. 2. %Difference/Drift for CCCs: VOCs and SVOCs ≤20%D (Note: D = difference when using RFs or drift when using least squares regression or non-linear calibration.)	Correct problem, then rerun CV. If that fails, repeat initial calibration. See section 5.5.10 and DoD clarification box 55.	Apply Q-flag if no sample material remains and analyte exceeds criteria.	NA	Pg.145 -148, VMS_G2 CCV 280-236704/2 (7/30/14) Pg.1 49, VMS_G2 CCV 280-236704/4 (7/30/14) Pg.155 -157, VMS_Z ICV/CCV 280-227817/22 (7/30/14) All COIs OK
Internal Standards Verification	In all field samples and standards	Retention time ± 30 seconds from retention time of the midpoint standard in the ICAL EICP area within - 50% to + 100% of ICAL midpoint standard	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory.	If corrective action fails in field samples, apply Q-flag to analytes associated with the non-compliant IS. Flagging criteria are not appropriate for failed standards.	Flagging criteria are not appropriate.	Pg. 103-104 ICIS 280-236135/19 All ok Pg. 105-106 ICIS 280-227817/19 All ok

Method Validated: 8260B | Initial Review by: J. Hartness | Date: 8/28/14 | SDG#: 280-58001-1
Senior Review by: D. Knaub | Date: 8/29/14 | Matrix: Groundwater

ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (METHODS 8260 AND 8270)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Method Blank	One per preparatory batch	No analytes detected >½ RL. For common laboratory contaminants, no analytes detected > RL.	Correct problem, then see criteria in box D-5. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank.	Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.		p.44 MB 280-236589/5 Naphthalene = 0.507 x 5 = 2.5 ug/L ***Flag TB01-071614 "B"*** p.46 MB 280-236704/7 MeCl = 0.489 x 10 = 4.89 ug/L ***Flag ST012-DUP01-WG-071614 "B"*** **See ADR**
LCS Containing All Analytes Required to be Reported, Including Surrogates	One LCS per preparatory batch	QC acceptance criteria specified by DoD, if available; see box D-7 and Appendix DoD-D.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. (See full explanation in Appendix DoDID.	If corrective action fails, applyIQ-flag to specific analyte(s) in all samples in the associated preparatory batch.		p.45 LCS 280-236589/4 All OK p.47 LCS 280-236704/7 All OK **See ADR**
MS	One MS per preparatory batch per matrix (see box D- 15)	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	Lab: For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error	No MS/MSD submitted for method 8260B

ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (METHODS 8260 AND 8270)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
MSD or Sample Duplicate	One per preparatory batch per matrix	RPD ≤ 30% (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	Lab: For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	NA -See above
Surrogate Spike (Analytes Identified in Appendix DoD-D)	All field and QC samples	QC acceptance criteria for LCS published by DoD, if available; otherwise method- specified criteria or laboratory's own in-house criteria.	For QC and field samples, correct problem, then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available.	For the specific analyte(s) in all field samples collected from the same site matrix as the parent, apply J-flag if acceptance criteria are not met. For QC samples, apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.		p. 41 All within QC limits
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD ≤30%	Qualify sample	For the specific analyte(s) in the parent & dup samples, apply J- flag if acceptance criteria are not met.		ST012-W30-WG-0714/ ST012-DUP01-WG-071614 Naphthalene= 46% - ***flag "J"***
Results Reported Between MDL and LOQ	NA	NA	NA	Apply J-flag to all results between MDL and LOQ. Validator flags: If using AFCEE; Apply "F" flag		Samples qualified as estimated and AFCEE flagged "F"

ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (METHODS 8260 AND 8270)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
QC Blanks (Trip Blanks, Equipment Blanks, and Field Blanks)	Trip Blank – one per cooler containing samples for VOCs Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value (10x for common lab contaminants) are qualified as estimated and flagged "B"		LF01-TB01-071614 Naphthalene = 0.43ug/L – ***flagged "B" due to method blank – no qualification required for samples.*** **See ADR**

Method Validated: 8015B (TPH-GRO) Initial Review by: J. Hartness Date: 8/27/14 SDG#:280-58001-1
Senior Review by: D. Knaub Date: 8/29/14 Matrix: Groundwater

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C)	QC acceptance criteria published by DoD, if available; otherwise method- specified criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	Not applicable (NA)	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	ok
Method Detection Limit (MDL) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly MDL verification checks shall be performed (see box 0-18)	See 40 CFR 1368. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL verification check at higher level and set MDL higher or reconduct MDL study (see box D-18).	NA	Samples cannot be analyzed without a valid MDL.	ok
Retention Time (RT) Window Width Calculated for Each Analyte and Surrogate	At method set-up and after major maintenance (e.g., column change)	RT width is ± 3 times standard deviation for each analyte RT from 72-hour study.	NA	NA		
Breakdown Check (Endrin/ DDT Method 8081 Only)	Daily prior to analysis of samples	Degradation ≤ 15% for both Endrin and DDT.	Correct problem then repeat breakdown check.	Flagging criteria are not appropriate	No samples shall be run until degradation ≤ 15%.	NA TPH-GRO

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ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Container, Preservation, and Holding Time	All field samples	GRO- Water: 40 ml VOA vial; HCl to pH < 2, Cool to 6°C Soil: (low-level) 5 g in 40 ml VOA w/H_2O or sodium bisulfate; Cool to 6°C (high-level) 5 g in 40 ml VOA w/methanol, Cool to 6°C, or EnCore® or equivalent (48 hrs to preservation) 14 days to analysis DRO – Water: 1 L Amber glass, Cool to 6°C Soil: 4 oz amber glass jar, Cool to 6°C Water: 7 days to extraction Soil: 14 days to extraction 40 days to analysis	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collected: 7/16/14 Temp= 17.6°C Received out of temp due to FED-X shipping delay. ***Flag samples "J/UJ"*** Analyzed: 7/24/14 ***ok***

Method Validated: 8015B (TPH-GRO) | Initial Review by: J. Hartness | Date: 8/27/14 | SDG#:280-58001-1
Senior Review by: D. Knaub | Date: 8/29/14 | Matrix: Groundwater

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Minimum Five-Point Initial Calibration For All Analytes (ICAL)	Initial calibration prior to sample analysis	One of the options below (except for Method 8082, which may only use Option 1 or 2): Option 1: RSD for each analyte ≤ 20% Option 2: linear least squares regression: r 2 ≥0.995 Option 3: non-linear regression: coefficient of determination (COD) r2 ≥0.99 (6 points shall be used for second order, 7 points shall be used for third order)	Correct problem then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed. For PCB analysis, a mixture of Aroclors 1016 and 1260 is normally used to establish detector calibration linearity, unless project-specific data suggest the presence of another Aroclor (e.g., 1232). In addition, a mid-level or lower standard for each of the remaining Aroclors is analyzed for pattern recognition and response factor.	Pg 177-178 Inst VGC_Q 3/12/14 OK
Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 20% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	Pg 180 ICV 280-216544/11 3/12/14 Inst VGC_Q
Retention Time Window Position Establishment for Each Analyte and Surrogate	Once per ICAL and at the beginning of the analytical shift	Position shall be set using the midpoint standard of the calibration curve or the value in the CCV run at the beginning of the analytical shift.	NA	NA		Pg 172 STD4 280-216544/7 3/12/14 Inst VGC_Q

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Retention Time Window Verification for Each Analyte and Surrogate	Each calibration verification standard	Analyte within established window	Correct problem, then reanalyze all samples analyzed since the last acceptable retention time check. If they fail, redo ICAL and reset retention time window,	Flagging criteria are not appropriate for initial verification. For CCV, apply a Q-flag to all results for analytes outside the established window.	No samples shall be run without a verified retention time window at the initial verification. For method 8015, check state methods for use of modified retention time markers with gasoline range organics (GRO) or diesel range organics (DRO).	Pg 173,183 CCVRT 280-235828/5 7/24/14 Inst VGC_Q Pg 180 ICV 280-216544/11 3/12/14 Inst VGC_Q Pg 185 CCV 280-235828/16 7/24/14 Inst VGC_Q
Calibration Verification (Initial [ICV] and Continuing [CCV])	ICV: Daily, before sample analysis CCV: After every 10 field samples and at the end of the analysis sequence	All analytes within ± 20% of expected value from the ICAL	ICV: Correct problem, rerun ICV. If that fails, repeat initial calibration. See section 5.5.10 and box 55. CCV: Correct problem then repeat CCV and reanalyze all samples since last successful calibration verification.	ICV: Flagging criteria are not appropriate. CCV: Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification, if . reanalysis is not possible.	If %D for an individual analyte is > 20%, no samples may be analyzed until the problem has been corrected.	Pg 182 CCVRT 280-235828/5 7/24/14 Inst VGC_Q Pg 184 CCV 280-235828/16 7/24/14 Inst VGC_Q
Method Blank	One per preparatory batch	No analytes detected > ½RL. For common laboratory contaminants, no analytes detected > RL.	Correct problem, then see criteria in box 0-5; if required, reprep then reanalyze method blank and all samples processed with the contaminated blank.	Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch		Pg 48 MB 280-235828/6 ND

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Laboratory Control Sample (LCS) Containing All Analytes Required to be Reported, Including Surrogates	One LCS per preparatory batch	QC acceptance criteria specified by DoD, if available; see box D-7 and Appendix DoD-D .	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix DoD D)	If corrective action fails apply J-flag to specific analyte(s) in all samples in the associated preparatory batch		Pg 48-49, 169 LCS/LCSD 280-235828/7,8 OK
Matrix Spike (MS)	One MS per preparatory batch per matrix (see box ID- 11)	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken,	Lab: For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	No MS/MSD submitted with this SDG
Matrix Spike Duplicate (MSD) or Sample Duplicate	One per preparatory batch per matrix	RPD ≤30% (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	Lab: For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	No MSD or lab dup performed with this SDG
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD ≤30%	Qualify sample	For the specific analyte(s) in the parent & dup samples, apply J- flag if acceptance criteria are not met.		No duplicate submitted for TPH-GRO in this SDG

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Surrogate Spike (Analytes Identified in Appendix DoD-D)	All field and QC samples	QC acceptance criteria for LCS specified by DoD, if available; otherwise method- specified criteria or laboratory's own in-house criteria	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary.	For the specific analyte(s) in all field samples collected from the same site matrix as the parent, apply J-flag if acceptance criteria are not met. For QC samples, apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Alternative surrogates are recommended when there is obvious chromatographic interference.	Pg 168 ST012-W11-WG-0714=243% ST012-W30-WG-0714=119% ***No flags; samples diluted***
Confirmation of Positive Results (Second Column or Second Detector)	All positive results must be confirmed (in Method 8081A exclude toxaphene and technical chlordane, in Method 8015B exclude GRO, DRO, and residual range organics (RRO)).	Calibration and QC criteria same as for initial or primary column analysis. Results between primary and second column RPD ≤ 40%.	NA	Apply J-flag if RFD > 40% or Q-flag if sample is not confirmed. Discuss in the case narrative.	Report the higher of two confirmed results unless overlapping peaks are causing erroneously high results, then report the non- affected result and document in the case narrative.	NA
Results Reported Between LOD and LOQ	NA	NA	NA	Apply J-flag to all results between LOD and LOQ. Validator flags: If using AFCEE; Apply "F" flag		No targets detected between LOD and LOQ

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
QC Blanks (Trip Blanks, Equipment Blanks, and Field Blanks)	Trip Blank – one per cooler containing samples for volatile parameters Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value (10x for common lab contaminants) are qualified as estimated and flagged "B"		TB01-071614 ND

Method Validated: 8015B (TPH-DRO) Initial Review by: J. Hartness Date: 8/27/14 SDG#:280-58001-1
Senior Review by: D. Knaub Date: 8/29/14 Matrix: Groundwater

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C)	QC acceptance criteria published by DoD, if available; otherwise method- specified criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	Not applicable (NA)	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	ok
Method Detection Limit (MDL) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly MDL verification checks shall be performed (see box 0-18)	See 40 CFR 1368. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL verification check at higher level and set MDL higher or reconduct MDL study (see box D-18).	NA	Samples cannot be analyzed without a valid MDL.	ok
Retention Time (RT) Window Width Calculated for Each Analyte and Surrogate	At method set-up and after major maintenance (e.g., column change)	RT width is ± 3 times standard deviation for each analyte RT from 72-hour study.	NA	NA		
Breakdown Check (Endrin/ DDT Method 8081 Only)	Daily prior to analysis of samples	Degradation ≤ 15% for both Endrin and DDT.	Correct problem then repeat breakdown check.	Flagging criteria are not appropriate	No samples shall be run until degradation ≤ 15%.	NA TPH-DRO

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ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Container, Preservation, and Holding Time	All field samples	GRO- Water: 40 ml VOA vial; HCl to pH < 2, Cool to 6°C Soil: (low-level) 5 g in 40 ml VOA w/H_2O or sodium bisulfate; Cool to 6°C (high-level) 5 g in 40 ml VOA w/methanol, Cool to 6°C, or EnCore® or equivalent (48 hrs to preservation) 14 days to analysis DRO – Water: 1 L Amber glass, Cool to 6°C Soil: 4 oz amber glass jar, Cool to 6°C Water: 7 days to extraction Soil: 14 days to extraction 40 days to analysis	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collected: 7/16/14 Temp= 17.6°C Received out of temp due to FED-X shipping delay. ***Flag samples "J/UJ"*** Extracted; 7/23/14 Analyzed: 7/29/14 ***ok***

Method Validated: 8015B (TPH-DRO) Initial Review by: J. Hartness Date: 8/27/14 SDG#:280-58001-1
Senior Review by: D. Knaub Date: 8/29/14 Matrix: Groundwater

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Minimum Five-Point Initial Calibration For All Analytes (ICAL)	Initial calibration prior to sample analysis	One of the options below (except for Method 8082, which may only use Option 1 or 2): Option 1: RSD for each analyte ≤ 20% Option 2: linear least squares regression: r 2 ≥0.995 Option 3: non-linear regression: coefficient of determination (COD) r2 ≥0.99 (6 points shall be used for second order, 7 points shall be used for third order)	Correct problem then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed. For PCB analysis, a mixture of Aroclors 1016 and 1260 is normally used to establish detector calibration linearity, unless project-specific data suggest the presence of another Aroclor (e.g., 1232). In addition, a mid-level or lower standard for each of the remaining Aroclors is analyzed for pattern recognition and response factor.	Pg 200-202 Inst SGC_U 7/16/14 OK
Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 20% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	Pg 203 ICV 280-234596/11 7/16/14 Inst SGC_U
Retention Time Window Position Establishment for Each Analyte and Surrogate	Once per ICAL and at the beginning of the analytical shift	Position shall be set using the midpoint standard of the calibration curve or the value in the CCV run at the beginning of the analytical shift.	NA	NA		Pg 197 CCVRT 280-236144/4 7/28/14 Inst SGC_U

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ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Retention Time Window Verification for Each Analyte and Surrogate	Each calibration verification standard	Analyte within established window	Correct problem, then reanalyze all samples analyzed since the last acceptable retention time check. If they fail, redo ICAL and reset retention time window,	Flagging criteria are not appropriate for initial verification. For CCV, apply a Q-flag to all results for analytes outside the established window.	No samples shall be run without a verified retention time window at the initial verification. For method 8015, check state methods for use of modified retention time markers with gasoline range organics (GRO) or diesel range organics (DRO).	Pg 204 ICV 280-234596/11 7/16/14 Inst SGC_U Pg 206 CCVRT 280-236144/4 7/28/14 Inst SGC_U Pg 208 CCV 280-236144/34 7/28/14 Inst SGC_U Pg 210 CCV 280-236144/49 7/29/14 Inst SGC_U
Calibration Verification (Initial [ICV] and Continuing [CCV])	ICV: Daily, before sample analysis CCV: After every 10 field samples and at the end of the analysis sequence	All analytes within ± 20% of expected value from the ICAL	ICV: Correct problem, rerun ICV. If that fails, repeat initial calibration. See section 5.5.10 and box 55. CCV: Correct problem then repeat CCV and reanalyze all samples since last successful calibration verification.	ICV: Flagging criteria are not appropriate. CCV: Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification, if . reanalysis is not possible.	If %D for an individual analyte is > 20%, no samples may be analyzed until the problem has been corrected.	Pg 205 CCVRT 280-236144/4 7/28/14 Inst SGC_U Pg 207 CCV 280-236144/34 7/28/14 Inst SGC_U Pg 209 CCV 280-236144/49 7/29/14 Inst SGC_U

Method Validated: 8015B (TPH-DRO) Initial Review by: J. Hartness Date: 8/27/14 SDG#:280-58001-1
Senior Review by: D. Knaub Date: 8/29/14 Matrix: Groundwater

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Method Blank	One per preparatory batch	No analytes detected > ½RL. For common laboratory contaminants, no analytes detected > RL.	Correct problem, then see criteria in box 0-5; if required, reprep then reanalyze method blank and all samples processed with the contaminated blank.	Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch		Pg 50 MB 280-235611/1-A DRO=0.174 x 5 =0.87 mg/L ***Flag both samples "B"*** ***See ADR***
Laboratory Control Sample (LCS) Containing All Analytes Required to be Reported, Including Surrogates	One LCS per preparatory batch	QC acceptance criteria specified by DoD, if available; see box D-7 and Appendix DoD-D .	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix DoD D)	If corrective action fails apply J-flag to specific analyte(s) in all samples in the associated preparatory batch		Pg 50-51, 194-195 LCS/LCSD 280-235611/ 2-A,3-A ***OK*** ***See ADR***
Matrix Spike (MS)	One MS per preparatory batch per matrix (see box ID- 11)	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken,	Lab: For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	No MS/MSD submitted with this SDG
Matrix Spike Duplicate (MSD) or Sample Duplicate	One per preparatory batch per matrix	RPD ≤30% (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	Lab: For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	No MSD or lab dup performed with this SDG

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ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD ≤30%	Qualify sample	For the specific analyte(s) in the parent & dup samples, apply J- flag if acceptance criteria are not met.		No duplicate submitted for TPH-DRO in this SDG
Surrogate Spike (Analytes Identified in Appendix DoD-D)	All field and QC samples	QC acceptance criteria for LCS specified by DoD, if available; otherwise method- specified criteria or laboratory's own in-house criteria	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary.	For the specific analyte(s) in all field samples collected from the same site matrix as the parent, apply J-flag if acceptance criteria are not met. For QC samples, apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Alternative surrogates are recommended when there is obvious chromatographic interference.	Pg 193 **All ok** **See ADR**
Confirmation of Positive Results (Second Column or Second Detector)	All positive results must be confirmed (in Method 8081A exclude toxaphene and technical chlordane, in Method 8015B exclude GRO, DRO, and residual range organics (RRO)).	Calibration and QC criteria same as for initial or primary column analysis. Results between primary and second column RPD ≤ 40%.	NA	Apply J-flag if RFD > 40% or Q-flag if sample is not confirmed. Discuss in the case narrative.	Report the higher of two confirmed results unless overlapping peaks are causing erroneously high results, then report the non- affected result and document in the case narrative.	NA

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Results Reported Between LOD and LOQ	NA	NA	NA	Apply J-flag to all results between LOD and LOQ. Validator flags: If using AFCEE; Apply "F" flag		No targets detected between LOD and LOQ
QC Blanks (Trip Blanks, Equipment Blanks, and Field Blanks)	Trip Blank – one per cooler containing samples for volatile parameters Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value (10x for common lab contaminants) are qualified as estimated and flagged "B"		No equipment blank collected for TPH-DRO

Method Validated: 6010 | Initial Review by: J. Hartness | Date: 8/27/14 | SDG#:280-58001-1
Senior Review by: D. Knaub | Date: 8/29/14 | Matrix: Groundwater

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C)	QC acceptance criteria published by DoD, if available; otherwise method- specified criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	Not applicable (NA)	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	Ok
Instrument Detection Limit (IDL) Study	At initial set-up and after significant change in instrument type, personnel, test method, or sample matrix	IDL shall be ≤ Limit of Detection (LOD)	NA	NA		p. 237 6/11/13
Container, Preservation, and Holding Time	All field samples	Water: 500 ml Poly, HNO_3 to pH < 2, Cool to 6°C, Soil: 4 oz glass or poly jar, Cool to 6°C 180 days to analysis	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collection date: 7/16/14 Prep; 7/28/14 Analysis date: 8/06/14 Temp: 17.6°C Received out of temp due to FED-X shipping delay. ***No qualification required for metals.***

Method Validated: 6010 | Initial Review by: J. Hartness | Date: 8/27/14 | SDG#: 280-58001-1
Senior Review by: D. Knaub | Date: 8/29/14 | Matrix: Groundwater

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Initial calibration (ICAL) for all analytes (minimum one high standard and a calibration blank)	Daily ICAL prior to sample analysis	If more than one calibration standard is used, r ≥ 0.995.	Correct problem then repeat ICAL.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed.	p. 247 run log ICIS analyzed 8/06/2014 13:32 IC analyzed 8/06/2014 13:35 and 13:38 ICVH 8/06/2014 13:48
Second Source Calibration Verification (ICV)	Once after each ICAL, prior to beginning sample run	Value of second source for all analytes within ± 10% of true value	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	p. 223 ICVH 280-237882/6 8/6/2014 All OK p. 224 ICV 280-237882/8,9 8/6/2014 All OK p. 226 ICV 280-237882/12 8/6/2014 All OK

Method Validated: 6010 | Initial Review by: J. Hartness | Date: 8/27/14 | SDG#:280-58001-1
Senior Review by: D. Knaub | Date: 8/29/14 | Matrix: Groundwater

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Continuing Calibration Verification (CCV)	After every 10 field samples and at the end of the analysis sequence	All analytes within ± 10% of true value	Correct problem, rerun CCV. If that fails, then repeat ICAL. Reanalyze all samples since last successful calibration verification	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) of interest in all samples since the last acceptable CCV. Validator flags: If using AFCEE; Apply "J" flag only if reanalysis cannot be performed	Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	p. 223 CCV 280-237882/27,39 8/6/2014 All OK p. 224 CCV 280-237882/28 8/6/2014 All OK p. 225 CCV 280-237882/40 8/6/2014 All OK p. 226 CCVL 280-237882/30 8/6/2014 Ca=112% Mn=117% K=111% NA=120% ***No flag: samples high level*** p. 226 CCVL 280-237882/42 8/6/2014 Ca=112% Mn=117% K=111% NA=120% ***No flag: samples high level***
Low-level calibration check standard	Daily, after one-point ICAL	Within ± 20% of true value	Correct problem, then reanalyze	Flagging criteria are not appropriate.	No samples may be analyzed without a valid low-level calibration check standard. Low-level calibration check standard should be less than or equal to the reporting limit.	p. 227 ***All OK***
Linear dynamic range or high-level check standard	Every 6 months -	Within ±10% of expected value	NA	NA		p. 245 7/21/2014

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Method Blank	One per preparatory batch	No analytes detected > ½ RL and greater than 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1).	Correct problem, then see criteria in box D-1; if required, reprep then reanalyze method blank and all samples processed with the contaminated blank.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch	Problem must be corrected. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where samples cannot be reanalyzed.	p. 52 & 229 MB-280-235312/1-A Ca = 113J x 5 =565 ug/L Na = 111J x 5 = 555 ug/L **Calcium & Sodium was detected in samples at 5x greater than MB: No qualification required** ***See ADR***
Calibration blank	Before beginning a sample run, after every 10 samples, and at end of the analysis sequence	No analytes detected > LOD	Correct problem. Reprep and reanalyze calibration blank. All samples following the last acceptable calibration blank must be reanalyzed	Apply B-flag to all results for specific analyte(s) in all samples associated with the blank.		p. 228 ICB 280-2337882/29 Na = 130J x 5 = 650 ug/L **Sodium was detected in samples at 5x greater than ICB: No qualification required** p. 228 ICB 280-2337882/41 Na = 114J x 5 = 570 ug/L **Sodium was detected in samples at 5x greater than ICB: No qualification required**
Interference check solutions (ICS-A and ICS-AB)	At the beginning of an analytical run and every 12 hours	ICS-A: Absolute value of concentration for all non-spiked analytes < LOD (unless they are a verified trace impurity from one of the spiked analytes) ICS-AB: Within ±20% of expected value	Terminate analysis, locate and correct problem, reanalyze ICS, reanalyze all samples.	If corrective action fails, apply Q-flag to all results for specific analyte(s) in all samples associated with the ICS. Validator flags: If using AFCEE; Apply "M" flag		p. 230 ICS-A Mn & Na >LOD ***No qualification- vendor verified trace impurities and samples do not have Al, Ca, Fe, or Mg at levels > ICS*** p. 231 ICS-AB :All OK

Method Validated: 6010 | Initial Review by: J. Hartness | Date: 8/27/14 | SDG#:280-58001-1
Senior Review by: D. Knaub | Date: 8/29/14 | Matrix: Groundwater

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Laboratory Control Sample (LCS) Containing All Analytes to be Reported	One per preparatory batch	QC acceptance criteria specified by DoD, if available; see box D-3 and Appendix G.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix G)	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch Validator flags: If using AFCEE; Apply "J" flag	Problem must be corrected. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	p. 52, 235 LCS-280-235312/2-A ***All OK*** ***See ADR***
Matrix Spike (MS)	One per preparatory batch per matrix (see box D-7)	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS.	Examine the project-specific DQOs. If the matrix spike falls outside of DoD criteria, additional quality control test (dilution test and post-digestion spike addition) are required to evaluate matrix effects.	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	p. 53-54, 232 ST012-W11-WG-0714 ***all ok*** ***See ADR***
Matrix Spike Duplicate (MSD)	One per preparatory batch per matrix (see Box D-7)	MSD: For matrix evaluation use QC acceptance criteria specified by DoD for LCS MSD RPD < 20%	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	Pg. 53-54 ST012-W11-WG-0714 ***RPDs are ok*** ***See ADR***
Dilution test	Once per preparatory batch	Five-fold dilution must agree within ± 10% of the original measurement	Perform post-digestion spike addition.	Flagging criteria are not appropriate.	Only applicable for samples with concentrations > 50 x LOQ.	Pg. 54, 236 ST012-W11-WG-0714 ***OK***
Post digestion spike addition	When dilution test fails or analyte concentration for all samples < 50 x LOQ	Recovery within 75-125% of (see Table B-1)	Run all associated samples in the preparatory batch by method of standard additions (MSA) or see flagging criteria.	For specific analyte(s) in the parent sample, apply J-flag of acceptance criteria are not met.	Spike addition should produce a concentration of 10 - 100 x LOQ	Pg. 53, 234 Ca = 70% Mn = 11% ***No qualification: sample result is greater than 4x spike amount***

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Method of standard additions (MSA)	When matrix interference is suspected	NA	NA	NA	Document use of MSA in the case narrative.	NA
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD 20%	Qualify samples	For the specific analyte(s) in the parent & dup samples, apply J-flag if acceptance criteria are not met.		No field dups analyzed for metals
Results Reported Between LOD and LOQ	NA	NA	NA	Apply J-flag to all results between DL and LOQ. Validator flags: If using AFCEE; Apply "F" flag		Results reported between MDL and RL flagged "F" for AFCEE.
QC Blanks (Equipment Blanks, and Field Blanks)	Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value are qualified as estimated and flagged "B".		No EB blanks

Method Validated: 9056A

Initial Review by: J. Hartness Date: 8/26/14
Senior Review by: D. Knaub Date: 8/29/14

SDG#: 280-58001-1
Matrix: Groundwater

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C)	QC acceptance criteria published by DoD, if available; otherwise method- specified criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	Not applicable (NA)	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	ok
Limit of Detection Determination and Verification (LOD) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly LOD verification checks shall be performed (see box D-13)	See 40 CFR 1368. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL / LOD verification check at higher level and set MDL higher or reconduct MDL study (see box D-13).	NA	Samples cannot be analyzed without a valid MDL.	Pg. 1209-1212 6/16/2013
Limit of Quantitation Establishment and Verification (LOQ) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly LOQ verification checks shall be performed (see box D-14)	Within calibration range including low standard; within method precision and accuracy.	Re-run LOQ	NA	Samples cannot be analyzed without a valid LOQ	MRL check: Level 4 Package Pg. 1208 (8/05/14) = OK

Method Validated: 9056A

Initial Review by: J. Hartness Date: 8/26/14
Senior Review by: D. Knaub Date: 8/29/14

SDG#: 280-58001-1
Matrix: Groundwater

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Retention Time (RT) Window Width Calculated for Each Analyte and Surrogate	At method set-up and after major maintenance (e.g., column change)	RT width is ± 3 times standard deviation for each analyte RT from 24-hour study.	NA	NA		OK
Container, Preservation, and Holding Time	All field samples	500 ml poly, Cool to 4°C Nitrate – 48 hours Nitrite, sulfate, chloride – 28 days	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collected: 7/16/14 Temp: 17.6°C Received out of temp due to FED-X shipping delay. ***No qualification required for anions.*** Analyzed: 8/05/14, 8/06/14 ***Ortho-phosphate out of hold - Flag results "J/UJ"***
ICAL for All Analytes (Minimum Three Standards and One Calibration Blank)	Initial calibration prior to sample analysis	R ≥ 0.995	Correct problem then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed.	Pg. 1216-1273 raw data Pg1265 Level IV Package Pg 1419 Inst: WC_IonChrom10 -7/24/14 OK Pg 1418 Inst: WC_IonChrom7 - 6/3/14 OK
Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 10% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	Pg. 1199-1201 Level 4 Package 8/05/14 OK

Method Validated: 9056A

Initial Review by: J. Hartness Date: 8/26/14
Senior Review by: D. Knaub Date: 8/29/14

SDG#: 280-58001-1
Matrix: Groundwater

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Retention Time Window Position Establishment for Each Analyte and Surrogate	Once per ICAL and at the beginning of the analytical shift	Position shall be set using the midpoint standard of the calibration curve or the value in the CCV run at the beginning of the analytical shift.	NA	NA		ICAL Pg. 1216-1273 raw data OK CCVs Pg 1274 Ok
Midrange Continuing Calibration Verification (CCV)	After every 10 field samples and at end of the analysis sequence.	All analytes within established retention time windows and within ± 10% of true value	Correct problem then repeat CCV. If that fails, then repeat ICAL. Reanalyze all samples since last successful calibration verification.	Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification, if . reanalysis is not possible.	No samples may be analyzed until the problem has been corrected.	Pg. 1199-1201 Level 4 Package 8/05/14-8/06/14 OK
Method Blank	One per preparatory batch	No analytes detected > ½ RL. See box D-1.	Correct problem, then see criteria in box D-1; if required, reprep then reanalyze method blank and all samples processed with the contaminated blank.	Lab: Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch. Validator; Apply "B" flag if result is less than 5x method blank.		Pg 60,63,66,1202 All MBs = ND Pg 1199-1201: CCBs Pg 1200; Chloride in CCB 19:01: 0.315 mg/L – ***no flag; samples >5x blank amount*** See ADR

Method Validated: 9056A

Initial Review by: J. Hartness Date: 8/26/14
Senior Review by: D. Knaub Date: 8/29/14

SDG#: 280-58001-1
Matrix: Groundwater

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Laboratory Control Sample (LCS) Containing All Analytes Required to be Reported, Including Surrogates	One LCS per preparatory batch	Use laboratory in-house LCS acceptance criteria (not to exceed 20%).See Box D-3.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix G)	If corrective action fails apply J-flag to specific analyte(s) in all samples in the associated preparatory batch		Pg 60,63,67,1206-1207 LCS/LCSD = OK See ADR
Matrix Spike (MS)	One MS per preparatory batch per matrix (see box D- 7)	For matrix evaluation, use laboratory in-house LCS acceptance criteria (not to exceed 20%).	Examine the project-specific 000s. Contact the client as to additional measures to be taken,	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	Pg 61,64,68, 1203-1204 ST012-W30-WG-0714 Cl: 60/59% ***No flag: sample results >4x spike amount*** ST012-W11-WG-0714 Br: 115/116% **Flag "J" for possible high bias.**
Matrix Spike Duplicate (MSD) or Sample Duplicate	One per preparatory batch per matrix	RPD ≤15% (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	RPDs = ok
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD ≤10%	Qualify sample	For the specific analyte(s) in the parent & dup samples, apply J- flag if acceptance criteria are not met.		No field duplicate collected Pg, 62, 65, 69, 1205 Lab Dup ST012-W11-WG-0714 SO4 = 17% **flag "J"** ST012-W30-WG-0714= OK

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COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Results Reported Between LOD and LOQ	NA	NA	NA	Apply J-flag to all results between LOD and LOQ. Validator flags: If using AFCEE; Apply "F" flag		No detections between LOD and LOQ
QC Blanks (Equipment Blanks and Field Blanks)	Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value (10x for common lab contaminants) are qualified as estimated and flagged "B".		Not collected

ED_005025_00007837-00146

Data Evaluation Narrative
AMEC Project: Former Williams AFB
AMEC Project Number: 9101110001.5300.5301
Site: ST012 – Enhanced Bioremediation Field Test
Sampling Event: September 2014
Matrix: Groundwater

SDG: 280-59565-1

1.0 INTRODUCTION

A data quality evaluation (DQE) was performed on the data reported for the Enhanced Bioremediation field test conducted at Site ST012 in September 2014, at the former Williams Air Force Base (AFB), Mesa, Arizona. The following sections provide summary discussions of the required data qualifications for each site and analytical methods for samples collected at the former WAFB. Data validation was conducted on 100% of the primary samples and field quality control samples (trip blanks, rinsate blanks, sample duplicates, and matrix spike/matrix spike duplicate [MS/MSD] samples). A Level III (Step IIB) data validation was performed using supplemental checklists to review the following quality control elements: laboratory case narrative, sample documentation, chain-of-custody, holding time protocols, method-specific calibration information, mass tunes, method blank results, laboratory control sample (LCS) results, surrogate recoveries (where applicable), MS/MSD recoveries and relative percent differences (RPDs), field duplicate RPDs, trip and equipment/rinsate blanks, method-specific QC elements (such as interelement check standards (ICS), serial dilutions, post digestion spikes (PDS), column breakdown, etc.), method sensitivity, and completeness. The Level III DQE checklists are attached to this narrative.

Data were reviewed using precision and accuracy control limits presented in The Department of Defense (DoD) Quality Systems Manual (QSM) Version 4.2 (DoD, 2010). DQE data qualifications were applied if necessary in accordance with procedures in Air Force Center for Environmental Excellence (AFCEE) Quality Assurance Project Plan (QAPP), Version 4.0.01 (AFCEE, 2005), the method, and professional judgment using the following qualifiers:

- J = The reported concentration is considered an estimated value due to discrepancies in meeting certain analyte-specific quality control criteria.
- F = The reported concentration is between the limit of quantitation/reporting limit (LOQ/RL) and method detection limit (MDL) and is considered an estimated value
- UJ = The target compound was not detected and the reporting limit is considered imprecise due to discrepancies in meeting certain analyte-specific quality control criteria.
- B = The result may be biased high or a false positive based on blank data.
- M = The reported concentration is estimated due to matrix effects.
- R = The data are considered unusable due to discrepancies in meeting certain quality control criteria and may not be used in decision making.

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2.0 DELIVERABLES

The data packages as submitted to AMEC Environment and Infrastructure, Inc. (AMEC) are complete as stipulated in the Draft Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) for Site ST012 Enhanced Bioremediation Field Test Plan (AMEC, 2014), and the applicable guidelines described in the former Williams AFB Performance Based Remediation Program QAPP and standard operating procedures (SOPs) (collectively referred to as the QAPP/SOP [AMEC, 2012]) for U.S. States Environmental Protection Agency (EPA) Methods SW8260B, SW8015B, SW9056A, and SW6010C.

3.0 SAMPLE INTEGRITY

Samples within this sample delivery group (SDG) collected from ST012 were submitted to TestAmerica Laboratories (TAL) in Denver, Colorado for select volatile organic compounds (VOCs) analysis by USEPA Method SW8260B, total petroleum hydrocarbons-gasoline range organics (TPH-GRO) and diesel range organics (TPH-DRO) by Method SW8015B, anions by Method SW9056A and select metals by Method SW6010C.

Based on the information provided on the cooler receipt forms, samples arrived at the laboratory within the recommended temperature and preservation requirements. Completed Chain-of-Custody (COC) documents are included in the data package.

4.0 SAMPLE IDENTIFICATION

This SDG contains the following water and quality control (QC) samples:

Site: ST012	QC Samples
ST012-W11-WG-090214	ST012-DUP01-090214
	TB01-090214
	ST012-EB01-090214

These samples were collected on 2 September 2014. Sample ST012-DUP01-090214 is a field duplicate of sample ST012-W11-WG-090214.

5.0 SAMPLE QUALIFICATION

Only those components that required qualification of the data are presented in this narrative. All Level III components were within the DoD QSM QC limits, with the following exceptions:

- Constituents were present in the associated blanks and flagged “B”.
- Surrogate recoveries were outside QC limits and results flagged “J”.
- Metals were detected in the Interference Check Solution A (ICSA) (no qualification required).
- PDS recoveries were outside QC limits for two metals (no flags applied).
- Field and laboratory duplicate precision was outside QC limits and results were flagged “J”.
- Results were present between the MDL and LOQ and flagged “F”.

6.0 VOCS (SW8260B)

Samples collected from site ST012 were submitted for VOCs by EPA Method SW8260B and analyzed for site-specific VOC compounds of interest (COIs).

A Level III validation was performed on this method and only those components that exceeded the QAPP/SOP criteria are presented below. Each of the Level III components was within the QAPP/SOP QC criteria; however the following qualification was noted:

- Constituents were present in the associated blanks and flagged "B".
- Surrogate recoveries were outside QC limits and results flagged "J".
- Results were present between the MDL and RL and flagged "F".

6.1 Receipt Condition

The samples were received out of temperature requirements and qualified as estimated (J/UJ) with a possible low bias. See Section 3.0 *Sample Integrity* for details.

6.2 Method Blank

The method blank for this SDG contained methylene chloride (0.1.01 J micrograms per liter [µg/L]). Any associated sample with results less than 5x (10x for common contaminants) the method blank results were considered as possibly biased high or false positive and flagged "B". The 5x/10x rule was applied to the raw response in the sample prior to dilution and sample volume calculations.

Action: The methylene chloride results in each of the samples in this SDG were qualified as estimated with a possible high bias and flagged "B".

6.3 Surrogate Recoveries

Surrogate 1,2-dichloroethane-d4 recovered above the QC limits in sample ST012-W11-WG-090214. No qualification is required if the samples were diluted or the surrogate recoveries were high and the sample results were non-detect.

Action: The detected benzene and toluene results in sample ST012-W11-WG-090214 were qualified as estimated with a possible high bias and flagged "J".

6.4 Equipment Blank and Trip Blank

The equipment blank and trip blank samples in this SDG contained methylene chloride at 0.37 J µg/L and 0.52 µg/L, respectively. Any associated sample with results less than 5x (10x for common contaminants) the blank results were considered as possibly biased high or false positive and flagged "B".

Action: The methylene chloride results for the equipment and trip blank samples were qualified as possibly biased high due to method blank contamination; therefore, no additional qualification was necessary.

6.5 Limits of Quantitation

The LOQs as specified in the QAPP/SOP (AMEC, 2012) were met for samples submitted for the analysis of VOCs by USEPA Method SW 8260B except where dilutions were required to place the constituent within the calibration range. Dilutions were required. The laboratory indicated a dilution with a "D" qualifier which was subsequently removed during the validation process.

Any result reported between the LOQ and MDL is considered a quantitative estimate. The results reported between the RL and MDL are presented in the attached data report.

Action: The associated results reported between the LOQ and MDL were qualified as estimated and flagged "F" unless overridden by other QC criteria.

7.0 TPH-GRO (8015B)

Samples collected from Site ST012 were submitted for TPH-GRO analysis by EPA Method SW8015B. A Level III validation was performed on this method and only those components that exceeded the program document QAPP/SOP criteria are presented below. Qualification was required for the following:

- Surrogate recoveries were outside QC limits (no flags applied).

7.1 Surrogate Recoveries

Surrogate a,a,a-trifluorotoluene recovered above the QC limits in samples ST012-W11-WG-090214 and ST012-DUP01-WG-090214. No qualification is required if the samples were diluted or the surrogate recoveries were high and the sample results were non-detect.

Action: No qualification was required because the samples were diluted.

7.2 Limits of Quantitation

The LOQ as specified in the QAPP/SOP (AMEC, 2012) was met for samples submitted for the analysis of TPH-GRO by EPA Method SW8015B except where dilutions were required to place the constituent within the calibration range. Samples reported with this SDG required dilution due to high levels of TPH-GRO. The laboratory indicated a dilution with a "D" qualifier which was subsequently removed during the validation process.

8.0 TPH-DRO (8015B)

Samples collected from Site ST012 were submitted for TPH-DRO analysis by EPA Method SW8015B. A Level III validation was performed on this method and each of the components met the program document QAPP/SOP criteria. It should be noted that the laboratory placed an "M"

qualifier on any result that was manually integrated. The "M" qualifier was subsequently removed during the data validation process.

8.1 Limits of Quantitation

The LOQ as specified in the QAPP/SOP (AMEC, 2012) was met for samples submitted for the analysis of TPH-DRO by EPA Method SW8015B. Dilutions were not required for TPH-DRO.

9.0 ANIONS (SW9056A)

Samples collected from site ST012 were submitted for Anions by Method SW9056A. A Level III validation was performed on this method and only those components that exceeded the QAPP/SOP criteria are presented below. Each of the Level III components was within the QAPP/SOP QC criteria except for the following:

- Field duplicate precision was outside QC limits and results were flagged "J".

9.1 Field Duplicates

One duplicate pair was collected and analyzed for anions: ST012-DUP01-090214/ST012-W11-WG-090214. The relative percent difference (RPD) between the parent and duplicate was exceeded for bromide. Positive sample results above the LOQ were qualified.

Action: The bromide results for samples ST012-W11-WG-090214 and ST012-DUP01-090214 were qualified as estimated and flagged "J".

9.2 Limits of Quantitation

The LOQs as specified in the QAPP/SOP (AMEC, 2012) were met for samples submitted for the analysis of Anions by USEPA Method SW 9056A with the exception of analytes that required dilution. Both samples in this SDG required dilution for chloride resulting in elevated LOQs. The laboratory indicated a dilution with a "D" qualifier which was subsequently removed during the validation process.

10.0 METALS (SW6010C)

Samples collected from Site ST012 were submitted for the major metal cations by EPA Method SW6010C. Samples were analyzed for calcium, iron, magnesium, manganese, potassium, and sodium. A Level III validation was performed on this method and only those components that exceeded the SAP/TAL SOP criteria are presented below. The following components exceeded the QC criteria or were noted:

- Constituents were present in the associated blanks and flagged "B" (no flags applied).
- Metals were detected in the Interference Check Solution A (ICSA) (no qualification required).
- PDS recoveries were outside QC limits for two metals (no flags applied).

- Results were present between the MDL and LOQ and flagged "F".

10.1 Continuing Calibration Blanks

Two CCBs showed the presence of low levels of magnesium (0.250 J µg/L and 0.280 µg/L). Associated sample results less than 5x the blank value were qualified as estimated and flagged "B".

Action: No qualification was required because the associated manganese results in the samples were greater than 5 x the blank value.

10.2 Interference Check Solution A (ICSA)

Manganese was detected in the ICSA solution associated with prep batch 280-241934. The vendor verified that the ICSA contained these trace impurities.

Action: No qualification is required for impurities verified by the vendor.

10.3 Post Digestion Spike

The laboratory performed a PDS on sample ST012-W11-WG-090214 and the recovery for calcium and manganese in sample recovered below the QC limit. No qualification is required if the recoveries were high and the samples were non-detect or the analyte was present in the sample at concentrations greater than 4x the spike amount.

Action: No qualification was required for calcium and manganese results in sample ST012-W11-WG-090214 because the metals were present in the sample at greater than 4x the spike amount.

10.4 Limits of Quantitation

The LOQs as specified in the QAPP/SOP (AMEC, 2012) were met for samples submitted for the analysis of metals by USEPA Method SW6010C except where dilutions were required to place the constituent concentration within the calibration range. No Dilutions were required.

11.0 OVERALL SITE EVALUATION AND PROFESSIONAL JUDGMENT

Edits to the DQE qualifiers by professional judgment were not required.

12.0 SUMMARY OF DATA QUALITY INDICATORS

This section provides an assessment of the data based on project data quality indicators (DQIs) described on QAPP Worksheet #37 of the Program Document QAPP/SOP (AMEC, 2012). The DQIs consist of precision, accuracy, representativeness, comparability, completeness, and sensitivity.

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12.1 Precision

An assessment of precision of analytical data is accomplished via review of field duplicate and MS/MSD analyses. Field duplicate and MS/MSD analyses are used to assess field variability, which includes sample collection/handling as well as matrix homogeneity. Precision is expressed as the relative percent difference (RPD) between results for duplicate pairs.

Field duplicate sample samples were submitted and the RPD was exceeded for bromide and the associated results are considered estimated. However estimated data is usable; therefore, impacts to DQOs are minimal. An MS/MSD was performed on a project sample for metals and the RPDs were within QC limits. Precision for TPH-GRO, TPH-DRO, and anions was evaluated through the analysis of the LCS/LCSD and the RPDs were compliant with the QAPP/SOP. Even though two bromine results were qualified as estimated, the overall method and sample matrix precision are acceptable and achieve project objectives.

12.2 Accuracy (Bias)

An assessment of accuracy of analytical data is accomplished via evaluation of the spike recoveries in the MS/MSD, LCS, post digestion spike samples, and surrogate spike compounds, in addition to calibration criteria. Accuracy is expressed as percent recovery. Accuracy data were compliant with the QAPP/SOP with the exception of TPH-GRO and VOC surrogates. The DQE resulted in the qualification of 2 VOC results as estimated in one sample. Estimated data is usable data and all remaining accuracy data for the other anions, VOCs, TPH-GRO, TPH-DRO, and metals were within QC limits or did not require qualification. Therefore, the data results indicate method and matrix accuracy is acceptable to achieve project objectives.

12.3 Representativeness

Representativeness for the analytical data is determined through evaluation of the associated blank data and evaluation of appropriate sample handling procedures. All samples were properly stored and preserved in the field and at TestAmerica. Method, trip, and equipment blanks were acceptable with the exception of methylene chloride. Blank contamination resulted in qualification of the associated sample data. Based on historical results and the low-level concentrations qualified, the impacts to project DQOs were minimal; therefore, the analytical results indicate sample data are representative of the Site conditions.

12.4 Comparability

Comparability addresses the confidence with which one data set can be compared to another. Use of appropriate sampling methods, COC procedures, and EPA-approved analytical methods, as well as adherence to strict QA/QC procedures, provide the basis for uniformity in sample collection and analysis. Analytical data were generated by TestAmerica using standard reporting units of micrograms per liter for VOCs, TPH-GRO, and metals and milligrams per liter for TPH-DRO and anions. In addition, sample collection and analytical method protocols were implemented in accordance with approved, documented procedures. Analytical data are determined to be comparable to previous Site results.

12.5 Completeness

Completeness of the field sampling activities were assessed in terms of the actual number and type of sample results received from the field and laboratory, as compared with the planned number and type of sample results. All samples planned were collected which meets a field completeness of 100%.

Analytical completeness of data is a measure of the number of valid project-specific data results obtained in comparison to the total number of data results projected to achieve project DQOs. Valid data are defined as data that meet the project-specific DQOs. No data were rejected as a result of the data validation; however, some of the results were qualified as estimated. Estimated data is usable data. The completeness goals met the 90 percent goal for field and laboratory data expected for this project.

12.6 Sensitivity

Analytical methods and RLs were implemented in accordance with the QAPP/SOP and EPA promulgated methodologies. Method RLs were achieved for the event except when sample dilutions were required to bring target compounds within the linear range of the instrument calibration. As previously mentioned, the samples within this SDG required dilutions for VOCs, TPH-GRO, and chloride to place the results within the calibration range. These include modified RLs for selected detections; therefore, sensitivity requirements were met for non-diluted constituents.

12.7 Usability Summary

The data generated during the September 2014 sampling event were usable with qualifications with respect to project DQOs. The DQOs for the Enhanced Bioremediation Field Test is to produce data to support design of anaerobic methods for the ST012 remedy if selected.

13.0 REFERENCES

AFCEE, 2005. Quality Assurance Project Plan, Version 4.0.01, May, 2005.

AMEC, August 11, 2014. *Draft Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) (Enhanced Bioremediation Field Test Plan) Operable Unit 2 Site ST012 - Liquid Fuels Storage Area, Former Williams Air Force Base, Mesa, Arizona.*

AMEC, February 23, 2012. *Performance Based Remediation Program Quality Assurance Project Plan (QAPP) and Standard Operating Procedures (SOPs) (QAP/SOP), Former Williams Air Force Base, Mesa, Arizona.*

DoD, 2010. Department of Defense Quality System Manual, Version 4.2 Final, October 2010.

Prepared/Date: DWK 10/21/14
Checked/Date: JAH 10/27/14

ED_005025_00007837-00154

Flagged Data Reports

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59565-1

Client Sample ID: **ST012-W11-WG-090214**

Lab Sample ID: 280-59565-1

Client Matrix: Water

Date Sampled: 09/02/2014 1340

Date Received: 09/03/2014 0945

8260B Volatile Organic Compounds (GC/MS)

Analysis Method:	8260B	Analysis Batch:	280-242744	Instrument ID:	VMS_G2
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	G2_5010.D
Dilution:	1.0			Initial Weight/Volume:	20 mL
Analysis Date:	09/11/2014 0022			Final Weight/Volume:	20 mL
Prep Date:	09/11/2014 0022				

DWK 10/21/14

Analyte	Result (ug/L)	Qualifier	DL	LOQ
1,2-Dichloroethane	0.40	U ~~Q~~	0.13	1.0
Benzene	45	~~Q~~ J	0.16	1.0
Methylene Chloride	1.1	~~J~~ B	0.32	5.0
Naphthalene	43		0.22	1.0
Toluene	1.2	~~Q~~ J	0.17	1.0
Trichloroethene (TCE)	0.20	U ~~Q~~	0.16	1.0
Trichlorofluoromethane	0.60	U	0.29	2.0

Surrogate	%Rec	Qualifier	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	130	~~Q~~ *	70 - 120
4-Bromofluorobenzene (Surr)	101		75 - 120
Dibromofluoromethane (Surr)	107		85 - 115
Toluene-d8 (Surr)	112		85 - 120

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59565-1

Client Sample ID: **ST012-W11-WG-090214**

Lab Sample ID: 280-59565-1

Client Matrix: Water

Date Sampled: 09/02/2014 1340

Date Received: 09/03/2014 0945

8260B Volatile Organic Compounds (GC/MS)

Analysis Method:	8260B	Analysis Batch:	280-242744	Instrument ID:	VMS_G2
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	G2_5011.D
Dilution:	10			Initial Weight/Volume:	20 mL
Analysis Date:	09/11/2014 0042	Run Type:	DL	Final Weight/Volume:	20 mL
Prep Date:	09/11/2014 0042				

DWK 10/01/14

Analyte	Result (ug/L)	Qualifier	DL	LOQ
Ethylbenzene	230	~~D~~	1.6	10
m-Xylene & p-Xylene	74	~~D~~	3.4	20
o-Xylene	4.0	U	1.9	10
Xylenes, Total	74	~~D~~	1.9	20

Surrogate	%Rec	Qualifier	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	100		70 - 120
4-Bromofluorobenzene (Surr)	95		75 - 120
Dibromofluoromethane (Surr)	96		85 - 115
Toluene-d8 (Surr)	93		85 - 120

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59565-1

Client Sample ID: **ST012-DUP01-090214**

Lab Sample ID: 280-59565-2FD

Client Matrix: Water

Date Sampled: 09/02/2014 1350

Date Received: 09/03/2014 0945

8260B Volatile Organic Compounds (GC/MS)

Analysis Method:	8260B	Analysis Batch:	280-242744	Instrument ID:	VMS_G2
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	G2_5012.D
Dilution:	1.0			Initial Weight/Volume:	20 mL
Analysis Date:	09/11/2014 0103			Final Weight/Volume:	20 mL
Prep Date:	09/11/2014 0103				

DWK 10/21/14

Analyte	Result (ug/L)	Qualifier	DL	LOQ
1,2-Dichloroethane	0.40	U	0.13	1.0
Benzene	44		0.16	1.0
Methylene Chloride	0.55	J B	0.32	5.0
Naphthalene	42		0.22	1.0
Toluene	1.2		0.17	1.0
Trichloroethene (TCE)	0.20	U	0.16	1.0
Trichlorofluoromethane	0.80	U	0.29	2.0

Surrogate	%Rec	Qualifier	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	98		70 - 120
4-Bromofluorobenzene (Surr)	89		75 - 120
Dibromofluoromethane (Surr)	85		85 - 115
Toluene-d8 (Surr)	95		85 - 120

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59565-1

Client Sample ID: **ST012-DUP01-090214**

Lab Sample ID: 280-59565-2FD

Client Matrix: Water

Date Sampled: 09/02/2014 1350

Date Received: 09/03/2014 0945

8260B Volatile Organic Compounds (GC/MS)

Analysis Method:	8260B	Analysis Batch:	280-242744	Instrument ID:	VMS_G2
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	G2_5013.D
Dilution:	10			Initial Weight/Volume:	20 mL
Analysis Date:	09/11/2014 0123	Run Type:	DL	Final Weight/Volume:	20 mL
Prep Date:	09/11/2014 0123				

DWK 10/20/14

Analyte	Result (ug/L)	Qualifier	DL	LOQ
Ethylbenzene	260	~~D~~	1.6	10
m-Xylene & p-Xylene	86	~~D~~	3.4	20
o-Xylene	4.0	U	1.9	10
Xylenes, Total	87	~~D~~	1.9	20

Surrogate	%Rec	Qualifier	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	99		70 - 120
4-Bromofluorobenzene (Surr)	99		75 - 120
Dibromofluoromethane (Surr)	99		85 - 115
Toluene-d8 (Surr)	98		85 - 120

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59565-1

Client Sample ID: **ST012-EB01-090214**

Lab Sample ID: 280-59565-3EB

Client Matrix: Water

Date Sampled: 09/02/2014 1425

Date Received: 09/03/2014 0945

8260B Volatile Organic Compounds (GC/MS)

Analysis Method:	8260B	Analysis Batch:	280-242744	Instrument ID:	VMS_G2
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	G2_5014.D
Dilution:	1.0			Initial Weight/Volume:	20 mL
Analysis Date:	09/11/2014 0143			Final Weight/Volume:	20 mL
Prep Date:	09/11/2014 0143				

DWY 10/20/14

Analyte	Result (ug/L)	Qualifier	DL	LOQ
1,2-Dichloroethane	0.40	U	0.13	1.0
Benzene	0.20	U	0.16	1.0
Ethylbenzene	0.20	U	0.16	1.0
Methylene Chloride	0.37	✓ B	0.32	5.0
m-Xylene & p-Xylene	0.80	U	0.34	2.0
Naphthalene	0.80	U	0.22	1.0
o-Xylene	0.40	U	0.19	1.0
Toluene	0.40	U	0.17	1.0
Trichloroethene (TCE)	0.20	U	0.16	1.0
Trichlorofluoromethane	0.80	U	0.29	2.0
Xylenes, Total	1.6	U	0.19	2.0

Surrogate	%Rec	Qualifier	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	91		70 - 120
4-Bromofluorobenzene (Surr)	97		75 - 120
Dibromofluoromethane (Surr)	93		85 - 115
Toluene-d8 (Surr)	93		85 - 120

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59565-1

Client Sample ID: **TB01-090214**

Lab Sample ID: 280-59565-4TB

Client Matrix: Water

Date Sampled: 09/02/2014 0900

Date Received: 09/03/2014 0945

8260B Volatile Organic Compounds (GC/MS)

Analysis Method:	8260B	Analysis Batch:	280-242744	Instrument ID:	VMS_G2
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	G2_5015.D
Dilution:	1.0			Initial Weight/Volume:	20 mL
Analysis Date:	09/11/2014 0203			Final Weight/Volume:	20 mL
Prep Date:	09/11/2014 0203				

DWK 10/24/14

Analyte	Result (ug/L)	Qualifier	DL	LOQ
1,2-Dichloroethane	0.40	U	0.13	1.0
Benzene	0.20	U	0.16	1.0
Ethylbenzene	0.20	U	0.16	1.0
Methylene Chloride	0.52	✓ B	0.32	5.0
m-Xylene & p-Xylene	0.80	U	0.34	2.0
Naphthalene	0.80	U	0.22	1.0
o-Xylene	0.40	U	0.19	1.0
Toluene	0.40	U	0.17	1.0
Trichloroethene (TCE)	0.20	U	0.16	1.0
Trichlorofluoromethane	0.80	U	0.29	2.0
Xylenes, Total	1.6	U	0.19	2.0

Surrogate	%Rec	Qualifier	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	89		70 - 120
4-Bromofluorobenzene (Surr)	96		75 - 120
Dibromofluoromethane (Surr)	94		85 - 115
Toluene-d8 (Surr)	91		85 - 120

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59565-1

Client Sample ID: **ST012-W11-WG-090214**

Lab Sample ID: 280-59565-1
Client Matrix: Water

Date Sampled: 09/02/2014 1340
Date Received: 09/03/2014 0945

8015B_GRO Gasoline Range Organics (GRO)

Analysis Method:	8015B_GRO	Analysis Batch:	280-242714	Instrument ID:	VGC_Q
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	008F0801.D
Dilution:	10			Initial Weight/Volume:	5 mL
Analysis Date:	09/09/2014 1731			Final Weight/Volume:	5 mL
Prep Date:	09/09/2014 1731			Injection Volume:	5 mL

DWK 10/2/14

Analyte	Result (ug/L)	Qualifier	DL	LOQ
Gasoline Range Organics (GRO)-C6-C10	2700	~~D M Q~~	100	250

Surrogate	%Rec	Qualifier	Acceptance Limits
a,a,a-Trifluorotoluene	147	Q *	82 - 110

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59565-1

Client Sample ID: **ST012-DUP01-090214**

Lab Sample ID: 280-59565-2FD

Client Matrix: Water

Date Sampled: 09/02/2014 1350

Date Received: 09/03/2014 0945

8015B_GRO Gasoline Range Organics (GRO)

Analysis Method:	8015B_GRO	Analysis Batch:	280-242714	Instrument ID:	VGC_Q
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	009F0901.D
Dilution:	10			Initial Weight/Volume:	5 mL
Analysis Date:	09/09/2014 1756			Final Weight/Volume:	5 mL
Prep Date:	09/09/2014 1756			Injection Volume:	5 mL

Analyte	Result (ug/L)	Qualifier	DL	LOQ
Gasoline Range Organics (GRO)-C6-C10	2800	~~D M Q~~	100	250

Surrogate	%Rec	Qualifier	Acceptance Limits
a,a,a-Trifluorotoluene	149	~~M Q~~	82 - 110

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59565-1

Client Sample ID: **ST012-W11-WG-090214**

Lab Sample ID: 280-59565-1

Client Matrix: Water

Date Sampled: 09/02/2014 1340

Date Received: 09/03/2014 0945

8015B_DRO Diesel Range Organics (DRO) (GC)

Analysis Method:	8015B_DRO	Analysis Batch:	280-242565	Instrument ID:	SGC_U
Prep Method:	3510C	Prep Batch:	280-241972	Initial Weight/Volume:	1049.4 mL
Dilution:	1.0			Final Weight/Volume:	1 mL
Analysis Date:	09/09/2014 2148			Injection Volume:	1 uL
Prep Date:	09/04/2014 1712			Result Type:	PRIMARY

DWK 10/21/14

Analyte	Result (mg/L)	Qualifier	DL	LOQ
Diesel Range Organics [C10-C28]	0.56	M	0.031	0.24

Surrogate	%Rec	Qualifier	Acceptance Limits
o-Terphenyl	79	M	50 - 115

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59565-1

Client Sample ID: **ST012-DUP01-090214**

Lab Sample ID: 280-59565-2FD

Client Matrix: Water

Date Sampled: 09/02/2014 1350

Date Received: 09/03/2014 0945

8015B_DRO Diesel Range Organics (DRO) (GC)

Analysis Method:	8015B_DRO	Analysis Batch:	280-242565	Instrument ID:	SGC_U
Prep Method:	3510C	Prep Batch:	280-241972	Initial Weight/Volume:	1055.9 mL
Dilution:	1.0			Final Weight/Volume:	1 mL
Analysis Date:	09/09/2014 2120			Injection Volume:	1 uL
Prep Date:	09/04/2014 1712			Result Type:	PRIMARY

DWK 10/21/14

Analyte	Result (mg/L)	Qualifier	DL	LOQ
Diesel Range Organics [C10-C28]	0.55	M7	0.031	0.24

Surrogate	%Rec	Qualifier	Acceptance Limits
o-Terphenyl	80		50 - 115

Client: AMEC Environment & Infrastructure, Inc. Job Number: 280-59565-1

Client Sample ID: **ST012-W11-WG-090214**

Lab Sample ID: 280-59565-1 Date Sampled: 09/02/2014 1340
Client Matrix: Water Date Received: 09/03/2014 0945

6010C Metals (ICP)

Analysis Method:	6010C	Analysis Batch:	280-242265	Instrument ID:	MT_026
Prep Method:	3010A	Prep Batch:	280-241934	Lab File ID:	26A090514D.asc
Dilution:	1.0			Initial Weight/Volume:	50 mL
Analysis Date:	09/05/2014 2059			Final Weight/Volume:	50 mL
Prep Date:	09/05/2014 0830				

Analyte	Result (ug/L)	Qualifier	DL	LOQ
Calcium	300000		35	1000
Iron	140		22	100
Magnesium	67000		11	500
Sodium	76000		92	5000

Analysis Method:	6010C	Analysis Batch:	280-242487	Instrument ID:	MT_026
Prep Method:	3010A	Prep Batch:	280-241934	Lab File ID:	26c090814.asc
Dilution:	1.0			Initial Weight/Volume:	50 mL
Analysis Date:	09/08/2014 2054			Final Weight/Volume:	50 mL
Prep Date:	09/05/2014 0830				

DWK 8/21/14

Analyte	Result (ug/L)	Qualifier	DL	LOQ
Manganese	2000	Q*	0.25	10
Potassium	16000		240	3000

Client: AMEC Environment & Infrastructure, Inc. Job Number: 280-59565-1

Client Sample ID: **ST012-DUP01-090214**

Lab Sample ID: 280-59565-2FD Date Sampled: 09/02/2014 1350
Client Matrix: Water Date Received: 09/03/2014 0945

6010C Metals (ICP)

Analysis Method:	6010C	Analysis Batch:	280-242265	Instrument ID:	MT_026
Prep Method:	3010A	Prep Batch:	280-241934	Lab File ID:	26A090514D.asc
Dilution:	1.0			Initial Weight/Volume:	50 mL
Analysis Date:	09/05/2014 2112			Final Weight/Volume:	50 mL
Prep Date:	09/05/2014 0830				

Analyte	Result (ug/L)	Qualifier	DL	LOQ
Calcium	310000		35	1000
Iron	150		22	100
Magnesium	68000		11	500
Sodium	78000		92	5000

Analysis Method:	6010C	Analysis Batch:	280-242487	Instrument ID:	MT_026
Prep Method:	3010A	Prep Batch:	280-241934	Lab File ID:	26c090814.asc
Dilution:	1.0			Initial Weight/Volume:	50 mL
Analysis Date:	09/08/2014 2107			Final Weight/Volume:	50 mL
Prep Date:	09/05/2014 0830				

DMV 9/30/14

Analyte	Result (ug/L)	Qualifier	DL	LOQ
Manganese	2100	Q	0.25	10
Potassium	16000		240	3000

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59565-1

General Chemistry

Client Sample ID: **ST012-W11-WG-090214**

Lab Sample ID: 280-59565-1

Client Matrix: Water

Date Sampled: 09/02/2014 1340

Date Received: 09/03/2014 0945

Dun Y 10/21/14

Analyte	Result	Qual	Units	DL	LOQ	Dil	Method
Bromide	2.6	J	mg/L	0.11	0.50	1.0	9056A
Analysis Batch: 280-241650	Analysis Date: 09/03/2014 1838						
Orthophosphate as P	0.20	U	mg/L	0.19	0.50	1.0	9056A
Analysis Batch: 280-241649	Analysis Date: 09/03/2014 1838						
Chloride	780	D	mg/L	1.3	15	5.0	9056A
Analysis Batch: 280-241650	Analysis Date: 09/03/2014 1858						
Sulfate	6.4		mg/L	0.23	5.0	1.0	9056A
Analysis Batch: 280-241650	Analysis Date: 09/03/2014 1838						

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59565-1

General Chemistry

Client Sample ID: **ST012-DUP01-090214**

Lab Sample ID: 280-59565-2FD

Client Matrix: Water

Date Sampled: 09/02/2014 1350

Date Received: 09/03/2014 0945

DWK 10/9/14

Analyte	Result	Qual	Units	DL	LOQ	Dil	Method
Bromide	1.5	J	mg/L	0.11	0.50	1.0	9056A
Analysis Batch: 280-241650	Analysis Date: 09/03/2014 1917						
Orthophosphate as P	0.20	U	mg/L	0.19	0.50	1.0	9056A
Analysis Batch: 280-241649	Analysis Date: 09/03/2014 1917						
Chloride	780	*D	mg/L	1.3	15	5.0	9056A
Analysis Batch: 280-241650	Analysis Date: 09/03/2014 1937						
Sulfate	6.6		mg/L	0.23	5.0	1.0	9056A
Analysis Batch: 280-241650	Analysis Date: 09/03/2014 1917						

Data Quality Evaluation Checklists

Method Validated: 8260B

Initial Review by: D. Knaub Date: 10/21/14 SDG#: 280-59565-1
Senior Review by: J. Hartness Date: 10/27/14 Matrix: Groundwater

ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (METHODS 8260 AND 8270)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C).	QC acceptance criteria published by DoD, if available; otherwise method- specific criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	NA	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	Ok
MDL Study	At initial set-up and subsequently once per 12-month period; otherwise quarterly MDL verification checks shall be performed (see box D-18)	See 40 CFR 136B. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL verification check at higher level and set MDL higher or reconduct MDL study (see box D-18)	NA	Samples cannot be analyzed without a valid MDL.	Ok
Tuning	Prior to calibration and every 12 hours during sample analysis	Refer to method for specific ion criteria.	Retune instrument and verify. Rerun affected samples.	Flagging criteria are not appropriate	Problem must be corrected. No samples may be accepted without a valid tune.	p. 217 – 219 level IV package VMS_G2, ICAL/ICV, 8/27/14 VMS_G2, ICAL/ICV, 9/04/14 VMS_G2, CCV 9/10/14 All ok
Breakdown Check (DDT Method 8270C Only)	Daily prior to analysis of samples	Degradation ≤ 20% for DDT	Correct problem then repeat breakdown check	Flagging criteria are not appropriate	No samples shall be run until degradation ≤ 20%. Benzidine and pentachlorophenol should be present at their normal responses and no peak tailing should be observed.	NA

ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (METHODS 8260 AND 8270)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Container, Preservation, and Holding Time	All field samples	8260 – 40 ml VOA vial HCl to pH < 2, Cool to 4°C 14 days to analysis 8270 – 1 L Amber glass, Cool to 4°C 7 days to extraction 40 days to analysis	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collection date: 9/02/14 Analysis date: 9/10/14 Temp 6.7 °C
Minimum Five-Point Initial Calibration For All Analytes (ICAL)	Initial calibration prior to sample analysis	Average response factor (RF) for SPCCs: VOCs - 0.30 for Chlorobenzene and 1,1,2,2-tetrachlorolethane. a 0.1 for chloromethane, bromoform, and 1,1-dicbloroethane. SVOCs - a 0.050. RSD for RFs for CCCs: The CCCs are vinyl chloride, 1,1-dichlorethene, chloroform, 1,2-dichloropropane, toluene, and ethylbenzene. VOCs and SVOCs - 30% and one option below; **Option 1**: RSD for each analyte ≤ 15% **Option 2**: linear least squares regression r a 0.995 **Option 3**: non-linear regression - coefficient of determination (COD) e a 0.99 (6 points shall be used for second order, 7 points shall be used for third order)	Correct problem then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed.	p. 256 VMS_G2, 8/27/14 All OK p. 296 VMS_G2, 9/04/14 (short list) All OK

Method Validated: 8260B

Initial Review by: D. Knaub Date: 10/21/14 SDG#: 280-59565-1
Senior Review by: J. Hartness Date: 10/27/14 Matrix: Groundwater

ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (METHODS 8260 AND 8270)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 25% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	p. 318, VMS_G2 ICV 280-240780/14 (8/27/14) p. 325, VMS_G2 ICV (short list) 280-241807/22 (9/04/14) All OK
Retention Time Window Position Establishment for Each Analyte and Surrogate	Once per ICAL	Position shall be set using the midpoint standard of the initial calibration curve.	NA			All OK
Evaluation of Relative Retention Times (RRT)	With each sample	RRT of each target analyte in each calibration standard within ± 0.06 RRT units.	Correct problem, then rerun ICAL.			All ok
Calibration Verification (CV)	Daily, before sample analysis, and every 12 hours of analysis time	Average RF for SPCCs: VOCs 0.30 for Chlorobenzene and 1,1,2,2-tetrachlorolethane, 0.1 for chloromethane, bromoform, and 1,1-dichloroethane. SVOCs 0.050. 2. %Difference/Drift for CCCs: VOCs and SVOCs ≤20%D (Note: D = difference when using RFs or drift when using least squares regression or non-linear calibration.)	Correct problem, then rerun CV. If that fails, repeat initial calibration. See section 5.5.10 and DoD clarification box 55.	Apply Q-flag if no sample material remains and analyte exceeds criteria.	NA	p. 329, VMS_G2 CCV 280-242744/2 (9/10/14) p. 336, VMS_G2 CCV short list 280-242744/2 (9/10/14) All COIs OK

ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (METHODS 8260 AND 8270)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Internal Standards Verification	In all field samples and standards	Retention time ± 30 seconds from retention time of the midpoint standard in the ICAL EICP area within - 50% to + 100% of ICAL midpoint standard	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory.	If corrective action fails in field samples, apply Q-flag to analytes associated with the non-compliant IS. Flagging criteria are not appropriate for failed standards.	Flagging criteria are not appropriate.	p. 220 -221 ICIS 280-240780/11 All ok
Method Blank	One per preparatory batch	No analytes detected >½ RL. For common laboratory contaminants, no analytes detected > RL.	Correct problem, then see criteria in box D-5. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank.	Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.		p.42 MB 280-242744/7 MeCl = 1.01 x 10 = 10.1 ug/L ***Flag ST012-W11-WG-090214, ST012-DUP01-WG-090214, ST012-EB01-090214, and TB01-090214 as "B"***
LCS Containing All Analytes Required to be Reported, Including Surrogates	One LCS per preparatory batch	QC acceptance criteria specified by DoD, if available; see box D-7 and Appendix DoD-D.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. (See full explanation in Appendix DoDID.	If corrective action fails, applyIQ-flag to specific analyte(s) in all samples in the associated preparatory batch.		p.43 LCS 280-242744/6 All OK

ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (METHODS 8260 AND 8270)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
MS	One MS per preparatory batch per matrix (see box D- 15)	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	Lab: For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error	No MS/MSD submitted for method 8260B
MSD or Sample Duplicate	One per preparatory batch per matrix	RPD ≤ 30% (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	Lab: For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	NA -See above
Surrogate Spike (Analytes Identified in Appendix DoD-D)	All field and QC samples	QC acceptance criteria for LCS published by DoD, if available; otherwise method- specified criteria or laboratory's own in-house criteria.	For QC and field samples, correct problem, then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available.	For the specific analyte(s) in all field samples collected from the same site matrix as the parent, apply J-flag if acceptance criteria are not met. For QC samples, apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.		p. 39 ST012-W11-WG-090214 DCA = 130 (70-120) Assoc results flagged Q by the lab qualified as "J" for positive results only.

ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (METHODS 8260 AND 8270)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD ≤30%	Qualify sample	For the specific analyte(s) in the parent & dup samples, apply J- flag if acceptance criteria are not met.		ST012-W11-WG-090214/ ST012-DUP01-WG-090214 See RPDs below
Results Reported Between MDL and LOQ	NA	NA	NA	Apply J-flag to all results between MDL and LOQ. Validator flags: If using AFCEE; Apply "F" flag		Samples qualified as estimated and AFCEE flagged "F"
QC Blanks (Trip Blanks, Equipment Blanks, and Field Blanks)	Trip Blank – one per cooler containing samples for VOCs Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value (10x for common lab contaminants) are qualified as estimated and flagged "B"		TB01-090214 MeCl = 0.52ug/L – ***flagged "B" due to method blank – no qualification required for samples.*** ST012-EB01-090214 MeCl = 0.37ug/L – ***flagged "B" due to method blank – no qualification required for samples.***

	ST012-W11-WG-090214	= ST012-DUP01-WG-090214	RPD
Benzene	45	44	22.5%
Ethylbenzene	230	260	12.2%
M,p-xylene	74	86	15%
Naphthalene	43	42	2.4%
Toluene	1.2 J	1.2	0.0%
Xylenes, total	74	87	16.4%

Method Validated: 8015B (TPH-GRO) | Initial Review by: D. Knaub | Date: 10/21/14 | SDG#:280-59565-1
Senior Review by: J. Hartness | Date: 10/27/14 | Matrix: Groundwater

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C)	QC acceptance criteria published by DoD, if available; otherwise method- specified criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	Not applicable (NA)	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	ok
Method Detection Limit (MDL) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly MDL verification checks shall be performed (see box 0-18)	See 40 CFR 1368. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL verification check at higher level and set MDL higher or reconduct MDL study (see box D-18).	NA	Samples cannot be analyzed without a valid MDL.	ok
Retention Time (RT) Window Width Calculated for Each Analyte and Surrogate	At method set-up and after major maintenance (e.g., column change)	RT width is ± 3 times standard deviation for each analyte RT from 72-hour study.	NA	NA		
Breakdown Check (Endrin/ DDT Method 8081 Only)	Daily prior to analysis of samples	Degradation ≤ 15% for both Endrin and DDT.	Correct problem then repeat breakdown check.	Flagging criteria are not appropriate	No samples shall be run until degradation ≤ 15%.	NA TPH-GRO

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Container, Preservation, and Holding Time	All field samples	GRO- Water: 40 ml VOA vial; HCl to pH < 2, Cool to 6°C Soil: (low-level) 5 g in 40 ml VOA w/H_2O or sodium bisulfate; Cool to 6°C (high-level) 5 g in 40 ml VOA w/methanol, Cool to 6°C, or EnCore® or equivalent (48 hrs to preservation) 14 days to analysis DRO – Water: 1 L Amber glass, Cool to 6°C Soil: 4 oz amber glass jar, Cool to 6°C Water: 7 days to extraction Soil: 14 days to extraction 40 days to analysis	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collected: 9/02/14 Temp=6.7°C Analyzed: 9/09/14 ***ok***

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Minimum Five-Point Initial Calibration For All Analytes (ICAL)	Initial calibration prior to sample analysis	One of the options below (except for Method 8082, which may only use Option 1 or 2): Option 1: RSD for each analyte ≤ 20% Option 2: linear least squares regression: r 2 ≥0.995 Option 3: non-linear regression: coefficient of determination (COD) r2 ≥0.99 (6 points shall be used for second order, 7 points shall be used for third order)	Correct problem then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed. For PCB analysis, a mixture of Aroclors 1016 and 1260 is normally used to establish detector calibration linearity, unless project-specific data suggest the presence of another Aroclor (e.g., 1232). In addition, a mid-level or lower standard for each of the remaining Aroclors is analyzed for pattern recognition and response factor.	p. 397 Inst VGC_Q 3/12/14 OK
Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 20% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	p. 426 ICV 280-216544/11 3/12/14 Inst VGC_Q
Retention Time Window Position Establishment for Each Analyte and Surrogate	Once per ICAL and at the beginning of the analytical shift	Position shall be set using the midpoint standard of the calibration curve or the value in the CCV run at the beginning of the analytical shift.	NA	NA		p. 397 ICAL

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Retention Time Window Verification for Each Analyte and Surrogate	Each calibration verification standard	Analyte within established window	Correct problem, then reanalyze all samples analyzed since the last acceptable retention time check. If they fail, redo ICAL and reset retention time window,	Flagging criteria are not appropriate for initial verification. For CCV, apply a Q-flag to all results for analytes outside the established window.	No samples shall be run without a verified retention time window at the initial verification. For method 8015, check state methods for use of modified retention time markers with gasoline range organics (GRO) or diesel range organics (DRO).	p. 427 ICV p. 433, 440 CCVs
Calibration Verification (Initial [ICV] and Continuing [CCV])	ICV: Daily, before sample analysis CCV: After every 10 field samples and at the end of the analysis sequence	All analytes within ± 20% of expected value from the ICAL	ICV: Correct problem, rerun ICV. If that fails, repeat initial calibration. See section 5.5.10 and box 55. CCV: Correct problem then repeat CCV and reanalyze all samples since last successful calibration verification.	ICV: Flagging criteria are not appropriate. CCV: Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification, if . reanalysis is not possible.	If %D for an individual analyte is > 20%, no samples may be analyzed until the problem has been corrected.	p. 432 CCVRT 280-242714/4 9/09/14 Inst VGC_Q p. 439 CCV 280-242714/19 9/09/14 Inst VGC_Q
Method Blank	One per preparatory batch	No analytes detected > ½RL. For common laboratory contaminants, no analytes detected > RL.	Correct problem, then see criteria in box 0-5; if required, reprep then reanalyze method blank and all samples processed with the contaminated blank.	Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch		p. 44 MB 280-242714/5 ND

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Laboratory Control Sample (LCS) Containing All Analytes Required to be Reported, Including Surrogates	One LCS per preparatory batch	QC acceptance criteria specified by DoD, if available; see box D-7 and Appendix DoD-D .	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix DoD D)	If corrective action fails apply J-flag to specific analyte(s) in all samples in the associated preparatory batch		p. 44, LCS/LCSD 280-24214/6,7 GRO = 83, 85 OK
Matrix Spike (MS)	One MS per preparatory batch per matrix (see box ID- 11)	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken,	Lab: For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	No MS/MSD submitted with this SDG
Matrix Spike Duplicate (MSD) or Sample Duplicate	One per preparatory batch per matrix	RPD ≤30% (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	Lab: For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	No MSD performed with this SDG
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD ≤30%	Qualify sample	For the specific analyte(s) in the parent & dup samples, apply J- flag if acceptance criteria are not met.		ST012-W11-WG-090214/ ST012-DUP01-WG-090214 RPD = 3.6%

ED_005025_00007837-00181

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Surrogate Spike (Analytes Identified in Appendix DoD-D)	All field and QC samples	QC acceptance criteria for LCS specified by DoD, if available; otherwise method- specified criteria or laboratory's own in-house criteria	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary.	For the specific analyte(s) in all field samples collected from the same site matrix as the parent, apply J-flag if acceptance criteria are not met. For QC samples, apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Alternative surrogates are recommended when there is obvious chromatographic interference.	p. 40 ST012-W11-WG-090214= 147% ST012-DUP01-WG-090214=149% ***No flags; samples diluted 10x***
Confirmation of Positive Results (Second Column or Second Detector)	All positive results must be confirmed (in Method 8081A exclude toxaphene and technical chlordane, in Method 8015B exclude GRO, DRO, and residual range organics (RRO)).	Calibration and QC criteria same as for initial or primary column analysis. Results between primary and second column RPD ≤ 40%.	NA	Apply J-flag if RFD > 40% or Q-flag if sample is not confirmed. Discuss in the case narrative.	Report the higher of two confirmed results unless overlapping peaks are causing erroneously high results, then report the non- affected result and document in the case narrative.	NA
Results Reported Between LOD and LOQ	NA	NA	NA	Apply J-flag to all results between LOD and LOQ. Validator flags: If using AFCEE; Apply "F" flag		No targets detected between LOD and LOQ

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
QC Blanks (Trip Blanks, Equipment Blanks, and Field Blanks)	Trip Blank – one per cooler containing samples for volatile parameters Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value (10x for common lab contaminants) are qualified as estimated and flagged "B"		TB01-090214 ST012-EB01-090214 Not analyzed for GRO

Method Validated: 8015B (TPH-DRO) | Initial Review by: D. Knaub | Date: 10/21/14 | SDG#:280-59565-1
Senior Review by: J. Hartness | Date: 10/27/14 | Matrix: Groundwater

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C)	QC acceptance criteria published by DoD, if available; otherwise method- specified criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	Not applicable (NA)	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	ok
Method Detection Limit (MDL) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly MDL verification checks shall be performed (see box 0-18)	See 40 CFR 1368. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL verification check at higher level and set MDL higher or reconduct MDL study (see box D-18).	NA	Samples cannot be analyzed without a valid MDL.	ok
Retention Time (RT) Window Width Calculated for Each Analyte and Surrogate	At method set-up and after major maintenance (e.g., column change)	RT width is ± 3 times standard deviation for each analyte RT from 72-hour study.	NA	NA		
Breakdown Check (Endrin/ DDT Method 8081 Only)	Daily prior to analysis of samples	Degradation ≤ 15% for both Endrin and DDT.	Correct problem then repeat breakdown check.	Flagging criteria are not appropriate	No samples shall be run until degradation ≤ 15%.	NA TPH-DRO

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Container, Preservation, and Holding Time	All field samples	GRO- Water: 40 ml VOA vial; HCl to pH < 2, Cool to 6°C Soil: (low-level) 5 g in 40 ml VOA w/H_2O or sodium bisulfate; Cool to 6°C (high-level) 5 g in 40 ml VOA w/methanol, Cool to 6°C, or EnCore® or equivalent (48 hrs to preservation) 14 days to analysis DRO – Water: 1 L Amber glass, Cool to 6°C Soil: 4 oz amber glass jar, Cool to 6°C Water: 7 days to extraction Soil: 14 days to extraction 40 days to analysis	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collected: 9/02/14 Temp= 6.7 **°C** Extracted; 9/04/14 Analyzed: 9/09/14 ***ok***

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Minimum Five-Point Initial Calibration For All Analytes (ICAL)	Initial calibration prior to sample analysis	One of the options below (except for Method 8082, which may only use Option 1 or 2): Option 1: RSD for each analyte ≤ 20% Option 2: linear least squares regression: r 2 ≥0.995 Option 3: non-linear regression: coefficient of determination (COD) r2 ≥0.99 (6 points shall be used for second order, 7 points shall be used for third order)	Correct problem then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed. For PCB analysis, a mixture of Aroclors 1016 and 1260 is normally used to establish detector calibration linearity, unless project-specific data suggest the presence of another Aroclor (e.g., 1232). In addition, a mid-level or lower standard for each of the remaining Aroclors is analyzed for pattern recognition and response factor.	p. 484 Inst SGC_U 7/16/14 OK
Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 20% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	p. 522 ICV 280-234596/11 7/16/14 Inst SGC_U
Retention Time Window Position Establishment for Each Analyte and Surrogate	Once per ICAL and at the beginning of the analytical shift	Position shall be set using the midpoint standard of the calibration curve or the value in the CCV run at the beginning of the analytical shift.	NA	NA		p. 483 ICAL

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Retention Time Window Verification for Each Analyte and Surrogate	Each calibration verification standard	Analyte within established window	Correct problem, then reanalyze all samples analyzed since the last acceptable retention time check. If they fail, redo ICAL and reset retention time window,	Flagging criteria are not appropriate for initial verification. For CCV, apply a Q-flag to all results for analytes outside the established window.	No samples shall be run without a verified retention time window at the initial verification. For method 8015, check state methods for use of modified retention time markers with gasoline range organics (GRO) or diesel range organics (DRO).	p. 523 ICV p. 530 CCV p. 537 CCV
Calibration Verification (Initial [ICV] and Continuing [CCV])	ICV: Daily, before sample analysis CCV: After every 10 field samples and at the end of the analysis sequence	All analytes within ± 20% of expected value from the ICAL	ICV: Correct problem, rerun ICV. If that fails, repeat initial calibration. See section 5.5.10 and box 55. CCV: Correct problem then repeat CCV and reanalyze all samples since last successful calibration verification.	ICV: Flagging criteria are not appropriate. CCV: Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification, if . reanalysis is not possible.	If %D for an individual analyte is > 20%, no samples may be analyzed until the problem has been corrected.	p. 529 CCVRT 280-242565/4 9/09/14 Inst SGC_U p. 536 CCV 280-242565/12 9/09/14 Inst SGC_U
Method Blank	One per preparatory batch	No analytes detected > ½RL. For common laboratory contaminants, no analytes detected > RL.	Correct problem, then see criteria in box 0-5; if required, reprep then reanalyze method blank and all samples processed with the contaminated blank.	Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch		p. 46 MB 280-241972/1-A DRO=ND

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Laboratory Control Sample (LCS) Containing All Analytes Required to be Reported, Including Surrogates	One LCS per preparatory batch	QC acceptance criteria specified by DoD, if available; see box D-7 and Appendix DoD-D .	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix DoD D)	If corrective action fails apply J-flag to specific analyte(s) in all samples in the associated preparatory batch		p. 46 LCS/LCSD 280-241972/ 2-A,3-A DRO = 70, 84 RPD = 17
Matrix Spike (MS)	One MS per preparatory batch per matrix (see box ID- 11)	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken,	Lab: For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	No MS/MSD submitted with this SDG
Matrix Spike Duplicate (MSD) or Sample Duplicate	One per preparatory batch per matrix	RPD ≤30% (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	Lab: For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	No MSD or lab dup performed with this SDG
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD ≤30%	Qualify sample	For the specific analyte(s) in the parent & dup samples, apply J- flag if acceptance criteria are not met.		ST012-W11-WG-090214/ ST012-DUP01-WG-090214 RPD = 1.8%

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Surrogate Spike (Analytes Identified in Appendix DoD-D)	All field and QC samples	QC acceptance criteria for LCS specified by DoD, if available; otherwise method- specified criteria or laboratory's own in-house criteria	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary.	For the specific analyte(s) in all field samples collected from the same site matrix as the parent, apply J-flag if acceptance criteria are not met. For QC samples, apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Alternative surrogates are recommended when there is obvious chromatographic interference.	p. 41 **All ok**
Confirmation of Positive Results (Second Column or Second Detector)	All positive results must be confirmed (in Method 8081A exclude toxaphene and technical chlordane, in Method 8015B exclude GRO, DRO, and residual range organics (RRO)).	Calibration and QC criteria same as for initial or primary column analysis. Results between primary and second column RPD ≤ 40%.	NA	Apply J-flag if RFD > 40% or Q-flag if sample is not confirmed. Discuss in the case narrative.	Report the higher of two confirmed results unless overlapping peaks are causing erroneously high results, then report the non- affected result and document in the case narrative.	NA
Results Reported Between LOD and LOQ	NA	NA	NA	Apply J-flag to all results between LOD and LOQ. Validator flags: If using AFCEE; Apply "F" flag		No targets detected between LOD and LOQ

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
QC Blanks (Trip Blanks, Equipment Blanks, and Field Blanks)	Trip Blank – one per cooler containing samples for volatile parameters Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value (10x for common lab contaminants) are qualified as estimated and flagged "B"		ST012-EB01-090214 not analyzed for DRO

Method Validated: 9056A

Initial Review by: D. Knaub Date: 10/21/14
Senior Review by: J. Hartness Date: 10/27/14

SDG#: 280-59565-1
Matrix: Groundwater

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C)	QC acceptance criteria published by DoD, if available; otherwise method- specified criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	Not applicable (NA)	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	ok
Limit of Detection Determination and Verification (LOD) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly LOD verification checks shall be performed (see box D-13)	See 40 CFR 1368. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL / LOD verification check at higher level and set MDL higher or reconduct MDL study (see box D-13).	NA	Samples cannot be analyzed without a valid MDL.	p. 1233 6/16/2013
Limit of Quantitation Establishment and Verification (LOQ) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly LOQ verification checks shall be performed (see box D-14)	Within calibration range including low standard; within method precision and accuracy.	Re-run LOQ	NA	Samples cannot be analyzed without a valid LOQ	MRL check: Level 4 Package Pg. 1232, 1323 (9/03/14) = All OK

Method Validated: 9056A

Initial Review by: D. Knaub Date: 10/21/14
Senior Review by: J. Hartness Date: 10/27/14

SDG#: 280-59565-1
Matrix: Groundwater

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Retention Time (RT) Window Width Calculated for Each Analyte and Surrogate	At method set-up and after major maintenance (e.g., column change)	RT width is ± 3 times standard deviation for each analyte RT from 24-hour study.	NA	NA		OK
Container, Preservation, and Holding Time	All field samples	500 ml poly, Cool to 4°C Nitrate – 48 hours Nitrite, sulfate, chloride – 28 days	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collected: 9/02/14 Temp: 6.7°C Analyzed: 9/03/14
ICAL for All Analytes (Minimum Three Standards and One Calibration Blank)	Initial calibration prior to sample analysis	R ≥ 0.995	Correct problem then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed.	p. 1237 Level IV package 8/27/14 6 levels Inst. 11 OK
Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 10% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	p. 1228, 1237 Level 4 Package OK
Retention Time Window Position Establishment for Each Analyte and Surrogate	Once per ICAL and at the beginning of the analytical shift	Position shall be set using the midpoint standard of the calibration curve or the value in the CCV run at the beginning of the analytical shift.	NA	NA		OK

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Midrange Continuing Calibration Verification (CCV)	After every 10 field samples and at end of the analysis sequence.	All analytes within established retention time windows and within ± 10% of true value	Correct problem then repeat CCV. If that fails, then repeat ICAL. Reanalyze all samples since last successful calibration verification.	Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification, if . reanalysis is not possible.	No samples may be analyzed until the problem has been corrected.	p. 1227, 1228 Level IV Package 9/03/14 All OK
Method Blank	One per preparatory batch	No analytes detected > ½ RL. See box D-1.	Correct problem, then see criteria in box D-1; if required, reprep then reanalyze method blank and all samples processed with the contaminated blank.	Lab: Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch. Validator; Apply "B" flag if result is less than 5x method blank.		p. 54 MB 280-24164/6 ortho-P = ND p. MB 280-241650/6 Br, Cl, SO4 = ND p. 1227: CCBs ortho-P All ND p. 1228: CCBs Cl 21:12 0.63 mg/L – ***no flag; samples >5x blank amount***
Laboratory Control Sample (LCS) Containing All Analytes Required to be Reported, Including Surrogates	One LCS per preparatory batch	Use laboratory in-house LCS acceptance criteria (not to exceed 20%).See Box D-3.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix G)	If corrective action fails apply J-flag to specific analyte(s) in all samples in the associated preparatory batch		p. 54 ortho-P = 95, 95 OK p. 57 Br = 98, 98 Cl = 98, 98 SO4 = 95, 94 All OK

Method Validated: 9056A

Initial Review by: D. Knaub Date: 10/21/14
Senior Review by: J. Hartness Date: 10/27/14

SDG#: 280-59565-1
Matrix: Groundwater

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Matrix Spike (MS)	One MS per preparatory batch per matrix (see box D- 7)	For matrix evaluation, use laboratory in-house LCS acceptance criteria (not to exceed 20%).	Examine the project-specific 000s. Contact the client as to additional measures to be taken,	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	No MS/MSDs from this SDG.
Matrix Spike Duplicate (MSD) or Sample Duplicate	One per preparatory batch per matrix	RPD ≤15% (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	NA
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD ≤10%	Qualify sample	For the specific analyte(s) in the parent & dup samples, apply J- flag if acceptance criteria are not met.		ST012-W11-WG-090214/ ST012-DUP01-WG-090214 See RPDs below
Results Reported Between LOD and LOQ	NA	NA	NA	Apply J-flag to all results between LOD and LOQ. Validator flags: If using AFCEE; Apply "F" flag		No detections between LOD and LOQ
QC Blanks (Equipment Blanks and Field Blanks)	Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value (10x for common lab contaminants) are qualified as estimated and flagged "B".		ST012-EB01-090214 not analyzed for anions

Method Validated: 9056A

Initial Review by: D. Knaub Date: 10/21/14
Senior Review by: J. Hartness Date: 10/27/14

SDG#: 280-59565-1
Matrix: Groundwater

Field Duplicates:

	ST012-W11-WG-090214/	ST012-DUP01-WG-090214	RPD	
Br	2.6	1.5	53.7	Flag both results "J"
Cl	780	780	0.0	
SO4	6.4	6.6	3.1	

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Method Validated: 6010

Initial Review by: D. Knaub Date: 10/21/14 SDG#:280-59565-1
Senior Review by: J. Hartness Date: 10/27/14 Matrix: Groundwater

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C)	QC acceptance criteria published by DoD, if available; otherwise method- specified criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	Not applicable (NA)	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	Ok
Instrument Detection Limit (IDL) Study	At initial set-up and after significant change in instrument type, personnel, test method, or sample matrix	IDL shall be ≤ Limit of Detection (LOD)	NA	NA		p. 589 6/11/13
Container, Preservation, and Holding Time	All field samples	Water: 500 ml Poly, HNO_3 to pH < 2, Cool to 6°C, Soil: 4 oz glass or poly jar, Cool to 6°C 180 days to analysis	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collection date: 9/02/14 Prep; 9/05/14 Analysis date: 9/05/14, 9/08/14 (Mg and K) Temp:6.7 °C

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Initial calibration (ICAL) for all analytes (minimum one high standard and a calibration blank)	Daily ICAL prior to sample analysis	If more than one calibration standard is used, r ≥ 0.995.	Correct problem then repeat ICAL.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed.	p. 599 run log (Ca, Fe, Mg, Na) ICIS analyzed 9/05/2014 13:36 IC analyzed 9/05/2014 13:39 and 13:41 p. 601 run log (K, Mn) ICIS analyzed 9/08/14 10:58 IC analyzed 9/0814 11:00 and 11:03
Second Source Calibration Verification (ICV)	Once after each ICAL, prior to beginning sample run	Value of second source for all analytes within ± 10% of true value	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	p. 568 ICVH 280-242265/6 9/05/2014 All OK p. 569 ICV 280-242265/7 9/05/2014 All OK p. 570 ICVL 280-242265/8 9/05/2014 All OK p. 571 ICVH 280-242487/6 9/08/14 p. 572 ICV 280-242487/7 9/08/14 p. 573 ICVL 280-242487/8 9/08/14

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TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Continuing Calibration Verification (CCV)	After every 10 field samples and at the end of the analysis sequence	All analytes within ± 10% of true value	Correct problem, rerun CCV. If that fails, then repeat ICAL. Reanalyze all samples since last successful calibration verification	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) of interest in all samples since the last acceptable CCV. Validator flags: If using AFCEE; Apply "J" flag only if reanalysis cannot be performed	Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	p. 568 CCVH 280-242265/24,36 9/05/14 All OK p. 569 CCV 280-242265/25, 37 9/05/14 All OK p. 570 CCVL 280-242265/27, 39 9/05/14 All OK Fe=117% ***No flag: samples high level*** p. 571 CCVH 280-242487/68, 80 9/08/2014 All OK p. 572 CCV 280-242487/69, 81 9/08/14 All OK p. 573 CCVL 280-242487/71, 83 9/08/14 All OK
Low-level calibration check standard	Daily, after one-point ICAL	Within ± 20% of true value	Correct problem, then reanalyze	Flagging criteria are not appropriate.	No samples may be analyzed without a valid low-level calibration check standard. Low-level calibration check standard should be less than or equal to the reporting limit.	p. 574 ***All OK***
Linear dynamic range or high-level check standard	Every 6 months -	Within ±10% of expected value	NA	NA		p. 597 7/21/14

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Method Blank	One per preparatory batch	No analytes detected > ½ RL and greater than 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1).	Correct problem, then see criteria in box D-1; if required, reprep then reanalyze method blank and all samples processed with the contaminated blank.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch	Problem must be corrected. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where samples cannot be reanalyzed.	p. 48 MB-280-241934/1-A All ND
Calibration blank	Before beginning a sample run, after every 10 samples, and at end of the analysis sequence	No analytes detected > LOD	Correct problem. Reprep and reanalyze calibration blank. All samples following the last acceptable calibration blank must be reanalyzed	Apply B-flag to all results for specific analyte(s) in all samples associated with the blank.		p. 575 9/05/14 ICB/CCBs 280-252265/12,26,38 All ND p. 576 9/08/14 ICB/CCBs 280-242487/11, 70, 82 Mn = 0.250 J x 5 = 1.25 ug/L Mn = 0.280 J x 5 = 1.4 ug/L *Mn detected in samples at 5x greater than CCB: No qualification required*
Interference check solutions (ICS-A and ICS-AB)	At the beginning of an analytical run and every 12 hours	ICS-A: Absolute value of concentration for all non-spiked analytes < LOD (unless they are a verified trace impurity from one of the spiked analytes) ICS-AB: Within ±20% of expected value	Terminate analysis, locate and correct problem, reanalyze ICS, reanalyze all samples.	If corrective action fails, apply Q-flag to all results for specific analyte(s) in all samples associated with the ICS. Validator flags: If using AFCEE; Apply "M" flag		p. 579 9/05/14 ICSA - All OK p. 580 9/05/14 ICS-AB All OK p. 581 9/08/14 ICS-A Mn >LOD *No qualification- vendor verified trace impurities* p. 582 9/08/14 ICS-AB All OK

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Method Validated: 6010 | Initial Review by: D. Knaub | Date: 10/21/14 | SDG#:280-59565-1
Senior Review by: J. Hartness | Date: 10/27/14 | Matrix: Groundwater

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Laboratory Control Sample (LCS) Containing All Analytes to be Reported	One per preparatory batch	QC acceptance criteria specified by DoD, if available; see box D-3 and Appendix G.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix G)	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch Validator flags: If using AFCEE; Apply "J" flag	Problem must be corrected. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	p. 49 LCS-280-241934/2-A 9/05/14 All OK
Matrix Spike (MS)	One per preparatory batch per matrix (see box D-7)	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS.	Examine the project-specific DQOs. If the matrix spike falls outside of DoD criteria, additional quality control test (dilution test and post-digestion spike addition) are required to evaluate matrix effects.	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	p. 51 ST012-W11-WG-090214 All ok
Matrix Spike Duplicate (MSD)	One per preparatory batch per matrix (see Box D-7)	MSD: For matrix evaluation use QC acceptance criteria specified by DoD for LCS MSD RPD < 20%	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	p. 51 ST012-W11-WG-0714 RPDs All ok
Dilution test	Once per preparatory batch	Five-fold dilution must agree within ± 10% of the original measurement	Perform post-digestion spike addition.	Flagging criteria are not appropriate.	Only applicable for samples with concentrations > 50 x LOQ.	p. 53 ST012-W11-WG-090214 All OK
Post digestion spike addition	When dilution test fails or analyte concentration for all samples < 50 x LOQ	Recovery within 75-125% of (see Table B-1)	Run all associated samples in the preparatory batch by method of standard additions (MSA) or see flagging criteria.	For specific analyte(s) in the parent sample, apply J-flag of acceptance criteria are not met.	Spike addition should produce a concentration of 10 - 100 x LOQ	p. 50 Ca = 61% Mn = ~25% ***No qualification: sample results greater than 4x spike amount***

Method Validated: 6010

Initial Review by: D. Knaub Date: 10/21/14 SDG#:280-59565-1
Senior Review by: J. Hartness Date: 10/27/14 Matrix: Groundwater

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Method of standard additions (MSA)	When matrix interference is suspected	NA	NA	NA	Document use of MSA in the case narrative.	NA
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD 20%	Qualify samples	For the specific analyte(s) in the parent & dup samples, apply J-flag if acceptance criteria are not met.		ST012-W11-WG-090214/ ST012-DUP01-WG-090214 See RPDs below – all ok
Results Reported Between LOD and LOQ	NA	NA	NA	Apply J-flag to all results between DL and LOQ. Validator flags: If using AFCEE; Apply "F" flag		Results reported between MDL and RL flagged "F" for AFCEE.
QC Blanks (Equipment Blanks, and Field Blanks)	Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value are qualified as estimated and flagged "B".		ST012-EB01-090214 not analyzed for metals

Field Duplicates:

	ST012-W11-WG-090214/	ST012-DUP01-WG-090214	RPD
Ca	300000	310000	3.3
Fe	140	150	6.9
Mg	67000	68000	1.5
Na	76000	78000	2.6
Mg	2000	2100	4.9
K	16000	16000	0.0

Data Evaluation Narrative
AMEC Project: Former Williams AFB
AMEC Project Number: 9101110001.5300.5301
Site: ST012 – Enhanced Bioremediation Field Test
Sampling Event: September 2014
Matrix: Groundwater

SDG: 280-59588-1

1.0 INTRODUCTION

A data quality evaluation (DQE) was performed on the data reported for the Enhanced Bioremediation field test conducted at Site ST012 in September 2014, at the former Williams Air Force Base (AFB), Mesa, Arizona. The following sections provide summary discussions of the required data qualifications for each site and analytical methods for samples collected at the former WAFB. Data validation was conducted on 100% of the primary samples and field quality control samples (trip blanks, rinsate blanks, sample duplicates, and matrix spike/matrix spike duplicate [MS/MSD] samples). A Level III (Step IIB) data validation was performed using supplemental checklists to review the following quality control elements: laboratory case narrative, sample documentation, chain-of-custody, holding time protocols, method-specific calibration information, mass tunes, method blank results, laboratory control sample (LCS) results, surrogate recoveries (where applicable), MS/MSD recoveries and relative percent differences (RPDs), field duplicate RPDs, trip and equipment/rinsate blanks, method-specific QC elements (such as interelement check standards (ICS), serial dilutions, post digestion spikes (PDS), column breakdown, etc.), method sensitivity, and completeness. The Level III DQE checklists are attached to this narrative.

Data were reviewed using precision and accuracy control limits presented in The Department of Defense (DoD) Quality Systems Manual (QSM) Version 4.2 (DoD, 2010). DQE data qualifications were applied if necessary in accordance with procedures in Air Force Center for Environmental Excellence (AFCEE) Quality Assurance Project Plan (QAPP), Version 4.0.01 (AFCEE, 2005), the method, and professional judgment using the following qualifiers:

- J = The reported concentration is considered an estimated value due to discrepancies in meeting certain analyte-specific quality control criteria.
- F = The reported concentration is between the limit of quantitation/reporting limit (LOQ/RL) and method detection limit (MDL) and is considered an estimated value
- UJ = The target compound was not detected and the reporting limit is considered imprecise due to discrepancies in meeting certain analyte-specific quality control criteria.
- B = The result may be biased high or a false positive based on blank data.
- M = The reported concentration is estimated due to matrix effects.
- R = The data are considered unusable due to discrepancies in meeting certain quality control criteria and may not be used in decision making.

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2.0 DELIVERABLES

The data packages as submitted to AMEC Environment and Infrastructure, Inc. (AMEC) are complete as stipulated in the Draft Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) for Site ST012 Enhanced Bioremediation Field Test Plan (AMEC, 2014), and the applicable guidelines described in the former Williams AFB Performance Based Remediation Program QAPP and standard operating procedures (SOPs) (collectively referred to as the QAPP/SOP [AMEC, 2012]) for U.S. States Environmental Protection Agency (EPA) Methods SW8260B, SW8015B, SW9056A, and SW6010C.

3.0 SAMPLE INTEGRITY

Samples within this sample delivery group (SDG) collected from ST012 were submitted to TestAmerica Laboratories (TAL) in Denver, Colorado for select volatile organic compounds (VOCs) analysis by USEPA Method SW8260B, total petroleum hydrocarbons-gasoline range organics (TPH-GRO) and diesel range organics (TPH-DRO) by Method SW8015B, anions by Method SW9056A and select metals by Method SW6010C.

Based on the information provided on the cooler receipt forms, samples arrived at the laboratory within the recommended temperature and preservation requirements. Completed Chain-of-Custody (COC) documents are included in the data package.

4.0 SAMPLE IDENTIFICATION

This SDG contains the following water and quality control (QC) samples:

Site: ST012	QC Samples
ST012-W30-WG-090214	TB01-090314

These samples were collected on 2 and 3 September 2014.

5.0 SAMPLE QUALIFICATION

Only those components that required qualification of the data are presented in this narrative. All Level III components were within the DoD QSM QC limits, with the following exceptions:

- Constituents were present in the associated blanks and flagged “B”.
- Surrogate recoveries were outside QC limits and results flagged “J”.
- Metals were detected in the Interference Check Solution A (ICSA) (no qualification required).
- PDS recoveries were outside QC limits for two metals (no flags applied).
- MS/MSD recoveries were outside of QC limits and results flagged “M”.

6.0 VOCS (SW8260B)

Samples collected from site ST012 were submitted for VOCs by EPA Method SW8260B and analyzed for site-specific VOC compounds of interest (COIs).

A Level III validation was performed on this method and only those components that exceeded the QAPP/SOP criteria are presented below. Each of the Level III components was within the QAPP/SOP QC criteria; however the following qualification was noted:

- Constituents were present in the associated blanks and flagged "B".

6.1 Method Blank

The method blank for this SDG contained methylene chloride (1.01 J micrograms per liter [µg/L]). Any associated sample with results less than 5x (10x for common contaminants) the method blank results were considered as possibly biased high or false positive and flagged "B". The 5x/10x rule was applied to the raw response in the sample prior to dilution and sample volume calculations.

Action: The methylene chloride results in each of the samples in this SDG were qualified as estimated with a possible high bias and flagged "B".

6.2 Trip Blank

The trip blank sample in this SDG contained methylene chloride at 0.36 J µg/L. Any associated sample with results less than 5x (10x for common contaminants) the blank results were considered as possibly biased high or false positive and flagged "B".

Action: The methylene chloride result for the trip blank sample was qualified as possibly biased high due to method blank contamination: therefore, no additional qualification was necessary.

6.3 Limits of Quantitation

The LOQs as specified in the QAPP/SOP (AMEC, 2012) were met for samples submitted for the analysis of VOCs by USEPA Method SW 8260B except where dilutions were required to place the constituent within the calibration range. Dilutions were required. The laboratory indicated a dilution with a "D" qualifier which was subsequently removed during the validation process.

Any result reported between the LOQ and MDL is considered a quantitative estimate. No results in this SDG were reported between the RL and MDL.

7.0 TPH-GRO (8015B)

Samples collected from Site ST012 were submitted for TPH-GRO analysis by EPA Method SW8015B. A Level III validation was performed on this method and only those components that

exceeded the program document QAPP/SOP criteria are presented below. Qualification was required for the following:

- Surrogate recoveries were outside QC limits and associated results flagged "J".

7.1 Surrogate Recoveries

Surrogate a,a,a-trifluorotoluene recovered above the QC limits in sample ST012-W30-WG-090214. No qualification is required if the samples were diluted or the surrogate recoveries were high and the sample results were non-detect.

Action: The GRO result for sample ST012-W30-WG-090214 was qualified as estimated and flagged "J".

7.2 Limits of Quantitation

The LOQ as specified in the QAPP/SOP (AMEC, 2012) was met for samples submitted for the analysis of TPH-GRO by EPA Method SW8015B except where dilutions were required to place the constituent within the calibration range. Due to high levels of TPH-GRO, one sample reported with this SDG (ST012-W30-WG-090214) was prepared using a reduced aliquot size to bring the results into the linear calibration range, resulting in an elevated RL.

8.0 TPH-DRO (8015B)

Samples collected from Site ST012 were submitted for TPH-DRO analysis by EPA Method SW8015B. A Level III validation was performed on this method and each of the components met the program document QAPP/SOP criteria. It should be noted that the laboratory placed an "M" qualifier on any result that was manually integrated. The "M" qualifier was subsequently removed during the data validation process.

8.1 Limits of Quantitation

The LOQ as specified in the QAPP/SOP (AMEC, 2012) was met for samples submitted for the analysis of TPH-DRO by EPA Method SW8015B. Dilutions were not required for TPH-DRO.

9.0 ANIONS (SW9056A)

Samples collected from site ST012 were submitted for Anions by Method SW9056A. A Level III validation was performed on this method and only those components that exceeded the QAPP/SOP criteria are presented below. Qualification was required for the following:

- MS/MSD recoveries were outside QC limits and results were flagged "M".

9.1 Matrix Spike/Matrix Spike Duplicate

An MS/MSD was performed on sample ST012-W30-WG-090214 for anions, and the recoveries were outside of QC limits for bromide and chloride.

Action: No qualification was necessary for chloride because the sample was analyzed at a dilution. The bromide result for sample ST012-W30-WG-090214 was qualified as estimated and flagged "M".

9.2 Limits of Quantitation

The LOQs as specified in the QAPP/SOP (AMEC, 2012) were met for samples submitted for the analysis of Anions by USEPA Method SW 9056A with the exception of analytes that required dilution. The sample in this SDG required dilution for chloride resulting in elevated LOQs. The laboratory indicated a dilution with a "D" qualifier which was subsequently removed during the validation process.

10.0 METALS (SW6010C)

Samples collected from Site ST012 were submitted for the major metal cations by EPA Method SW6010C. Samples were analyzed for calcium, iron, magnesium, manganese, potassium, and sodium. A Level III validation was performed on this method and only those components that required qualification of the data are presented in this narrative. All Level III validation was performed on this method and only those components that exceeded the SAP/TAL SOP criteria are presented below. The following components exceeded the QC criteria or were noted:

- Constituents were present in the associated blanks and flagged "B" (no flags applied).
- Metals were detected in the Interference Check Solution A (ICSA) (no qualification required).
- PDS recoveries were outside QC limits for two metals (no flags applied).
- Results were present between the MDL and LOQ and flagged "F".

10.1 Method Blanks

The method blank showed the presence of low levels of calcium (375 J µg/L). Associated sample results less than 5x the blank value were qualified as estimated and flagged "B".

Action: No qualification was required because the associated calcium result in the sample was greater than 5 x the blank value.

10.2 Continuing Calibration Blanks

Two CCBs showed the presence of low levels of magnesium (0.270 J µg/L and 0.330 µg/L). Associated sample results less than 5x the blank value were qualified as estimated and flagged "B".

Action: No qualification was required because the associated manganese results in the samples were greater than 5 x the blank value.

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10.3 Interference Check Solution A (ICSA)

Manganese was detected in the ICSA solution associated with prep batch 280-242295. The vendor verified that the ICSA contained these trace impurities.

Action: No qualification is required for impurities verified by the vendor.

10.4 Post Digestion Spike

The laboratory performed a PDS on sample ST012-W30-WG-090214 and the recoveries for calcium and manganese were outside of the QC limits. No qualification is required if the recoveries were high and the samples were non-detect or the analyte was present in the sample at concentrations greater than 4x the spike amount.

Action: No qualification was required for calcium and manganese results in sample ST012-W30-WG-090214 because the metals were present in the sample at greater than 4x the spike amount.

10.5 Limits of Quantitation

The LOQs as specified in the QAPP/SOP (AMEC, 2012) were met for samples submitted for the analysis of metals by USEPA Method SW6010C except where dilutions were required to place the constituent concentration within the calibration range. No Dilutions were required.

11.0 OVERALL SITE EVALUATION AND PROFESSIONAL JUDGMENT

Edits to the DQE qualifiers by professional judgment were not required.

12.0 SUMMARY OF DATA QUALITY INDICATORS

This section provides an assessment of the data based on project data quality indicators (DQIs) described on QAPP Worksheet #37 of the Program Document QAPP/SOP (AMEC, 2012). The DQIs consist of precision, accuracy, representativeness, comparability, completeness, and sensitivity.

12.1 Precision

An assessment of precision of analytical data is accomplished via review of field duplicate and MS/MSD analyses. Field duplicate and MS/MSD analyses are used to assess field variability, which includes sample collection/handling as well as matrix homogeneity. Precision is expressed as the relative percent difference (RPD) between results for duplicate pairs.

No field duplicate samples or project specific MS/MSDs were submitted; however, a MS/MSD was performed on a project sample for metals and anions and the RPDs were within QC limits. Precision for TPH-GRO and TPH-DRO was evaluated through the analysis of the LCS/LCSD and the RPDs were compliant with the QAPP/SOP. The overall method and sample matrix precision are acceptable and achieve project objectives.

12.2 Accuracy (Bias)

An assessment of accuracy of analytical data is accomplished via evaluation of the spike recoveries in the MS/MSD, LCS, post digestion spike samples, and surrogate spike compounds, in addition to calibration criteria. Accuracy is expressed as percent recovery. Accuracy data were compliant with the QAPP/SOP with the exception of TPH-GRO surrogates and MS/MSD recoveries for anions. The DQE resulted in the qualification of the TPH-GRO and bromide result as estimated in one sample. Estimated data is usable data and all remaining accuracy data for the other anions, VOCs, TPH-DRO, and metals were within QC limits or did not require qualification. Therefore, the data results indicate method and matrix accuracy is acceptable to achieve project objectives.

12.3 Representativeness

Representativeness for the analytical data is determined through evaluation of the associated blank data and evaluation of appropriate sample handling procedures. All samples were properly stored and preserved in the field and at TestAmerica. Method, trip, and equipment blanks were acceptable with the exception of methylene chloride. Blank contamination resulted in qualification of the associated sample data. Based on historical results and the low-level concentrations qualified, the impacts to project DQOs were minimal; therefore, the analytical results indicate sample data are representative of the Site conditions.

12.4 Comparability

Comparability addresses the confidence with which one data set can be compared to another. Use of appropriate sampling methods, COC procedures, and EPA-approved analytical methods, as well as adherence to strict QA/QC procedures, provide the basis for uniformity in sample collection and analysis. Analytical data were generated by TestAmerica using standard reporting units of micrograms per liter for VOCs, TPH-GRO, and metals and milligrams per liter for TPH-DRO and anions. In addition, sample collection and analytical method protocols were implemented in accordance with approved, documented procedures. Analytical data are determined to be comparable to previous Site results.

12.5 Completeness

Completeness of the field sampling activities were assessed in terms of the actual number and type of sample results received from the field and laboratory, as compared with the planned number and type of sample results. All samples planned were collected which meets a field completeness of 100%.

Analytical completeness of data is a measure of the number of valid project-specific data results obtained in comparison to the total number of data results projected to achieve project DQOs. Valid data are defined as data that meet the project-specific DQOs. No data were rejected as a result of the data validation; however, some of the results were qualified as estimated. Estimated data is usable data. The completeness goals met the 90 percent goal for field and laboratory data expected for this project.

12.6 Sensitivity

Analytical methods and RLs were implemented in accordance with the QAPP/SOP and EPA promulgated methodologies. Method RLs were achieved for the event except when sample dilutions were required to bring target compounds within the linear range of the instrument calibration. As previously mentioned, the samples within this SDG required dilutions for VOCs and chloride to place the results within the calibration range. These include modified RLs for selected detections; therefore, sensitivity requirements were met for non-diluted constituents.

12.7 Usability Summary

The data generated during the September 2014 sampling event were usable with qualifications with respect to project DQOs. The DQOs for the Enhanced Bioremediation Field Test is to produce data to support design of anaerobic methods for the ST012 remedy if selected.

13.0 REFERENCES

AFCEE, 2005. Quality Assurance Project Plan, Version 4.0.01, May, 2005.

AMEC, August 11, 2014. *Draft Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) (Enhanced Bioremediation Field Test Plan) Operable Unit 2 Site ST012 - Liquid Fuels Storage Area, Former Williams Air Force Base, Mesa, Arizona*.

AMEC, February 23, 2012. *Performance Based Remediation Program Quality Assurance Project Plan (QAPP) and Standard Operating Procedures (SOPs) (QAP/SOP), Former Williams Air Force Base, Mesa, Arizona*.

DoD, 2010. Department of Defense Quality System Manual, Version 4.2 Final, October 2010.

Prepared/Date: DWK 10/23/14
Checked/Date: JAH 10/27/14

ED_005025_00007837-00209

Flagged Data Reports

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59588-1

Client Sample ID: **ST012-W30-WG-090214**

Lab Sample ID: 280-59588-1

Client Matrix: Water

Date Sampled: 09/02/2014 1037

Date Received: 09/04/2014 1000

8260B Volatile Organic Compounds (GC/MS)

Analysis Method:	8260B	Analysis Batch:	280-242744	Instrument ID:	VMS_G2
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	G2_5016.D
Dilution:	10			Initial Weight/Volume:	20 mL
Analysis Date:	09/11/2014 0223			Final Weight/Volume:	20 mL
Prep Date:	09/11/2014 0223				

DWK 10/29/14

Analyte	Result (ug/L)	Qualifier	DL	LOQ
1,2-Dichloroethane	4.0	U	1.3	10
Methylene Chloride	12	~~J D~~ B	3.2	50
m-Xylene & p-Xylene	570	~~D~~	3.4	20
Naphthalene	110	~~D~~	2.2	10
o-Xylene	130	~~D~~	1.9	10
Toluene	160	~~D~~	1.7	10
Trichloroethene (TCE)	2.0	U	1.6	10
Trichlorofluoromethane	8.0	U	2.9	20
Xylenes, Total	700	~~D~~	1.9	20

Surrogate	%Rec	Qualifier	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	102		70 - 120
4-Bromofluorobenzene (Surr)	106		75 - 120
Dibromofluoromethane (Surr)	101		85 - 115
Toluene-d8 (Surr)	105		85 - 120

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59588-1

Client Sample ID: **ST012-W30-WG-090214**

Lab Sample ID: 280-59588-1

Client Matrix: Water

Date Sampled: 09/02/2014 1037

Date Received: 09/04/2014 1000

8260B Volatile Organic Compounds (GC/MS)

Analysis Method:	8260B	Analysis Batch:	280-242801	Instrument ID:	VMS_Z
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	Z0494.D
Dilution:	100			Initial Weight/Volume:	20 mL
Analysis Date:	09/11/2014 1523	Run Type:	DL	Final Weight/Volume:	20 mL
Prep Date:	09/11/2014 1523				

DWK 10/03/14

Analyte	Result (ug/L)	Qualifier	DL	LOQ
Benzene	2700	D	16	100
Ethylbenzene	920	D	16	100

Surrogate	%Rec	Qualifier	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	88		70 - 120
4-Bromofluorobenzene (Surr)	116		75 - 120
Dibromofluoromethane (Surr)	108		85 - 115
Toluene-d8 (Surr)	107		85 - 120

Client: AMEC Environment & Infrastructure, Inc. Job Number: 280-59588-1

Client Sample ID: **TB01-090314**

Lab Sample ID: 280-59588-2TB Date Sampled: 09/02/2014 0000
Client Matrix: Water Date Received: 09/04/2014 1000

8260B Volatile Organic Compounds (GC/MS)

Analysis Method:	8260B	Analysis Batch:	280-242744	Instrument ID:	VMS_G2
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	G2_5018.D
Dilution:	1.0			Initial Weight/Volume:	20 mL
Analysis Date:	09/11/2014 0304			Final Weight/Volume:	20 mL
Prep Date:	09/11/2014 0304				

DWK 10/03/14

Analyte	Result (ug/L)	Qualifier	DL	LOQ
1,2-Dichloroethane	0.40	U	0.13	1.0
Benzene	0.20	U	0.16	1.0
Ethylbenzene	0.20	U	0.16	1.0
Methylene Chloride	0.36	J B	0.32	5.0
m-Xylene & p-Xylene	0.80	U	0.34	2.0
Naphthalene	0.80	U	0.22	1.0
o-Xylene	0.40	U	0.19	1.0
Toluene	0.40	U	0.17	1.0
Trichloroethene (TCE)	0.20	U	0.16	1.0
Trichlorofluoromethane	0.80	U	0.29	2.0
Xylenes, Total	1.6	U	0.19	2.0

Surrogate	%Rec	Qualifier	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	90		70 - 120
4-Bromofluorobenzene (Surr)	95		75 - 120
Dibromofluoromethane (Surr)	93		85 - 115
Toluene-d8 (Surr)	90		85 - 120

Analytical Data

Client: AMEC Environment & Infrastructure, Inc. Job Number: 280-59588-1

Client Sample ID: **ST012-W30-WG-090214**

Lab Sample ID: 280-59588-1 Date Sampled: 09/02/2014 1037
Client Matrix: Water Date Received: 09/04/2014 1000

8015B_GRO Gasoline Range Organics (GRO)

Analysis Method:	8015B_GRO	Analysis Batch:	280-243077	Instrument ID:	VGC_Q
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	001F0701.D
Dilution:	1.0			Initial Weight/Volume:	0.25 mL
Analysis Date:	09/12/2014 1258			Final Weight/Volume:	5 mL
Prep Date:	09/12/2014 1258			Injection Volume:	5 mL

Analyte	Result (ug/L)	Qualifier	DL	LOQ
Gasoline Range Organics (GRO)-C6-C10	13000	J	200	500

Surrogate	%Rec	Qualifier	Acceptance Limits
a,a,a-Trifluorotoluene	154	Q *	82 - 110

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59588-1

Client Sample ID: **TB01-090314**

Lab Sample ID: 280-59588-2TB

Client Matrix: Water

Date Sampled: 09/02/2014 0000

Date Received: 09/04/2014 1000

8015B_GRO Gasoline Range Organics (GRO)

Analysis Method:	8015B_GRO	Analysis Batch:	280-242714	Instrument ID:	VGC_Q
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	020F2001.D
Dilution:	1.0			Initial Weight/Volume:	5 mL
Analysis Date:	09/09/2014 2228			Final Weight/Volume:	5 mL
Prep Date:	09/09/2014 2228			Injection Volume:	5 mL

Analyte	Result (ug/L)	Qualifier	DL	LOQ
Gasoline Range Organics (GRO)-C6-C10	20	U	10	25

Surrogate	%Rec	Qualifier	Acceptance Limits
a,a,a-Trifluorotoluene	87		82 - 110

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59588-1

Client Sample ID: **ST012-W30-WG-090214**

Lab Sample ID: 280-59588-1

Client Matrix: Water

Date Sampled: 09/02/2014 1037

Date Received: 09/04/2014 1000

8015B_DRO Diesel Range Organics (DRO) (GC)

Analysis Method:	8015B_DRO	Analysis Batch:	280-242565	Instrument ID:	SGC_U
Prep Method:	3510C	Prep Batch:	280-241972	Initial Weight/Volume:	1050.3 mL
Dilution:	1.0			Final Weight/Volume:	1 mL
Analysis Date:	09/09/2014 2052			Injection Volume:	1 uL
Prep Date:	09/04/2014 1712			Result Type:	PRIMARY

DWK 10/03/14

Analyte	Result (mg/L)	Qualifier	DL	LOQ
Diesel Range Organics [C10-C28]	1.2	~~M~~	0.031	0.24

Surrogate	%Rec	Qualifier	Acceptance Limits
o-Terphenyl	73	~~M~~	50 - 115

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59588-1

Client Sample ID: **ST012-W30-WG-090214**

Lab Sample ID: 280-59588-1
Client Matrix: Water

Date Sampled: 09/02/2014 1037
Date Received: 09/04/2014 1000

6010C Metals (ICP)

Analysis Method:	6010C	Analysis Batch:	280-242836	Instrument ID:	MT_026
Prep Method:	3010A	Prep Batch:	280-242295	Lab File ID:	26a091014b.asc
Dilution:	1.0			Initial Weight/Volume:	50 mL
Analysis Date:	09/10/2014 1541			Final Weight/Volume:	50 mL
Prep Date:	09/09/2014 0800				

DWH 10/03/14

Analyte	Result (ug/L)	Qualifier	DL	LOQ
Calcium	190000		35	1000
Iron	1200		22	100
Magnesium	43000		11	500
Manganese	3300	Q	0.25	10
Potassium	91000		240	3000
Sodium	62000		92	5000

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59588-1

General Chemistry

Client Sample ID: **ST012-W30-WG-090214**

Lab Sample ID: 280-59588-1

Client Matrix: Water

Date Sampled: 09/02/2014 1037

Date Received: 09/04/2014 1000

DWK 10/23/14

Analyte	Result	Qual	Units	DL	LOQ	Dil	Method
Bromide	3.5	M	mg/L	0.11	0.50	1.0	9056A
Analysis Batch: 280-243071	Analysis Date: 09/12/2014 1819						
Chloride	580	"D"	mg/L	2.5	30	10	9056A
Analysis Batch: 280-243071	Analysis Date: 09/13/2014 0535						
Sulfate	18		mg/L	0.23	5.0	1.0	9056A
Analysis Batch: 280-243071	Analysis Date: 09/12/2014 1819						

Data Quality Evaluation Checklists

Method Validated: 8260B

Initial Review by: D. Knaub Date: 10/23/14
Senior Review by: J. Hartness Date: 10/27/14

SDG#: 280-59588-1
Matrix: Groundwater

ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (METHODS 8260 AND 8270)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C).	QC acceptance criteria published by DoD, if available; otherwise method- specific criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	NA	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	Ok
MDL Study	At initial set-up and subsequently once per 12-month period; otherwise quarterly MDL verification checks shall be performed (see box D-18)	See 40 CFR 136B. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL verification check at higher level and set MDL higher or reconduct MDL study (see box D-18)	NA	Samples cannot be analyzed without a valid MDL.	Ok
Tuning	Prior to calibration and every 12 hours during sample analysis	Refer to method for specific ion criteria.	Retune instrument and verify. Rerun affected samples.	Flagging criteria are not appropriate	Problem must be corrected. No samples may be accepted without a valid tune.	p. 223 – 228 level IV package VMS_G2, ICAL/ICV, 8/27/14 VMS_G2, ICAL/ICV, 9/04/14 VMS_G2, CCV 9/10/14 VMS_Z, ICAL/ICV 8/11/14 VMS_Z ICAL/ICV 9/04/14 VMS_Z CCV 9/11/14 All ok

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ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (METHODS 8260 AND 8270)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Breakdown Check (DDT Method 8270C Only)	Daily prior to analysis of samples	Degradation ≤ 20% for DDT	Correct problem then repeat breakdown check	Flagging criteria are not appropriate	No samples shall be run until degradation ≤ 20%. Benzidine and pentachlorophenol should be present at their normal responses and no peak tailing should be observed.	NA
Container, Preservation, and Holding Time	All field samples	8260 – 40 ml VOA vial HCl to pH < 2, Cool to 4°C 14 days to analysis 8270 – 1 L Amber glass, Cool to 4°C 7 days to extraction 40 days to analysis	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collection date: 9/02/14 Analysis date: 9/10/14, 9/11/14 Temp 3.0 °C

ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (METHODS 8260 AND 8270)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Minimum Five-Point Initial Calibration For All Analytes (ICAL)	Initial calibration prior to sample analysis	Average response factor (RF) for SPCCs: VOCs - 0.30 for Chlorobenzene and 1,1,2,2-tetrachlorolethane. a 0.1 for chloromethane, bromoform, and 1,1-dicbloroethane. SVOCs - a 0.050. RSD for RFs for CCCs: The CCCs are vinyl chloride, 1,1-dichlorethene, chloroform, 1,2-dichloropropane, toluene, and ethylbenzene. VOCs and SVOCs - 30% and one option below; **Option 1**: RSD for each analyte ≤ 15% **Option 2**: linear least squares regression r a 0.995 **Option 3**: non-linear regression - coefficient of determination (COD) e a 0.99 (6 points shall be used for second order, 7 points shall be used for third order)	Correct problem then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed.	p. 252 VMS_G2, 8/27/14 All OK p. 292 VMS_G2, 9/04/14 (short list) All OK p. 314 VMS_Z, 8/11/14 (short list) All OK p. 336 VMS_Z 9/04/14 All OK
Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 25% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	p. 377, VMS_G2 ICV 280-240780/14 (8/27/14) p.384,VMS_G2 ICV(short list) 280-241807/13 p. 404, VMS_Z ICV (short list) 280-238260/16 (8/11/14) p. 408 VMS_Z (9/04/14) 280-241805/19 All OK

Method Validated: 8260B

Initial Review by: D. Knaub Date: 10/23/14 SDG#: 280-59588-1
Senior Review by: J. Hartness Date: 10/27/14 Matrix: Groundwater

ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (METHODS 8260 AND 8270)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Retention Time Window Position Establishment for Each Analyte and Surrogate	Once per ICAL	Position shall be set using the midpoint standard of the initial calibration curve.	NA			All OK
Evaluation of Relative Retention Times (RRT)	With each sample	RRT of each target analyte in each calibration standard within ± 0.06 RRT units.	Correct problem, then rerun ICAL.			All ok
Calibration Verification (CV)	Daily, before sample analysis, and every 12 hours of analysis time	Average RF for SPCCs: VOCs 0.30 for Chlorobenzene and 1,1,2,2-tetrachlorolethane, 0.1 for chloromethane, bromoform, and 1,1-dichloroethane. SVOCs 0.050. 2. %Difference/Drift for CCCs: VOCs and SVOCs ≤20%D (Note: D = difference when using RFs or drift when using least squares regression or non-linear calibration.)	Correct problem, then rerun CV. If that fails, repeat initial calibration. See section 5.5.10 and DoD clarification box 55.	Apply Q-flag if no sample material remains and analyte exceeds criteria.	NA	p. 388, VMS_G2 CCV 280-242744/2 (9/10/14) p. 395 VMS_G2 CCV (short list) 280-242744/2 (9/10/14) p. 415, VMS_Z CCV 280-242801/2 (9/11/14) p. 427 VMS_Z CCV (short list) 280-242801/3 All COIs OK
Internal Standards Verification	In all field samples and standards	Retention time ± 30 seconds from retention time of the midpoint standard in the ICAL EICP area within - 50% to + 100% of ICAL midpoint standard	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory.	If corrective action fails in field samples, apply Q-flag to analytes associated with the non-compliant IS. Flagging criteria are not appropriate for failed standards.	Flagging criteria are not appropriate.	p. 229 -234 ICIS 280-240780/11 ICIS 280-241807/10 ICIS 280-238260/13 All ok

ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (METHODS 8260 AND 8270)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Method Blank	One per preparatory batch	No analytes detected >½ RL. For common laboratory contaminants, no analytes detected > RL.	Correct problem, then see criteria in box D-5. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank.	Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.		p.40 MB 280-242744/7 MeCl = 1.01 x 10 = 10.1 ug/L ***Flag ST012-W30-WG-090214, and TB01-090314 as "B"*** p. 42 MB0280-242801/6 All ND
LCS Containing All Analytes Required to be Reported, Including Surrogates	One LCS per preparatory batch	QC acceptance criteria specified by DoD, if available; see box D-7 and Appendix DoD-D.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. (See full explanation in Appendix DoDID.	If corrective action fails, applyIQ-flag to specific analyte(s) in all samples in the associated preparatory batch.		p.41 LCS 280-242744/6 All OK p. 43 LCS 280-242801/4 All OK
MS	One MS per preparatory batch per matrix (see box D- 15)	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	Lab: For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error	No MS/MSD submitted for method 8260B
MSD or Sample Duplicate	One per preparatory batch per matrix	RPD ≤ 30% (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	Lab: For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	NA -See above

ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (METHODS 8260 AND 8270)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Surrogate Spike (Analytes Identified in Appendix DoD-D)	All field and QC samples	QC acceptance criteria for LCS published by DoD, if available; otherwise method- specified criteria or laboratory's own in-house criteria.	For QC and field samples, correct problem, then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available.	For the specific analyte(s) in all field samples collected from the same site matrix as the parent, apply J-flag if acceptance criteria are not met. For QC samples, apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.		p. 37 All OK.
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD ≤30%	Qualify sample	For the specific analyte(s) in the parent & dup samples, apply J- flag if acceptance criteria are not met.		None in this SDG
Results Reported Between MDL and LOQ	NA	NA	NA	Apply J-flag to all results between MDL and LOQ. Validator flags: If using AFCEE; Apply "F" flag		Samples qualified as estimated and AFCEE flagged "F" unless overridden by flags for other criteria
QC Blanks (Trip Blanks, Equipment Blanks, and Field Blanks)	Trip Blank – one per cooler containing samples for VOCs Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value (10x for common lab contaminants) are qualified as estimated and flagged "B"		TB01-090314 MeCl = 0.36ug/L – ***flagged "B" due to method blank – no qualification required for samples.***

Method Validated: 8015B (TPH-GRO) | Initial Review by: D. Knaub | Date: 10/23/14 | SDG#:280-59588-1
Senior Review by: J. Hartness | Date: 10/27/14 | Matrix: Groundwater

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C)	QC acceptance criteria published by DoD, if available; otherwise method- specified criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	Not applicable (NA)	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	ok
Method Detection Limit (MDL) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly MDL verification checks shall be performed (see box 0-18)	See 40 CFR 1368. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL verification check at higher level and set MDL higher or reconduct MDL study (see box D-18).	NA	Samples cannot be analyzed without a valid MDL.	ok
Retention Time (RT) Window Width Calculated for Each Analyte and Surrogate	At method set-up and after major maintenance (e.g., column change)	RT width is ± 3 times standard deviation for each analyte RT from 72-hour study.	NA	NA		
Breakdown Check (Endrin/ DDT Method 8081 Only)	Daily prior to analysis of samples	Degradation ≤ 15% for both Endrin and DDT.	Correct problem then repeat breakdown check.	Flagging criteria are not appropriate	No samples shall be run until degradation ≤ 15%.	NA TPH-GRO

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Container, Preservation, and Holding Time	All field samples	GRO- Water: 40 ml VOA vial; HCl to pH < 2, Cool to 6°C Soil: (low-level) 5 g in 40 ml VOA w/H_2O or sodium bisulfate; Cool to 6°C (high-level) 5 g in 40 ml VOA w/methanol, Cool to 6°C, or EnCore® or equivalent (48 hrs to preservation) 14 days to analysis DRO – Water: 1 L Amber glass, Cool to 6°C Soil: 4 oz amber glass jar, Cool to 6°C Water: 7 days to extraction Soil: 14 days to extraction 40 days to analysis	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collected: 9/02/14 Temp=3.0°C Analyzed: 9/09/14, 9/12/14 ***ok***

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Minimum Five-Point Initial Calibration For All Analytes (ICAL)	Initial calibration prior to sample analysis	One of the options below (except for Method 8082, which may only use Option 1 or 2): Option 1: RSD for each analyte ≤ 20% Option 2: linear least squares regression: r 2 ≥0.995 Option 3: non-linear regression: coefficient of determination (COD) r2 ≥0.99 (6 points shall be used for second order, 7 points shall be used for third order)	Correct problem then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed. For PCB analysis, a mixture of Aroclors 1016 and 1260 is normally used to establish detector calibration linearity, unless project-specific data suggest the presence of another Aroclor (e.g., 1232). In addition, a mid-level or lower standard for each of the remaining Aroclors is analyzed for pattern recognition and response factor.	p. 533 Inst VGC_Q 3/12/14 OK
Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 20% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	p. 561 ICV 280-216544/11 3/12/14 Inst VGC_Q
Retention Time Window Position Establishment for Each Analyte and Surrogate	Once per ICAL and at the beginning of the analytical shift	Position shall be set using the midpoint standard of the calibration curve or the value in the CCV run at the beginning of the analytical shift.	NA	NA		p. 532 ICAL

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Retention Time Window Verification for Each Analyte and Surrogate	Each calibration verification standard	Analyte within established window	Correct problem, then reanalyze all samples analyzed since the last acceptable retention time check. If they fail, redo ICAL and reset retention time window,	Flagging criteria are not appropriate for initial verification. For CCV, apply a Q-flag to all results for analytes outside the established window.	No samples shall be run without a verified retention time window at the initial verification. For method 8015, check state methods for use of modified retention time markers with gasoline range organics (GRO) or diesel range organics (DRO).	p. 562 ICV p. 568, 575, 582, 589, 596 CCVs
Calibration Verification (Initial [ICV] and Continuing [CCV])	ICV: Daily, before sample analysis CCV: After every 10 field samples and at the end of the analysis sequence	All analytes within ± 20% of expected value from the ICAL	ICV: Correct problem, rerun ICV. If that fails, repeat initial calibration. See section 5.5.10 and box 55. CCV: Correct problem then repeat CCV and reanalyze all samples since last successful calibration verification.	ICV: Flagging criteria are not appropriate. CCV: Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification, if . reanalysis is not possible.	If %D for an individual analyte is > 20%, no samples may be analyzed until the problem has been corrected.	p. 561 ICVRT 280-216544/11 3/12/14 Inst VGC_Q OK p. 567 CCV 280-242714/4 9/09/14 Inst VGC_Q OK p. 574 CCV 280-242714/19 9/09/14 Inst VGC_Q OK p. 581 CCV 280-242714/26 9/10/14 Inst VGC_Q OK p. 588 CCV 280-243077/3 9/12/14 Inst VGC_Q OK p. 595 CCV 280-243077/19 9/12/14 Inst VGC_Q OK

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Method Blank	One per preparatory batch	No analytes detected > ½RL. For common laboratory contaminants, no analytes detected > RL.	Correct problem, then see criteria in box 0-5; if required, reprep then reanalyze method blank and all samples processed with the contaminated blank.	Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch		p. 44 MB 280-242714/5 ND p. 46 MB 280-243077/4 ND
Laboratory Control Sample (LCS) Containing All Analytes Required to be Reported, Including Surrogates	One LCS per preparatory batch	QC acceptance criteria specified by DoD, if available; see box D-7 and Appendix DoD-D .	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix DoD D)	If corrective action fails apply J-flag to specific analyte(s) in all samples in the associated preparatory batch		p. 44, LCS/LCSD 280-24214/6,7 GRO = 83, 85 OK p. 46 LCS/LCSD 280-243077/5,6 GRO = 119, 109
Matrix Spike (MS)	One MS per preparatory batch per matrix (see box ID- 11)	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken,	Lab: For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	No MS/MSD submitted with this SDG
Matrix Spike Duplicate (MSD) or Sample Duplicate	One per preparatory batch per matrix	RPD ≤30% (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	Lab: For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	No MSD performed with this SDG

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD ≤30%	Qualify sample	For the specific analyte(s) in the parent & dup samples, apply J- flag if acceptance criteria are not met.		None in this SDG
Surrogate Spike (Analytes Identified in Appendix DoD-D)	All field and QC samples	QC acceptance criteria for LCS specified by DoD, if available; otherwise method- specified criteria or laboratory's own in-house criteria	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary.	For the specific analyte(s) in all field samples collected from the same site matrix as the parent, apply J-flag if acceptance criteria are not met. For QC samples, apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Alternative surrogates are recommended when there is obvious chromatographic interference.	p. 38 ST012-W30-WG-090214= 154% ***Flag assoc. result "J"***
Confirmation of Positive Results (Second Column or Second Detector)	All positive results must be confirmed (in Method 8081A exclude toxaphene and technical chlordane, in Method 8015B exclude GRO, DRO, and residual range organics (RRO)).	Calibration and QC criteria same as for initial or primary column analysis. Results between primary and second column RPD ≤ 40%.	NA	Apply J-flag if RFD > 40% or Q-flag if sample is not confirmed. Discuss in the case narrative.	Report the higher of two confirmed results unless overlapping peaks are causing erroneously high results, then report the non- affected result and document in the case narrative.	NA

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Results Reported Between LOD and LOQ	NA	NA	NA	Apply J-flag to all results between LOD and LOQ. Validator flags: If using AFCEE; Apply "F" flag		No targets detected between LOD and LOQ
QC Blanks (Trip Blanks, Equipment Blanks, and Field Blanks)	Trip Blank – one per cooler containing samples for volatile parameters Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value (10x for common lab contaminants) are qualified as estimated and flagged "B"		TB01-090314 ND for GRO

Method Validated: 8015B (TPH-DRO) | Initial Review by: D. Knaub | Date: 10/23/14 | SDG#:280-59588-1
Senior Review by: J. Hartness | Date: 10/27/14 | Matrix: Groundwater

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C)	QC acceptance criteria published by DoD, if available; otherwise method- specified criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	Not applicable (NA)	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	ok
Method Detection Limit (MDL) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly MDL verification checks shall be performed (see box 0-18)	See 40 CFR 1368. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL verification check at higher level and set MDL higher or reconduct MDL study (see box D-18).	NA	Samples cannot be analyzed without a valid MDL.	ok
Retention Time (RT) Window Width Calculated for Each Analyte and Surrogate	At method set-up and after major maintenance (e.g., column change)	RT width is ± 3 times standard deviation for each analyte RT from 72-hour study.	NA	NA		
Breakdown Check (Endrin/ DDT Method 8081 Only)	Daily prior to analysis of samples	Degradation ≤ 15% for both Endrin and DDT.	Correct problem then repeat breakdown check.	Flagging criteria are not appropriate	No samples shall be run until degradation ≤ 15%.	NA TPH-DRO

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Container, Preservation, and Holding Time	All field samples	GRO- Water: 40 ml VOA vial; HCl to pH < 2, Cool to 6°C Soil: (low-level) 5 g in 40 ml VOA w/H_2O or sodium bisulfate; Cool to 6°C (high-level) 5 g in 40 ml VOA w/methanol, Cool to 6°C, or EnCore® or equivalent (48 hrs to preservation) 14 days to analysis DRO – Water: 1 L Amber glass, Cool to 6°C Soil: 4 oz amber glass jar, Cool to 6°C Water: 7 days to extraction Soil: 14 days to extraction 40 days to analysis	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collected: 9/02/14 Temp= 3.0 **°C** Extracted; 9/04/14 Analyzed: 9/09/14 ***ok***

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Minimum Five-Point Initial Calibration For All Analytes (ICAL)	Initial calibration prior to sample analysis	One of the options below (except for Method 8082, which may only use Option 1 or 2): Option 1: RSD for each analyte ≤ 20% Option 2: linear least squares regression: r 2 ≥0.995 Option 3: non-linear regression: coefficient of determination (COD) r2 ≥0.99 (6 points shall be used for second order, 7 points shall be used for third order)	Correct problem then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed. For PCB analysis, a mixture of Aroclors 1016 and 1260 is normally used to establish detector calibration linearity, unless project-specific data suggest the presence of another Aroclor (e.g., 1232). In addition, a mid-level or lower standard for each of the remaining Aroclors is analyzed for pattern recognition and response factor.	p. 651 Inst SGC_U 7/16/14 OK
Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 20% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	p. 689 ICV 280-234596/11 7/16/14 Inst SGC_U
Retention Time Window Position Establishment for Each Analyte and Surrogate	Once per ICAL and at the beginning of the analytical shift	Position shall be set using the midpoint standard of the calibration curve or the value in the CCV run at the beginning of the analytical shift.	NA	NA		p. 650 ICAL

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Retention Time Window Verification for Each Analyte and Surrogate	Each calibration verification standard	Analyte within established window	Correct problem, then reanalyze all samples analyzed since the last acceptable retention time check. If they fail, redo ICAL and reset retention time window,	Flagging criteria are not appropriate for initial verification. For CCV, apply a Q-flag to all results for analytes outside the established window.	No samples shall be run without a verified retention time window at the initial verification. For method 8015, check state methods for use of modified retention time markers with gasoline range organics (GRO) or diesel range organics (DRO).	p. 690 ICV p. 697 CCV p. 704 CCV
Calibration Verification (Initial [ICV] and Continuing [CCV])	ICV: Daily, before sample analysis CCV: After every 10 field samples and at the end of the analysis sequence	All analytes within ± 20% of expected value from the ICAL	ICV: Correct problem, rerun ICV. If that fails, repeat initial calibration. See section 5.5.10 and box 55. CCV: Correct problem then repeat CCV and reanalyze all samples since last successful calibration verification.	ICV: Flagging criteria are not appropriate. CCV: Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification, if . reanalysis is not possible.	If %D for an individual analyte is > 20%, no samples may be analyzed until the problem has been corrected.	p. 689 ICV 280-234596/11 7/16/14 Inst SGC_U p. 696 CCV 280-242565/4 9/09/14 Inst SGC_U p. 703 CCV 280-242565/12 9/09/14 Inst SGC_U
Method Blank	One per preparatory batch	No analytes detected > ½RL. For common laboratory contaminants, no analytes detected > RL.	Correct problem, then see criteria in box 0-5; if required, reprep then reanalyze method blank and all samples processed with the contaminated blank.	Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch		p. 48 MB 280-241972/1-A DRO=ND

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Laboratory Control Sample (LCS) Containing All Analytes Required to be Reported, Including Surrogates	One LCS per preparatory batch	QC acceptance criteria specified by DoD, if available; see box D-7 and Appendix DoD-D .	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix DoD D)	If corrective action fails apply J-flag to specific analyte(s) in all samples in the associated preparatory batch		p. 48 LCS/LCSD 280-241972/ 2-A,3-A DRO = 70, 84 RPD = 17
Matrix Spike (MS)	One MS per preparatory batch per matrix (see box ID- 11)	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken,	Lab: For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	No MS/MSD submitted with this SDG
Matrix Spike Duplicate (MSD) or Sample Duplicate	One per preparatory batch per matrix	RPD ≤30% (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	Lab: For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	No MSD or lab dup performed with this SDG
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD ≤30%	Qualify sample	For the specific analyte(s) in the parent & dup samples, apply J- flag if acceptance criteria are not met.		None in this SDG

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ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Surrogate Spike (Analytes Identified in Appendix DoD-D)	All field and QC samples	QC acceptance criteria for LCS specified by DoD, if available; otherwise method- specified criteria or laboratory's own in-house criteria	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary.	For the specific analyte(s) in all field samples collected from the same site matrix as the parent, apply J-flag if acceptance criteria are not met. For QC samples, apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Alternative surrogates are recommended when there is obvious chromatographic interference.	p. 39 **All ok**
Confirmation of Positive Results (Second Column or Second Detector)	All positive results must be confirmed (in Method 8081A exclude toxaphene and technical chlordane, in Method 8015B exclude GRO, DRO, and residual range organics (RRO)).	Calibration and QC criteria same as for initial or primary column analysis. Results between primary and second column RPD ≤ 40%.	NA	Apply J-flag if RFD > 40% or Q-flag if sample is not confirmed. Discuss in the case narrative.	Report the higher of two confirmed results unless overlapping peaks are causing erroneously high results, then report the non- affected result and document in the case narrative.	NA
Results Reported Between LOD and LOQ	NA	NA	NA	Apply J-flag to all results between LOD and LOQ. Validator flags: If using AFCEE; Apply "F" flag		No targets detected between LOD and LOQ

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
QC Blanks (Trip Blanks, Equipment Blanks, and Field Blanks)	Trip Blank – one per cooler containing samples for volatile parameters Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value (10x for common lab contaminants) are qualified as estimated and flagged "B"		No EB

Method Validated: 6010

Initial Review by: D. Knaub Date: 10/23/14 SDG#:280-59588-1
Senior Review by: J. Hartness Date: 10/27/14 Matrix: Groundwater

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C)	QC acceptance criteria published by DoD, if available; otherwise method- specified criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	Not applicable (NA)	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	Ok
Instrument Detection Limit (IDL) Study	At initial set-up and after significant change in instrument type, personnel, test method, or sample matrix	IDL shall be ≤ Limit of Detection (LOD)	NA	NA		p. 748 6/11/13
Container, Preservation, and Holding Time	All field samples	Water: 500 ml Poly, HNO_3 to pH < 2, Cool to 6°C, Soil: 4 oz glass or poly jar, Cool to 6°C 180 days to analysis	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collection date: 9/02/14 Prep; 9/09/14 Analysis date: 9/10/14 Temp:3.0 °C
Initial calibration (ICAL) for all analytes (minimum one high standard and a calibration blank)	Daily ICAL prior to sample analysis	If more than one calibration standard is used, r ≥ 0.995.	Correct problem then repeat ICAL.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed.	p. 758 run log ICIS analyzed 9/10/2014 11:24 IC analyzed 9/10/2014 11:27 and 11:30

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Second Source Calibration Verification (ICV)	Once after each ICAL, prior to beginning sample run	Value of second source for all analytes within ± 10% of true value	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	p. 734 ICVH 280-242836/6 9/10/2014 All OK p. 735 ICV 280-242836/8 9/10/2014 All OK p. 737 ICVL 280-242836/10 9/10/2014 All OK
Continuing Calibration Verification (CCV)	After every 10 field samples and at the end of the analysis sequence	All analytes within ± 10% of true value	Correct problem, rerun CCV. If that fails, then repeat ICAL. Reanalyze all samples since last successful calibration verification	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) of interest in all samples since the last acceptable CCV. Validator flags: If using AFCEE; Apply "J" flag only if reanalysis cannot be performed	Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	p. 734 CCVH 280-242836/24,35 9/10/14 All OK p. 735 CCV 280-242265/9, 25, 36 9/10/14 All OK p. 737 CCVL 280-242836/27, 38 9/10/14 Ca = 118% *No flag, associated sample result very high*
Low-level calibration check standard	Daily, after one-point ICAL	Within ± 20% of true value	Correct problem, then reanalyze	Flagging criteria are not appropriate.	No samples may be analyzed without a valid low-level calibration check standard. Low-level calibration check standard should be less than or equal to the reporting limit.	p. 738 ***All OK***

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Linear dynamic range or high-level check standard	Every 6 months	Within ±10% of expected value	NA	NA		p. 756 7/21/14
Method Blank	One per preparatory batch	No analytes detected > ½ RL and greater than 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1).	Correct problem, then see criteria in box D-1; if required, reprep then reanalyze method blank and all samples processed with the contaminated blank.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch	Problem must be corrected. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where samples cannot be reanalyzed.	p. 50 MB-280-242295/1-A Ca = 375 5x = 1875 *Assoc. result > 5x blank, no flags necessary*
Calibration blank	Before beginning a sample run, after every 10 samples, and at end of the analysis sequence	No analytes detected > LOD	Correct problem. Reprep and reanalyze calibration blank. All samples following the last acceptable calibration blank must be reanalyzed	Apply B-flag to all results for specific analyte(s) in all samples associated with the blank.		p. 739 9/10/14 ICB/CCBs 280-242836/13 ND 280-242836/26, 37 Mn = 0.270 J x 5 = 1.35 ug/L Mn = 0.330 J x 5 = 1.65 ug/L *Mn detected in samples at 5x greater than CCB: No qualification required*
Interference check solutions (ICS-A and ICS-AB)	At the beginning of an analytical run and every 12 hours	ICS-A: Absolute value of concentration for all non-spiked analytes < LOD (unless they are a verified trace impurity from one of the spiked analytes) ICS-AB: Within ±20% of expected value	Terminate analysis, locate and correct problem, reanalyze ICS, reanalyze all samples.	If corrective action fails, apply Q-flag to all results for specific analyte(s) in all samples associated with the ICS. Validator flags: If using AFCEE; Apply "M" flag		p. 741 9/10/14 ICSA - ICS-A Mn >LOD *No qualification- vendor verified trace impurities* p. 742 9/10/14 ICS-AB All OK

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Laboratory Control Sample (LCS) Containing All Analytes to be Reported	One per preparatory batch	QC acceptance criteria specified by DoD, if available; see box D-3 and Appendix G.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix G)	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch Validator flags: If using AFCEE; Apply "J" flag	Problem must be corrected. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	p. 50 LCS-280-242295/2-A 9/10/14 All OK
Matrix Spike (MS)	One per preparatory batch per matrix (see box D-7)	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS.	Examine the project-specific DQOs. If the matrix spike falls outside of DoD criteria, additional quality control test (dilution test and post-digestion spike addition) are required to evaluate matrix effects.	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	p. 51 ST012-W30-WG-090214 All ok
Matrix Spike Duplicate (MSD)	One per preparatory batch per matrix (see Box D-7)	MSD: For matrix evaluation use QC acceptance criteria specified by DoD for LCS MSD RPD < 20%	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	p. 51 ST012-W30-WG-090214 RPDs All ok
Dilution test	Once per preparatory batch	Five-fold dilution must agree within ± 10% of the original measurement	Perform post-digestion spike addition.	Flagging criteria are not appropriate.	Only applicable for samples with concentrations > 50 x LOQ.	p. 52 ST012-W30-WG-090214 All OK
Post digestion spike addition	When dilution test fails or analyte concentration for all samples < 50 x LOQ	Recovery within 75-125% of (see Table B-1)	Run all associated samples in the preparatory batch by method of standard additions (MSA) or see flagging criteria.	For specific analyte(s) in the parent sample, apply J-flag of acceptance criteria are not met.	Spike addition should produce a concentration of 10 - 100 x LOQ	p. 51 Ca = 70% Mn = -61% ***No qualification: sample results greater than 4x spike amount***

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Method of standard additions (MSA)	When matrix interference is suspected	NA	NA	NA	Document use of MSA in the case narrative.	NA
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD 20%	Qualify samples	For the specific analyte(s) in the parent & dup samples, apply J-flag if acceptance criteria are not met.		None in this SDG
Results Reported Between LOD and LOQ	NA	NA	NA	Apply J-flag to all results between DL and LOQ. Validator flags: If using AFCEE; Apply "F" flag		Results reported between MDL and RL flagged "F" for AFCEE.
QC Blanks (Equipment Blanks, and Field Blanks)	Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value are qualified as estimated and flagged "B".		No EB

ED_005025_00007837-00244

Method Validated: 9056A

Initial Review by: D. Knaub Date: 10/23/14
Senior Review by: J. Hartness Date: 10/27/14

SDG#: 280-59588-1
Matrix: Groundwater

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C)	QC acceptance criteria published by DoD, if available; otherwise method- specified criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	Not applicable (NA)	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	ok
Limit of Detection Determination and Verification (LOD) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly LOD verification checks shall be performed (see box D-13)	See 40 CFR 1368. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL / LOD verification check at higher level and set MDL higher or reconduct MDL study (see box D-13).	NA	Samples cannot be analyzed without a valid MDL.	p. 1033 6/16/2013
Limit of Quantitation Establishment and Verification (LOQ) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly LOQ verification checks shall be performed (see box D-14)	Within calibration range including low standard; within method precision and accuracy.	Re-run LOQ	NA	Samples cannot be analyzed without a valid LOQ	MRL check: Level 4 Package Pg. 1032 (9/12/14) = All OK

Method Validated: 9056A

Initial Review by: D. Knaub Date: 10/23/14
Senior Review by: J. Hartness Date: 10/27/14

SDG#: 280-59588-1
Matrix: Groundwater

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Retention Time (RT) Window Width Calculated for Each Analyte and Surrogate	At method set-up and after major maintenance (e.g., column change)	RT width is ± 3 times standard deviation for each analyte RT from 24-hour study.	NA	NA		OK
Container, Preservation, and Holding Time	All field samples	500 ml poly, Cool to 4°C Nitrate – 48 hours Nitrite, sulfate, chloride – 28 days	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collected: 9/02/14 Temp: 3.0°C Analyzed: 9/12/14, 9/13/14
ICAL for All Analytes (Minimum Three Standards and One Calibration Blank)	Initial calibration prior to sample analysis	R ≥ 0.995	Correct problem then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed.	p. 1036 Level IV package 9/04/14 6 levels Inst. IC7 OK
Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 10% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	p. 1047 Level 4 Package OK
Retention Time Window Position Establishment for Each Analyte and Surrogate	Once per ICAL and at the beginning of the analytical shift	Position shall be set using the midpoint standard of the calibration curve or the value in the CCV run at the beginning of the analytical shift.	NA	NA		OK

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Midrange Continuing Calibration Verification (CCV)	After every 10 field samples and at end of the analysis sequence.	All analytes within established retention time windows and within ± 10% of true value	Correct problem then repeat CCV. If that fails, then repeat ICAL. Reanalyze all samples since last successful calibration verification.	Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification, if . reanalysis is not possible.	No samples may be analyzed until the problem has been corrected.	p. 1025 Level IV Package 9/12/14 All OK
Method Blank	One per preparatory batch	No analytes detected > ½ RL. See box D-1.	Correct problem, then see criteria in box D-1; if required, reprep then reanalyze method blank and all samples processed with the contaminated blank.	Lab: Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch. Validator; Apply "B" flag if result is less than 5x method blank.		p. 53 MB 280-243071/6 All ND p. 1025: CCBs - All ND
Laboratory Control Sample (LCS) Containing All Analytes Required to be Reported, Including Surrogates	One LCS per preparatory batch	Use laboratory in-house LCS acceptance criteria (not to exceed 20%).See Box D-3.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix G)	If corrective action fails apply J-flag to specific analyte(s) in all samples in the associated preparatory batch		p. 54 Br = 102, 94 Cl = 100, 92 SO4 = 103, 93 All OK

Method Validated: 9056A

Initial Review by: D. Knaub Date: 10/23/14
Senior Review by: J. Hartness Date: 10/27/14

SDG#: 280-59588-1
Matrix: Groundwater

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Matrix Spike (MS)	One MS per preparatory batch per matrix (see box D- 7)	For matrix evaluation, use laboratory in-house LCS acceptance criteria (not to exceed 20%).	Examine the project-specific 000s. Contact the client as to additional measures to be taken,	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	p. 55 ST012-W30-WG-090214 *Br = 116, 116* *Cl = 49, 49* SO4 = 109, 110 No flag for Cl, anal. at 10x dilution Flag assoc. Br result as "M"
Matrix Spike Duplicate (MSD) or Sample Duplicate	One per preparatory batch per matrix	RPD ≤15% (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	RPDs OK
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD ≤10%	Qualify sample	For the specific analyte(s) in the parent & dup samples, apply J- flag if acceptance criteria are not met.		No field dups in this SDG p. 56 Lab dup on ST012-W30-WG-090214, RPDs OK
Results Reported Between LOD and LOQ	NA	NA	NA	Apply J-flag to all results between LOD and LOQ. Validator flags: If using AFCEE; Apply "F" flag		No detections between LOD and LOQ
QC Blanks (Equipment Blanks and Field Blanks)	Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value (10x for common lab contaminants) are qualified as estimated and flagged "B".		No EB

Data Evaluation Narrative
AMEC Project: Former Williams AFB
AMEC Project Number: 9101110001.5300.5301
Site: ST012 – Enhanced Bioremediation Field Test
Sampling Event: September 2014
Matrix: Groundwater

SDG: 280-59740-1

1.0 INTRODUCTION

A data quality evaluation (DQE) was performed on the data reported for the Enhanced Bioremediation field test conducted at Site ST012 in September 2014, at the former Williams Air Force Base (AFB), Mesa, Arizona. The following sections provide summary discussions of the required data qualifications for each site and analytical methods for samples collected at the former WAFB. Data validation was conducted on 100% of the primary samples and field quality control samples (trip blanks, rinsate blanks, sample duplicates, and matrix spike/matrix spike duplicate [MS/MSD] samples). A Level III (Step IIB) data validation was performed using supplemental checklists to review the following quality control elements: laboratory case narrative, sample documentation, chain-of-custody, holding time protocols, method-specific calibration information, mass tunes, method blank results, laboratory control sample (LCS) results, surrogate recoveries (where applicable), MS/MSD recoveries and relative percent differences (RPDs), field duplicate RPDs, trip and equipment/rinsate blanks, method-specific QC elements (such as interelement check standards (ICS), serial dilutions, post digestion spikes (PDS), column breakdown, etc.), method sensitivity, and completeness. The Level III DQE checklists are attached to this narrative.

Data were reviewed using precision and accuracy control limits presented in The Department of Defense (DoD) Quality Systems Manual (QSM) Version 4.2 (DoD, 2010). DQE data qualifications were applied if necessary in accordance with procedures in Air Force Center for Environmental Excellence (AFCEE) Quality Assurance Project Plan (QAPP), Version 4.0.01 (AFCEE, 2005), the method, and professional judgment using the following qualifiers:

- J = The reported concentration is considered an estimated value due to discrepancies in meeting certain analyte-specific quality control criteria.
- F = The reported concentration is between the limit of quantitation/reporting limit (LOQ/RL) and method detection limit (MDL) and is considered an estimated value
- UJ = The target compound was not detected and the reporting limit is considered imprecise due to discrepancies in meeting certain analyte-specific quality control criteria.
- B = The result may be biased high or a false positive based on blank data.
- M = The reported concentration is estimated due to matrix effects.
- R = The data are considered unusable due to discrepancies in meeting certain quality control criteria and may not be used in decision making.

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2.0 DELIVERABLES

The data packages as submitted to AMEC Environment and Infrastructure, Inc. (AMEC) are complete as stipulated in the Draft Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) for Site ST012 Enhanced Bioremediation Field Test Plan (AMEC, 2014), and the applicable guidelines described in the former Williams AFB Performance Based Remediation Program QAPP and standard operating procedures (SOPs) (collectively referred to as the QAPP/SOP [AMEC, 2012]) for U.S. States Environmental Protection Agency (EPA) Methods SW8260B, SW8015B, SW9056A, and SW6010C.

3.0 SAMPLE INTEGRITY

Samples within this sample delivery group (SDG) collected from ST012 were submitted to TestAmerica Laboratories (TAL) in Denver, Colorado for select volatile organic compounds (VOCs) analysis by USEPA Method SW8260B, total petroleum hydrocarbons-gasoline range organics (TPH-GRO) and diesel range organics (TPH-DRO) by Method SW8015B, anions by Method SW9056A and select metals by Method SW6010C.

Based on the information provided on the cooler receipt forms, samples arrived at the laboratory within the recommended temperature and preservation requirements. Completed Chain-of-Custody (COC) documents are included in the data package.

4.0 SAMPLE IDENTIFICATION

This SDG contains the following water and quality control (QC) samples:

Site: ST012	QC Samples
ST012-W11-WG-090814	TB01-090814

These samples were collected on 8 September 2014.

5.0 SAMPLE QUALIFICATION

Only those components that required qualification of the data are presented in this narrative. All Level III components were within the DoD QSM QC limits, with the following exceptions:

- Constituents were present in the associated blanks and flagged “B” (no flags applied).
- Surrogate recoveries were outside QC limits and results flagged “J”
- Metals were detected in the Interference Check Solution A (ICSA) (no qualification required).
- PDS recoveries were outside QC limits for one metal (no flags applied).
- Results were present between the MDL and LOQ and flagged “F”.

6.0 VOCS (SW8260B)

Samples collected from site ST012 were submitted for VOCs by EPA Method SW8260B and analyzed for site-specific VOC compounds of interest (COIs).

A Level III validation was performed on this method and only those components that exceeded the QAPP/SOP criteria are presented below. Each of the Level III components was within the QAPP/SOP QC criteria; however the following qualification was noted:

- Results were present between the MDL and LOQ and flagged "F".

6.1 Limits of Quantitation

The LOQs as specified in the QAPP/SOP (AMEC, 2012) were met for samples submitted for the analysis of VOCs by USEPA Method SW 8260B except where dilutions were required to place the constituent within the calibration range. No dilutions were required on samples from this SDG.

Any result reported between the LOQ and MDL is considered a quantitative estimate. Any result reported between the LOQ and MDL is considered a quantitative estimate. The results reported between the RL and MDL are presented in the attached data report.

Action: The associated results reported between the LOQ and MDL were qualified as estimated and flagged "F" unless overridden by other QC criteria.

7.0 TPH-GRO (8015B)

Samples collected from Site ST012 were submitted for TPH-GRO analysis by EPA Method SW8015B. A Level III validation was performed on this method and only those components that exceeded the program document QAPP/SOP criteria are presented below. Qualification was required for the following:

- Surrogate recoveries were outside QC limits and associated results flagged "J".

7.1 Surrogate Recoveries

Surrogate a,a,a-trifluorotoluene recovered above the QC limits in sample ST012-W11-WG-090814. No qualification is required if the samples were diluted or the surrogate recoveries were high and the sample results were non-detect.

Action: The GRO result for sample ST012-W11-WG-090814 was qualified as estimated and flagged "J".

7.2 Limits of Quantitation

The LOQ as specified in the QAPP/SOP (AMEC, 2012) was met for samples submitted for the analysis of TPH-GRO by EPA Method SW8015B except where dilutions were required to place the constituent within the calibration range. No samples from this SDG required a dilution for GRO.

8.0 TPH-DRO (8015B)

Samples collected from Site ST012 were submitted for TPH-DRO analysis by EPA Method SW8015B. A Level III validation was performed on this method and each of the components met the program document QAPP/SOP criteria.

8.1 Limits of Quantitation

The LOQ as specified in the QAPP/SOP (AMEC, 2012) was met for samples submitted for the analysis of TPH-DRO by EPA Method SW8015B. Dilutions were not required for TPH-DRO.

9.0 ANIONS (SW9056A)

Samples collected from site ST012 were submitted for Anions by Method SW9056A. A Level III validation was performed on this method and only those components that exceeded the QAPP/SOP criteria are presented below. Each of the Level III components was within the QAPP/SOP QC criteria; however the following qualification was noted:

- Constituents were present in the associated blanks and flagged “B” (no flags applied).

9.1 Continuing Calibration Blank

One of the CCBs associated with the samples in this SDG reported low levels of chloride.

Action: No qualification was necessary for chloride because the associated sample result was greater than five times the blank value.

9.2 Limits of Quantitation

The LOQs as specified in the QAPP/SOP (AMEC, 2012) were met for samples submitted for the analysis of Anions by USEPA Method SW 9056A with the exception of analytes that required dilution. The sample in this SDG required dilution for bromide, chloride, and sulfate resulting in elevated LOQs. The laboratory indicated a dilution with a “D” qualifier which was subsequently removed during the validation process.

10.0 METALS (SW6010C)

Samples collected from Site ST012 were submitted for the major metal cations by EPA Method SW6010C. Samples were analyzed for calcium, iron, magnesium, manganese, potassium, and sodium. A Level III validation was performed on this method and only those components that exceeded the SAP/TAL SOP criteria are presented below. The following components exceeded the QC criteria or were noted:

- Initial and continuing calibration standards recovered outside of QC limits and results flagged "UJ".
- Metals were detected in the Interference Check Solution A (ICSA) (no qualification required).
- PDS recoveries were outside QC limits for two metals (no flags applied).

10.1 Initial and Continuing Calibration Verification

The low level ICVs and/or CCVs recovered below the QC limit for calcium and iron, therefore only low-level results require qualification.

Action: No qualification was required for calcium because calcium was not reported from that particular analytical run. The associated iron result in sample ST012-W11-WG-090814 was qualified as estimated and flagged "UJ".

10.2 Interference Check Solution A (ICSA)

Manganese was detected in the ICSA solution associated with prep batch 280-242657. The vendor verified that the ICSA contained these trace impurities.

Action: No qualification is required for impurities verified by the vendor.

10.3 Post Digestion Spike

The laboratory performed a PDS on sample ST012-W11-WG-090814 and the recoveries for magnesium were outside of the QC limits. No qualification is required if the recoveries were high and the samples were non-detect or the analyte was present in the sample at concentrations greater than 4x the spike amount.

Action: No qualification was required for magnesium results because the metals were present in the sample at greater than 4x the spike amount.

10.4 Limits of Quantitation

The LOQs as specified in the QAPP/SOP (AMEC, 2012) were met for samples submitted for the analysis of metals by USEPA Method SW6010C except where dilutions were required to place the constituent concentration within the calibration range. No Dilutions were required.

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11.0 OVERALL SITE EVALUATION AND PROFESSIONAL JUDGMENT

Edits to the DQE qualifiers by professional judgment were not required.

12.0 SUMMARY OF DATA QUALITY INDICATORS

This section provides an assessment of the data based on project data quality indicators (DQIs) described on QAPP Worksheet #37 of the Program Document QAPP/SOP (AMEC, 2012). The DQIs consist of precision, accuracy, representativeness, comparability, completeness, and sensitivity.

12.1 Precision

An assessment of precision of analytical data is accomplished via review of field duplicate and MS/MSD analyses. Field duplicate and MS/MSD analyses are used to assess field variability, which includes sample collection/handling as well as matrix homogeneity. Precision is expressed as the relative percent difference (RPD) between results for duplicate pairs.

No field duplicate samples or project specific MS/MSDs were submitted. An MS/MSD was performed on a project sample for metals and the RPDs were within QC limits. Precision for TPH-GRO, TPH-DRO, and anions was evaluated through the analysis of the LCS/LCSD and the RPDs were compliant with the QAPP/SOP. The overall method and sample matrix precision are acceptable and achieve project objectives.

12.2 Accuracy (Bias)

An assessment of accuracy of analytical data is accomplished via evaluation of the spike recoveries in the MS/MSD, LCS, post digestion spike samples, and surrogate spike compounds, in addition to calibration criteria. Accuracy is expressed as percent recovery. Accuracy data were compliant with the QAPP/SOP with the exception of TPH-GRO surrogates and low-level iron CCVs. The DQE resulted in the qualification of the TPH-GRO and iron results as estimated in one sample. Estimated data is usable data and all remaining accuracy data for the other anions, VOCs, TPH-DRO, and metals were within QC limits or did not require qualification. Therefore, the data results indicate method and matrix accuracy is acceptable to achieve project objectives.

12.3 Representativeness

Representativeness for the analytical data is determined through evaluation of the associated blank data and evaluation of appropriate sample handling procedures. All samples were properly stored and preserved in the field and at TestAmerica. Method, trip, and equipment blanks were acceptable. One calibration blank reported low-levels of chloride, however the blank contamination did not result in qualification of the associated sample data. Based on historical results, the impacts to project DQOs were minimal; therefore, the analytical results indicate sample data are representative of the Site conditions.

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12.4 Comparability

Comparability addresses the confidence with which one data set can be compared to another. Use of appropriate sampling methods, COC procedures, and EPA-approved analytical methods, as well as adherence to strict QA/QC procedures, provide the basis for uniformity in sample collection and analysis. Analytical data were generated by TestAmerica using standard reporting units of micrograms per liter for VOCs, TPH-GRO, and metals and milligrams per liter for TPH-DRO and anions. In addition, sample collection and analytical method protocols were implemented in accordance with approved, documented procedures. Analytical data are determined to be comparable to previous Site results.

12.5 Completeness

Completeness of the field sampling activities were assessed in terms of the actual number and type of sample results received from the field and laboratory, as compared with the planned number and type of sample results. All samples planned were collected which meets a field completeness of 100%.

Analytical completeness of data is a measure of the number of valid project-specific data results obtained in comparison to the total number of data results projected to achieve project DQOs. Valid data are defined as data that meet the project-specific DQOs. No data were rejected as a result of the data validation; however, some of the results were qualified as estimated. Estimated data is usable data. The completeness goals met the 90 percent goal for field and laboratory data expected for this project.

12.6 Sensitivity

Analytical methods and RLs were implemented in accordance with the QAPP/SOP and EPA promulgated methodologies. Method RLs were achieved for the event except when sample dilutions were required to bring target compounds within the linear range of the instrument calibration. As previously mentioned, the samples within this SDG required dilutions for anions to place the results within the calibration range. These include modified RLs for selected detections; therefore, sensitivity requirements were met for non-diluted constituents.

12.7 Usability Summary

The data generated during the September 2014 sampling event were usable with qualifications with respect to project DQOs. The DQOs for the Enhanced Bioremediation Field Test is to produce data to support design of anaerobic methods for the ST012 remedy if selected.

13.0 REFERENCES

AFCEE, 2005. Quality Assurance Project Plan, Version 4.0.01, May, 2005.

AMEC, August 11, 2014. *Draft Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) (Enhanced Bioremediation Field Test Plan) Operable Unit 2 Site ST012 - Liquid Fuels Storage Area, Former Williams Air Force Base, Mesa, Arizona.*

AMEC, February 23, 2012. *Performance Based Remediation Program Quality Assurance Project Plan (QAPP) and Standard Operating Procedures (SOPs) (QAP/SOP), Former Williams Air Force Base, Mesa, Arizona.*

DoD, 2010. Department of Defense Quality System Manual, Version 4.2 Final, October 2010.

Prepared/Date: DWK 10/23/14
Checked/Date: JAH 10/27/14

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Flagged Data Reports

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59740-1

Client Sample ID: **TB01-090814**

Lab Sample ID: 280-59740-1TB

Client Matrix: Water

Date Sampled: 09/08/2014 0117

Date Received: 09/09/2014 0915

8260B Volatile Organic Compounds (GC/MS)

Analysis Method:	8260B	Analysis Batch:	280-243756	Instrument ID:	VMS_H
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	H4391.D
Dilution:	1.0			Initial Weight/Volume:	20 mL
Analysis Date:	09/18/2014 1104			Final Weight/Volume:	20 mL
Prep Date:	09/18/2014 1104				

DWK
No Flags

Analyte	Result (ug/L)	Qualifier	DL	LOQ
1,2-Dichloroethane	0.40	U	0.13	1.0
Benzene	0.20	U	0.16	1.0
Ethylbenzene	0.20	U	0.16	1.0
Methylene Chloride	0.80	U	0.32	5.0
m-Xylene & p-Xylene	0.80	U	0.34	2.0
Naphthalene	0.80	U	0.22	1.0
o-Xylene	0.40	U	0.19	1.0
Toluene	0.40	U	0.17	1.0
Trichloroethene (TCE)	0.20	U	0.16	1.0
Trichlorofluoromethane	0.80	U	0.29	2.0
Xylenes, Total	1.6	U	0.19	2.0

Surrogate	%Rec	Qualifier	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	107		70 - 120
4-Bromofluorobenzene (Surr)	105		75 - 120
Dibromofluoromethane (Surr)	108		85 - 115
Toluene-d8 (Surr)	109		85 - 120

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59740-1

Client Sample ID: **ST012-W11-WG-090814**

Lab Sample ID: 280-59740-2

Client Matrix: Water

Date Sampled: 09/08/2014 0117

Date Received: 09/09/2014 0915

8260B Volatile Organic Compounds (GC/MS)

Analysis Method:	8260B	Analysis Batch:	280-243756	Instrument ID:	VMS_H
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	H4402.D
Dilution:	1.0			Initial Weight/Volume:	20 mL
Analysis Date:	09/18/2014 1502			Final Weight/Volume:	20 mL
Prep Date:	09/18/2014 1502				

DWK 10/23/14

Analyte	Result (ug/L)	Qualifier	DL	LOQ
1,2-Dichloroethane	0.40	U	0.13	1.0
Benzene	0.37	F	0.16	1.0
Ethylbenzene	2.4		0.16	1.0
Methylene Chloride	0.80	U	0.32	5.0
m-Xylene & p-Xylene	2.2		0.34	2.0
Naphthalene	0.40	F	0.22	1.0
o-Xylene	0.40	U	0.19	1.0
Toluene	0.40	U	0.17	1.0
Trichloroethene (TCE)	0.20	U	0.16	1.0
Trichlorofluoromethane	0.80	U	0.29	2.0
Xylenes, Total	2.2		0.19	2.0

Surrogate	%Rec	Qualifier	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	111		70 - 120
4-Bromofluorobenzene (Surr)	106		75 - 120
Dibromofluoromethane (Surr)	113		85 - 115
Toluene-d8 (Surr)	114		85 - 120

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59740-1

Client Sample ID: TB01-090814

Lab Sample ID: 280-59740-1TB

Client Matrix: Water

Date Sampled: 09/08/2014 0117

Date Received: 09/09/2014 0915

8015B_GRO Gasoline Range Organics (GRO)

Analysis Method:	8015B_GRO	Analysis Batch:	280-242714	Instrument ID:	VGC_Q
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	024F2401.D
Dilution:	1.0			Initial Weight/Volume:	5 mL
Analysis Date:	09/10/2014 0006			Final Weight/Volume:	5 mL
Prep Date:	09/10/2014 0006			Injection Volume:	5 mL

DWR
No Flags

Analyte	Result (ug/L)	Qualifier	DL	LOQ
Gasoline Range Organics (GRO)-C6-C10	20	U	10	25

Surrogate	%Rec	Qualifier	Acceptance Limits
a,a,a-Trifluorotoluene	85		82 - 110

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59740-1

Client Sample ID: **ST012-W11-WG-090814**

Lab Sample ID: 280-59740-2

Client Matrix: Water

Date Sampled: 09/08/2014 0117

Date Received: 09/09/2014 0915

8015B_GRO Gasoline Range Organics (GRO)

Analysis Method:	8015B_GRO	Analysis Batch:	280-242714	Instrument ID:	VGC_Q
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	023F2301.D
Dilution:	1.0			Initial Weight/Volume:	5 mL
Analysis Date:	09/09/2014 2341			Final Weight/Volume:	5 mL
Prep Date:	09/09/2014 2341			Injection Volume:	5 mL

DMK 10/03/14

Analyte	Result (ug/L)	Qualifier	DL	LOQ
Gasoline Range Organics (GRO)-C6-C10	73	~~M Q~~ J	10	25

Surrogate	%Rec	Qualifier	Acceptance Limits
a,a,a-Trifluorotoluene	118	Ø *	82 - 110

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59740-1

Client Sample ID: **ST012-W11-WG-090814**

Lab Sample ID: 280-59740-2

Client Matrix: Water

Date Sampled: 09/08/2014 0117

Date Received: 09/09/2014 0915

8015B_DRO Diesel Range Organics (DRO) (GC)

Analysis Method:	8015B_DRO	Analysis Batch:	280-243251	Instrument ID:	SGC_U2a
Prep Method:	3510C	Prep Batch:	280-243123	Initial Weight/Volume:	1050 mL
Dilution:	1.0			Final Weight/Volume:	1 mL
Analysis Date:	09/16/2014 0249			Injection Volume:	1 uL
Prep Date:	09/12/2014 2029			Result Type:	PRIMARY

DWK no Flags

Analyte	Result (mg/L)	Qualifier	DL	LOQ
Diesel Range Organics [C10-C28]	0.095	U	0.031	0.24

Surrogate	%Rec	Qualifier	Acceptance Limits
o-Terphenyl	76		50 - 115

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59740-1

Client Sample ID: **ST012-W11-WG-090814**

Lab Sample ID: 280-59740-2
Client Matrix: Water

Date Sampled: 09/08/2014 0117
Date Received: 09/09/2014 0915

6010C Metals (ICP)

Analysis Method:	6010C	Analysis Batch:	280-242996	Instrument ID:	MT_025
Prep Method:	3010A	Prep Batch:	280-242657	Lab File ID:	25D091114.asc
Dilution:	1.0			Initial Weight/Volume:	50 mL
Analysis Date:	09/11/2014 1609			Final Weight/Volume:	50 mL
Prep Date:	09/10/2014 1330				

DWK 10/23/14

Analyte	Result (ug/L)	Qualifier	DL	LOQ
Iron	30	U J	22	100
Magnesium	140000		11	500
Manganese	67	~~Q~~	0.25	10
Potassium	21000		240	3000
Sodium	92000		92	5000

Analysis Method:	6010C	Analysis Batch:	280-243179	Instrument ID:	MT_025
Prep Method:	3010A	Prep Batch:	280-242657	Lab File ID:	25A091214.asc
Dilution:	10			Initial Weight/Volume:	50 mL
Analysis Date:	09/12/2014 1458			Final Weight/Volume:	50 mL
Prep Date:	09/10/2014 1330				

Analyte	Result (ug/L)	Qualifier	DL	LOQ
Calcium	770000	~~D~~	350	10000

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59740-1

General Chemistry

Client Sample ID: **ST012-W11-WG-090814**

Lab Sample ID: 280-59740-2

Client Matrix: Water

Date Sampled: 09/08/2014 0117

Date Received: 09/09/2014 0915

Analyte	Result	Qual	Units	DL	LOQ	Dil	Method
Bromide	2.5	~~D~~	mg/L	0.23	1.0	2.0	9056A
Analysis Batch: 280-242495	Analysis Date: 09/09/2014 2155						
Orthophosphate as P	0.40	U	mg/L	0.37	1.0	2.0	9056A
Analysis Batch: 280-242528	Analysis Date: 09/09/2014 1750						
Chloride	1600	~~D~~	mg/L	5.1	60	20	9056A
Analysis Batch: 280-242529	Analysis Date: 09/09/2014 1806						
Sulfate	280	~~D~~	mg/L	0.46	10	2.0	9056A
Analysis Batch: 280-242529	Analysis Date: 09/09/2014 1750						

Data Quality Evaluation Checklists

Method Validated: 8260B

Initial Review by: D. Knaub Date: 10/23/14 SDG#: 280-59740-1
Senior Review by: J. Hartness Date: 10/27/14 Matrix: Groundwater

ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (METHODS 8260 AND 8270)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C).	QC acceptance criteria published by DoD, if available; otherwise method- specific criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	NA	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	Ok
MDL Study	At initial set-up and subsequently once per 12-month period; otherwise quarterly MDL verification checks shall be performed (see box D-18)	See 40 CFR 136B. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL verification check at higher level and set MDL higher or reconduct MDL study (see box D-18)	NA	Samples cannot be analyzed without a valid MDL.	Ok
Tuning	Prior to calibration and every 12 hours during sample analysis	Refer to method for specific ion criteria.	Retune instrument and verify. Rerun affected samples.	Flagging criteria are not appropriate	Problem must be corrected. No samples may be accepted without a valid tune.	p. 223 – 224 level IV package VMS_H, ICAL/ICV, 9/17/14 VMS_H, CCV 9/18/14 All ok
Breakdown Check (DDT Method 8270C Only)	Daily prior to analysis of samples	Degradation ≤ 20% for DDT	Correct problem then repeat breakdown check	Flagging criteria are not appropriate	No samples shall be run until degradation ≤ 20%. Benzidine and pentachlorophenol should be present at their normal responses and no peak tailing should be observed.	NA

ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (METHODS 8260 AND 8270)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Container, Preservation, and Holding Time	All field samples	8260 – 40 ml VOA vial HCl to pH < 2, Cool to 4°C 14 days to analysis 8270 – 1 L Amber glass, Cool to 4°C 7 days to extraction 40 days to analysis	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collection date: 9/08/14 Analysis date: 9/18/14, Temp 1.9 °C
Minimum Five-Point Initial Calibration For All Analytes (ICAL)	Initial calibration prior to sample analysis	Average response factor (RF) for SPCCs: VOCs - 0.30 for Chlorobenzene and 1,1,2,2-tetrachlorolethane. a 0.1 for chloromethane, bromoform, and 1,1-dicbloroethane. SVOCs - a 0.050. RSD for RFs for CCCs: The CCCs are vinyl chloride, 1,1-dichlorethene, chloroform, 1,2-dichloropropane, toluene, and ethylbenzene. VOCs and SVOCs - 30% and one option below; **Option 1**: RSD for each analyte ≤ 15% **Option 2**: linear least squares regression r a 0.995 **Option 3**: non-linear regression - coefficient of determination (COD) e a 0.99 (6 points shall be used for second order, 7 points shall be used for third order)	Correct problem then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed.	p. 237 VMS_H, 9/17/14 All OK p. 284 VMS_H, 9/17/14 (short list) All OK

Method Validated: 8260B

Initial Review by: D. Knaub Date: 10/23/14 SDG#: 280-59740-1
Senior Review by: J. Hartness Date: 10/27/14 Matrix: Groundwater

ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (METHODS 8260 AND 8270)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 25% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	VMS_H ICV not included but run on 9/17/14 12:53 and 15:46 –see page 346.
Retention Time Window Position Establishment for Each Analyte and Surrogate	Once per ICAL	Position shall be set using the midpoint standard of the initial calibration curve.	NA			All OK
Evaluation of Relative Retention Times (RRT)	With each sample	RRT of each target analyte in each calibration standard within ± 0.06 RRT units.	Correct problem, then rerun ICAL.			All ok
Calibration Verification (CV)	Daily, before sample analysis, and every 12 hours of analysis time	Average RF for SPCCs: VOCs 0.30 for Chlorobenzene and 1,1,2,2-tetrachlorolethane, 0.1 for chloromethane, bromoform, and 1,1-dichloroethane. SVOCs 0.050. 2. %Difference/Drift for CCCs: VOCs and SVOCs ≤20%D (Note: D = difference when using RFs or drift when using least squares regression or non-linear calibration.)	Correct problem, then rerun CV. If that fails, repeat initial calibration. See section 5.5.10 and DoD clarification box 55.	Apply Q-flag if no sample material remains and analyte exceeds criteria.	NA	p. 309, VMS_H ICV/CCV 280-243756/2 (9/18/14) p. 325 VMS_H CCV (short list) 280-243756/3 (9/18/14) All COIs OK
Internal Standards Verification	In all field samples and standards	Retention time ± 30 seconds from retention time of the midpoint standard in the ICAL	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples	If corrective action fails in field samples, apply Q-flag to analytes associated	Flagging criteria are not appropriate.	p. 225 -226 ICIS 280-243577/22 All ok

ED_005025_00007837-00268

ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (METHODS 8260 AND 8270)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
		EICP area within - 50% to + 100% of ICAL midpoint standard	analyzed while system was malfunctioning is mandatory.	with the non-compliant IS. Flagging criteria are not appropriate for failed standards.		
Method Blank	One per preparatory batch	No analytes detected >½ RL. For common laboratory contaminants, no analytes detected > RL.	Correct problem, then see criteria in box D-5. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank.	Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.		p.44 MB 280-243756/6 All ND
LCS Containing All Analytes Required to be Reported, Including Surrogates	One LCS per preparatory batch	QC acceptance criteria specified by DoD, if available; see box D-7 and Appendix DoD-D.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. (See full explanation in Appendix DoDID.	If corrective action fails, applyIQ-flag to specific analyte(s) in all samples in the associated preparatory batch.		p.45 LCS 280-24376/4 All OK
MS	One MS per preparatory batch per matrix (see box D- 15)	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	Lab: For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error	No MS/MSD submitted for method 8260B

ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (METHODS 8260 AND 8270)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
MSD or Sample Duplicate	One per preparatory batch per matrix	RPD ≤ 30% (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	Lab: For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	NA -See above
Surrogate Spike (Analytes Identified in Appendix DoD-D)	All field and QC samples	QC acceptance criteria for LCS published by DoD, if available; otherwise method- specified criteria or laboratory's own in-house criteria.	For QC and field samples, correct problem, then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available.	For the specific analyte(s) in all field samples collected from the same site matrix as the parent, apply J-flag if acceptance criteria are not met. For QC samples, apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.		p. 41 All OK.
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD ≤30%	Qualify sample	For the specific analyte(s) in the parent & dup samples, apply J- flag if acceptance criteria are not met.		None in this SDG
Results Reported Between MDL and LOQ	NA	NA	NA	Apply J-flag to all results between MDL and LOQ. Validator flags: If using AFCEE; Apply "F" flag		Samples qualified as estimated and AFCEE flagged "F" unless overridden by flags for other criteria

ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (METHODS 8260 AND 8270)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
QC Blanks (Trip Blanks, Equipment Blanks, and Field Blanks)	Trip Blank – one per cooler containing samples for VOCs Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value (10x for common lab contaminants) are qualified as estimated and flagged "B"		TB01-090814 All ND

Method Validated: 8015B (TPH-GRO) | Initial Review by: D. Knaub | Date: 10/23/14 | SDG#:280-59740-1
Senior Review by: J. Hartness | Date: 10/27/14 | Matrix: Groundwater

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C)	QC acceptance criteria published by DoD, if available; otherwise method- specified criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	Not applicable (NA)	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	ok
Method Detection Limit (MDL) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly MDL verification checks shall be performed (see box 0-18)	See 40 CFR 1368. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL verification check at higher level and set MDL higher or reconduct MDL study (see box D-18).	NA	Samples cannot be analyzed without a valid MDL.	ok
Retention Time (RT) Window Width Calculated for Each Analyte and Surrogate	At method set-up and after major maintenance (e.g., column change)	RT width is ± 3 times standard deviation for each analyte RT from 72-hour study.	NA	NA		
Breakdown Check (Endrin/ DDT Method 8081 Only)	Daily prior to analysis of samples	Degradation ≤ 15% for both Endrin and DDT.	Correct problem then repeat breakdown check.	Flagging criteria are not appropriate	No samples shall be run until degradation ≤ 15%.	NA TPH-GRO

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Container, Preservation, and Holding Time	All field samples	GRO- Water: 40 ml VOA vial; HCl to pH < 2, Cool to 6°C Soil: (low-level) 5 g in 40 ml VOA w/H_2O or sodium bisulfate; Cool to 6°C (high-level) 5 g in 40 ml VOA w/methanol, Cool to 6°C, or EnCore® or equivalent (48 hrs to preservation) 14 days to analysis DRO – Water: 1 L Amber glass, Cool to 6°C Soil: 4 oz amber glass jar, Cool to 6°C Water: 7 days to extraction Soil: 14 days to extraction 40 days to analysis	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collected: 9/08/14 Temp=1.9°C (CoC) Narrative : 2.6°C Analyzed: 9/09/14, 9/10/14 ***ok***

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Minimum Five-Point Initial Calibration For All Analytes (ICAL)	Initial calibration prior to sample analysis	One of the options below (except for Method 8082, which may only use Option 1 or 2): Option 1: RSD for each analyte ≤ 20% Option 2: linear least squares regression: r 2 ≥0.995 Option 3: non-linear regression: coefficient of determination (COD) r2 ≥0.99 (6 points shall be used for second order, 7 points shall be used for third order)	Correct problem then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed. For PCB analysis, a mixture of Aroclors 1016 and 1260 is normally used to establish detector calibration linearity, unless project-specific data suggest the presence of another Aroclor (e.g., 1232). In addition, a mid-level or lower standard for each of the remaining Aroclors is analyzed for pattern recognition and response factor.	p. 376 Inst VGC_Q 3/12/14 OK
Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 20% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	p. 404 ICV 280-216544/11 3/12/14 Inst VGC_Q
Retention Time Window Position Establishment for Each Analyte and Surrogate	Once per ICAL and at the beginning of the analytical shift	Position shall be set using the midpoint standard of the calibration curve or the value in the CCV run at the beginning of the analytical shift.	NA	NA		p. 375 ICAL

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Retention Time Window Verification for Each Analyte and Surrogate	Each calibration verification standard	Analyte within established window	Correct problem, then reanalyze all samples analyzed since the last acceptable retention time check. If they fail, redo ICAL and reset retention time window,	Flagging criteria are not appropriate for initial verification. For CCV, apply a Q-flag to all results for analytes outside the established window.	No samples shall be run without a verified retention time window at the initial verification. For method 8015, check state methods for use of modified retention time markers with gasoline range organics (GRO) or diesel range organics (DRO).	p. 405 ICV p. 411, 418, 425 CCVs
Calibration Verification (Initial [ICV] and Continuing [CCV])	ICV: Daily, before sample analysis CCV: After every 10 field samples and at the end of the analysis sequence	All analytes within ± 20% of expected value from the ICAL	ICV: Correct problem, rerun ICV. If that fails, repeat initial calibration. See section 5.5.10 and box 55. CCV: Correct problem then repeat CCV and reanalyze all samples since last successful calibration verification.	ICV: Flagging criteria are not appropriate. CCV: Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification, if . reanalysis is not possible.	If %D for an individual analyte is > 20%, no samples may be analyzed until the problem has been corrected.	p. 404 ICVRT 280-216544/11 3/12/14 Inst VGC_Q OK p. 410 CCV 280-242714/4 9/09/14 Inst VGC_Q OK p. 417 CCV 280-242714/19 9/09/14 Inst VGC_Q OK p. 424 CCV 280-242714/26 9/10/14 Inst VGC_Q OK
Method Blank	One per preparatory batch	No analytes detected > ½RL. For common laboratory contaminants, no analytes detected > RL.	Correct problem, then see criteria in box 0-5; if required, reprep then reanalyze method blank and all samples processed with the contaminated blank.	Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch		p. 46 MB 280-242714/5 ND

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Laboratory Control Sample (LCS) Containing All Analytes Required to be Reported, Including Surrogates	One LCS per preparatory batch	QC acceptance criteria specified by DoD, if available; see box D-7 and Appendix DoD-D .	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix DoD D)	If corrective action fails apply J-flag to specific analyte(s) in all samples in the associated preparatory batch		p. 46, LCS/LCSD 280-24214/6,7 GRO = 83, 85 RPD = 2
Matrix Spike (MS)	One MS per preparatory batch per matrix (see box ID- 11)	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken,	Lab: For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	No MS/MSD submitted with this SDG
Matrix Spike Duplicate (MSD) or Sample Duplicate	One per preparatory batch per matrix	RPD ≤30% (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	Lab: For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	No MSD performed with this SDG
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD ≤30%	Qualify sample	For the specific analyte(s) in the parent & dup samples, apply J- flag if acceptance criteria are not met.		None in this SDG

ED_005025_00007837-00276

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Surrogate Spike (Analytes Identified in Appendix DoD-D)	All field and QC samples	QC acceptance criteria for LCS specified by DoD, if available; otherwise method- specified criteria or laboratory's own in-house criteria	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary.	For the specific analyte(s) in all field samples collected from the same site matrix as the parent, apply J-flag if acceptance criteria are not met. For QC samples, apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Alternative surrogates are recommended when there is obvious chromatographic interference.	p. 42 ST012-W11-WG-090814= 118% ***Flag assoc. result "J"***
Confirmation of Positive Results (Second Column or Second Detector)	All positive results must be confirmed (in Method 8081A exclude toxaphene and technical chlordane, in Method 8015B exclude GRO, DRO, and residual range organics (RRO)).	Calibration and QC criteria same as for initial or primary column analysis. Results between primary and second column RPD ≤ 40%.	NA	Apply J-flag if RFD > 40% or Q-flag if sample is not confirmed. Discuss in the case narrative.	Report the higher of two confirmed results unless overlapping peaks are causing erroneously high results, then report the non- affected result and document in the case narrative.	NA
Results Reported Between LOD and LOQ	NA	NA	NA	Apply J-flag to all results between LOD and LOQ. Validator flags: If using AFCEE; Apply "F" flag		No targets detected between LOD and LOQ

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
QC Blanks (Trip Blanks, Equipment Blanks, and Field Blanks)	Trip Blank – one per cooler containing samples for volatile parameters Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value (10x for common lab contaminants) are qualified as estimated and flagged "B"		TB01-090814 ND for GRO

Method Validated: 8015B (TPH-DRO) | Initial Review by: D. Knaub | Date: 10/23/14 | SDG#:280-59740-1
Senior Review by: J. Hartness | Date: 10/27/14 | Matrix: Groundwater

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C)	QC acceptance criteria published by DoD, if available; otherwise method- specified criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	Not applicable (NA)	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	ok
Method Detection Limit (MDL) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly MDL verification checks shall be performed (see box 0-18)	See 40 CFR 1368. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL verification check at higher level and set MDL higher or reconduct MDL study (see box D-18).	NA	Samples cannot be analyzed without a valid MDL.	ok
Retention Time (RT) Window Width Calculated for Each Analyte and Surrogate	At method set-up and after major maintenance (e.g., column change)	RT width is ± 3 times standard deviation for each analyte RT from 72-hour study.	NA	NA		
Breakdown Check (Endrin/ DDT Method 8081 Only)	Daily prior to analysis of samples	Degradation ≤ 15% for both Endrin and DDT.	Correct problem then repeat breakdown check.	Flagging criteria are not appropriate	No samples shall be run until degradation ≤ 15%.	NA TPH-DRO

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Container, Preservation, and Holding Time	All field samples	GRO- Water: 40 ml VOA vial; HCl to pH < 2, Cool to 6°C Soil: (low-level) 5 g in 40 ml VOA w/H_2O or sodium bisulfate; Cool to 6°C (high-level) 5 g in 40 ml VOA w/methanol, Cool to 6°C, or EnCore® or equivalent (48 hrs to preservation) 14 days to analysis DRO – Water: 1 L Amber glass, Cool to 6°C Soil: 4 oz amber glass jar, Cool to 6°C Water: 7 days to extraction Soil: 14 days to extraction 40 days to analysis	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collected: 9/08/14 Temp= 1.9 °C (CoC) Narrative: 2.6°C Extracted; 9/12/14 Analyzed: 9/16/14 ***ok***

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Minimum Five-Point Initial Calibration For All Analytes (ICAL)	Initial calibration prior to sample analysis	One of the options below (except for Method 8082, which may only use Option 1 or 2): Option 1: RSD for each analyte ≤ 20% Option 2: linear least squares regression: r 2 ≥0.995 Option 3: non-linear regression: coefficient of determination (COD) r2 ≥0.99 (6 points shall be used for second order, 7 points shall be used for third order)	Correct problem then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed. For PCB analysis, a mixture of Aroclors 1016 and 1260 is normally used to establish detector calibration linearity, unless project-specific data suggest the presence of another Aroclor (e.g., 1232). In addition, a mid-level or lower standard for each of the remaining Aroclors is analyzed for pattern recognition and response factor.	p. 460 Inst SGC_U 2a 3/26/14 OK
Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 20% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	p. 501 ICV 280-218430/11 3/26/14 Inst SGC_U2a
Retention Time Window Position Establishment for Each Analyte and Surrogate	Once per ICAL and at the beginning of the analytical shift	Position shall be set using the midpoint standard of the calibration curve or the value in the CCV run at the beginning of the analytical shift.	NA	NA		p. 459 ICAL

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Retention Time Window Verification for Each Analyte and Surrogate	Each calibration verification standard	Analyte within established window	Correct problem, then reanalyze all samples analyzed since the last acceptable retention time check. If they fail, redo ICAL and reset retention time window,	Flagging criteria are not appropriate for initial verification. For CCV, apply a Q-flag to all results for analytes outside the established window.	No samples shall be run without a verified retention time window at the initial verification. For method 8015, check state methods for use of modified retention time markers with gasoline range organics (GRO) or diesel range organics (DRO).	p. 502 ICV p. 510 CCV p. 517 CCV p. 524 CCV p. 531 CCV
Calibration Verification (Initial [ICV] and Continuing [CCV])	ICV: Daily, before sample analysis CCV: After every 10 field samples and at the end of the analysis sequence	All analytes within ± 20% of expected value from the ICAL	ICV: Correct problem, rerun ICV. If that fails, repeat initial calibration. See section 5.5.10 and box 55. CCV: Correct problem then repeat CCV and reanalyze all samples since last successful calibration verification.	ICV: Flagging criteria are not appropriate. CCV: Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification, if . reanalysis is not possible.	If %D for an individual analyte is > 20%, no samples may be analyzed until the problem has been corrected.	p. 501 ICV 280-218430/11 3/26/14 Inst SGC_U2a p. 509 CCV 280-243251/3 9/15/14 Inst SGC_U2a p. 516 CCV 280-243251/25 9/15/14 Inst SGC_U2a p. 523 CCV 280-243251/37 9/16/14 Inst SGC_U2a p. 530 CCV 280-243251/43 9/16/14 Inst SGC_U2a

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Method Blank	One per preparatory batch	No analytes detected > ½RL. For common laboratory contaminants, no analytes detected > RL.	Correct problem, then see criteria in box 0-5; if required, reprep then reanalyze method blank and all samples processed with the contaminated blank.	Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch		p. 48 MB 280-243123/1-A DRO=ND
Laboratory Control Sample (LCS) Containing All Analytes Required to be Reported, Including Surrogates	One LCS per preparatory batch	QC acceptance criteria specified by DoD, if available; see box D-7 and Appendix DoD-D .	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix DoD D)	If corrective action fails apply J-flag to specific analyte(s) in all samples in the associated preparatory batch		p. 48 LCS/LCSD 280-242123/ 2-A,3-A DRO = 83, 77 RPD = 7
Matrix Spike (MS)	One MS per preparatory batch per matrix (see box ID- 11)	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken,	Lab: For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	No MS/MSD submitted with this SDG
Matrix Spike Duplicate (MSD) or Sample Duplicate	One per preparatory batch per matrix	RPD ≤30% (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	Lab: For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	No MSD or lab dup performed with this SDG

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ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD ≤30%	Qualify sample	For the specific analyte(s) in the parent & dup samples, apply J- flag if acceptance criteria are not met.		None in this SDG
Surrogate Spike (Analytes Identified in Appendix DoD-D)	All field and QC samples	QC acceptance criteria for LCS specified by DoD, if available; otherwise method- specified criteria or laboratory's own in-house criteria	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary.	For the specific analyte(s) in all field samples collected from the same site matrix as the parent, apply J-flag if acceptance criteria are not met. For QC samples, apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Alternative surrogates are recommended when there is obvious chromatographic interference.	p. 43 **All ok**
Confirmation of Positive Results (Second Column or Second Detector)	All positive results must be confirmed (in Method 8081A exclude toxaphene and technical chlordane, in Method 8015B exclude GRO, DRO, and residual range organics (RRO)).	Calibration and QC criteria same as for initial or primary column analysis. Results between primary and second column RPD ≤ 40%.	NA	Apply J-flag if RFD > 40% or Q-flag if sample is not confirmed. Discuss in the case narrative.	Report the higher of two confirmed results unless overlapping peaks are causing erroneously high results, then report the non- affected result and document in the case narrative.	NA

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Results Reported Between LOD and LOQ	NA	NA	NA	Apply J-flag to all results between LOD and LOQ. Validator flags: If using AFCEE; Apply "F" flag		No targets detected between LOD and LOQ
QC Blanks (Trip Blanks, Equipment Blanks, and Field Blanks)	Trip Blank – one per cooler containing samples for volatile parameters Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value (10x for common lab contaminants) are qualified as estimated and flagged "B"		No EB

Method Validated: 6010

Initial Review by: D. Knaub Date: 10/23/14 SDG#:280-59740-1
Senior Review by: J. Hartness Date: 10/27/14 Matrix: Groundwater

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C)	QC acceptance criteria published by DoD, if available; otherwise method- specified criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	Not applicable (NA)	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	Ok
Instrument Detection Limit (IDL) Study	At initial set-up and after significant change in instrument type, personnel, test method, or sample matrix	IDL shall be ≤ Limit of Detection (LOD)	NA	NA		p. 577 6/11/13
Container, Preservation, and Holding Time	All field samples	Water: 500 ml Poly, HNO_3 to pH < 2, Cool to 6°C, Soil: 4 oz glass or poly jar, Cool to 6°C 180 days to analysis	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collection date: 9/08/14 Prep; 9/10/14 Analysis date: 9/11/14, 9/12/14 Temp:1.9 °C (CoC) Narrative: 2.6°C
Initial calibration (ICAL) for all analytes (minimum one high standard and a calibration blank)	Daily ICAL prior to sample analysis	If more than one calibration standard is used, r ≥ 0.995.	Correct problem then repeat ICAL.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed.	p. 587 run log ICIS analyzed 9/11/2014 09:57 IC analyzed 9/11/2014 09:59 and 10:02

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Second Source Calibration Verification (ICV)	Once after each ICAL, prior to beginning sample run	Value of second source for all analytes within ± 10% of true value	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	p. 558 ICVH 280-242996/6 9/11/2014 All OK p. 559 ICV 280-242996/7 9/11/2014 All OK p. 560 ICVL 280-242996/8 9/11/2014 Ca = 85% Fe = 87% *Ca not reported from this run, Fe results qualified as estimated and flagged "UJ"* p. 562 ICV 280-243179/11 9/12/14 All OK p. 563 ICVL 280-243179/14 9/12/14 All OK
Continuing Calibration Verification (CCV)	After every 10 field samples and at the end of the analysis sequence	All analytes within ± 10% of true value	Correct problem, rerun CCV. If that fails, then repeat ICAL. Reanalyze all samples since last successful calibration verification	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) of interest in all samples since the last acceptable CCV. Validator flags: If using AFCEE; Apply "J" flag only if reanalysis cannot be performed	Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	p. 558CCVH 280-242996/22,33 9/11/14 All OK p. 559 CCV 280-242996/23, 34, 36 9/10/14 All OK p. 560 CCVL 280-242996/25, 36 9/11/14 Ca = 84, 89% Fe = 88, 97% *Ca not reported from this run, Fe results previously qualified as estimated and flagged "UJ"* p. 561 CCVH 280-243179/42, 51 9/12/14 All OK p. 562 CCV 280-243179/43, 52 9/12/14 All OK p. 563 CCV 280-243179/45, 54 9/12/15 All OK

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Low-level calibration check standard	Daily, after one-point ICAL	Within ± 20% of true value	Correct problem, then reanalyze	Flagging criteria are not appropriate.	No samples may be analyzed without a valid low-level calibration check standard. Low-level calibration check standard should be less than or equal to the reporting limit.	p. 564 ***All OK***
Linear dynamic range or high-level check standard	Every 6 months	Within ±10% of expected value	NA	NA		p. 585 7/21/14
Method Blank	One per preparatory batch	No analytes detected > ½ RL and greater than 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1).	Correct problem, then see criteria in box D-1; if required, reprep then reanalyze method blank and all samples processed with the contaminated blank.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch	Problem must be corrected. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where samples cannot be reanalyzed.	p. 50 MB-280-242657/1-A All ND
Calibration blank	Before beginning a sample run, after every 10 samples, and at end of the analysis sequence	No analytes detected > LOD	Correct problem. Reprep and reanalyze calibration blank. All samples following the last acceptable calibration blank must be reanalyzed	Apply B-flag to all results for specific analyte(s) in all samples associated with the blank.		p. 565 9/11/14 ICB/CCBs 280-242996/11,24,35 ND p. 566 9/12/14 ICB/CCBs 280-243179/17, 44, 53 All ND

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Interference check solutions (ICS-A and ICS-AB)	At the beginning of an analytical run and every 12 hours	ICS-A: Absolute value of concentration for all non-spiked analytes < LOD (unless they are a verified trace impurity from one of the spiked analytes) ICS-AB: Within ±20% of expected value	Terminate analysis, locate and correct problem, reanalyze ICS, reanalyze all samples.	If corrective action fails, apply Q-flag to all results for specific analyte(s) in all samples associated with the ICS. Validator flags: If using AFCEE; Apply "M" flag		p. 568 9/11/14 ICSA - ICS-A Mn >LOD *No qualification- vendor verified trace impurities* p. 569 9/11/14 ICSAB All OK p. 570 9/12/14 ICSA All OK p. 571 9/12/14 ICS-AB All OK
Laboratory Control Sample (LCS) Containing All Analytes to be Reported	One per preparatory batch	QC acceptance criteria specified by DoD, if available; see box D-3 and Appendix G.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix G)	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch Validator flags: If using AFCEE; Apply "J" flag	Problem must be corrected. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	p. 50 LCS-280-242657/2-A 9/11/14 All OK
Matrix Spike (MS)	One per preparatory batch per matrix (see box D-7)	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS.	Examine the project-specific DQOs. If the matrix spike falls outside of DoD criteria, additional quality control test (dilution test and post-digestion spike addition) are required to evaluate matrix effects.	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	p. 52 ST012-W11-WG-090814 All ok
Matrix Spike Duplicate (MSD)	One per preparatory batch per matrix (see Box D-7)	MSD: For matrix evaluation use QC acceptance criteria specified by DoD for LCS MSD RPD < 20%	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	p. 52 ST012-W11-WG-090814 RPDs All ok

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Dilution test	Once per preparatory batch	Five-fold dilution must agree within ± 10% of the original measurement	Perform post-digestion spike addition.	Flagging criteria are not appropriate.	Only applicable for samples with concentrations > 50 x LOQ.	p. 54 ST012-W11-WG-090814 All OK
Post digestion spike addition	When dilution test fails or analyte concentration for all samples < 50 x LOQ	Recovery within 75-125% of (see Table B-1)	Run all associated samples in the preparatory batch by method of standard additions (MSA) or see flagging criteria.	For specific analyte(s) in the parent sample, apply J-flag of acceptance criteria are not met.	Spike addition should produce a concentration of 10 - 100 x LOQ	p. 51 Mg = 67% ***No qualification: sample results greater than 4x spike amount***
Method of standard additions (MSA)	When matrix interference is suspected	NA	NA	NA	Document use of MSA in the case narrative.	NA
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD 20%	Qualify samples	For the specific analyte(s) in the parent & dup samples, apply J-flag if acceptance criteria are not met.		None in this SDG
Results Reported Between LOD and LOQ	NA	NA	NA	Apply J-flag to all results between DL and LOQ. Validator flags: If using AFCEE; Apply "F" flag		Results reported between MDL and RL flagged "F" for AFCEE.
QC Blanks (Equipment Blanks, and Field Blanks)	Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value are qualified as estimated and flagged "B".		No EB

Method Validated: 9056A

Initial Review by: D. Knaub Date: 10/23/14
Senior Review by: J. Hartness Date: 10/27/14

SDG#: 280-59740-1
Matrix: Groundwater

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C)	QC acceptance criteria published by DoD, if available; otherwise method- specified criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	Not applicable (NA)	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	ok
Limit of Detection Determination and Verification (LOD) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly LOD verification checks shall be performed (see box D-13)	See 40 CFR 1368. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL / LOD verification check at higher level and set MDL higher or reconduct MDL study (see box D-13).	NA	Samples cannot be analyzed without a valid MDL.	p. 1131, 1133 6/16/2013
Limit of Quantitation Establishment and Verification (LOQ) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly LOQ verification checks shall be performed (see box D-14)	Within calibration range including low standard; within method precision and accuracy.	Re-run LOQ	NA	Samples cannot be analyzed without a valid LOQ	MRL check: Level 4 Package Pg. 1130 (9/09/14) = All OK

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Retention Time (RT) Window Width Calculated for Each Analyte and Surrogate	At method set-up and after major maintenance (e.g., column change)	RT width is ± 3 times standard deviation for each analyte RT from 24-hour study.	NA	NA		OK
Container, Preservation, and Holding Time	All field samples	500 ml poly, Cool to 4°C Nitrate – 48 hours Nitrite, sulfate, chloride – 28 days	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collected: 9/08/14 Temp: 1.9°C (Coc) Narrative: 2.6°C Analyzed: 9/09/14
ICAL for All Analytes (Minimum Three Standards and One Calibration Blank)	Initial calibration prior to sample analysis	R ≥ 0.995	Correct problem then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed.	p. 1138, 1162 Level IV package 8/27/14 6 levels Inst. IC11 OK
Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 10% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	p. 1177, 1124 Level 4 Package OK
Retention Time Window Position Establishment for Each Analyte and Surrogate	Once per ICAL and at the beginning of the analytical shift	Position shall be set using the midpoint standard of the calibration curve or the value in the CCV run at the beginning of the analytical shift.	NA	NA		OK

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Midrange Continuing Calibration Verification (CCV)	After every 10 field samples and at end of the analysis sequence.	All analytes within established retention time windows and within ± 10% of true value	Correct problem then repeat CCV. If that fails, then repeat ICAL. Reanalyze all samples since last successful calibration verification.	Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification, if . reanalysis is not possible.	No samples may be analyzed until the problem has been corrected.	p. 1124 Level IV Package 9/09/14 All OK
Method Blank	One per preparatory batch	No analytes detected > ½ RL. See box D-1.	Correct problem, then see criteria in box D-1; if required, reprep then reanalyze method blank and all samples processed with the contaminated blank.	Lab: Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch. Validator; Apply "B" flag if result is less than 5x method blank.		p. 55 MB 280-242495/6 All ND p. 57 MB 280-242528/19 ortho-P = ND p. 59 MB 280-242529/19 All ND p. 1124: CCBs ending CCB (9/09/14 22:55) Cl = 0.634 *No assoc. results < 5x blank, no flags necessary*

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COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Laboratory Control Sample (LCS) Containing All Analytes Required to be Reported, Including Surrogates	One LCS per preparatory batch	Use laboratory in-house LCS acceptance criteria (not to exceed 20%).See Box D-3.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix G)	If corrective action fails apply J-flag to specific analyte(s) in all samples in the associated preparatory batch		p. 56 Br = 98, 98 Cl = 98, 98 SO4 = 95, 95 p. 57 ortho-P = 103, 100 p. 59 Cl = 100, 100 SO4 = 100, 100 All OK
Matrix Spike (MS)	One MS per preparatory batch per matrix (see box D- 7)	For matrix evaluation, use laboratory in-house LCS acceptance criteria (not to exceed 20%).	Examine the project-specific 000s. Contact the client as to additional measures to be taken,	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	None from this SDG
Matrix Spike Duplicate (MSD) or Sample Duplicate	One per preparatory batch per matrix	RPD ≤15% (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	NA
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD ≤10%	Qualify sample	For the specific analyte(s) in the parent & dup samples, apply J- flag if acceptance criteria are not met.		No field dups in this SDG

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Results Reported Between LOD and LOQ	NA	NA	NA	Apply J-flag to all results between LOD and LOQ. Validator flags: If using AFCEE; Apply "F" flag		No detections between LOD and LOQ
QC Blanks (Equipment Blanks and Field Blanks)	Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value (10x for common lab contaminants) are qualified as estimated and flagged "B".		No EB

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Data Evaluation Narrative
AMEC Project: Former Williams AFB
AMEC Project Number: 9101110001.5300.5301
Site: ST012 – Enhanced Bioremediation Field Test
Sampling Event: September 2014
Matrix: Groundwater

SDG: 280-59873-1

1.0 INTRODUCTION

A data quality evaluation (DQE) was performed on the data reported for the Enhanced Bioremediation field test conducted at Site ST012 in September 2014, at the former Williams Air Force Base (AFB), Mesa, Arizona. The following sections provide summary discussions of the required data qualifications for each site and analytical methods for samples collected at the former WAFB. Data validation was conducted on 100% of the primary samples and field quality control samples (trip blanks, rinsate blanks, sample duplicates, and matrix spike/matrix spike duplicate [MS/MSD] samples). A Level III (Step IIB) data validation was performed using supplemental checklists to review the following quality control elements: laboratory case narrative, sample documentation, chain-of-custody, holding time protocols, method-specific calibration information, mass tunes, method blank results, laboratory control sample (LCS) results, surrogate recoveries (where applicable), MS/MSD recoveries and relative percent differences (RPDs), field duplicate RPDs, trip and equipment/rinsate blanks, method-specific QC elements (such as interelement check standards (ICS), serial dilutions, post digestion spikes (PDS), column breakdown, etc.), method sensitivity, and completeness. The Level III DQE checklists are attached to this narrative.

Data were reviewed using precision and accuracy control limits presented in The Department of Defense (DoD) Quality Systems Manual (QSM) Version 4.2 (DoD, 2010). DQE data qualifications were applied if necessary in accordance with procedures in Air Force Center for Environmental Excellence (AFCEE) Quality Assurance Project Plan (QAPP), Version 4.0.01 (AFCEE, 2005), the method, and professional judgment using the following qualifiers:

- J = The reported concentration is considered an estimated value due to discrepancies in meeting certain analyte-specific quality control criteria.
- F = The reported concentration is between the limit of quantitation/reporting limit (LOQ/RL) and method detection limit (MDL) and is considered an estimated value
- UJ = The target compound was not detected and the reporting limit is considered imprecise due to discrepancies in meeting certain analyte-specific quality control criteria.
- B = The result may be biased high or a false positive based on blank data.
- M = The reported concentration is estimated due to matrix effects.
- R = The data are considered unusable due to discrepancies in meeting certain quality control criteria and may not be used in decision making.

ED_005025_00007837-00296

2.0 DELIVERABLES

The data packages as submitted to AMEC Environment and Infrastructure, Inc. (AMEC) are complete as stipulated in the Draft Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) for Site ST012 Enhanced Bioremediation Field Test Plan (AMEC, 2014), and the applicable guidelines described in the former Williams AFB Performance Based Remediation Program QAPP and standard operating procedures (SOPs) (collectively referred to as the QAPP/SOP [AMEC, 2012]) for U.S. States Environmental Protection Agency (EPA) Methods SW8260B, SW8015B, SW9056A, and SW6010C.

3.0 SAMPLE INTEGRITY

Samples within this sample delivery group (SDG) collected from ST012 were submitted to TestAmerica Laboratories (TAL) in Denver, Colorado for select volatile organic compounds (VOCs) analysis by USEPA Method SW8260B, total petroleum hydrocarbons-gasoline range organics (TPH-GRO) and diesel range organics (TPH-DRO) by Method SW8015B, anions by Method SW9056A and select metals by Method SW6010C.

Based on the information provided on the cooler receipt forms, samples arrived at the laboratory within the recommended temperature and preservation requirements. Completed Chain-of-Custody (COC) documents are included in the data package.

4.0 SAMPLE IDENTIFICATION

This SDG contains the following water and quality control (QC) samples:

Site: ST012	**QC Samples**
ST012-W30-WG-091014	TB01-091014

These samples were collected on 10 September 2014.

5.0 SAMPLE QUALIFICATION

Only those components that required qualification of the data are presented in this narrative. All Level III components were within the DoD QSM QC limits, with the following exceptions:

- Constituents were present in the associated blanks and flagged “B” (no flags applied).
- Surrogate recoveries were outside QC limits (no flags applied).
- Metals were detected in the Interference Check Solution A (ICSA) (no qualification required).
- PDS recoveries were outside QC limits for two metals (no flags applied).

6.0 VOCS (SW8260B)

Samples collected from site ST012 were submitted for VOCs by EPA Method SW8260B and analyzed for site-specific VOC compounds of interest (COIs).

A Level III validation was performed on this method and only those components that exceeded the QAPP/SOP criteria are presented below. Each of the Level III components was within the QAPP/SOP QC criteria.

6.1 Limits of Quantitation

The LOQs as specified in the QAPP/SOP (AMEC, 2012) were met for samples submitted for the analysis of VOCs by USEPA Method SW 8260B except where dilutions were required to place the constituent within the calibration range. Dilutions were required on samples from this SDG. The laboratory indicated a dilution with a "D" qualifier which was subsequently removed during the validation process.

Any result reported between the LOQ and MDL is considered a quantitative estimate. No results in this SDG were reported between the RL and MDL.

7.0 TPH-GRO (8015B)

Samples collected from Site ST012 were submitted for TPH-GRO analysis by EPA Method SW8015B. A Level III validation was performed on this method and only those components that exceeded the program document QAPP/SOP criteria are presented below. Qualification was required for the following:

- Surrogate recoveries were outside QC limits (no flags applied).

7.1 Surrogate Recoveries

Surrogate a,a,a-trifluorotoluene recovered above the QC limits in sample ST012-W30-WG-091014. No qualification is required if the samples were diluted or the surrogate recoveries were high and the sample results were non-detect.

Action: No qualification was necessary because the sample was analyzed at a dilution.

7.2 Limits of Quantitation

The LOQ as specified in the QAPP/SOP (AMEC, 2012) was met for samples submitted for the analysis of TPH-GRO by EPA Method SW8015B except where dilutions were required to place the constituent within the calibration range. Dilutions were required on samples from this SDG. The laboratory indicated a dilution with a "D" qualifier which was subsequently removed during the validation process.

ED_005025_00007837-00298

8.0 TPH-DRO (8015B)

Samples collected from Site ST012 were submitted for TPH-DRO analysis by EPA Method SW8015B. A Level III validation was performed on this method and no components exceeded the program document QAPP/SOP criteria. It should be noted that the laboratory placed an "M" qualifier on any result that was manually integrated. The "M" qualifier was subsequently removed during the data validation process.

8.1 Limits of Quantitation

The LOQ as specified in the QAPP/SOP (AMEC, 2012) was met for samples submitted for the analysis of TPH-DRO by EPA Method SW8015B. Dilutions were not required for TPH-DRO.

9.0 ANIONS (SW9056A)

Samples collected from site ST012 were submitted for Anions by Method SW9056A. A Level III validation was performed on this method and only those components that exceeded the QAPP/SOP criteria are presented below. Each of the Level III components was within the QAPP/SOP QC criteria; however the following qualification was noted:

- Constituents were present in the associated blanks and flagged "B" (no flags applied).

9.1 Continuing Calibration Blank

The CCBs associated with the samples in this SDG reported low levels of chloride.

Action: No qualification was necessary for chloride because the associated sample result was greater than five times the blank value.

9.2 Limits of Quantitation

The LOQs as specified in the QAPP/SOP (AMEC, 2012) were met for samples submitted for the analysis of Anions by USEPA Method SW 9056A with the exception of analytes that required dilution. The sample in this SDG required dilution for chloride resulting in elevated LOQs. The laboratory indicated a dilution with a "D" qualifier which was subsequently removed during the validation process.

10.0 METALS (SW6010C)

Samples collected from Site ST012 were submitted for the major metal cations by EPA Method SW6010C. Samples were analyzed for calcium, iron, magnesium, manganese, potassium, and sodium. A Level III validation was performed on this method and only those components that exceeded the SAP/TAL SOP criteria are presented below. The following components exceeded the QC criteria or were noted:

- Metals were detected in the Interference Check Solution A (ICSA) (no qualification required).
- PDS recoveries were outside QC limits for two metals (no flags applied).

10.1 Interference Check Solution A (ICSA)

Manganese was detected in the ICSA solution associated with prep batch 280-243607. The vendor verified that the ICSA contained these trace impurities.

Action: No qualification is required for impurities verified by the vendor.

10.2 Post Digestion Spike

The laboratory performed a PDS on sample ST012-W30-WG-091014 and the recoveries for calcium and manganese were outside of the QC limits. No qualification is required if the recoveries were high and the samples were non-detect or the analyte was present in the sample at concentrations greater than 4x the spike amount.

Action: No qualification was required for calcium and manganese results because the metals were present in the sample at greater than 4x the spike amount.

10.3 Limits of Quantitation

The LOQs as specified in the QAPP/SOP (AMEC, 2012) were met for samples submitted for the analysis of metals by USEPA Method SW6010C except where dilutions were required to place the constituent concentration within the calibration range. No Dilutions were required.

11.0 OVERALL SITE EVALUATION AND PROFESSIONAL JUDGMENT

Edits to the DQE qualifiers by professional judgment were not required.

12.0 SUMMARY OF DATA QUALITY INDICATORS

This section provides an assessment of the data based on project data quality indicators (DQIs) described on QAPP Worksheet #37 of the Program Document QAPP/SOP (AMEC, 2012). The DQIs consist of precision, accuracy, representativeness, comparability, completeness, and sensitivity.

12.1 Precision

An assessment of precision of analytical data is accomplished via review of field duplicate and MS/MSD analyses. Field duplicate and MS/MSD analyses are used to assess field variability, which includes sample collection/handling as well as matrix homogeneity. Precision is expressed as the relative percent difference (RPD) between results for duplicate pairs.

No field duplicate samples or project specific MS/MSDs were submitted. An MS/MSD was performed on a project sample for metals and the RPDs were within QC limits. Precision for TPH-GRO, TPH-DRO, and anions was evaluated through the analysis of the LCS/LCSD and the RPDs were compliant with the QAPP/SOP. The overall method and sample matrix precision are acceptable and achieve project objectives.

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12.2 Accuracy (Bias)

An assessment of accuracy of analytical data is accomplished via evaluation of the spike recoveries in the MS/MSD, LCS, post digestion spike samples, and surrogate spike compounds, in addition to calibration criteria. Accuracy is expressed as percent recovery. Accuracy data were compliant with the QAPP/SOP with the exception of TPH-GRO surrogates; however, no data was qualified as a result. Accuracy data for anions, VOCs, TPH-DRO, and metals were within QC limits or did not require qualification. Therefore, the data results indicate method and matrix accuracy is acceptable to achieve project objectives.

12.3 Representativeness

Representativeness for the analytical data is determined through evaluation of the associated blank data and evaluation of appropriate sample handling procedures. All samples were properly stored and preserved in the field and at TestAmerica. Method, trip, and equipment blanks were acceptable. One calibration blank reported low-levels of chloride, however the blank contamination did not result in qualification of the associated sample data. Based on historical results, the impacts to project DQOs were minimal; therefore, the analytical results indicate sample data are representative of the Site conditions.

12.4 Comparability

Comparability addresses the confidence with which one data set can be compared to another. Use of appropriate sampling methods, COC procedures, and EPA-approved analytical methods, as well as adherence to strict QA/QC procedures, provide the basis for uniformity in sample collection and analysis. Analytical data were generated by TestAmerica using standard reporting units of micrograms per liter for VOCs, TPH-GRO, and metals and milligrams per liter for TPH-DRO and anions. In addition, sample collection and analytical method protocols were implemented in accordance with approved, documented procedures. Analytical data are determined to be comparable to previous Site results.

12.5 Completeness

Completeness of the field sampling activities were assessed in terms of the actual number and type of sample results received from the field and laboratory, as compared with the planned number and type of sample results. All samples planned were collected which meets a field completeness of 100%.

Analytical completeness of data is a measure of the number of valid project-specific data results obtained in comparison to the total number of data results projected to achieve project DQOs. Valid data are defined as data that meet the project-specific DQOs. No data were rejected as a result of the data validation; however, some of the results were qualified as estimated. Estimated data is usable data. The completeness goals met the 90 percent goal for field and laboratory data expected for this project.

12.6 Sensitivity

Analytical methods and RLs were implemented in accordance with the QAPP/SOP and EPA promulgated methodologies. Method RLs were achieved for the event except when sample

dilutions were required to bring target compounds within the linear range of the instrument calibration. As previously mentioned, the samples within this SDG required dilutions for VOCs, TPH-GRO, and chloride to place the results within the calibration range. These include modified RLs for selected detections; therefore, sensitivity requirements were met for non-diluted constituents.

12.7 Usability Summary

The data generated during the September 2014 sampling event were usable with qualifications with respect to project DQOs. The DQOs for the Enhanced Bioremediation Field Test is to produce data to support design of anaerobic methods for the ST012 remedy if selected.

13.0 REFERENCES

AFCEE, 2005. Quality Assurance Project Plan, Version 4.0.01, May, 2005.

AMEC, August 11, 2014. *Draft Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) (Enhanced Bioremediation Field Test Plan) Operable Unit 2 Site ST012 - Liquid Fuels Storage Area, Former Williams Air Force Base, Mesa, Arizona*.

AMEC, February 23, 2012. *Performance Based Remediation Program Quality Assurance Project Plan (QAPP) and Standard Operating Procedures (SOPs) (QAP/SOP), Former Williams Air Force Base, Mesa, Arizona*.

DoD, 2010. Department of Defense Quality System Manual, Version 4.2 Final, October 2010.

Prepared/Date: DWK 10/24/14
Checked/Date: JAH 10/27/14

ED_005025_00007837-00302

Flagged Data Reports

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59873-1

Client Sample ID: **ST012-W30-WG-091014**

Lab Sample ID: 280-59873-1
Client Matrix: Water

Date Sampled: 09/10/2014 1056
Date Received: 09/11/2014 0920

8260B Volatile Organic Compounds (GC/MS)

Analysis Method:	8260B	Analysis Batch:	280-243756	Instrument ID:	VMS_H
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	H4403.D
Dilution:	5.0			Initial Weight/Volume:	20 mL
Analysis Date:	09/18/2014 1524			Final Weight/Volume:	20 mL
Prep Date:	09/18/2014 1524				

DWK 10/24/14

Analyte	Result (ug/L)	Qualifier	DL	LOQ
1,2-Dichloroethane	2.0	U	0.65	5.0
Methylene Chloride	4.0	U	1.6	25
Naphthalene	84	~~D~~	1.1	5.0
Toluene	160	~~D~~	0.85	5.0
Trichloroethene (TCE)	1.0	U	0.80	5.0
Trichlorofluoromethane	4.0	U	1.5	10

Surrogate	%Rec	Qualifier	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	118		70 - 120
4-Bromofluorobenzene (Surr)	103		75 - 120
Dibromofluoromethane (Surr)	110		85 - 115
Toluene-d8 (Surr)	113		85 - 120

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59873-1

Client Sample ID: **ST012-W30-WG-091014**

Lab Sample ID: 280-59873-1
Client Matrix: Water

Date Sampled: 09/10/2014 1056
Date Received: 09/11/2014 0920

8260B Volatile Organic Compounds (GC/MS)

Analysis Method:	8260B	Analysis Batch:	280-243756	Instrument ID:	VMS_H
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	H4404.D
Dilution:	50			Initial Weight/Volume:	20 mL
Analysis Date:	09/18/2014 1546	Run Type:	DL	Final Weight/Volume:	20 mL
Prep Date:	09/18/2014 1546				

DWK 10/3 9/14

Analyte	Result (ug/L)	Qualifier	DL	LOQ
Benzene	1900	D	8.0	50
Ethylbenzene	740	D	8.0	50
m-Xylene & p-Xylene	950	D	17	100
o-Xylene	85	D	9.5	50
Xylenes, Total	1000	D	9.5	100

Surrogate	%Rec	Qualifier	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	101		70 - 120
4-Bromofluorobenzene (Surr)	98		75 - 120
Dibromofluoromethane (Surr)	101		85 - 115
Toluene-d8 (Surr)	108		85 - 120

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59873-1

Client Sample ID: **TB01-091014**

Lab Sample ID: 280-59873-2TB
Client Matrix: Water

Date Sampled: 09/10/2014 0000
Date Received: 09/11/2014 0920

8260B Volatile Organic Compounds (GC/MS)

Analysis Method:	8260B	Analysis Batch:	280-243756	Instrument ID:	VMS_H
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	H4392.D
Dilution:	1.0			Initial Weight/Volume:	20 mL
Analysis Date:	09/18/2014 1126			Final Weight/Volume:	20 mL
Prep Date:	09/18/2014 1126				

pwk
N. Flags

Analyte	Result (ug/L)	Qualifier	DL	LOQ
1,2-Dichloroethane	0.40	U	0.13	1.0
Benzene	0.20	U	0.16	1.0
Ethylbenzene	0.20	U	0.16	1.0
Methylene Chloride	0.80	U	0.32	5.0
m-Xylene & p-Xylene	0.80	U	0.34	2.0
Naphthalene	0.80	U	0.22	1.0
o-Xylene	0.40	U	0.19	1.0
Toluene	0.40	U	0.17	1.0
Trichloroethene (TCE)	0.20	U	0.16	1.0
Trichlorofluoromethane	0.80	U	0.29	2.0
Xylenes, Total	1.6	U	0.19	2.0

Surrogate	%Rec	Qualifier	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	102		70 - 120
4-Bromofluorobenzene (Surr)	97		75 - 120
Dibromofluoromethane (Surr)	100		85 - 115
Toluene-d8 (Surr)	105		85 - 120

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59873-1

Client Sample ID: **ST012-W30-WG-091014**

Lab Sample ID: 280-59873-1
Client Matrix: Water

Date Sampled: 09/10/2014 1056
Date Received: 09/11/2014 0920

8015B_GRO Gasoline Range Organics (GRO)

Analysis Method:	8015B_GRO	Analysis Batch:	280-243683	Instrument ID:	VGC_Q
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	001F1601.D
Dilution:	20			Initial Weight/Volume:	5 mL
Analysis Date:	09/17/2014 1935			Final Weight/Volume:	5 mL
Prep Date:	09/17/2014 1935			Injection Volume:	5 mL

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Analyte	Result (ug/L)	Qualifier	DL	LOQ
Gasoline Range Organics (GRO)-C6-C10	14000	~~D M Q~~	200	500

Surrogate	%Rec	Qualifier	Acceptance Limits
a,a,a-Trifluorotoluene	181	~~M Q~~ *	82 - 110

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59873-1

Client Sample ID: **TB01-091014**

Lab Sample ID: 280-59873-2TB

Client Matrix: Water

Date Sampled: 09/10/2014 0000

Date Received: 09/11/2014 0920

8015B_GRO Gasoline Range Organics (GRO)

Analysis Method:	8015B_GRO	Analysis Batch:	280-243077	Instrument ID:	VGC_Q
Prep Method:	5030B	Prep Batch:	N/A	Lab File ID:	017F2301.D
Dilution:	1.0			Initial Weight/Volume:	5 mL
Analysis Date:	09/12/2014 1939			Final Weight/Volume:	5 mL
Prep Date:	09/12/2014 1939			Injection Volume:	5 mL

DUK
No Flags

Analyte	Result (ug/L)	Qualifier	DL	LOQ
Gasoline Range Organics (GRO)-C6-C10	20	U	10	25

Surrogate	%Rec	Qualifier	Acceptance Limits
a,a,a-Trifluorotoluene	93		82 - 110

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59873-1

Client Sample ID: **ST012-W30-WG-091014**

Lab Sample ID: 280-59873-1
Client Matrix: Water

Date Sampled: 09/10/2014 1056
Date Received: 09/11/2014 0920

8015B_DRO Diesel Range Organics (DRO) (GC)

Analysis Method:	8015B_DRO	Analysis Batch:	280-243251	Instrument ID:	SGC_U2a
Prep Method:	3510C	Prep Batch:	280-243123	Initial Weight/Volume:	1024.1 mL
Dilution:	1.0			Final Weight/Volume:	1 mL
Analysis Date:	09/16/2014 0313			Injection Volume:	1 uL
Prep Date:	09/12/2014 2029			Result Type:	PRIMARY

DWK 10/20/14

Analyte	Result (mg/L)	Qualifier	DL	LOQ
Diesel Range Organics [C10-C28]	11	-M-	0.032	0.24

Surrogate	%Rec	Qualifier	Acceptance Limits
o-Terphenyl	78	M	50 - 115

Client: AMEC Environment & Infrastructure, Inc.

Job Number: 280-59873-1

Client Sample ID: **ST012-W30-WG-091014**

Lab Sample ID: 280-59873-1
Client Matrix: Water

Date Sampled: 09/10/2014 1056
Date Received: 09/11/2014 0920

6010C Metals (ICP)

Analysis Method:	6010C	Analysis Batch:	280-243607	Instrument ID:	MT_026
Prep Method:	3010A	Prep Batch:	280-243011	Lab File ID:	26A091614.asc
Dilution:	1.0			Initial Weight/Volume:	50 mL
Analysis Date:	09/16/2014 1333			Final Weight/Volume:	50 mL
Prep Date:	09/15/2014 0915				

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Analyte	Result (ug/L)	Qualifier	DL	LOQ
Calcium	200000		35	1000
Iron	2700		22	100
Magnesium	43000		11	500
Manganese	3200	Q	0.25	10
Potassium	55000		240	3000
Sodium	60000		92	5000

General Chemistry

Client Sample ID: **ST012-W30-WG-091014**

Lab Sample ID: 280-59873-1 Date Sampled: 09/10/2014 1056

Client Matrix: Water Date Received: 09/11/2014 0920

DWK 10/24/14

Analyte	Result	Qual	Units	DL	LOQ	Dil	Method
Bromide	2.3		mg/L	0.11	0.50	1.0	9056A
Analysis Batch: 280-242847	Analysis Date: 09/11/2014 1813						
Orthophosphate as P	0.20	U	mg/L	0.19	0.50	1.0	9056A
Analysis Batch: 280-242846	Analysis Date: 09/11/2014 1813						
Chloride	510	~~D~~	mg/L	2.5	30	10	9056A
Analysis Batch: 280-242847	Analysis Date: 09/12/2014 0251						
Sulfate	13		mg/L	0.23	5.0	1.0	9056A
Analysis Batch: 280-242847	Analysis Date: 09/11/2014 1813						

Data Quality Evaluation Checklists

Method Validated: 8260B

Initial Review by: D. Knaub Date: 10/24/14
Senior Review by: J. Hartness Date: 10/27/14

SDG#: 280-59873-1
Matrix: Groundwater

ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (METHODS 8260 AND 8270)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C).	QC acceptance criteria published by DoD, if available; otherwise method- specific criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	NA	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	Ok
MDL Study	At initial set-up and subsequently once per 12-month period; otherwise quarterly MDL verification checks shall be performed (see box D-18)	See 40 CFR 136B. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL verification check at higher level and set MDL higher or reconduct MDL study (see box D-18)	NA	Samples cannot be analyzed without a valid MDL.	Ok
Tuning	Prior to calibration and every 12 hours during sample analysis	Refer to method for specific ion criteria.	Retune instrument and verify. Rerun affected samples.	Flagging criteria are not appropriate	Problem must be corrected. No samples may be accepted without a valid tune.	p. 220-221 level IV package VMS_H, ICAL/ICV, 9/17/14 VMS_H, CCV 9/18/14 All ok
Breakdown Check (DDT Method 8270C Only)	Daily prior to analysis of samples	Degradation ≤ 20% for DDT	Correct problem then repeat breakdown check	Flagging criteria are not appropriate	No samples shall be run until degradation ≤ 20%. Benzidine and pentachlorophenol should be present at their normal responses and no peak tailing should be observed.	NA

ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (METHODS 8260 AND 8270)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Container, Preservation, and Holding Time	All field samples	8260 – 40 ml VOA vial HCl to pH < 2, Cool to 4°C 14 days to analysis 8270 – 1 L Amber glass, Cool to 4°C 7 days to extraction 40 days to analysis	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collection date: 9/10/14 Analysis date: 9/18/14, Temp 1.7 °C (CoC) Narrative: 1.0°C OK
Minimum Five-Point Initial Calibration For All Analytes (ICAL)	Initial calibration prior to sample analysis	Average response factor (RF) for SPCCs: VOCs - 0.30 for Chlorobenzene and 1,1,2,2-tetrachlorolethane. a 0.1 for chloromethane, bromoform, and 1,1-dicbloroethane. SVOCs - a 0.050. RSD for RFs for CCCs: The CCCs are vinyl chloride, 1,1-dichlorethene, chloroform, 1,2-dichloropropane, toluene, and ethylbenzene. VOCs and SVOCs - 30% and one option below; **Option 1**: RSD for each analyte ≤ 15% **Option 2**: linear least squares regression r a 0.995 **Option 3**: non-linear regression - coefficient of determination (COD) e a 0.99 (6 points shall be used for second order, 7 points shall be used for third order)	Correct problem then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed.	p. 240 VMS_H, 9/17/14 All OK p. 287 VMS_H, 9/17/14 (short list) All OK

Method Validated: 8260B

Initial Review by: D. Knaub Date: 10/24/14 SDG#: 280-59873-1
Senior Review by: J. Hartness Date: 10/27/14 Matrix: Groundwater

ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (METHODS 8260 AND 8270)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 25% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	VMS_H ICV not included in data packages Analyzed on 9/17/14 at 12:53 & 15:46 – see run log on page 349.
Retention Time Window Position Establishment for Each Analyte and Surrogate	Once per ICAL	Position shall be set using the midpoint standard of the initial calibration curve.	NA			All OK
Evaluation of Relative Retention Times (RRT)	With each sample	RRT of each target analyte in each calibration standard within ± 0.06 RRT units.	Correct problem, then rerun ICAL.			All ok
Calibration Verification (CV)	Daily, before sample analysis, and every 12 hours of analysis time	Average RF for SPCCs: VOCs 0.30 for Chlorobenzene and 1,1,2,2-tetrachlorolethane, 0.1 for chloromethane, bromoform, and 1,1-dichloroethane. SVOCs 0.050. 2. %Difference/Drift for CCCs: VOCs and SVOCs ≤20%D (Note: D = difference when using RFs or drift when using least squares regression or non-linear calibration.)	Correct problem, then rerun CV. If that fails, repeat initial calibration. See section 5.5.10 and DoD clarification box 55.	Apply Q-flag if no sample material remains and analyte exceeds criteria.	NA	p. 312, VMS_H CCV 280-243756/2 (9/18/14) p. 328 VMS_H CCV (short list) 280-243756/3 (9/18/14) All COIs OK

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ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (METHODS 8260 AND 8270)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Internal Standards Verification	In all field samples and standards	Retention time ± 30 seconds from retention time of the midpoint standard in the ICAL EICP area within - 50% to + 100% of ICAL midpoint standard	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory.	If corrective action fails in field samples, apply Q-flag to analytes associated with the non-compliant IS. Flagging criteria are not appropriate for failed standards.	Flagging criteria are not appropriate.	p. 222 -224 ICIS 280-243577/22 All ok
Method Blank	One per preparatory batch	No analytes detected >½ RL. For common laboratory contaminants, no analytes detected > RL.	Correct problem, then see criteria in box D-5. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank.	Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.		p.43 MB 280-243756/6 All ND
LCS Containing All Analytes Required to be Reported, Including Surrogates	One LCS per preparatory batch	QC acceptance criteria specified by DoD, if available; see box D-7 and Appendix DoD-D.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. (See full explanation in Appendix DoDID.	If corrective action fails, applyIQ-flag to specific analyte(s) in all samples in the associated preparatory batch.		p.44 LCS 280-243756/4 All OK
MS	One MS per preparatory batch per matrix (see box D- 15)	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	Lab: For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error	No MS/MSD submitted for method 8260B

ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (METHODS 8260 AND 8270)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
MSD or Sample Duplicate	One per preparatory batch per matrix	RPD ≤ 30% (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	Lab: For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	NA -See above
Surrogate Spike (Analytes Identified in Appendix DoD-D)	All field and QC samples	QC acceptance criteria for LCS published by DoD, if available; otherwise method- specified criteria or laboratory's own in-house criteria.	For QC and field samples, correct problem, then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available.	For the specific analyte(s) in all field samples collected from the same site matrix as the parent, apply J-flag if acceptance criteria are not met. For QC samples, apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.		p. 40 All OK.
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD ≤30%	Qualify sample	For the specific analyte(s) in the parent & dup samples, apply J- flag if acceptance criteria are not met.		None in this SDG
Results Reported Between MDL and LOQ	NA	NA	NA	Apply J-flag to all results between MDL and LOQ. Validator flags: If using AFCEE; Apply "F" flag		Samples qualified as estimated and AFCEE flagged "F" unless overridden by flags for other criteria

ORGANIC ANALYSIS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (METHODS 8260 AND 8270)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
QC Blanks (Trip Blanks, Equipment Blanks, and Field Blanks)	Trip Blank – one per cooler containing samples for VOCs Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value (10x for common lab contaminants) are qualified as estimated and flagged "B"		TB01-091014 All ND

Method Validated: 8015B (TPH-GRO) | Initial Review by: D. Knaub | Date: 10/24/14 | SDG#:280-59873-1
Senior Review by: J. Hartness | Date: 10/27/14 | Matrix: Groundwater

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C)	QC acceptance criteria published by DoD, if available; otherwise method- specified criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	Not applicable (NA)	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	ok
Method Detection Limit (MDL) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly MDL verification checks shall be performed (see box 0-18)	See 40 CFR 1368. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL verification check at higher level and set MDL higher or reconduct MDL study (see box D-18).	NA	Samples cannot be analyzed without a valid MDL.	ok
Retention Time (RT) Window Width Calculated for Each Analyte and Surrogate	At method set-up and after major maintenance (e.g., column change)	RT width is ± 3 times standard deviation for each analyte RT from 72-hour study.	NA	NA		
Breakdown Check (Endrin/ DDT Method 8081 Only)	Daily prior to analysis of samples	Degradation ≤ 15% for both Endrin and DDT.	Correct problem then repeat breakdown check.	Flagging criteria are not appropriate	No samples shall be run until degradation ≤ 15%.	NA TPH-GRO

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Container, Preservation, and Holding Time	All field samples	GRO- Water: 40 ml VOA vial; HCl to pH < 2, Cool to 6°C Soil: (low-level) 5 g in 40 ml VOA w/H_2O or sodium bisulfate; Cool to 6°C (high-level) 5 g in 40 ml VOA w/methanol, Cool to 6°C, or EnCore® or equivalent (48 hrs to preservation) 14 days to analysis DRO – Water: 1 L Amber glass, Cool to 6°C Soil: 4 oz amber glass jar, Cool to 6°C Water: 7 days to extraction Soil: 14 days to extraction 40 days to analysis	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collected: 9/10/14 Temp=1.7°C (CoC) Narrative; 1.0°C Analyzed: 9/12/14, 9/17/14 ***ok***

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ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Minimum Five-Point Initial Calibration For All Analytes (ICAL)	Initial calibration prior to sample analysis	One of the options below (except for Method 8082, which may only use Option 1 or 2): Option 1: RSD for each analyte ≤ 20% Option 2: linear least squares regression: r 2 ≥0.995 Option 3: non-linear regression: coefficient of determination (COD) r2 ≥0.99 (6 points shall be used for second order, 7 points shall be used for third order)	Correct problem then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed. For PCB analysis, a mixture of Aroclors 1016 and 1260 is normally used to establish detector calibration linearity, unless project-specific data suggest the presence of another Aroclor (e.g., 1232). In addition, a mid-level or lower standard for each of the remaining Aroclors is analyzed for pattern recognition and response factor.	p. 384 Inst VGC_Q 3/12/14 OK
Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 20% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	p. 412 ICV 280-216544/11 3/12/14 Inst VGC_Q
Retention Time Window Position Establishment for Each Analyte and Surrogate	Once per ICAL and at the beginning of the analytical shift	Position shall be set using the midpoint standard of the calibration curve or the value in the CCV run at the beginning of the analytical shift.	NA	NA		p. 383 ICAL

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Retention Time Window Verification for Each Analyte and Surrogate	Each calibration verification standard	Analyte within established window	Correct problem, then reanalyze all samples analyzed since the last acceptable retention time check. If they fail, redo ICAL and reset retention time window,	Flagging criteria are not appropriate for initial verification. For CCV, apply a Q-flag to all results for analytes outside the established window.	No samples shall be run without a verified retention time window at the initial verification. For method 8015, check state methods for use of modified retention time markers with gasoline range organics (GRO) or diesel range organics (DRO).	p. 413 ICV p. 419, 426, 433, 440, 447 CCVs
Calibration Verification (Initial [ICV] and Continuing [CCV])	ICV: Daily, before sample analysis CCV: After every 10 field samples and at the end of the analysis sequence	All analytes within ± 20% of expected value from the ICAL	ICV: Correct problem, rerun ICV. If that fails, repeat initial calibration. See section 5.5.10 and box 55. CCV: Correct problem then repeat CCV and reanalyze all samples since last successful calibration verification.	ICV: Flagging criteria are not appropriate. CCV: Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification, if . reanalysis is not possible.	If %D for an individual analyte is > 20%, no samples may be analyzed until the problem has been corrected.	p. 412 ICVRT 280-216544/11 3/12/14 Inst VGC_Q OK p. 418 CCV 280-243077/3 9/12/14 Inst VGC_Q OK p. 425 CCV 280-243077/19 9/12/14 Inst VGC_Q OK p. 432 CCV 280-243077/30 9/12/14 Inst VGC_Q OK p. 439 CCV 280-243683/3 9/17/14 Inst VGC_Q p. 446 CCV 280-243683/17 9/17/14 Inst VGC_Q

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Method Blank	One per preparatory batch	No analytes detected > ½RL. For common laboratory contaminants, no analytes detected > RL.	Correct problem, then see criteria in box 0-5; if required, reprep then reanalyze method blank and all samples processed with the contaminated blank.	Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch		p. 45 MB 280-243077/4 ND p. 47 MB 280-243683 /4 ND
Laboratory Control Sample (LCS) Containing All Analytes Required to be Reported, Including Surrogates	One LCS per preparatory batch	QC acceptance criteria specified by DoD, if available; see box D-7 and Appendix DoD-D .	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix DoD D)	If corrective action fails apply J-flag to specific analyte(s) in all samples in the associated preparatory batch		p. 46, LCS/LCSD 280-243077/5,6 GRO = 119, 109 RPD = 8 p. 47, LCS/LCSD 280-243683/5,6 GRO = 103, 104 RPD = 1
Matrix Spike (MS)	One MS per preparatory batch per matrix (see box ID- 11)	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken,	Lab: For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	No MS/MSD submitted with this SDG
Matrix Spike Duplicate (MSD) or Sample Duplicate	One per preparatory batch per matrix	RPD ≤30% (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	Lab: For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	No MSD performed with this SDG

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD ≤30%	Qualify sample	For the specific analyte(s) in the parent & dup samples, apply J- flag if acceptance criteria are not met.		None in this SDG
Surrogate Spike (Analytes Identified in Appendix DoD-D)	All field and QC samples	QC acceptance criteria for LCS specified by DoD, if available; otherwise method- specified criteria or laboratory's own in-house criteria	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary.	For the specific analyte(s) in all field samples collected from the same site matrix as the parent, apply J-flag if acceptance criteria are not met. For QC samples, apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Alternative surrogates are recommended when there is obvious chromatographic interference.	p. 41 ST012-W30-WG-091014= 181% *No flag, assoc. result anal. at a 20x dilution*
Confirmation of Positive Results (Second Column or Second Detector)	All positive results must be confirmed (in Method 8081A exclude toxaphene and technical chlordane, in Method 8015B exclude GRO, DRO, and residual range organics (RRO)).	Calibration and QC criteria same as for initial or primary column analysis. Results between primary and second column RPD ≤ 40%.	NA	Apply J-flag if RFD > 40% or Q-flag if sample is not confirmed. Discuss in the case narrative.	Report the higher of two confirmed results unless overlapping peaks are causing erroneously high results, then report the non- affected result and document in the case narrative.	NA

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Results Reported Between LOD and LOQ	NA	NA	NA	Apply J-flag to all results between LOD and LOQ. Validator flags: If using AFCEE; Apply "F" flag		No targets detected between LOD and LOQ
QC Blanks (Trip Blanks, Equipment Blanks, and Field Blanks)	Trip Blank – one per cooler containing samples for volatile parameters Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value (10x for common lab contaminants) are qualified as estimated and flagged "B"		TB01-090814 ND for GRO

Method Validated: 8015B (TPH-DRO) | Initial Review by: D. Knaub | Date: 10/24/14 | SDG#:280-59873-1
Senior Review by: J. Hartness | Date: 10/27/14 | Matrix: Groundwater

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C)	QC acceptance criteria published by DoD, if available; otherwise method- specified criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	Not applicable (NA)	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	ok
Method Detection Limit (MDL) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly MDL verification checks shall be performed (see box 0-18)	See 40 CFR 1368. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL verification check at higher level and set MDL higher or reconduct MDL study (see box D-18).	NA	Samples cannot be analyzed without a valid MDL.	ok
Retention Time (RT) Window Width Calculated for Each Analyte and Surrogate	At method set-up and after major maintenance (e.g., column change)	RT width is ± 3 times standard deviation for each analyte RT from 72-hour study.	NA	NA		
Breakdown Check (Endrin/ DDT Method 8081 Only)	Daily prior to analysis of samples	Degradation ≤ 15% for both Endrin and DDT.	Correct problem then repeat breakdown check.	Flagging criteria are not appropriate	No samples shall be run until degradation ≤ 15%.	NA TPH-DRO

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Container, Preservation, and Holding Time	All field samples	GRO- Water: 40 ml VOA vial; HCl to pH < 2, Cool to 6°C Soil: (low-level) 5 g in 40 ml VOA w/H_2O or sodium bisulfate; Cool to 6°C (high-level) 5 g in 40 ml VOA w/methanol, Cool to 6°C, or EnCore® or equivalent (48 hrs to preservation) 14 days to analysis DRO – Water: 1 L Amber glass, Cool to 6°C Soil: 4 oz amber glass jar, Cool to 6°C Water: 7 days to extraction Soil: 14 days to extraction 40 days to analysis	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collected: 9/10/14 Temp= 1.7 °C (CoC) Narrative: 1.0°C Extracted; 9/12/14 Analyzed: 9/16/14 ***ok***

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Minimum Five-Point Initial Calibration For All Analytes (ICAL)	Initial calibration prior to sample analysis	One of the options below (except for Method 8082, which may only use Option 1 or 2): Option 1: RSD for each analyte ≤ 20% Option 2: linear least squares regression: r 2 ≥0.995 Option 3: non-linear regression: coefficient of determination (COD) r2 ≥0.99 (6 points shall be used for second order, 7 points shall be used for third order)	Correct problem then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed. For PCB analysis, a mixture of Aroclors 1016 and 1260 is normally used to establish detector calibration linearity, unless project-specific data suggest the presence of another Aroclor (e.g., 1232). In addition, a mid-level or lower standard for each of the remaining Aroclors is analyzed for pattern recognition and response factor.	p. 499 Inst SGC_U 2a 3/26/14 OK
Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 20% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	p. 540 ICV 280-218430/11 3/26/14 Inst SGC_U2a
Retention Time Window Position Establishment for Each Analyte and Surrogate	Once per ICAL and at the beginning of the analytical shift	Position shall be set using the midpoint standard of the calibration curve or the value in the CCV run at the beginning of the analytical shift.	NA	NA		p. 498 ICAL

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Retention Time Window Verification for Each Analyte and Surrogate	Each calibration verification standard	Analyte within established window	Correct problem, then reanalyze all samples analyzed since the last acceptable retention time check. If they fail, redo ICAL and reset retention time window,	Flagging criteria are not appropriate for initial verification. For CCV, apply a Q-flag to all results for analytes outside the established window.	No samples shall be run without a verified retention time window at the initial verification. For method 8015, check state methods for use of modified retention time markers with gasoline range organics (GRO) or diesel range organics (DRO).	p. 541 ICV p. 549 CCV p. 556 CCV p. 563 CCV p. 570 CCV
Calibration Verification (Initial [ICV] and Continuing [CCV])	ICV: Daily, before sample analysis CCV: After every 10 field samples and at the end of the analysis sequence	All analytes within ± 20% of expected value from the ICAL	ICV: Correct problem, rerun ICV. If that fails, repeat initial calibration. See section 5.5.10 and box 55. CCV: Correct problem then repeat CCV and reanalyze all samples since last successful calibration verification.	ICV: Flagging criteria are not appropriate. CCV: Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification, if . reanalysis is not possible.	If %D for an individual analyte is > 20%, no samples may be analyzed until the problem has been corrected.	p. 540 ICV 280-218430/11 3/26/14 Inst SGC_U2a p. 548 CCV 280-243251/3 9/15/14 Inst SGC_U2a p. 555 CCV 280-243251/25 9/15/14 Inst SGC_U2a p. 562 CCV 280-243251/37 9/16/14 Inst SGC_U2a p. 569 CCV 280-243251/43 9/16/14 Inst SGC_U2a

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Method Blank	One per preparatory batch	No analytes detected > ½RL. For common laboratory contaminants, no analytes detected > RL.	Correct problem, then see criteria in box 0-5; if required, reprep then reanalyze method blank and all samples processed with the contaminated blank.	Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch		p. 49 MB 280-243123/1-A DRO=ND
Laboratory Control Sample (LCS) Containing All Analytes Required to be Reported, Including Surrogates	One LCS per preparatory batch	QC acceptance criteria specified by DoD, if available; see box D-7 and Appendix DoD-D .	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix DoD D)	If corrective action fails apply J-flag to specific analyte(s) in all samples in the associated preparatory batch		p. 49 LCS/LCSD 280-242123/ 2-A,3-A DRO = 83, 77 RPD = 7
Matrix Spike (MS)	One MS per preparatory batch per matrix (see box ID- 11)	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken,	Lab: For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	No MS/MSD submitted with this SDG
Matrix Spike Duplicate (MSD) or Sample Duplicate	One per preparatory batch per matrix	RPD ≤30% (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	Lab: For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	No MSD or lab dup performed with this SDG

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ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD ≤30%	Qualify sample	For the specific analyte(s) in the parent & dup samples, apply J- flag if acceptance criteria are not met.		None in this SDG
Surrogate Spike (Analytes Identified in Appendix DoD-D)	All field and QC samples	QC acceptance criteria for LCS specified by DoD, if available; otherwise method- specified criteria or laboratory's own in-house criteria	For QC and field samples, correct problem then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary.	For the specific analyte(s) in all field samples collected from the same site matrix as the parent, apply J-flag if acceptance criteria are not met. For QC samples, apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Alternative surrogates are recommended when there is obvious chromatographic interference.	p. 42 **All ok**
Confirmation of Positive Results (Second Column or Second Detector)	All positive results must be confirmed (in Method 8081A exclude toxaphene and technical chlordane, in Method 8015B exclude GRO, DRO, and residual range organics (RRO)).	Calibration and QC criteria same as for initial or primary column analysis. Results between primary and second column RPD ≤ 40%.	NA	Apply J-flag if RFD > 40% or Q-flag if sample is not confirmed. Discuss in the case narrative.	Report the higher of two confirmed results unless overlapping peaks are causing erroneously high results, then report the non- affected result and document in the case narrative.	NA

ORGANIC ANALYSIS BY GAS CHRO000MATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (METHODS 8011, 8015, 8021, 8070, 8081, 8082, 8141, 8151, 8310, AND 8330)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Results Reported Between LOD and LOQ	NA	NA	NA	Apply J-flag to all results between LOD and LOQ. Validator flags: If using AFCEE; Apply "F" flag		No targets detected between LOD and LOQ
QC Blanks (Trip Blanks, Equipment Blanks, and Field Blanks)	Trip Blank – one per cooler containing samples for volatile parameters Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value (10x for common lab contaminants) are qualified as estimated and flagged "B"		No EB

Method Validated: 6010

Initial Review by: D. Knaub Date: 10/24/14 SDG#:280-59873-1
Senior Review by: J. Hartness Date: 10/27/14 Matrix: Groundwater

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C)	QC acceptance criteria published by DoD, if available; otherwise method- specified criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	Not applicable (NA)	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	Ok
Instrument Detection Limit (IDL) Study	At initial set-up and after significant change in instrument type, personnel, test method, or sample matrix	IDL shall be ≤ Limit of Detection (LOD)	NA	NA		p. 610 6/11/13
Container, Preservation, and Holding Time	All field samples	Water: 500 ml Poly, HNO_3 to pH < 2, Cool to 6°C, Soil: 4 oz glass or poly jar, Cool to 6°C 180 days to analysis	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collection date: 9/10/14 Prep; 9/15/14 Analysis date: 9/16/14 Temp:1.7 °C (CoC) Narrative: 1.0°C Ok
Initial calibration (ICAL) for all analytes (minimum one high standard and a calibration blank)	Daily ICAL prior to sample analysis	If more than one calibration standard is used, r ≥ 0.995.	Correct problem then repeat ICAL.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed.	p. 620 run log ICIS analyzed 9/16/2014 11:11 IC analyzed 9/16/2014 11:13 and 11:16

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Second Source Calibration Verification (ICV)	Once after each ICAL, prior to beginning sample run	Value of second source for all analytes within ± 10% of true value	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	p. 597 ICVH 280-243607/6 9/16/2014 All OK p. 598 ICV 280-243607/7 9/16/2014 All OK p. 599 ICVL 280-243607/8 9/16/2014 All OK
Continuing Calibration Verification (CCV)	After every 10 field samples and at the end of the analysis sequence	All analytes within ± 10% of true value	Correct problem, rerun CCV. If that fails, then repeat ICAL. Reanalyze all samples since last successful calibration verification	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) of interest in all samples since the last acceptable CCV. Validator flags: If using AFCEE; Apply "J" flag only if reanalysis cannot be performed	Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	p. 597 CCVH 280-243607/42,53 9/16/14 All OK p. 598 CCV 280-243607/43, 54 9/18/14 All OK p. 599 CCVL 280-243607/45, 56 9/18/14 All OK
Low-level calibration check standard	Daily, after one-point ICAL	Within ± 20% of true value	Correct problem, then reanalyze	Flagging criteria are not appropriate.	No samples may be analyzed without a valid low-level calibration check standard. Low-level calibration check standard should be less than or equal to the reporting limit.	p.600 ***All OK***

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TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Linear dynamic range or high-level check standard	Every 6 months	Within ±10% of expected value	NA	NA		p. 618 7/21/14
Method Blank	One per preparatory batch	No analytes detected > ½ RL and greater than 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1).	Correct problem, then see criteria in box D-1; if required, reprep then reanalyze method blank and all samples processed with the contaminated blank.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch	Problem must be corrected. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where samples cannot be reanalyzed.	p. 51 MB-280-243011/1-A All ND
Calibration blank	Before beginning a sample run, after every 10 samples, and at end of the analysis sequence	No analytes detected > LOD	Correct problem. Reprep and reanalyze calibration blank. All samples following the last acceptable calibration blank must be reanalyzed	Apply B-flag to all results for specific analyte(s) in all samples associated with the blank.		p. 601 9/16/14 ICB/CCBs 280-243607/11,44,55 ND
Interference check solutions (ICS-A and ICS-AB)	At the beginning of an analytical run and every 12 hours	ICS-A: Absolute value of concentration for all non-spiked analytes < LOD (unless they are a verified trace impurity from one of the spiked analytes) ICS-AB: Within ±20% of expected value	Terminate analysis, locate and correct problem, reanalyze ICS, reanalyze all samples.	If corrective action fails, apply Q-flag to all results for specific analyte(s) in all samples associated with the ICS. Validator flags: If using AFCEE; Apply "M" flag		p. 603 9/16/14 ICSA - ICS-A Mn >LOD *No qualification- vendor verified trace impurities* p. 604 9/16/14 ICSAB All OK

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Laboratory Control Sample (LCS) Containing All Analytes to be Reported	One per preparatory batch	QC acceptance criteria specified by DoD, if available; see box D-3 and Appendix G.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix G)	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch Validator flags: If using AFCEE; Apply "J" flag	Problem must be corrected. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	p. 51 LCS-280-243011/2-A 9/16/14 All OK
Matrix Spike (MS)	One per preparatory batch per matrix (see box D-7)	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS.	Examine the project-specific DQOs. If the matrix spike falls outside of DoD criteria, additional quality control test (dilution test and post-digestion spike addition) are required to evaluate matrix effects.	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	p. 52 ST012-W30-WG-091014 All ok
Matrix Spike Duplicate (MSD)	One per preparatory batch per matrix (see Box D-7)	MSD: For matrix evaluation use QC acceptance criteria specified by DoD for LCS MSD RPD < 20%	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	p. 52 ST012-W30-WG-091014 RPDs All ok
Dilution test	Once per preparatory batch	Five-fold dilution must agree within ± 10% of the original measurement	Perform post-digestion spike addition.	Flagging criteria are not appropriate.	Only applicable for samples with concentrations > 50 x LOQ.	p. 53 ST012-W30-WG-091014 All OK
Post digestion spike addition	When dilution test fails or analyte concentration for all samples < 50 x LOQ	Recovery within 75-125% of (see Table B-1)	Run all associated samples in the preparatory batch by method of standard additions (MSA) or see flagging criteria.	For specific analyte(s) in the parent sample, apply J-flag of acceptance criteria are not met.	Spike addition should produce a concentration of 10 - 100 x LOQ	p. 52 Ca = 62% Mn = -104% ***No qualification: sample results greater than 4x spike amount***

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETRY (METHOD 6010)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Method of standard additions (MSA)	When matrix interference is suspected	NA	NA	NA	Document use of MSA in the case narrative.	NA
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD 20%	Qualify samples	For the specific analyte(s) in the parent & dup samples, apply J-flag if acceptance criteria are not met.		None in this SDG
Results Reported Between LOD and LOQ	NA	NA	NA	Apply J-flag to all results between DL and LOQ. Validator flags: If using AFCEE; Apply "F" flag		Results reported between MDL and RL flagged "F" for AFCEE.
QC Blanks (Equipment Blanks, and Field Blanks)	Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value are qualified as estimated and flagged "B".		No EB

ED_005025_00007837-00337

Method Validated: 9056A

Initial Review by: D. Knaub Date: 10/24/14
Senior Review by: J. Hartness Date: 10/27/14

SDG#: 280-59873-1
Matrix: Groundwater

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C)	QC acceptance criteria published by DoD, if available; otherwise method- specified criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	Not applicable (NA)	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	ok
Limit of Detection Determination and Verification (LOD) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly LOD verification checks shall be performed (see box D-13)	See 40 CFR 1368. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL / LOD verification check at higher level and set MDL higher or reconduct MDL study (see box D-13).	NA	Samples cannot be analyzed without a valid MDL.	p. 1075 6/16/2013
Limit of Quantitation Establishment and Verification (LOQ) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly LOQ verification checks shall be performed (see box D-14)	Within calibration range including low standard; within method precision and accuracy.	Re-run LOQ	NA	Samples cannot be analyzed without a valid LOQ	MRL check: Level 4 Package Pg. 54, 56,1074 (9/11/14) = All OK

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Retention Time (RT) Window Width Calculated for Each Analyte and Surrogate	At method set-up and after major maintenance (e.g., column change)	RT width is ± 3 times standard deviation for each analyte RT from 24-hour study.	NA	NA		OK
Container, Preservation, and Holding Time	All field samples	500 ml poly, Cool to 4°C Nitrate – 48 hours Nitrite, sulfate, chloride – 28 days	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collected: 9/10/14 Temp: 1.7°C (CoC) Narrative: 1.0°C Analyzed: 9/11/14
ICAL for All Analytes (Minimum Three Standards and One Calibration Blank)	Initial calibration prior to sample analysis	R ≥ 0.995	Correct problem then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed.	p. 1079 Level IV package 8/27/14 6 levels Inst. IC11 OK
Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 10% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	p. 1090 Level 4 Package OK
Retention Time Window Position Establishment for Each Analyte and Surrogate	Once per ICAL and at the beginning of the analytical shift	Position shall be set using the midpoint standard of the calibration curve or the value in the CCV run at the beginning of the analytical shift.	NA	NA		OK

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Midrange Continuing Calibration Verification (CCV)	After every 10 field samples and at end of the analysis sequence.	All analytes within established retention time windows and within ± 10% of true value	Correct problem then repeat CCV. If that fails, then repeat ICAL. Reanalyze all samples since last successful calibration verification.	Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification, if . reanalysis is not possible.	No samples may be analyzed until the problem has been corrected.	p. 1069-1070 Level IV Package 9/11/14 All OK
Method Blank	One per preparatory batch	No analytes detected > ½ RL. See box D-1.	Correct problem, then see criteria in box D-1; if required, reprep then reanalyze method blank and all samples processed with the contaminated blank.	Lab: Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch. Validator; Apply "B" flag if result is less than 5x method blank.		p. 54 MB 280-242846/6 ortho-P = ND p. 56 MB 280-242847/6 All ND p. 1070: CCBs CCBs (9/11/14) Cl = 0.631, 0.640, 0.643 *No assoc. results < 5x blank, no flags necessary*

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COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Laboratory Control Sample (LCS) Containing All Analytes Required to be Reported, Including Surrogates	One LCS per preparatory batch	Use laboratory in-house LCS acceptance criteria (not to exceed 20%).See Box D-3.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix G)	If corrective action fails apply J-flag to specific analyte(s) in all samples in the associated preparatory batch		p. 54 ortho-P = 99, 101 p. 57 Br = 99, 100 Cl = 99, 99 SO4 = 95, 95 All OK
Matrix Spike (MS)	One MS per preparatory batch per matrix (see box D- 7)	For matrix evaluation, use laboratory in-house LCS acceptance criteria (not to exceed 20%).	Examine the project-specific 000s. Contact the client as to additional measures to be taken,	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	None from this SDG
Matrix Spike Duplicate (MSD) or Sample Duplicate	One per preparatory batch per matrix	RPD ≤15% (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	NA
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD ≤10%	Qualify sample	For the specific analyte(s) in the parent & dup samples, apply J- flag if acceptance criteria are not met.		No field dups in this SDG

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Results Reported Between LOD and LOQ	NA	NA	NA	Apply J-flag to all results between LOD and LOQ. Validator flags: If using AFCEE; Apply "F" flag		No detections between LOD and LOQ
QC Blanks (Equipment Blanks and Field Blanks)	Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value (10x for common lab contaminants) are qualified as estimated and flagged "B".		No EB

ED_005025_00007837-00342

Data Evaluation Narrative
AMEC Project: Former Williams AFB
AMEC Project Number: 9101110001.5300.5301
Site: ST012 – Enhanced Bioremediation Field Test
Sampling Event: July 2014
Matrix: Groundwater

SDG: 550-28463-1

1.0 INTRODUCTION

A data quality evaluation (DQE) was performed on the data reported for the Enhanced Bioremediation Field Test conducted at Site ST012 in July 2014 at the former Williams Air Force Base (WAFB), located in Mesa, Arizona. The following sections provide summary discussions of the required data qualifications for each site and analytical methods for samples collected at the former WAFB. Data validation was conducted on 100% of the primary samples and field quality control samples (rinsate blanks and laboratory control sample/laboratory control sample duplicate [LCS/LCSD] samples). Data validation was performed using supplemental checklists to review the following quality control elements. A Level II DQE was performed on the analyses using the following criteria: laboratory case narrative, sample documentation, chain-of-custody, holding time protocols, method blank results, laboratory control sample (LCS) results, surrogate recoveries (where applicable), method sensitivity, and completeness.

Data was reviewed using precision and accuracy control limits presented in The Department of Defense (DoD) Quality Systems Manual (QSM) Version 4.2 (DoD, 2010). DQE data qualifications were applied if necessary in accordance with procedures in Air Force Center for Environmental Excellence (AFCEE) Quality Assurance Project Plan (QAPP), Version 4.0.01 (AFCEE, 2005), the method, and professional judgment using the following qualifiers:

- J = The reported concentration is considered an estimated value due to discrepancies in meeting certain analyte-specific quality control criteria.
- F = The reported concentration is between the reporting limit (RL) and method detection limit (MDL) and is considered an estimated value
- UJ = The target compound was not detected and the reporting limit is considered imprecise due to discrepancies in meeting certain analyte-specific quality control criteria.
- B = The result may be biased high or a false positive based on blank data.
- M = The reported concentration is estimated due to matrix effects.
- R = The data are considered unusable due to discrepancies in meeting certain quality control criteria and may not be used in decision making.

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2.0 DELIVERABLES

The data packages as submitted to AMEC Environment and Infrastructure, Inc. (AMEC) are complete as stipulated in the Draft Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) for Site ST012 Enhanced Bioremediation Field Test Plan (AMEC, 2014), and the applicable guidelines described in the former Williams AFB Performance Based Remediation Program QAPP and standard operating procedures (SOPs) (collectively referred to as the QAPP/SOP [AMEC, 2012]) for U.S. States Environmental Protection Agency (EPA) Methods 200.7, 300.0, SM2340B, SM2540C, and SM1030F.

3.0 SAMPLE INTEGRITY

Samples within this sample delivery group (SDG), collected from ST012, were submitted to TestAmerica Laboratories (TAL) in Phoenix, Arizona. The samples were submitted for calcium, magnesium, potassium, and sodium by USEPA Method E200.7, bromide and sulfate by USEPA Method E300.0, bicarbonate, carbonate, hydroxide, phenolphthalein, and total alkalinity by Method SM2320B, and total dissolved solids by Method SM2540C. Anion/cation balance for each sample was also determined by Method SM1030F (meq).

Based on the information provided on the cooler receipt forms, samples arrived at the laboratory within temperature and preservation requirements. Completed COC documents are included in the data package.

4.0 SAMPLE IDENTIFICATION

This SDG contains the following water and quality control (QC) samples:

Site: ST012	QC Samples
ST012-W11-NABRSOL	ST012-DUP01-072214
ST012-W11-WG-072214	
ST012-W30-WG-072214	

These samples were collected on 21 and 22 July 2014. Sample ST012-DUP01-072214 is a field duplicate of sample ST012-W30-WG-072214.

5.0 SAMPLE QUALIFICATION

Only those components that required qualification of the data are presented in this narrative. All Level II components were within the QC limits; therefore, no qualification was required for the data.

6.0 CALCIUM, MAGNESIUM, POTASSIUM, AND SODIUM (EPA 200.7)

Samples collected from site ST012 were submitted for metals by USEPA Method 200.7. The sample submitted to the TAL-Phoenix laboratory was analyzed for total calcium, magnesium,

potassium, and sodium. A Level II validation was performed on this method and all components were within the SAP/TAL SOP criteria.

6.1 Limits of Quantitation

The LOQs as specified in the QAPP/SOP (AMEC, 2012) were met for samples submitted for the analysis of metals by USEPA Method 200.7 with the exception of analytes that required dilution. All samples in this SDG required dilution for potassium resulting in elevated LOQs. The laboratory indicated a dilution with a "D1" qualifier which was subsequently removed during the validation process.

7.0 BROMIDE AND SULFATE (EPA 300.0)

Samples collected from site ST012 were submitted for bromide and sulfate by Method E300.0. A Level II validation was performed on this method and all components were within the QAPP/SOP criteria.

7.1 Limits of Quantitation

The LOQs as specified in the QAPP/SOP (AMEC, 2012) were met for samples submitted for the analysis of bromide and sulfate by USEPA Method E300.0 with the exception of analytes that required dilution. All samples in this SDG required dilution for bromide and sulfate resulting in elevated LOQs.

8.0 BICARBONATE, CARBONATE, HYDROXIDE, PHENOLPHTHALEIN, AND TOTAL ALKALINITY (SM2320B)

Samples collected from site ST012 were submitted for bicarbonate, carbonate, hydroxide, phenolphthalein, and total alkalinity by Method SM2320B. A Level II validation was performed on this method and all components were within the QAPP/SOP criteria.

9.0 TOTAL DISSOLVED SOLIDS (SM2540C)

Samples collected from site ST012 were submitted for total dissolved solids by Method SM2540C. A Level II validation was performed on this method and all components were within the QAPP/SOP criteria.

9.1 Limits of Quantitation

The LOQs as specified in the QAPP/SOP (AMEC, 2012) were met for samples submitted for the analysis of total dissolved solids by USEPA Method SM2540C with the exception of analytes that required dilution. All samples in this SDG required dilution for total dissolved solids resulting in elevated LOQs. The laboratory indicated a dilution with a "D2" qualifier which was subsequently removed during the validation process.

10.0 OVERALL SITE EVALUATION AND PROFESSIONAL JUDGMENT FLAGGING CHANGES

Edits to the DQE qualifiers by professional judgment were not required, and the data are usable as qualified in this data narrative.

11.0 SUMMARY OF DATA QUALITY INDICATORS

This section provides an assessment of the data based on project data quality indicators (DQIs) described on QAPP Worksheet #37 of the QAPP/SOP (AMEC, 2012). The DQIs consist of precision, accuracy, representativeness, comparability, completeness, and sensitivity.

11.1 Precision

An assessment of precision of analytical data is accomplished via review of field duplicate and MS/MSD analyses. Field duplicate and MS/MSD analyses are used to assess field variability, which includes sample collection/handling as well as matrix homogeneity. Precision is expressed as the relative percent difference (RPD) between results for duplicate pairs.

A field duplicate was analyzed for all methods list above in this SDG. Duplicate precision for each method was within QC limits, therefore, overall method and sample matrix precision are acceptable and achieve project objectives.

11.2 Accuracy (Bias)

An assessment of accuracy of analytical data is accomplished via evaluation of the spike recoveries in the MS/MSD, LCS, post digestion spike samples, and surrogate spike compounds, in addition to calibration criteria. Accuracy is expressed as percent recovery. Accuracy data were compliant with the program document QAPP/SOP, as all associated LCS/LCSD recoveries were within control. Therefore, the data results indicate method and matrix accuracy is acceptable to achieve project objectives.

11.3 Representativeness

Representativeness for the analytical data is determined through evaluation of the associated blank data and evaluation of appropriate sample handling procedures. All samples were properly stored and preserved in the field and at TestAmerica and blanks were all non-detect. The analytical results indicate sample data are representative of the Site conditions.

11.4 Comparability

Comparability addresses the confidence with which one data set can be compared to another. Use of appropriate sampling methods, COC procedures, and EPA-approved analytical methods, as well as adherence to strict QA/QC procedures, provide the basis for uniformity in sample collection and analysis. Analytical data were generated by TestAmerica using standard reporting units of milligrams per liter and methods for all parameters. In addition, sample collection and analytical method protocols were implemented in accordance with approved,

documented procedures. Analytical data are determined to be comparable to previous Site results.

11.5 Completeness

Completeness of the field sampling activities were assessed in terms of the actual number and type of sample results received from the field and laboratory, as compared with the planned number and type of sample results. All samples planned were collected which meets a field completeness of 100%.

Analytical completeness of data is a measure of the number of valid project-specific data results obtained in comparison to the total number of data results projected to achieve project DQOs. Valid data are defined as data that meet the project-specific DQOs. No data were rejected as a result of the data validation. The completeness goals met the 90 percent goal for field and laboratory data expected for this project.

11.6 Sensitivity

Analytical methods and LOQs were implemented in accordance with the QAPP/SOP and EPA promulgated methodologies. Method RLs were achieved for the event except when sample dilutions were required to bring target compounds within the linear range of the instrument calibration. These include modified RLs for selected detections. Although the laboratory RLs for samples requiring dilution exceed the QAPP RLs, sensitivity requirements were met.

11.7 Usability Summary

The data generated during the July 2014 sampling event did not require qualification and the analytical results indicate sample data is representative of the Site conditions. The DQOs for the Enhanced Bioremediation Field Test is to produce data to support design of anaerobic methods for the ST012 remedy if selected.

12.0 REFERENCES

AFCEE, 2005. Quality Assurance Project Plan, Version 4.0.01, May, 2005.

AMEC, August 11, 2014. *Draft Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) (Enhanced Bioremediation Field Test Plan) Operable Unit 2 Site ST012 - Liquid Fuels Storage Area, Former Williams Air Force Base, Mesa, Arizona.*

AMEC, February 23, 2012. *Performance Based Remediation Program Quality Assurance Project Plan (QAPP) and Standard Operating Procedures (SOPs) (QAP/SOP), Former Williams Air Force Base, Mesa, Arizona.*

DoD, 2010. Department of Defense Quality System Manual, Version 4.2 Final, October 2010.

Prepared/Date: MHA 8/14/2014
Checked/Date: DWK 8/18/2014

ED_005025_00007837-00347

Flagged Data Reports

Client Sample Results

Client: AMEC Environment & Infrastructure, Inc.
Project/Site: Williams AFB

TestAmerica Job ID: 550-28463-1

Client Sample ID: ST012-W11-WG-072214

Lab Sample ID: 550-28463-1
Matrix: Water

Date Collected: 07/22/14 12:41
Date Received: 07/22/14 16:15

AHA 7/24/14

Method: 300.0 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	55		50		mg/L			07/23/14 03:27	100
Sulfate	1000		200		mg/L			07/23/14 03:27	100

Method: 200.7 Rev 4.4 - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Calcium	570		2.0		mg/L		07/24/14 06:28	07/24/14 14:57	1
Magnesium	110		2.0		mg/L		07/24/14 06:28	07/24/14 14:57	1
Sodium	95		0.50		mg/L		07/24/14 06:28	07/24/14 14:57	1
Potassium	640	D1	5.0		mg/L		07/24/14 06:28	07/25/14 14:43	10

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Anion/Cation Balance	0.60				%			07/31/14 11:04	1
Alkalinity as CaCO3	100		6.0		mg/L			07/29/14 18:27	1
Bicarbonate Alkalinity as CaCO3	100		6.0		mg/L			07/29/14 18:27	1
Carbonate Alkalinity as CaCO3	ND		6.0		mg/L			07/29/14 18:27	1
Alkalinity, Phenolphthalein	ND		6.0		mg/L			07/29/14 18:27	1
Hydroxide Alkalinity as CaCO3	ND		6.0		mg/L			07/29/14 18:27	1
Total Dissolved Solids	4800	~~D2~~	100		mg/L			07/24/14 10:09	1

Client Sample ID: ST012-W30-WG-072214

Lab Sample ID: 550-28463-2
Matrix: Water

Date Collected: 07/22/14 09:25
Date Received: 07/22/14 16:15

Method: 300.0 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	99		50		mg/L			07/23/14 04:23	100
Sulfate	1900		200		mg/L			07/23/14 04:23	100

Method: 200.7 Rev 4.4 - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Calcium	430		2.0		mg/L		07/24/14 06:28	07/24/14 15:04	1
Magnesium	78		2.0		mg/L		07/24/14 06:28	07/24/14 15:04	1
Sodium	150		0.50		mg/L		07/24/14 06:28	07/24/14 15:04	1
Potassium	920	~~D1~~	5.0		mg/L		07/24/14 06:28	07/25/14 14:46	10

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Anion/Cation Balance	0.38				%			07/31/14 11:04	1
Alkalinity as CaCO3	220		6.0		mg/L			07/29/14 18:39	1
Bicarbonate Alkalinity as CaCO3	220		6.0		mg/L			07/29/14 18:39	1
Carbonate Alkalinity as CaCO3	ND		6.0		mg/L			07/29/14 18:39	1
Alkalinity, Phenolphthalein	ND		6.0		mg/L			07/29/14 18:39	1
Hydroxide Alkalinity as CaCO3	ND		6.0		mg/L			07/29/14 18:39	1
Total Dissolved Solids	4500	~~D2~~	100		mg/L			07/24/14 10:09	1

Client Sample Results

Client: AMEC Environment & Infrastructure, Inc.
Project/Site: Williams AFB

TestAmerica Job ID: 550-28463-1

8/14/14

Client Sample ID: ST012-DUP01-072214

Lab Sample ID: 550-28463-3
Matrix: Water

Date Collected: 07/22/14 10:30
Date Received: 07/22/14 16:15

Method: 300.0 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	110		50		mg/L			07/23/14 05:19	100
Sulfate	1900		200		mg/L			07/23/14 05:19	100

Method: 200.7 Rev 4.4 - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Calcium	430		2.0		mg/L		07/24/14 06:28	07/24/14 15:09	1
Magnesium	77		2.0		mg/L		07/24/14 06:28	07/24/14 15:09	1
Sodium	150		0.50		mg/L		07/24/14 06:28	07/24/14 15:09	1
Potassium	900	~~D1~~	5.0		mg/L		07/24/14 06:28	07/25/14 14:49	10

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Anion/Cation Balance	-0.14				%			07/31/14 11:04	1
Alkalinity as CaCO3	220		6.0		mg/L			07/29/14 18:50	1
Bicarbonate Alkalinity as CaCO3	220		6.0		mg/L			07/29/14 18:50	1
Carbonate Alkalinity as CaCO3	ND		6.0		mg/L			07/29/14 18:50	1
Alkalinity, Phenolphthalein	ND		6.0		mg/L			07/29/14 18:50	1
Hydroxide Alkalinity as CaCO3	ND		6.0		mg/L			07/29/14 18:50	1
Total Dissolved Solids	4500	~~D2~~	100		mg/L			07/24/14 10:09	1

Client Sample ID: ST012-W11-NaBrSol

Lab Sample ID: 550-28463-4
Matrix: Water

Date Collected: 07/21/14 15:45
Date Received: 07/22/14 16:15

Method: 300.0 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	150		50		mg/L			07/23/14 07:39	100
Sulfate	2300		200		mg/L			07/23/14 07:39	100

Method: 200.7 Rev 4.4 - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Calcium	580		2.0		mg/L		07/24/14 06:28	07/24/14 15:15	1
Magnesium	110		2.0		mg/L		07/24/14 06:28	07/24/14 15:15	1
Sodium	110		0.50		mg/L		07/24/14 06:28	07/24/14 15:15	1
Potassium	1600	~~D1~~	5.0		mg/L		07/24/14 06:28	07/25/14 14:53	10

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Anion/Cation Balance	-2.0				%			07/31/14 11:04	1
Alkalinity as CaCO3	93		6.0		mg/L			07/29/14 19:02	1
Bicarbonate Alkalinity as CaCO3	93		6.0		mg/L			07/29/14 19:02	1
Carbonate Alkalinity as CaCO3	ND		6.0		mg/L			07/29/14 19:02	1
Alkalinity, Phenolphthalein	ND		6.0		mg/L			07/29/14 19:02	1
Hydroxide Alkalinity as CaCO3	ND		6.0		mg/L			07/29/14 19:02	1
Total Dissolved Solids	6500	~~D2~~	100		mg/L			07/24/14 10:09	1

Data Quality Evaluation Checklists

Method Validated: 200.7 | Initial Review by: M. Andrews | Date: 8/13/2014 | SDG#: 550-28463-1
Senior Review by: D. Knaub | Date: 8/18/2014 | Matrix: Groundwater

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA (METHOD 200.7)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C)	QC acceptance criteria published by DoD, if available; otherwise method- specified criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	Not applicable (NA)	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	Level 2 NA
Method Detection Limit (MDL) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly MDL verification checks shall be performed (see box 0-18)	See 40 CFR 1368. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL verification check at higher level and set MDL higher or reconduct MDL study (see box D-18).	NA	Samples cannot be analyzed without a valid MDL.	Level 2 NA
Instrument Detection Limit (IDL) Study	At initial set-up and after significant change in instrument type, personnel, test method, or sample matrix	IDL shall be ≤ Limit of Detection (LOD)	NA	NA		Level 2 NA
Container, Preservation, and Holding Time	All field samples	500 ml Poly, HNO3 to pH < 2, Cool to 4oC, 180 days to analysis	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Coll. 7/21/2014 and 7/22/2014 Prep. 7/24/2014 Anal. 7/24/2014 and 7/25/2014 Temp 1.7°C

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA (METHOD 200.7)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Tuning	Prior to analysis of samples	Mass calibration ≤ 0.1 amu from the true value; Resolution ≤ 0.9 amu full width at 10% peak height; For stability, RSD ≤ 5% for at least four replicate analyses.	Retune instrument then reanalyze tuning solutions	Flagging criteria are not appropriate	No analysis shall be performed without a valid MS tune.	Level 2 NA
Initial calibration (ICAL) for all analytes (minimum one high standard and a calibration blank)	Daily ICAL prior to sample analysis	If more than one calibration standard is used, r ≥ 0.995.	Correct problem then repeat ICAL.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed.	Level 2 NA
Second Source Calibration Verification	Once after each ICAL	Value of second source for all analytes within ± 10% of true value	Verify second source standard. Rerun second source verification. If that fails, correct problem and repeat ICAL.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	Level 2 NA
Continuing Calibration Verification (CCV)	After every 10 field samples and at the end of the analysis sequence	All analytes within ± 10% of true value	Correct problem, rerun CCV. If that fails, then repeat ICAL. Reanalyze all samples since last successful calibration verification	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) of interest in all samples since the last acceptable CCV. Validator flags: If using AFCEE; Apply "J" flag only if reanalysis cannot be performed	Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Level 2 NA

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TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA (METHOD 200.7)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Low-level calibration check standard	Daily, after one-point ICAL	Within ± 20% of truevalue	Correct problem, then reanalyze	Flagging criteria are not appropriate.	No samples may be analyzed without a valid low-level calibration check standard. Low-level calibration check standard should be less than or equal to the reporting limit.	Level 2 NA
Linear dynamic range or high-level check standard	Every 6 months	Within ±10% of expected value	NA	NA		Level 2 NA
Method Blank	One per preparatory batch	No analytes detected > ½ RL and greater than 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results. For common laboratory contaminants, no analytes detected > RL (see Box D-1).	Correct problem, then see criteria in box D-1; if required, reprep then reanalyze method blank and all samples processed with the contaminated blank.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch	Problem must be corrected. Results may not be reported without a valid method blank. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.	p.11 MB 550-40228/1-A All ND

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA (METHOD 200.7)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Calibration blank	Before beginning a sample run, after every 10 samples, and at end of the analysis sequence	No analytes detected > LOD	Correct problem. Reprep and reanalyze calibration blank. All samples following the last acceptable calibration blank must be reanalyzed	Apply B-flag to all results for specific analyte(s) in all samples associated with the blank.		Level 2 NA
Interference check solutions (ICS-A and ICS-AB)	At the beginning of an analytical run and every 12 hours	ICS-A: Absolute value of concentration for all non-spiked analytes < LOD (unless they are a verified trace impurity from one of the spiked analytes) ICS-AB: Within ±20% of expected value	Terminate analysis, locate and correct problem, reanalyze ICS, reanalyze all samples.	If corrective action fails, apply Q-flag to all results for specific analyte(s) in all samples associated with the ICS. Validator flags: If using AFCEE; Apply "M" flag		Levell II NA
Laboratory Control Sample (LCS) Containing All Analytes to be Reported	One per preparatory batch	QC acceptance criteria specified by DoD, if available; see box D-3 and Appendix G.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix G)	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch Validator flags: If using AFCEE; Apply "J" flag	Problem must be corrected. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	p. 11 LCS/LCSD 550-40228/2-A All ok

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA (METHOD 200.7)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Matrix Spike (MS)	One per preparatory batch per matrix (see box D-7)	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS.	Examine the project-specific DQOs. If the matrix spike falls outside of DoD criteria, additional quality control test (dilution test and post-digestion spike addition) are required to evaluate matrix effects.	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	Pg. 11 MS/MSD listed is not associated with this SDG
Matrix Spike Duplicate (MSD)	One per preparatory batch per matrix (see Box D-7)	MSD: For matrix evaluation use QC acceptance criteria specified by DoD for LCS MSD RPD < 20%	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. Validator flags: If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	See Above
Dilution test	Each preparatory batch	Five-fold dilution must agree within ± 10% of the original measurement	Perform post-digestion spike addition.	Flagging criteria are not appropriate.	Only applicable for samples with concentrations > 50 x LOQ.	NA
Post digestion spike addition	When dilution test fails or analyte concentration for all samples < 50 x LOQ	Recovery within 75-125% of (see Table B-1)	Run all associated samples in the preparatory batch by method of standard additions (MSA) or see flagging criteria.	For specific analyte(s) in the parent sample, apply J-flag of acceptance criteria are not met.	Spike addition should produce a concentration of 10 - 100 x LOQ	NA
Method of standard additions (MSA)	When matrix interference is suspected	NA	NA	NA	Document use of MSA in the case narrative.	NA
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD 20%	Qualify samples	For the specific analyte(s) in the parent & dup samples, apply J- flag if acceptance criteria are not met.		ST012-Dup01-072214 = ST012-W30-WG-072214 See RPDs below – All OK

TRACE METALS ANALYSIS BY INDUCTIVELY COUPLED PLASMA (METHOD 200.7)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Results Reported Between MDL and LOQ	NA	NA	NA	Apply J-flag to all results between MDL and LOQ. Validator flags: If using AFCEE; Apply "F" flag		All ok
QC Blanks (Equipment Blanks, and Field Blanks)	Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value are qualified as estimated and flagged "B".		No equipment blank was collected.

ST012-DUP01-072214/ST012-W30-WG-072214

	Dup	Sample	RPD
Potassium	900	920	2.19%
Sodium	150	150	0%
Calcium	430	430	0%
Magnesium	77	78	1.29%

Method Validated: 9056A/300.0 | Initial Review by: M. Andrews | Date: 8/13/2014 | SDG#: 550-28463-1
Senior Review by: D. Knaub | Date: 8/18/2014 | Matrix: Groundwater

COMMON ANIONS ANALYSIS (METHOD 9056/300.0)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C)	QC acceptance criteria published by DoD, if available; otherwise method- specified criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	Not applicable (NA)	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	ok
Limit of Detection Determination and Verification (LOD) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly LOD verification checks shall be performed (see box D-13)	See 40 CFR 1368. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL / LOD verification check at higher level and set MDL higher or reconduct MDL study (see box D-13).	NA	Samples cannot be analyzed without a valid MDL.	Level II
Limit of Quantitation Establishment and Verification (LOQ) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly LOQ verification checks shall be performed (see box D-14)	Within calibration range including low standard; within method precision and accuracy.	Re-run LOQ	NA	Samples cannot be analyzed without a valid LOQ	Level II

COMMON ANIONS ANALYSIS (METHOD 9056/300.0)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Retention Time (RT) Window Width Calculated for Each Analyte and Surrogate	At method set-up and after major maintenance (e.g., column change)	RT width is ± 3 times standard deviation for each analyte RT from 24-hour study.	NA	NA		OK
Container, Preservation, and Holding Time	All field samples	500 ml poly, Cool to 4°C Nitrate – 48 hours Nitrite, sulfate, chloride – 28 days	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collected: 7/21/2014 and 7/22/2014 Temp: 1.7°C Bromide and Sulfate Analyzed: 7/23/2014 OK
ICAL for All Analytes (Minimum Three Standards and One Calibration Blank)	Initial calibration prior to sample analysis	R ≥ 0.995	Correct problem then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed.	Level II
Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 10% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	Level II
Retention Time Window Position Establishment for Each Analyte and Surrogate	Once per ICAL and at the beginning of the analytical shift	Position shall be set using the midpoint standard of the calibration curve or the value in the CCV run at the beginning of the analytical shift.	NA	NA		Level II

COMMON ANIONS ANALYSIS (METHOD 9056/300.0)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Midrange Continuing Calibration Verification (CCV)	After every 10 field samples and at end of the analysis sequence.	All analytes within established retention time windows and within ± 10% of true value	Correct problem then repeat CCV. If that fails, then repeat ICAL. Reanalyze all samples since last successful calibration verification.	Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification, if . reanalysis is not possible.	No samples may be analyzed until the problem has been corrected.	Level II
Method Blank	One per preparatory batch	No analytes detected > ½ RL. See box D-1.	Correct problem, then see criteria in box D-1; if required, reprep then reanalyze method blank and all samples processed with the contaminated blank.	Lab: Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch. Validator; Apply "B" flag if result is less than 5x method blank.		Pg 10 Bromide and Sulfate MB 550-40119/2= ND
Laboratory Control Sample (LCS) Containing All Analytes Required to be Reported, Including Surrogates	One LCS per preparatory batch	Use laboratory in-house LCS acceptance criteria (not to exceed 20%).See Box D-3.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix G)	If corrective action fails apply J-flag to specific analyte(s) in all samples in the associated preparatory batch		Pg 10 Bromide and Sulfate LCS/LCSD 550-40119/5,6 All ok

Method Validated: 9056A/300.0 | Initial Review by: M. Andrews | Date: 8/13/2014 | SDG#: 550-28463-1
Senior Review by: D. Knaub | Date: 8/18/2014 | Matrix: Groundwater

COMMON ANIONS ANALYSIS (METHOD 9056/300.0)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Matrix Spike (MS)	One MS per preparatory batch per matrix (see box D- 7)	For matrix evaluation, use laboratory in-house LCS acceptance criteria (not to exceed 20%).	Examine the project-specific 000s. Contact the client as to additional measures to be taken,	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	MS/MSD listed is not associated with this SDG
Matrix Spike Duplicate (MSD) or Sample Duplicate	One per preparatory batch per matrix	RPD 15% (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	See above
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD 10%	Qualify sample	For the specific analyte(s) in the parent & dup samples, apply J- flag if acceptance criteria are not met.		ST012-Dup01-072214 = ST012-W30-WG-072214 See RPDs below – All ok
Results Reported Between LOD and LOQ	NA	NA	NA	Apply J-flag to all results between LOD and LOQ. Validator flags: If using AFCEE; Apply "F" flag		No samples reported between LOD and LOQ
QC Blanks (Equipment Blanks and Field Blanks)	Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value (10x for common lab contaminants) are qualified as estimated and flagged "B".		Not collected

ST012-DUP01-072214/ST012-W30-WG-072214

	Dup	Sample	RPD
Bromide	110	99	10%
Sulfate	1900	1900	0%

LEVEL II DATA QUALITY VALIDATION RECORD

Project: Former Williams AFB – ST012 Enhanced Bio Remediation Field Test
Project No: 9101110001.5300.5301
Method: Alkalinity by SM2320B and TDS by SM2540C
Laboratory and Lot: TAL Phoenix SDG: 550-28463-1
Reviewer/Date: M. Andrews 8/13/2014 **Senior Reviewer/Date:** D. Knaub 8/18/2014

YES NO NA **COMMENTS**

Methods listed above were analyzed on water samples: ST012-W11-NABRSOL, ST012-W11-WG-072214, ST012-W30-WG-072214, and ST012-DUP01-072214

Case Narrative and COC Completeness Review

X **Holding times met**

Alkalinity: Bicarbonate, Carbonate, Hydroxide, and Phenolphthalein (HT = 14 days); Sampled; 7/21/2014 and 7/22/2014 Analyzed: 7/29/2014
TDS (HT = 7days); Sampled: 7/21/2014 and 7/22/2014 Analyzed: 7/24/2014

X **Calibration Criteria met (if applicable)**

X **QC Blanks Review**

Alk (all)	MB 550-40702/59=ND
TDS	MB 550-40253/1= ND

X **Laboratory Control Sample (LCS) recovery within limits**

Alk (all)	LCS 550-40702/58= ok
TDS	LCS/LCSD 550-40253/2,3= ok

X **Lab Duplicate - Field Duplicate precision goals met (20%)**

ST012-DUP01-072214/ST012-W30-WG-072214

	Dup	Sample	RPD
Alkalinity, Bicarbonate	220	220	0%
Alkalinity, Total	220	220	0%
TDS	4500	4500	0%

X **Matrix Spike recoveries and RPDs within limits (if applicable)**

No MS/MSD listed in this SDG

X **EDD Data Verification vs. Hardcopy (10% samples for each SDG)**

Data Evaluation Narrative
AMEC Project: Former Williams AFB
AMEC Project Number: 9101110001.5300.5301
Site: ST012 – Enhanced Bioremediation Field Test
Sampling Event: July 2014
Matrix: Groundwater

SDG: 550-28624-1

1.0 INTRODUCTION

A data quality evaluation (DQE) was performed on the data reported for the Enhanced Bioremediation Field Test conducted at Site ST012 in July 2014 at the former Williams Air Force Base (WAFB), located in Mesa, Arizona. The following sections provide summary discussions of the required data qualifications for each site and analytical methods for samples collected at the former WAFB. Data validation was conducted on 100% of the primary samples and field quality control samples (rinsate blanks and laboratory control sample/laboratory control sample duplicate [LCS/LCSD] samples). A Level II DQE was performed using supplemental checklists to review the following quality control elements: laboratory case narrative, sample documentation, chain-of-custody, holding time protocols, method blank results, laboratory control sample (LCS) results, surrogate recoveries (where applicable), method sensitivity, and completeness.

Data was reviewed using precision and accuracy control limits presented in The Department of Defense (DoD) Quality Systems Manual (QSM) Version 4.2 (DoD, 2010). DQE data qualifications were applied if necessary in accordance with procedures in Air Force Center for Environmental Excellence (AFCEE) Quality Assurance Project Plan (QAPP), Version 4.0.01 (AFCEE, 2005), the method, and professional judgment using the following qualifiers:

J = The reported concentration is considered an estimated value due to discrepancies in meeting certain analyte-specific quality control criteria.
F = The reported concentration is between the reporting limit (RL) and method detection limit (MDL) and is considered an estimated value
UJ = The target compound was not detected and the reporting limit is considered imprecise due to discrepancies in meeting certain analyte-specific quality control criteria.
B = The result may be biased high or a false positive based on blank data.
M = The reported concentration is estimated due to matrix effects.
R = The data are considered unusable due to discrepancies in meeting certain quality control criteria and may not be used in decision making.

ED_005025_00007837-00364

2.0 DELIVERABLES

The data packages as submitted to AMEC Environment and Infrastructure, Inc. (AMEC) are complete as stipulated in the Draft Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) for Site ST012 Enhanced Bioremediation Field Test Plan (AMEC, 2014), and the applicable guidelines described in the former Williams AFB Performance Based Remediation Program QAPP and standard operating procedures (SOPs) (collectively referred to as the QAPP/SOP [AMEC, 2012]) for U.S. States Environmental Protection Agency (EPA) Method 300.0.

3.0 SAMPLE INTEGRITY

Samples within this sample delivery group (SDG), collected from ST012, were submitted to TestAmerica Laboratories (TAL) in Phoenix, Arizona. The samples were submitted for bromide and sulfate by USEPA method E300.0.

Based on the information provided on the cooler receipt forms, samples arrived at the laboratory above temperature requirements, but the laboratory received the sample less than two hours after collection. Therefore the sample did not have time to cool to 4°C, so no samples qualifications were required. Completed COC documents are included in the data package.

4.0 SAMPLE IDENTIFICATION

This SDG contains the following water samples:

Site: ST012	
ST012-W11-WG-072414	
ST012-W30-WG-072414	

These samples were collected on 24 July 2014.

5.0 SAMPLE QUALIFICATION

Only those components that required qualification of the data are presented in this narrative. All Level II components were within the QC limits; therefore, no qualification was required for the data.

6.0 BROMIDE AND SULFATE (EPA 300.0)

Samples collected from site ST012 were submitted for metals by USEPA Method 300.0. The sample submitted to the TAL-Phoenix laboratory was analyzed for Bromide and Sulfate. A Level II validation was performed on this method and all components were within the SAP/TAL SOP criteria.

6.1 Limits of Quantitation

The LOQs as specified in the QAPP/SOP (AMEC, 2012) were met for samples submitted for the analysis of metals by USEPA Method 300.0 with the exception of analytes that required dilution. All samples in this SDG required dilution for Bromide and Sulfate resulting in elevated LOQs.

7.0 OVERALL SITE EVALUATION AND PROFESSIONAL JUDGMENT FLAGGING CHANGES

Edits to the DQE qualifiers by professional judgment were not required, and the data are usable as qualified in this data narrative.

8.0 SUMMARY OF DATA QUALITY INDICATORS

This section provides an assessment of the data based on project data quality indicators (DQIs) described on QAPP Worksheet #37 of the QAPP/SOP (AMEC, 2012). The DQIs consist of precision, accuracy, representativeness, comparability, completeness, and sensitivity.

8.1 Precision

An assessment of precision of analytical data is accomplished via review of field duplicate and MS/MSD analyses. Field duplicate and MS/MSD analyses are used to assess field variability, which includes sample collection/handling as well as matrix homogeneity. Precision is expressed as the relative percent difference (RPD) between results for duplicate pairs.

No field duplicate or MS/MSD samples were submitted with this SDG; however, the laboratory analyzed a sample duplicate for anions on sample ST012-W30-WG-072414. Duplicate precision for the method was within QC limits. In addition precision was also measured through the analysis of a non-project MS/MSD and a LCS/LCSD pair and precision was within the QC limits. Therefore, overall method and sample matrix precision acceptable and achieve project objectives.

8.2 Accuracy (Bias)

An assessment of accuracy of analytical data is accomplished via evaluation of the spike recoveries in the MS/MSD, LCS, post digestion spike samples, and surrogate spike compounds, in addition to calibration criteria. Accuracy is expressed as percent recovery. Accuracy data were compliant with the program document QAPP/SOP, as all associated LCS/LCSD recoveries were within control. Therefore, the data results indicate method and matrix accuracy is acceptable to achieve project objectives.

8.3 Representativeness

Representativeness for the analytical data is determined through evaluation of the associated blank data and evaluation of appropriate sample handling procedures. All samples were

properly stored and preserved in the field and at TestAmerica and blanks were all non-detect. The analytical results indicate sample data are representative of the Site conditions.

8.4 Comparability

Comparability addresses the confidence with which one data set can be compared to another. Use of appropriate sampling methods, COC procedures, and EPA-approved analytical methods, as well as adherence to strict QA/QC procedures, provide the basis for uniformity in sample collection and analysis. Analytical data were generated by TestAmerica using standard reporting units of micrograms per liter and methods for all parameters. In addition, sample collection and analytical method protocols were implemented in accordance with approved, documented procedures. Analytical data are determined to be comparable to previous Site results.

8.5 Completeness

Completeness of the field sampling activities were assessed in terms of the actual number and type of sample results received from the field and laboratory, as compared with the planned number and type of sample results. All samples planned were collected which meets a field completeness of 100%.

Analytical completeness of data is a measure of the number of valid project-specific data results obtained in comparison to the total number of data results projected to achieve project DQOs. Valid data are defined as data that meet the project-specific DQOs. No data were rejected as a result of the data validation. The completeness goals met the 90 percent goal for field and laboratory data expected for this project.

8.6 Sensitivity

Analytical methods and LOQs were implemented in accordance with the QAPP/SOP and EPA promulgated methodologies. Method RLs were achieved for the event except when sample dilutions were required to bring target compounds within the linear range of the instrument calibration. These include modified RLs for selected detections. Although the laboratory RLs for samples requiring dilution exceed the QAPP RLs, sensitivity requirements were met.

8.7 Usability Summary

The data generated during the July 2014 sampling event did not require qualification and the analytical results indicate sample data is representative of the Site conditions. The DQOs for the Enhanced Bioremediation Field Test is to produce data to support design of anaerobic methods for the ST012 remedy if selected

ED_005025_00007837-00367

9.0 REFERENCES

AFCEE, 2005. Quality Assurance Project Plan, Version 4.0.01, May, 2005.

AMEC, August 11, 2014. *Draft Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) (Enhanced Bioremediation Field Test Plan) Operable Unit 2 Site ST012 - Liquid Fuels Storage Area, Former Williams Air Force Base, Mesa, Arizona.*

AMEC, February 23, 2012. *Performance Based Remediation Program Quality Assurance Project Plan (QAPP) and Standard Operating Procedures (SOPs) (QAP/SOP), Former Williams Air Force Base, Mesa, Arizona.*

DoD, 2010. Department of Defense Quality System Manual, Version 4.2 Final, October 2010.

Prepared/Date: DLH 8/18/2014
Checked/Date: JAH 8/19/2014

ED_005025_00007837-00368

Flagged Data Reports

SCH
8/18/14

Client Sample Results

Client: AMEC Environment & Infrastructure, Inc.
Project/Site: FWAFB ST012 EBR

TestAmerica Job ID: 550-28624-1
SDG: Project 9101110001.5300.5301

Client Sample ID: ST012-W30-WG-072414

Lab Sample ID: 550-28624-1
Date Collected: 07/24/14 09:27
Matrix: Water
Date Received: 07/24/14 12:24

Method: 300.0 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	92		50		mg/L			07/24/14 22:30	100
Sulfate	1600		200		mg/L			07/24/14 22:30	100

Client Sample ID: ST012-W11-WG-072414

Lab Sample ID: 550-28624-2
Date Collected: 07/24/14 10:41
Matrix: Water
Date Received: 07/24/14 12:24

Method: 300.0 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	39		25		mg/L			07/26/14 03:34	50
Sulfate	2000		200		mg/L			07/24/14 23:25	100

Data Quality Evaluation Checklists

Method Validated: 9056A

Initial Review by: D Howard Date: 8/18/14
Senior Review by: J. Hartness Date: 8/19/14

SDG#: 550-28624-1
Matrix: Groundwater

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C)	QC acceptance criteria published by DoD, if available; otherwise method- specified criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	Not applicable (NA)	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	ok
Limit of Detection Determination and Verification (LOD) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly LOD verification checks shall be performed (see box D-13)	See 40 CFR 1368. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL / LOD verification check at higher level and set MDL higher or reconduct MDL study (see box D-13).	NA	Samples cannot be analyzed without a valid MDL.	Level II
Limit of Quantitation Establishment and Verification (LOQ) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly LOQ verification checks shall be performed (see box D-14)	Within calibration range including low standard; within method precision and accuracy.	Re-run LOQ	NA	Samples cannot be analyzed without a valid LOQ	Level II

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Retention Time (RT) Window Width Calculated for Each Analyte and Surrogate	At method set-up and after major maintenance (e.g., column change)	RT width is ± 3 times standard deviation for each analyte RT from 24-hour study.	NA	NA		Level II
Container, Preservation, and Holding Time	All field samples	500 ml poly, Cool to 4°C Nitrate – 48 hours Nitrite, sulfate, chloride – 28 days	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collected: 7/24/14 Temp: 12.2°C The lab received the samples the same day that they were collected; therefore the samples did not have time to cool down before the lab received them. ***No qualification is required due to sample temperature.*** Br Analyzed: 7/24/14, 7/26/14 OK SO4 Analyzed: 7/24/14 OK
ICAL for All Analytes (Minimum Three Standards and One Calibration Blank)	Initial calibration prior to sample analysis	R ≥ 0.995	Correct problem then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed.	Level II

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 10% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	Level II
Retention Time Window Position Establishment for Each Analyte and Surrogate	Once per ICAL and at the beginning of the analytical shift	Position shall be set using the midpoint standard of the calibration curve or the value in the CCV run at the beginning of the analytical shift.	NA	NA		Level II
Midrange Continuing Calibration Verification (CCV)	After every 10 field samples and at end of the analysis sequence.	All analytes within established retention time windows and within ± 10% of true value	Correct problem then repeat CCV. If that fails, then repeat ICAL. Reanalyze all samples since last successful calibration verification.	Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification, if . reanalysis is not possible.	No samples may be analyzed until the problem has been corrected.	Level II

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COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Method Blank	One per preparatory batch	No analytes detected > ½ RL. See box D-1.	Correct problem, then see criteria in box D-1; if required, reprep then reanalyze method blank and all samples processed with the contaminated blank.	Lab: Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch. Validator; Apply "B" flag if result is less than 5x method blank.		Pg 8, Br and SO4 MB 550-40353/2= All ND Pg 8-9, Br and SO4 MB 550-40541/2= All ND
Laboratory Control Sample (LCS) Containing All Analytes Required to be Reported, Including Surrogates	One LCS per preparatory batch	Use laboratory in-house LCS acceptance criteria (not to exceed 20%).See Box D-3.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix G)	If corrective action fails apply J-flag to specific analyte(s) in all samples in the associated preparatory batch		Pg 8, Br and SO4 LCS/LCSD 550-40353/5,6 OK Pg 8-9, Br and SO4 LCS/LCSD 550-40541/5,6 OK
Matrix Spike (MS)	One MS per preparatory batch per matrix (see box D- 7)	For matrix evaluation, use laboratory in-house LCS acceptance criteria (not to exceed 20%).	Examine the project-specific 000s. Contact the client as to additional measures to be taken,	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	p. 8 , Br and SO4 550-28611-A-1 MS/MSD Non project sample. Not evaluated p. 9 550-28695-J-1 MS/MSD Non Project sample. Not evaluated

Method Validated: 9056A

Initial Review by: D Howard Date: 8/18/14
Senior Review by: J. Hartness Date: 8/19/14

SDG#: 550-28624-1
Matrix: Groundwater

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Matrix Spike Duplicate (MSD) or Sample Duplicate	One per preparatory batch per matrix	RPD ≤15% (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	See above
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD ≤10%	Qualify sample	For the specific analyte(s) in the parent & dup samples, apply J- flag if acceptance criteria are not met.		p. 8, Lab Dup STO12-W30WG-072414 Br RPD = 0.1 SO4 RPD = 0.00007 **OK**
Results Reported Between LOD and LOQ	NA	NA	NA	Apply J-flag to all results between LOD and LOQ. Validator flags: If using AFCEE; Apply "F" flag		No samples reported between LOD and LOQ
QC Blanks (Equipment Blanks and Field Blanks)	Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value (10x for common lab contaminants) are qualified as estimated and flagged "B".		Not collected

Data Evaluation Narrative
AMEC Project: Former Williams AFB
AMEC Project Number: 9101110001.5300.5301
Site: ST012 – Enhanced Bioremediation Field Test
Sampling Event: July 2014
Matrix: Groundwater

SDG: 550-28799-1

1.0 INTRODUCTION

A data quality evaluation (DQE) was performed on the data reported for the Enhanced Bioremediation Field Test conducted at Site ST012 in July 2014 at the former Williams Air Force Base (WAFB), located in Mesa, Arizona. The following sections provide summary discussions of the required data qualifications for each site and analytical methods for samples collected at the former WAFB. Data validation was conducted on 100% of the primary samples and field quality control samples (rinsate blanks and laboratory control sample/laboratory control sample duplicate [LCS/LCSD] samples). A Level II DQE was performed using supplemental checklists to review the following quality control elements: laboratory case narrative, sample documentation, chain-of-custody, holding time protocols, method blank results, laboratory control sample (LCS) results, surrogate recoveries (where applicable), method sensitivity, and completeness.

Data was reviewed using precision and accuracy control limits presented in The Department of Defense (DoD) Quality Systems Manual (QSM) Version 4.2 (DoD, 2010). DQE data qualifications were applied if necessary in accordance with procedures in Air Force Center for Environmental Excellence (AFCEE) Quality Assurance Project Plan (QAPP), Version 4.0.01 (AFCEE, 2005), the method, and professional judgment using the following qualifiers:

- J = The reported concentration is considered an estimated value due to discrepancies in meeting certain analyte-specific quality control criteria.
- F = The reported concentration is between the reporting limit (RL) and method detection limit (MDL) and is considered an estimated value
- UJ = The target compound was not detected and the reporting limit is considered imprecise due to discrepancies in meeting certain analyte-specific quality control criteria.
- B = The result may be biased high or a false positive based on blank data.
- M = The reported concentration is estimated due to matrix effects.
- R = The data are considered unusable due to discrepancies in meeting certain quality control criteria and may not be used in decision making.

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2.0 DELIVERABLES

The data packages as submitted to AMEC Environment and Infrastructure, Inc. (AMEC) are complete as stipulated in the Draft Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) for Site ST012 Enhanced Bioremediation Field Test Plan (AMEC, 2014), and the applicable guidelines described in the former Williams AFB Performance Based Remediation Program QAPP and standard operating procedures (SOPs) (collectively referred to as the QAPP/SOP [AMEC, 2012]) for U.S. States Environmental Protection Agency (EPA) Method 300.0.

3.0 SAMPLE INTEGRITY

Samples within this sample delivery group (SDG), collected from ST012, were submitted to TestAmerica Laboratories (TAL) in Phoenix, Arizona. The samples were submitted for bromide and sulfate by USEPA method E300.0.

Based on the information provided on the cooler receipt forms, samples arrived at the laboratory within temperature requirements. Completed COC documents are included in the data package.

4.0 SAMPLE IDENTIFICATION

This SDG contains the following water samples:

Site: ST012	
ST012-W11-WG-072914	
ST012-W30-WG-072914	

These samples were collected on 29 July 2014.

5.0 SAMPLE QUALIFICATION

Only those components that required qualification of the data are presented in this narrative. All Level II components were within the QC limits; therefore, no qualification was required for the data.

6.0 BROMIDE AND SULFATE (EPA 300.0)

Samples collected from site ST012 were submitted for metals by USEPA Method 300.0. The sample submitted to the TAL-Phoenix laboratory was analyzed for Bromide and Sulfate. A Level II validation was performed on this method and all components were within the SAP/TAL SOP criteria.

6.1 Limits of Quantitation

The LOQs as specified in the QAPP/SOP (AMEC, 2012) were met for samples submitted for the analysis of metals by USEPA Method 300.0 with the exception of analytes that required dilution. All samples in this SDG required dilution for Sulfate resulting in elevated LOQs.

7.0 OVERALL SITE EVALUATION AND PROFESSIONAL JUDGMENT FLAGGING CHANGES

Edits to the DQE qualifiers by professional judgment were not required, and the data are usable as qualified in this data narrative.

8.0 SUMMARY OF DATA QUALITY INDICATORS

This section provides an assessment of the data based on project data quality indicators (DQIs) described on QAPP Worksheet #37 of the QAPP/SOP (AMEC, 2012). The DQIs consist of precision, accuracy, representativeness, comparability, completeness, and sensitivity.

8.1 Precision

An assessment of precision of analytical data is accomplished via review of field duplicate and MS/MSD analyses. Field duplicate and MS/MSD analyses are used to assess field variability, which includes sample collection/handling as well as matrix homogeneity. Precision is expressed as the relative percent difference (RPD) between results for duplicate pairs.

No associated field duplicates or MS/MSDs were analyzed with this SDG.

8.2 Accuracy (Bias)

An assessment of accuracy of analytical data is accomplished via evaluation of the spike recoveries in the MS/MSD, LCS, post digestion spike samples, and surrogate spike compounds, in addition to calibration criteria. Accuracy is expressed as percent recovery. Accuracy data were compliant with the program document QAPP/SOP, as all associated LCS/LCSD recoveries were within control. Therefore, the data results indicate method and matrix accuracy is acceptable to achieve project objectives.

8.3 Representativeness

Representativeness for the analytical data is determined through evaluation of the associated blank data and evaluation of appropriate sample handling procedures. All samples were properly stored and preserved in the field and at TestAmerica and blanks were all non-detect. The analytical results indicate sample data are representative of the Site conditions.

8.4 Comparability

Comparability addresses the confidence with which one data set can be compared to another. Use of appropriate sampling methods, COC procedures, and EPA-approved analytical methods, as well as adherence to strict QA/QC procedures, provide the basis for uniformity in sample collection and analysis. Analytical data were generated by TestAmerica using standard reporting units of micrograms per liter and methods for all parameters. In addition, sample collection and analytical method protocols were implemented in accordance with approved, documented procedures. Analytical data are determined to be comparable to previous Site results.

8.5 Completeness

Completeness of the field sampling activities were assessed in terms of the actual number and type of sample results received from the field and laboratory, as compared with the planned number and type of sample results. All samples planned were collected which meets a field completeness of 100%.

Analytical completeness of data is a measure of the number of valid project-specific data results obtained in comparison to the total number of data results projected to achieve project DQOs. Valid data are defined as data that meet the project-specific DQOs. No data were rejected as a result of the data validation. The completeness goals met the 90 percent goal for field and laboratory data expected for this project.

8.6 Sensitivity

Analytical methods and LOQs were implemented in accordance with the QAPP/SOP and EPA promulgated methodologies. Method RLs were achieved for the event except when sample dilutions were required to bring target compounds within the linear range of the instrument calibration. These include modified RLs for selected detections. Although the laboratory RLs for samples requiring dilution exceed the QAPP RLs, sensitivity requirements were met.

8.7 Usability Summary

The data generated during the July 2014 sampling event did not require qualification and the analytical results indicate sample data is representative of the Site conditions. The DQOs for the Enhanced Bioremediation Field Test is to produce data to support design of anaerobic methods for the ST012 remedy if selected.

ED_005025_00007837-00380

9.0 REFERENCES

AFCEE, 2005. Quality Assurance Project Plan, Version 4.0.01, May, 2005.

AMEC, August 11, 2014. *Draft Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) (Enhanced Bioremediation Field Test Plan) Operable Unit 2 Site ST012 - Liquid Fuels Storage Area, Former Williams Air Force Base, Mesa, Arizona.*

AMEC, February 23, 2012. *Performance Based Remediation Program Quality Assurance Project Plan (QAPP) and Standard Operating Procedures (SOPs) (QAP/SOP), Former Williams Air Force Base, Mesa, Arizona.*

DoD, 2010. Department of Defense Quality System Manual, Version 4.2 Final, October 2010.

Prepared/Date: DLH 8/18/2014
Checked/Date: JAH 8/19/2014

ED_005025_00007837-00381

Flagged Data Reports

8/18/14

Client Sample Results

DKH

Client: AMEC Environment & Infrastructure, Inc.
Project/Site: FWAFB ST012 EBR

TestAmerica Job ID: 550-28799-1
SDG: Project #910111.5300.5301

Client Sample ID: ST012-W30-WG-072914

Lab Sample ID: 550-28799-1

Date Collected: 07/29/14 09:17
Date Received: 07/29/14 13:32

Matrix: Water

Method: 300.0 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	47		25		mg/L			07/29/14 18:39	50
Sulfate	840		100		mg/L			07/29/14 18:39	50

Client Sample ID: ST012-W11-WG-072914

Lab Sample ID: 550-28799-2

Date Collected: 07/29/14 10:52
Date Received: 07/29/14 13:32

Matrix: Water

Method: 300.0 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	18		10		mg/L			07/30/14 19:50	20
Sulfate	940		100		mg/L			07/29/14 18:58	50

Data Quality Evaluation Checklists

Method Validated: 9056A

Initial Review by: D Howard Date: 8/15/14
Senior Review by: J. Hartness Date: 8/19/14

SDG#: 550-28799-1
Matrix: Groundwater

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C)	QC acceptance criteria published by DoD, if available; otherwise method- specified criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	Not applicable (NA)	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	ok
Limit of Detection Determination and Verification (LOD) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly LOD verification checks shall be performed (see box D-13)	See 40 CFR 1368. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL / LOD verification check at higher level and set MDL higher or reconduct MDL study (see box D-13).	NA	Samples cannot be analyzed without a valid MDL.	Level II
Limit of Quantitation Establishment and Verification (LOQ) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly LOQ verification checks shall be performed (see box D-14)	Within calibration range including low standard; within method precision and accuracy.	Re-run LOQ	NA	Samples cannot be analyzed without a valid LOQ	Level II

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Retention Time (RT) Window Width Calculated for Each Analyte and Surrogate	At method set-up and after major maintenance (e.g., column change)	RT width is ± 3 times standard deviation for each analyte RT from 24-hour study.	NA	NA		OK
Container, Preservation, and Holding Time	All field samples	500 ml poly, Cool to 4°C Nitrate – 48 hours Nitrite, sulfate, chloride – 28 days	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collected: 7/29/14 Temp: 2.9°C Br Analyzed: 7/29/14, 7/30/14 OK SO4 Analyzed: 7/29/14 OK
ICAL for All Analytes (Minimum Three Standards and One Calibration Blank)	Initial calibration prior to sample analysis	R ≥ 0.995	Correct problem then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed.	Level II
Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 10% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	Level II
Retention Time Window Position Establishment for Each Analyte and Surrogate	Once per ICAL and at the beginning of the analytical shift	Position shall be set using the midpoint standard of the calibration curve or the value in the CCV run at the beginning of the analytical shift.	NA	NA		Level II

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Midrange Continuing Calibration Verification (CCV)	After every 10 field samples and at end of the analysis sequence.	All analytes within established retention time windows and within ± 10% of true value	Correct problem then repeat CCV. If that fails, then repeat ICAL. Reanalyze all samples since last successful calibration verification.	Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification, if . reanalysis is not possible.	No samples may be analyzed until the problem has been corrected.	Level II
Method Blank	One per preparatory batch	No analytes detected > ½ RL. See box D-1.	Correct problem, then see criteria in box D-1; if required, reprep then reanalyze method blank and all samples processed with the contaminated blank.	Lab: Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch. Validator; Apply "B" flag if result is less than 5x method blank.		Pg 8, Br and SO4 MB 550-40717/2= ND Pg 8, Br and SO4 MB 550-40828/2= ND
Laboratory Control Sample (LCS) Containing All Analytes Required to be Reported, Including Surrogates	One LCS per preparatory batch	Use laboratory in-house LCS acceptance criteria (not to exceed 20%).See Box D-3.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix G)	If corrective action fails apply J-flag to specific analyte(s) in all samples in the associated preparatory batch		Pg 8, Br and SO4 LCS/LCSD 550-40717/5,6 OK Pg 8-9, Br and SO4 LCS/LCSD 550-40828/6,7 OK

Method Validated: 9056A

Initial Review by: D Howard Date: 8/15/14
Senior Review by: J. Hartness Date: 8/19/14

SDG#: 550-28799-1
Matrix: Groundwater

COMMON ANIONS ANALYSIS (METHOD 9056)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Matrix Spike (MS)	One MS per preparatory batch per matrix (see box D- 7)	For matrix evaluation, use laboratory in-house LCS acceptance criteria (not to exceed 20%).	Examine the project-specific 000s. Contact the client as to additional measures to be taken,	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	p. 8 Br and SO4 550-28804-G-3MS/MSD Non project sample. Not evaluated 550-28887-B-1MS/MSD Non Project sample. Not evaluated
Matrix Spike Duplicate (MSD) or Sample Duplicate	One per preparatory batch per matrix	RPD ≤15% (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	See above
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD ≤10%	Qualify sample	For the specific analyte(s) in the parent & dup samples, apply J- flag if acceptance criteria are not met.		No field duplicate collected
Results Reported Between LOD and LOQ	NA	NA	NA	Apply J-flag to all results between LOD and LOQ. Validator flags: If using AFCEE; Apply "F" flag		No samples reported between LOD and LOQ
QC Blanks (Equipment Blanks and Field Blanks)	Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value (10x for common lab contaminants) are qualified as estimated and flagged "B".		Not collected

ED_005025_00007837-00388

Data Evaluation Narrative
AMEC Project: Former Williams AFB
AMEC Project Number: 9101110001.5300.5301
Site: ST012 – Enhanced Bioremediation Field Test
Sampling Event: July 2014
Matrix: Groundwater

SDG: 550-28984-1

1.0 INTRODUCTION

A data quality evaluation (DQE) was performed on the data reported for the Enhanced Bioremediation Field Test conducted at Site ST012 in July 2014 at the former Williams Air Force Base (WAFB), located in Mesa, Arizona. The following sections provide summary discussions of the required data qualifications for each site and analytical methods for samples collected at the former WAFB. Data validation was conducted on 100% of the primary samples and field quality control samples (rinsate blanks and laboratory control sample/laboratory control sample duplicate [LCS/LCSD] samples). Data validation was performed using supplemental checklists to review the following quality control elements. A Level II DQE was performed on the analyses using the following criteria: laboratory case narrative, sample documentation, chain-of-custody, holding time protocols, method blank results, laboratory control sample (LCS) results, surrogate recoveries (where applicable), method sensitivity, and completeness.

Data was reviewed using precision and accuracy control limits presented in The Department of Defense (DoD) Quality Systems Manual (QSM) Version 4.2 (DoD, 2010). DQE data qualifications were applied if necessary in accordance with procedures in Air Force Center for Environmental Excellence (AFCEE) Quality Assurance Project Plan (QAPP), Version 4.0.01 (AFCEE, 2005), the method, and professional judgment using the following qualifiers:

- J = The reported concentration is considered an estimated value due to discrepancies in meeting certain analyte-specific quality control criteria.
- F = The reported concentration is between the reporting limit (RL) and method detection limit (MDL) and is considered an estimated value
- UJ = The target compound was not detected and the reporting limit is considered imprecise due to discrepancies in meeting certain analyte-specific quality control criteria.
- B = The result may be biased high or a false positive based on blank data.
- M = The reported concentration is estimated due to matrix effects.
- R = The data are considered unusable due to discrepancies in meeting certain quality control criteria and may not be used in decision making.

ED_005025_00007837-00389

2.0 DELIVERABLES

The data packages as submitted to AMEC Environment and Infrastructure, Inc. (AMEC) are complete as stipulated in the Draft Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) for Site ST012 Enhanced Bioremediation Field Test Plan (AMEC, 2014), and the applicable guidelines described in the former Williams AFB Performance Based Remediation Program QAPP and standard operating procedures (SOPs) (collectively referred to as the QAPP/SOP [AMEC, 2012]) for U.S. States Environmental Protection Agency (EPA) Method 300.0.

3.0 SAMPLE INTEGRITY

Samples within this sample delivery group (SDG), collected from ST012, were submitted to TestAmerica Laboratories (TAL) in Phoenix, Arizona. The samples were submitted for bromide and sulfate by USEPA Method E300.0.

Based on the information provided on the cooler receipt forms, samples arrived at the laboratory within temperature and preservation requirements. Completed COC documents are included in the data package.

4.0 SAMPLE IDENTIFICATION

This SDG contains the following water and quality control (QC) samples:

Site: ST012	QC Samples
ST012-W11-WG-073114	
ST012-W30-WG-073114	

These samples were collected on 31 July 2014.

5.0 SAMPLE QUALIFICATION

Only those components that required qualification of the data are presented in this narrative. All Level II components were within the QC limits; therefore, no qualification was required for the data.

6.0 BROMIDE AND SULFATE (EPA 300.0)

Samples collected from site ST012 were submitted for bromide and sulfate by Method E300.0. A Level II validation was performed on this method and all components were within the QAPP/SOP criteria.

6.1 Limits of Quantitation

The LOQs as specified in the QAPP/SOP (AMEC, 2012) were met for samples submitted for the analysis of bromide and sulfate by USEPA Method E300.0 with the exception of analytes that

required dilution. Each of the samples reported in this SDG required dilution for bromide and sulfate resulting in elevated LOQs.

7.0 OVERALL SITE EVALUATION AND PROFESSIONAL JUDGMENT FLAGGING CHANGES

Edits to the DQE qualifiers by professional judgment were not required, and the data are usable as qualified in this data narrative.

8.0 SUMMARY OF DATA QUALITY INDICATORS

This section provides an assessment of the data based on project data quality indicators (DQIs) described on QAPP Worksheet #37 of the QAPP/SOP (AMEC, 2012). The DQIs consist of precision, accuracy, representativeness, comparability, completeness, and sensitivity.

8.1 Precision

An assessment of precision of analytical data is accomplished via review of field duplicate and MS/MSD analyses. Field duplicate and MS/MSD analyses are used to assess field variability, which includes sample collection/handling as well as matrix homogeneity. Precision is expressed as the relative percent difference (RPD) between results for duplicate pairs.

No field duplicate or project specific samples were submitted for MS/MSD analyses in the SDG; however, the laboratory analyzed a LCS/LCSD and a MS/MSD on a non-project sample for batch precision. Duplicate precision for anions was within QC limits, therefore, overall method and sample matrix precision are acceptable and achieve project objectives.

8.2 Accuracy (Bias)

An assessment of accuracy of analytical data is accomplished via evaluation of the spike recoveries in the MS/MSD, LCS, post digestion spike samples, and surrogate spike compounds, in addition to calibration criteria. Accuracy is expressed as percent recovery. Accuracy data were compliant with the program document QAPP/SOP, as all associated LCS/LCSD recoveries were within control. Therefore, the data results indicate method and matrix accuracy is acceptable to achieve project objectives.

8.3 Representativeness

Representativeness for the analytical data is determined through evaluation of the associated blank data and evaluation of appropriate sample handling procedures. All samples were properly stored and preserved in the field and at TestAmerica and blanks were all non-detect. The analytical results indicate sample data are representative of the Site conditions.

8.4 Comparability

Comparability addresses the confidence with which one data set can be compared to another. Use of appropriate sampling methods, COC procedures, and EPA-approved analytical methods, as well as adherence to strict QA/QC procedures, provide the basis for uniformity in sample collection and analysis. Analytical data were generated by TestAmerica using standard reporting units of milligrams per liter and methods for all parameters. In addition, sample collection and analytical method protocols were implemented in accordance with approved, documented procedures. Analytical data are determined to be comparable to previous Site results.

8.5 Completeness

Completeness of the field sampling activities were assessed in terms of the actual number and type of sample results received from the field and laboratory, as compared with the planned number and type of sample results. All samples planned were collected which meets a field completeness of 100%.

Analytical completeness of data is a measure of the number of valid project-specific data results obtained in comparison to the total number of data results projected to achieve project DQOs. Valid data are defined as data that meet the project-specific DQOs. No data were rejected as a result of the data validation. The completeness goals met the 90 percent goal for field and laboratory data expected for this project.

8.6 Sensitivity

Analytical methods and LOQs were implemented in accordance with the QAPP/SOP and EPA promulgated methodologies. Method RLs were achieved for the event except when sample dilutions were required to bring target compounds within the linear range of the instrument calibration. These include modified RLs for selected detections. Although the laboratory RLs for samples requiring dilution exceed the QAPP RLs, sensitivity requirements were met.

8.7 Usability Summary

The data generated during the July 2014 sampling event did not require qualification and the analytical results indicate sample data is representative of the Site conditions. The DQOs for the Enhanced Bioremediation Field Test is to produce data to support design of anaerobic methods for the ST012 remedy if selected.

ED_005025_00007837-00392

9.0 REFERENCES

AFCEE, 2005. Quality Assurance Project Plan, Version 4.0.01, May, 2005.

AMEC, August 11, 2014. *Draft Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) (Enhanced Bioremediation Field Test Plan) Operable Unit 2 Site ST012 - Liquid Fuels Storage Area, Former Williams Air Force Base, Mesa, Arizona*.

AMEC, February 23, 2012. *Performance Based Remediation Program Quality Assurance Project Plan (QAPP) and Standard Operating Procedures (SOPs) (QAP/SOP), Former Williams Air Force Base, Mesa, Arizona.*

DoD, 2010. Department of Defense Quality System Manual, Version 4.2 Final, October 2010.

Prepared/Date: JAH 8/26/2014
Checked/Date: DWK 8/28/2014

ED_005025_00007837-00393

Flagged Data Reports

Client Sample Results

Client: AMEC Environment & Infrastructure, Inc.
Project/Site: FWAFB ST012 EBR

TestAmerica Job ID: 550-28984-1

Client Sample ID: ST012-W11-WG-073114

Lab Sample ID: 550-28984-1
Matrix: Water

Date Collected: 07/31/14 12:38
Date Received: 07/31/14 15:49

Nr flag
GW 8-26-14

Method: 300.0 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	12		10		mg/L			08/01/14 01:01	20
Sulfate	610		40		mg/L			08/01/14 01:01	20

Client Sample ID: ST012-W30-WG-073114

Lab Sample ID: 550-28984-2
Matrix: Water

Date Collected: 07/31/14 10:43
Date Received: 07/31/14 15:49

Method: 300.0 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	35		10		mg/L			08/01/14 01:19	20
Sulfate	660		40		mg/L			08/01/14 01:19	20

Data Quality Evaluation Checklists

Method Validated: 300.0

Initial Review by: J. Hartness Date: 8/26/2014 SDG#: 550-28984-1
Senior Review by: D. Knaub Date: 8/28/2014 Matrix: Groundwater

COMMON ANIONS ANALYSIS (METHOD 9056/300.0)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C)	QC acceptance criteria published by DoD, if available; otherwise method- specified criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	Not applicable (NA)	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	ok
Limit of Detection Determination and Verification (LOD) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly LOD verification checks shall be performed (see box D-13)	See 40 CFR 1368. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL / LOD verification check at higher level and set MDL higher or reconduct MDL study (see box D-13).	NA	Samples cannot be analyzed without a valid MDL.	Level II
Limit of Quantitation Establishment and Verification (LOQ) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly LOQ verification checks shall be performed (see box D-14)	Within calibration range including low standard; within method precision and accuracy.	Re-run LOQ	NA	Samples cannot be analyzed without a valid LOQ	Level II

COMMON ANIONS ANALYSIS (METHOD 9056/300.0)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Retention Time (RT) Window Width Calculated for Each Analyte and Surrogate	At method set-up and after major maintenance (e.g., column change)	RT width is ± 3 times standard deviation for each analyte RT from 24-hour study.	NA	NA		Level II
Container, Preservation, and Holding Time	All field samples	500 ml poly, Cool to 4°C Nitrate – 48 hours Nitrite, sulfate, chloride – 28 days	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collected: 7/31/2014 Temp: 1.2°C Bromide and Sulfate Analyzed: 8/01/2014 OK
ICAL for All Analytes (Minimum Three Standards and One Calibration Blank)	Initial calibration prior to sample analysis	R ≥ 0.995	Correct problem then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed.	Level II
Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 10% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	Level II
Retention Time Window Position Establishment for Each Analyte and Surrogate	Once per ICAL and at the beginning of the analytical shift	Position shall be set using the midpoint standard of the calibration curve or the value in the CCV run at the beginning of the analytical shift.	NA	NA		Level II

ED_005025_00007837-00398

COMMON ANIONS ANALYSIS (METHOD 9056/300.0)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Midrange Continuing Calibration Verification (CCV)	After every 10 field samples and at end of the analysis sequence.	All analytes within established retention time windows and within ± 10% of true value	Correct problem then repeat CCV. If that fails, then repeat ICAL. Reanalyze all samples since last successful calibration verification.	Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification, if . reanalysis is not possible.	No samples may be analyzed until the problem has been corrected.	Level II
Method Blank	One per preparatory batch	No analytes detected > ½ RL. See box D-1.	Correct problem, then see criteria in box D-1; if required, reprep then reanalyze method blank and all samples processed with the contaminated blank.	Lab: Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch. Validator; Apply "B" flag if result is less than 5x method blank.		Pg 8 Bromide and Sulfate MB 550-40926/2= ND
Laboratory Control Sample (LCS) Containing All Analytes Required to be Reported, Including Surrogates	One LCS per preparatory batch	Use laboratory in-house LCS acceptance criteria (not to exceed 20%).See Box D-3.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix G)	If corrective action fails apply J-flag to specific analyte(s) in all samples in the associated preparatory batch		Pg 8 Bromide and Sulfate LCS/LCSD 550-40926/5,6 All ok

Method Validated: 300.0

Initial Review by: J. Hartness Date: 8/26/2014 SDG#: 550-28984-1
Senior Review by: D. Knaub Date: 8/28/2014 Matrix: Groundwater

COMMON ANIONS ANALYSIS (METHOD 9056/300.0)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Matrix Spike (MS)	One MS per preparatory batch per matrix (see box D- 7)	For matrix evaluation, use laboratory in-house LCS acceptance criteria (not to exceed 20%).	Examine the project-specific 000s. Contact the client as to additional measures to be taken,	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	MS/MSD listed is not associated with this SDG
Matrix Spike Duplicate (MSD) or Sample Duplicate	One per preparatory batch per matrix	RPD ≤15% (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	See above
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD ≤10%	Qualify sample	For the specific analyte(s) in the parent & dup samples, apply J- flag if acceptance criteria are not met.		No field duplicates submitted with this SDG
Results Reported Between LOD and LOQ	NA	NA	NA	Apply J-flag to all results between LOD and LOQ. Validator flags: If using AFCEE; Apply "F" flag		No samples reported between LOD and LOQ
QC Blanks (Equipment Blanks and Field Blanks)	Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value (10x for common lab contaminants) are qualified as estimated and flagged "B".		Not collected

Data Evaluation Narrative
AMEC Project: Former Williams AFB
AMEC Project Number: 9101110001.5300.5301
Site: ST012 – Enhanced Bioremediation Field Test
Sampling Event: August 2014
Matrix: Groundwater

SDG: 550-29160-1

1.0 INTRODUCTION

A data quality evaluation (DQE) was performed on the data reported for the Enhanced Bioremediation field test conducted at Site ST012 in August 2014 at the former Williams Air Force Base (WAFB), located in Mesa, Arizona. The following sections provide summary discussions of the required data qualifications for each site and analytical methods for samples collected at the former WAFB. Data validation was conducted on 100% of the primary samples and field quality control samples (rinsate blanks and laboratory control sample/laboratory control sample duplicate [LCS/LCSD] samples). Data validation was performed using supplemental checklists to review the following quality control elements. A Level II DQE was performed on the analyses using the following criteria: laboratory case narrative, sample documentation, chain-of-custody, holding time protocols, method blank results, laboratory control sample (LCS) results, surrogate recoveries (where applicable), method sensitivity, and completeness.

Data was reviewed using precision and accuracy control limits presented in The Department of Defense (DoD) Quality Systems Manual (QSM) Version 4.2 (DoD, 2010). DQE data qualifications were applied if necessary in accordance with procedures in Air Force Center for Environmental Excellence (AFCEE) Quality Assurance Project Plan (QAPP), Version 4.0.01 (AFCEE, 2005), the method, and professional judgment using the following qualifiers:

- J = The reported concentration is considered an estimated value due to discrepancies in meeting certain analyte-specific quality control criteria.
- F = The reported concentration is between the reporting limit (RL) and method detection limit (MDL) and is considered an estimated value
- UJ = The target compound was not detected and the reporting limit is considered imprecise due to discrepancies in meeting certain analyte-specific quality control criteria.
- B = The result may be biased high or a false positive based on blank data.
- M = The reported concentration is estimated due to matrix effects.
- R = The data are considered unusable due to discrepancies in meeting certain quality control criteria and may not be used in decision making.

ED_005025_00007837-00401

2.0 DELIVERABLES

The data packages as submitted to AMEC Environment and Infrastructure, Inc. (AMEC) are complete as stipulated in the Draft Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) for Site ST012 Enhanced Bioremediation Field Test Plan (AMEC, 2014), and the applicable guidelines described in the former Williams AFB Performance Based Remediation Program QAPP and standard operating procedures (SOPs) (collectively referred to as the QAPP/SOP [AMEC, 2012]) for U.S. States Environmental Protection Agency (EPA) Method 300.0.

3.0 SAMPLE INTEGRITY

Samples within this sample delivery group (SDG), collected from ST012, were submitted to TestAmerica Laboratories (TAL) in Phoenix, Arizona. The samples were submitted for bromide and sulfate by USEPA Method E300.0.

Based on the information provided on the cooler receipt forms, samples arrived at the laboratory within temperature and preservation requirements. Completed COC documents are included in the data package.

4.0 SAMPLE IDENTIFICATION

This SDG contains the following water and quality control (QC) samples:

Site: ST012	QC Samples
ST012-W11-WG-080514	
ST012-W30-WG-080514	

These samples were collected on 8 August 2014.

5.0 SAMPLE QUALIFICATION

Only those components that required qualification of the data are presented in this narrative. All Level II components were within the QC limits; therefore, no qualification was required for the data.

6.0 BROMIDE AND SULFATE (EPA 300.0)

Samples collected from site ST012 were submitted for bromide and sulfate by Method E300.0. A Level II validation was performed on this method and all components were within the QAPP/SOP criteria.

6.1 Limits of Quantitation

The LOQs as specified in the QAPP/SOP (AMEC, 2012) were met for samples submitted for the analysis of bromide and sulfate by USEPA Method E300.0 with the exception of analytes that

required dilution. Each of the samples reported in this SDG required dilution for bromide and sulfate resulting in elevated LOQs.

7.0 OVERALL SITE EVALUATION AND PROFESSIONAL JUDGMENT FLAGGING CHANGES

Edits to the DQE qualifiers by professional judgment were not required, and the data are usable as qualified in this data narrative.

8.0 SUMMARY OF DATA QUALITY INDICATORS

This section provides an assessment of the data based on project data quality indicators (DQIs) described on QAPP Worksheet #37 of the QAPP/SOP (AMEC, 2012). The DQIs consist of precision, accuracy, representativeness, comparability, completeness, and sensitivity.

8.1 Precision

An assessment of precision of analytical data is accomplished via review of field duplicate and MS/MSD analyses. Field duplicate and MS/MSD analyses are used to assess field variability, which includes sample collection/handling as well as matrix homogeneity. Precision is expressed as the relative percent difference (RPD) between results for duplicate pairs.

No field duplicate or project specific samples were submitted for MS/MSD analyses in the SDG; however, the laboratory analyzed a LCS/LCSD and a MS/MSD on a non-project sample for batch precision. Duplicate precision for anions was within QC limits, therefore, overall method and sample matrix precision are acceptable and achieve project objectives.

8.2 Accuracy (Bias)

An assessment of accuracy of analytical data is accomplished via evaluation of the spike recoveries in the MS/MSD, LCS, post digestion spike samples, and surrogate spike compounds, in addition to calibration criteria. Accuracy is expressed as percent recovery. Accuracy data were compliant with the program document QAPP/SOP, as all associated LCS/LCSD recoveries were within control. Therefore, the data results indicate method and matrix accuracy is acceptable to achieve project objectives.

8.3 Representativeness

Representativeness for the analytical data is determined through evaluation of the associated blank data and evaluation of appropriate sample handling procedures. All samples were properly stored and preserved in the field and at TestAmerica and blanks were all non-detect. The analytical results indicate sample data are representative of the Site conditions.

ED_005025_00007837-00403

8.4 Comparability

Comparability addresses the confidence with which one data set can be compared to another. Use of appropriate sampling methods, COC procedures, and EPA-approved analytical methods, as well as adherence to strict QA/QC procedures, provide the basis for uniformity in sample collection and analysis. Analytical data were generated by TestAmerica using standard reporting units of milligrams per liter and methods for all parameters. In addition, sample collection and analytical method protocols were implemented in accordance with approved, documented procedures. Analytical data are determined to be comparable to previous Site results.

8.5 Completeness

Completeness of the field sampling activities were assessed in terms of the actual number and type of sample results received from the field and laboratory, as compared with the planned number and type of sample results. All samples planned were collected which meets a field completeness of 100%.

Analytical completeness of data is a measure of the number of valid project-specific data results obtained in comparison to the total number of data results projected to achieve project DQOs. Valid data are defined as data that meet the project-specific DQOs. No data were rejected as a result of the data validation. The completeness goals met the 90 percent goal for field and laboratory data expected for this project.

8.6 Sensitivity

Analytical methods and LOQs were implemented in accordance with the QAPP/SOP and EPA promulgated methodologies. Method RLs were achieved for the event except when sample dilutions were required to bring target compounds within the linear range of the instrument calibration. These include modified RLs for selected detections. Although the laboratory RLs for samples requiring dilution exceed the QAPP RLs, sensitivity requirements were met.

8.7 Usability Summary

The data generated during the August 2014 sampling event did not require qualification and the analytical results indicate sample data is representative of the Site conditions. The DQOs for the Enhanced Bioremediation Field Test is to produce data to support design of anaerobic methods for the ST012 remedy if selected.

ED_005025_00007837-00404

9.0 REFERENCES

AFCEE, 2005. Quality Assurance Project Plan, Version 4.0.01, May, 2005.

AMEC, August 11, 2014. *Draft Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) (Enhanced Bioremediation Field Test Plan) Operable Unit 2 Site ST012 - Liquid Fuels Storage Area, Former Williams Air Force Base, Mesa, Arizona.*

AMEC, February 23, 2012. *Performance Based Remediation Program Quality Assurance Project Plan (QAPP) and Standard Operating Procedures (SOPs) (QAP/SOP), Former Williams Air Force Base, Mesa, Arizona.*

DoD, 2010. Department of Defense Quality System Manual, Version 4.2 Final, October 2010.

Prepared/Date: JAH 8/26/2014
Checked/Date: DWK 8/28/2014

ED_005025_00007837-00405

Flagged Data Reports

Client Sample Results

Client: AMEC Environment & Infrastructure, Inc.
Project/Site: Williams AFB ST012 ERB Field Test

TestAmerica Job ID: 550-29160-1

Client Sample ID: ST012-W30-WG-080514

No flags 8-26-14

Lab Sample ID: 550-29160-1
Matrix: Water

Date Collected: 08/05/14 08:13
Date Received: 08/05/14 12:09

Method: 300.0 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	20		10		mg/L			08/05/14 20:26	20
Sulfate	320		40		mg/L			08/05/14 20:26	20

Client Sample ID: ST012-W11-WG-080514

Lab Sample ID: 550-29160-2
Matrix: Water

Date Collected: 08/05/14 09:18
Date Received: 08/05/14 12:09

Method: 300.0 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	6.2		0.50		mg/L			08/06/14 20:32	1
Sulfate	300		40		mg/L			08/05/14 20:44	20

Data Quality Evaluation Checklists

Method Validated: 300.0

Initial Review by: J. Hartness Date: 8/26/2014 SDG#: 550-29160-1
Senior Review by: D. Knaub Date: 8/28/2014 Matrix: Groundwater

COMMON ANIONS ANALYSIS (METHOD 9056/300.0)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C)	QC acceptance criteria published by DoD, if available; otherwise method- specified criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	Not applicable (NA)	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	ok
Limit of Detection Determination and Verification (LOD) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly LOD verification checks shall be performed (see box D-13)	See 40 CFR 1368. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL / LOD verification check at higher level and set MDL higher or reconduct MDL study (see box D-13).	NA	Samples cannot be analyzed without a valid MDL.	Level II
Limit of Quantitation Establishment and Verification (LOQ) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly LOQ verification checks shall be performed (see box D-14)	Within calibration range including low standard; within method precision and accuracy.	Re-run LOQ	NA	Samples cannot be analyzed without a valid LOQ	Level II

COMMON ANIONS ANALYSIS (METHOD 9056/300.0)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Retention Time (RT) Window Width Calculated for Each Analyte and Surrogate	At method set-up and after major maintenance (e.g., column change)	RT width is ± 3 times standard deviation for each analyte RT from 24-hour study.	NA	NA		Level II
Container, Preservation, and Holding Time	All field samples	500 ml poly, Cool to 4°C Nitrate – 48 hours Nitrite, sulfate, chloride – 28 days	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collected: 8/05/2014 Temp: 0.8°C Bromide and Sulfate Analyzed: 8/05/2014 and 8/06/2014 OK
ICAL for All Analytes (Minimum Three Standards and One Calibration Blank)	Initial calibration prior to sample analysis	R ≥ 0.995	Correct problem then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed.	Level II
Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 10% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	Level II
Retention Time Window Position Establishment for Each Analyte and Surrogate	Once per ICAL and at the beginning of the analytical shift	Position shall be set using the midpoint standard of the calibration curve or the value in the CCV run at the beginning of the analytical shift.	NA	NA		Level II

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COMMON ANIONS ANALYSIS (METHOD 9056/300.0)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Midrange Continuing Calibration Verification (CCV)	After every 10 field samples and at end of the analysis sequence.	All analytes within established retention time windows and within ± 10% of true value	Correct problem then repeat CCV. If that fails, then repeat ICAL. Reanalyze all samples since last successful calibration verification.	Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification, if . reanalysis is not possible.	No samples may be analyzed until the problem has been corrected.	Level II
Method Blank	One per preparatory batch	No analytes detected > ½ RL. See box D-1.	Correct problem, then see criteria in box D-1; if required, reprep then reanalyze method blank and all samples processed with the contaminated blank.	Lab: Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch. Validator; Apply "B" flag if result is less than 5x method blank.		Pg 8 Bromide and Sulfate MB 550-41231/2= ND MB 550-41356/2= ND
Laboratory Control Sample (LCS) Containing All Analytes Required to be Reported, Including Surrogates	One LCS per preparatory batch	Use laboratory in-house LCS acceptance criteria (not to exceed 20%).See Box D-3.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix G)	If corrective action fails apply J-flag to specific analyte(s) in all samples in the associated preparatory batch		Pg 8 Bromide and Sulfate LCS/LCSD 550-41231/5,6 All ok Pg 8-9 LCS/LCSD 550-41356/5,6 All ok

Method Validated: 300.0

Initial Review by: J. Hartness Date: 8/26/2014 SDG#: 550-29160-1
Senior Review by: D. Knaub Date: 8/28/2014 Matrix: Groundwater

COMMON ANIONS ANALYSIS (METHOD 9056/300.0)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Matrix Spike (MS)	One MS per preparatory batch per matrix (see box D- 7)	For matrix evaluation, use laboratory in-house LCS acceptance criteria (not to exceed 20%).	Examine the project-specific 000s. Contact the client as to additional measures to be taken,	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	MS/MSD listed is not associated with this SDG
Matrix Spike Duplicate (MSD) or Sample Duplicate	One per preparatory batch per matrix	RPD ≤15% (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	See above
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD ≤10%	Qualify sample	For the specific analyte(s) in the parent & dup samples, apply J- flag if acceptance criteria are not met.		No field duplicates submitted with this SDG
Results Reported Between LOD and LOQ	NA	NA	NA	Apply J-flag to all results between LOD and LOQ. Validator flags: If using AFCEE; Apply "F" flag		No samples reported between LOD and LOQ
QC Blanks (Equipment Blanks and Field Blanks)	Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value (10x for common lab contaminants) are qualified as estimated and flagged "B".		Not collected

Data Evaluation Narrative
AMEC Project: Former Williams AFB
AMEC Project Number: 9101110001.5300.5301
Site: ST012 – Enhanced Bioremediation Field Test
Sampling Event: August 2014
Matrix: Groundwater

SDG: 550-29406-1

1.0 INTRODUCTION

A data quality evaluation (DQE) was performed on the data reported for the Enhanced Bioremediation field test conducted at Site ST012 in August 2014 at the former Williams Air Force Base (WAFB), located in Mesa, Arizona. The following sections provide summary discussions of the required data qualifications for each site and analytical methods for samples collected at the former WAFB. Data validation was conducted on 100% of the primary samples and field quality control samples (rinsate blanks and laboratory control sample/laboratory control sample duplicate [LCS/LCSD] samples). Data validation was performed using supplemental checklists to review the following quality control elements. A Level II DQE was performed on the analyses using the following criteria: laboratory case narrative, sample documentation, chain-of-custody, holding time protocols, method blank results, laboratory control sample (LCS) results, surrogate recoveries (where applicable), method sensitivity, and completeness.

Data was reviewed using precision and accuracy control limits presented in The Department of Defense (DoD) Quality Systems Manual (QSM) Version 4.2 (DoD, 2010). DQE data qualifications were applied if necessary in accordance with procedures in Air Force Center for Environmental Excellence (AFCEE) Quality Assurance Project Plan (QAPP), Version 4.0.01 (AFCEE, 2005), the method, and professional judgment using the following qualifiers:

- J = The reported concentration is considered an estimated value due to discrepancies in meeting certain analyte-specific quality control criteria.
- F = The reported concentration is between the reporting limit (RL) and method detection limit (MDL) and is considered an estimated value
- UJ = The target compound was not detected and the reporting limit is considered imprecise due to discrepancies in meeting certain analyte-specific quality control criteria.
- B = The result may be biased high or a false positive based on blank data.
- M = The reported concentration is estimated due to matrix effects.
- R = The data are considered unusable due to discrepancies in meeting certain quality control criteria and may not be used in decision making.

ED_005025_00007837-00413

2.0 DELIVERABLES

The data packages as submitted to AMEC Environment and Infrastructure, Inc. (AMEC) are complete as stipulated in the Draft Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) for Site ST012 Enhanced Bioremediation Field Test Plan (AMEC, 2014), and the applicable guidelines described in the former Williams AFB Performance Based Remediation Program QAPP and standard operating procedures (SOPs) (collectively referred to as the QAPP/SOP [AMEC, 2012]) for U.S. States Environmental Protection Agency (EPA) Method 300.0.

3.0 SAMPLE INTEGRITY

Samples within this sample delivery group (SDG), collected from ST012, were submitted to TestAmerica Laboratories (TAL) in Phoenix, Arizona. The samples were submitted for bromide and sulfate by USEPA Method E300.0.

Based on the information provided on the cooler receipt forms, samples arrived at the laboratory within temperature and preservation requirements. Completed COC documents are included in the data package.

4.0 SAMPLE IDENTIFICATION

This SDG contains the following water and quality control (QC) samples:

Site: ST012	QC Samples
ST012-W11-WG-080714	
ST012-W30-WG-080714	

These samples were collected on 7 August 2014.

5.0 SAMPLE QUALIFICATION

Only those components that required qualification of the data are presented in this narrative. All Level II components were within the QC limits; therefore, no qualification was required for the data.

6.0 BROMIDE AND SULFATE (EPA 300.0)

Samples collected from site ST012 were submitted for bromide and sulfate by Method E300.0. A Level II validation was performed on this method and all components were within the QAPP/SOP criteria.

6.1 Limits of Quantitation

The LOQs as specified in the QAPP/SOP (AMEC, 2012) were met for samples submitted for the analysis of bromide and sulfate by USEPA Method E300.0 with the exception of analytes that

required dilution. Each of the samples reported in this SDG required dilution for sulfate and one sample required dilution for bromide resulting in elevated LOQs.

7.0 OVERALL SITE EVALUATION AND PROFESSIONAL JUDGMENT FLAGGING CHANGES

Edits to the DQE qualifiers by professional judgment were not required, and the data are usable as qualified in this data narrative.

8.0 SUMMARY OF DATA QUALITY INDICATORS

This section provides an assessment of the data based on project data quality indicators (DQIs) described on QAPP Worksheet #37 of the QAPP/SOP (AMEC, 2012). The DQIs consist of precision, accuracy, representativeness, comparability, completeness, and sensitivity.

8.1 Precision

An assessment of precision of analytical data is accomplished via review of field duplicate and MS/MSD analyses. Field duplicate and MS/MSD analyses are used to assess field variability, which includes sample collection/handling as well as matrix homogeneity. Precision is expressed as the relative percent difference (RPD) between results for duplicate pairs.

No field duplicate or project specific samples were submitted for MS/MSD analyses in the SDG; however, the laboratory analyzed a LCS/LCSD and a MS/MSD on a non-project sample for batch precision. Duplicate precision for anions was within QC limits; therefore, overall method and sample matrix precision are acceptable and achieve project objectives.

8.2 Accuracy (Bias)

An assessment of accuracy of analytical data is accomplished via evaluation of the spike recoveries in the MS/MSD, LCS, post digestion spike samples, and surrogate spike compounds, in addition to calibration criteria. Accuracy is expressed as percent recovery. Accuracy data were compliant with the program document QAPP/SOP, as all associated LCS/LCSD recoveries were within control. Therefore, the data results indicate method and matrix accuracy is acceptable to achieve project objectives.

8.3 Representativeness

Representativeness for the analytical data is determined through evaluation of the associated blank data and evaluation of appropriate sample handling procedures. All samples were properly stored and preserved in the field and at TestAmerica and blanks were all non-detect. The analytical results indicate sample data are representative of the Site conditions.

8.4 Comparability

Comparability addresses the confidence with which one data set can be compared to another. Use of appropriate sampling methods, COC procedures, and EPA-approved analytical methods, as well as adherence to strict QA/QC procedures, provide the basis for uniformity in sample collection and analysis. Analytical data were generated by TestAmerica using standard reporting units of milligrams per liter and methods for the parameters. In addition, sample collection and analytical method protocols were implemented in accordance with approved, documented procedures. Analytical data are determined to be comparable to previous Site results.

8.5 Completeness

Completeness of the field sampling activities were assessed in terms of the actual number and type of sample results received from the field and laboratory, as compared with the planned number and type of sample results. All samples planned were collected which meets a field completeness of 100%.

Analytical completeness of data is a measure of the number of valid project-specific data results obtained in comparison to the total number of data results projected to achieve project DQOs. Valid data are defined as data that meet the project-specific DQOs. No data were rejected as a result of the data validation. The completeness goals met the 90 percent goal for field and laboratory data expected for this project.

8.6 Sensitivity

Analytical methods and LOQs were implemented in accordance with the QAPP/SOP and EPA promulgated methodologies. Method RLs were achieved for the event except when sample dilutions were required to bring target compounds within the linear range of the instrument calibration. These include modified RLs for selected detections. Although the laboratory RLs for samples requiring dilution exceed the QAPP RLs, sensitivity requirements were met.

8.7 Usability Summary

The data generated during the August 2014 sampling event did not require qualification and the analytical results indicate sample data is representative of the Site conditions. The DQOs for the Enhanced Bioremediation Field Test is to produce data to support design of anaerobic methods for the ST012 remedy if selected.

ED_005025_00007837-00416

9.0 REFERENCES

AFCEE, 2005. Quality Assurance Project Plan, Version 4.0.01, May, 2005.

AMEC, August 11, 2014. *Draft Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) (Enhanced Bioremediation Field Test Plan) Operable Unit 2 Site ST012 - Liquid Fuels Storage Area, Former Williams Air Force Base, Mesa, Arizona*.

AMEC, February 23, 2012. *Performance Based Remediation Program Quality Assurance Project Plan (QAPP) and Standard Operating Procedures (SOPs) (QAP/SOP), Former Williams Air Force Base, Mesa, Arizona.*

DoD, 2010. Department of Defense Quality System Manual, Version 4.2 Final, October 2010.

Prepared/Date: DWK 8/28/2014
Checked/Date: JAH 9/02/2014

ED_005025_00007837-00417

Flagged Data Reports

Client Sample Results

Client: AMEC Environment & Infrastructure, Inc.
Project/Site: Former Williams AFB ST012 ERB

TestAmerica Job ID: 550-29406-1

Client Sample ID: ST012-W30-WG-080714

Lab Sample ID: 550-29406-1
Matrix: Water

Date Collected: 08/07/14 08:37
Date Received: 08/07/14 13:20

No Flags
DWK 8/20/14

Method: 300.0 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	16		10		mg/L			08/08/14 21:11	20
Sulfate	240		40		mg/L			08/08/14 21:11	20

Client Sample ID: ST012-W11-WG-080714

Lab Sample ID: 550-29406-2
Matrix: Water

Date Collected: 08/07/14 10:30
Date Received: 08/07/14 13:20

Method: 300.0 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	4.9		0.50		mg/L			08/12/14 19:40	1
Sulfate	230		40		mg/L			08/08/14 21:29	20

Data Quality Evaluation Checklists

Method Validated: 300.0 | Initial Review by: D. Knaub | Date: 8/28/2014 | SDG#: 550-29406-1
Senior Review by: J. Hartness | Date: 9/02/2014 | Matrix: Groundwater

COMMON ANIONS ANALYSIS (METHOD 9056/300.0)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Demonstrate Acceptable Analyst Capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, or test method (see Appendix C)	QC acceptance criteria published by DoD, if available; otherwise method- specified criteria.	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria (see section C.1.f).	Not applicable (NA)	This is a demonstration of ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample (e.g., LCS or PT sample). No analysis shall be allowed by analyst until successful demonstration of capability is complete.	ok
Limit of Detection Determination and Verification (LOD) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly LOD verification checks shall be performed (see box D-13)	See 40 CFR 1368. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL / LOD verification check at higher level and set MDL higher or reconduct MDL study (see box D-13).	NA	Samples cannot be analyzed without a valid MDL.	Level II
Limit of Quantitation Establishment and Verification (LOQ) Study	At initial set-up and subsequently once per 12 month period; otherwise quarterly LOQ verification checks shall be performed (see box D-14)	Within calibration range including low standard; within method precision and accuracy.	Re-run LOQ	NA	Samples cannot be analyzed without a valid LOQ	Level II

Method Validated: 300.0

Initial Review by: D. Knaub Date: 8/28/2014 SDG#: 550-29406-1
Senior Review by: J. Hartness Date: 9/02/2014 Matrix: Groundwater

COMMON ANIONS ANALYSIS (METHOD 9056/300.0)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Retention Time (RT) Window Width Calculated for Each Analyte and Surrogate	At method set-up and after major maintenance (e.g., column change)	RT width is ± 3 times standard deviation for each analyte RT from 24-hour study.	NA	NA		Level II
Container, Preservation, and Holding Time	All field samples	500 ml poly, Cool to 4°C Nitrate – 48 hours Nitrite, sulfate, chloride – 28 days	NA	Samples analyzed outside of holding time or received unpreserved are qualified as estimated and flagged "J" or "UJ"	Use professional judgment to determine effect of improper container	Collected: 8/07/14 Temp: 3.3°C Bromide and Sulfate Analyzed: 8/08/14 and 8/12/14 OK
ICAL for All Analytes (Minimum Three Standards and One Calibration Blank)	Initial calibration prior to sample analysis	R ≥ 0.995	Correct problem then repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed.	Level II
Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 10% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration has been verified.	Level II
Retention Time Window Position Establishment for Each Analyte and Surrogate	Once per ICAL and at the beginning of the analytical shift	Position shall be set using the midpoint standard of the calibration curve or the value in the CCV run at the beginning of the analytical shift.	NA	NA		Level II

COMMON ANIONS ANALYSIS (METHOD 9056/300.0)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Midrange Continuing Calibration Verification (CCV)	After every 10 field samples and at end of the analysis sequence.	All analytes within established retention time windows and within ± 10% of true value	Correct problem then repeat CCV. If that fails, then repeat ICAL. Reanalyze all samples since last successful calibration verification.	Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification, if . reanalysis is not possible.	No samples may be analyzed until the problem has been corrected.	Level II
Method Blank	One per preparatory batch	No analytes detected > ½ RL. See box D-1.	Correct problem, then see criteria in box D-1; if required, reprep then reanalyze method blank and all samples processed with the contaminated blank.	Lab: Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch. Validator; Apply "B" flag if result is less than 5x method blank.		p. 8 Bromide and Sulfate MB 550-41742/2= ND MB 550-41898/2= ND
Laboratory Control Sample (LCS) Containing All Analytes Required to be Reported, Including Surrogates	One LCS per preparatory batch	Use laboratory in-house LCS acceptance criteria (not to exceed 20%).See Box D-3.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available (see full explanation in Appendix G)	If corrective action fails apply J-flag to specific analyte(s) in all samples in the associated preparatory batch		p. 8 Bromide and Sulfate LCS/LCSD 550-41742/5,6 All ok p. 8-9 LCS/LCSD 550-41898/5,6 All ok

Method Validated: 300.0

Initial Review by: D. Knaub Date: 8/28/2014 SDG#: 550-29406-1
Senior Review by: J. Hartness Date: 9/02/2014 Matrix: Groundwater

COMMON ANIONS ANALYSIS (METHOD 9056/300.0)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments	DQE Notes/Flags
Matrix Spike (MS)	One MS per preparatory batch per matrix (see box D- 7)	For matrix evaluation, use laboratory in-house LCS acceptance criteria (not to exceed 20%).	Examine the project-specific 000s. Contact the client as to additional measures to be taken,	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. If using AFCEE; Apply "M" flag	For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	MS/MSD listed is not associated with this SDG
Matrix Spike Duplicate (MSD) or Sample Duplicate	One per preparatory batch per matrix	RPD ≤15% (between MS and MSD or sample and sample duplicate)	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply J- flag if acceptance criteria are not met. If using AFCEE; Apply "M" flag	The data shall be evaluated to determine the source of difference.	See above
Field Duplicate	Project specified – 1 dup for every 10 samples	RPD ≤10%	Qualify sample	For the specific analyte(s) in the parent & dup samples, apply J- flag if acceptance criteria are not met.		No field duplicates submitted with this SDG
Results Reported Between LOD and LOQ	NA	NA	NA	Apply J-flag to all results between LOD and LOQ. Validator flags: If using AFCEE; Apply "F" flag		No samples reported between LOD and LOQ
QC Blanks (Equipment Blanks and Field Blanks)	Equipment Blank – as needed Field Blank – as needed	NA	NA	Associated samples less than 5x the blank value (10x for common lab contaminants) are qualified as estimated and flagged "B".		Not collected

APPENDIX D

MICROBIAL ANALYTICAL REPORTS
(INCLUDED ON CD ONLY)

Lab Name	Sample Name	Sample Date	Date Received	Sample Matrix	LIMS Identifier	Extraction Date	Analysis Date	Analysis Method	Parameter	Result	Result Qualifier	Units	Detection Limit	Report Limit
MI	ST012-W11-WG-0714	7/16/2014	7/17/2014	Water	042LG-1	7/17/2014	7/23/2014	CENSUS	APS	3.76E+04	=	cells/mL	0.00E+00	0.00E+00
MI	ST012-W11-WG-0714	7/16/2014	7/17/2014	Water	042LG-1	7/17/2014	7/23/2014	CENSUS	GEO	8.94E+01	=	cells/mL	0.00E+00	0.00E+00
MI	ST012-W11-WG-0714	7/16/2014	7/17/2014	Water	042LG-1	7/17/2014	7/23/2014	CENSUS	MGN	5.73E+05	=	cells/mL	0.00E+00	0.00E+00
MI	ST012-W11-WG-0714	7/16/2014	7/17/2014	Water	042LG-1	7/17/2014	7/23/2014	CENSUS	nirK	2.26E+06	=	cells/mL	1.00E-01	4.60E+00
MI	ST012-W11-WG-0714	7/16/2014	7/17/2014	Water	042LG-1	7/17/2014	7/23/2014	CENSUS	nirS	1.34E+05	=	cells/mL	1.00E-01	4.60E+00
MI	ST012-W30-WG-0714	7/16/2014	7/17/2014	Water	042LG-2	7/17/2014	7/23/2014	CENSUS	MGN	5.05E+04	=	cells/mL	0.00E+00	0.00E+00
MI	ST012-W30-WG-0714	7/16/2014	7/17/2014	Water	042LG-2	7/17/2014	7/23/2014	CENSUS	APS	4.45E+04	=	cells/mL	0.00E+00	0.00E+00
MI	ST012-W30-WG-0714	7/16/2014	7/17/2014	Water	042LG-2	7/17/2014	7/23/2014	CENSUS	NIRK	8.06E+05	=	cells/mL	1.00E-01	4.50E+00
MI	ST012-W30-WG-0714	7/16/2014	7/17/2014	Water	042LG-2	7/17/2014	7/23/2014	CENSUS	NIRS	4.25E+05	=	cells/mL	1.00E-01	4.50E+00
MI	ST012-W30-WG-0714	7/16/2014	7/17/2014	Water	042LG-2	7/17/2014	7/23/2014	CENSUS	GEO	2.33E+01	=	cells/mL	0.00E+00	0.00E+00
MI	ST012-W11-WG-0714	7/17/2014	7/18/2014	Water	042LG-1	7/18/2014	7/29/2014	PLFA	Cells	28200	=	cells/mL	5.17E+03	1.72E+04
MI	ST012-W11-WG-0714	7/17/2014	7/18/2014	Water	042LG-1	7/18/2014	7/29/2014	PLFA	Firmicutes (TerBrSats)	34.68	=	%		
MI	ST012-W11-WG-0714	7/17/2014	7/18/2014	Water	042LG-1	7/18/2014	7/29/2014	PLFA	Proteobacteria (Monos)	33.82	=	%		
MI	ST012-W11-WG-0714	7/17/2014	7/18/2014	Water	042LG-1	7/18/2014	7/29/2014	PLFA	Anaerobic metal reducers (BrMonos)	1.68	=	%		
MI	ST012-W11-WG-0714	7/17/2014	7/18/2014	Water	042LG-1	7/18/2014	7/29/2014	PLFA	SRB/Actinomycetes (MidBrSats)	2.77	=	%		
MI	ST012-W11-WG-0714	7/17/2014	7/18/2014	Water	042LG-1	7/18/2014	7/29/2014	PLFA	General (Nsats)	27.06	=	%		
MI	ST012-W11-WG-0714	7/17/2014	7/18/2014	Water	042LG-1	7/18/2014	7/29/2014	PLFA	Eukaryotes (polyenoics)	0	ND	%		
MI	ST012-W11-WG-0714	7/17/2014	7/18/2014	Water	042LG-1	7/18/2014	7/29/2014	PLFA	Slowed Growth	0.966045	=	ratio cy/cis		
MI	ST012-W11-WG-0714	7/17/2014	7/18/2014	Water	042LG-1	7/18/2014	7/29/2014	PLFA	Decreased Permeability	0	ND	ratio trans/cis		
MI	ST012-W30-WG-0714	7/17/2014	7/18/2014	Water	042LG-2	7/18/2014	7/29/2014	PLFA	Cells	57500	=	cells/mL	2.74E+03	9.14E+03
MI	ST012-W30-WG-0714	7/17/2014	7/18/2014	Water	042LG-2	7/18/2014	7/29/2014	PLFA	Firmicutes (TerBrSats)	48.44	=	%		
MI	ST012-W30-WG-0714	7/17/2014	7/18/2014	Water	042LG-2	7/18/2014	7/29/2014	PLFA	Proteobacteria (Monos)	22.59	=	%		
MI	ST012-W30-WG-0714	7/17/2014	7/18/2014	Water	042LG-2	7/18/2014	7/29/2014	PLFA	Anaerobic metal reducers (BrMonos)	5.4	=	%		
MI	ST012-W30-WG-0714	7/17/2014	7/18/2014	Water	042LG-2	7/18/2014	7/29/2014	PLFA	SRB/Actinomycetes (MidBrSats)	3.99	=	%		
MI	ST012-W30-WG-0714	7/17/2014	7/18/2014	Water	042LG-2	7/18/2014	7/29/2014	PLFA	General (Nsats)	19.6	=	%		
MI	ST012-W30-WG-0714	7/17/2014	7/18/2014	Water	042LG-2	7/18/2014	7/29/2014	PLFA	Eukaryotes (polyenoics)	0	ND	%		
MI	ST012-W30-WG-0714	7/17/2014	7/18/2014	Water	042LG-2	7/18/2014	7/29/2014	PLFA	Slowed Growth	0.902733	=	ratio cy/cis		
MI	ST012-W30-WG-0714	7/17/2014	7/18/2014	Water	042LG-2	7/18/2014	7/29/2014	PLFA	Decreased Permeability	0.118881	=	ratio trans/cis		

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Project Manager: Stu Pearson
Project Name: FWAFB ST012 EBR
Project No.: 910111000.5300.5301

Purchase Order No. F014200244
Subcontract No.
MI Quote No. Q 201471.0001

Please Check One:
X More samples to follow
☐ No Additional Samples

Report Type: ☐ Standard (default) ☐ Microbial Insights Level III raw data (5% surcharge) ☐ Microbial Insights Level IV (25% surcharge) ☐ Comprehensive Interpretive (15%) ☐ Historical Interpretive (35%)
EDD type: ☐ Microbial Insights Standard (default) ☐ All other available EDDs (5% surcharge) Specify EDD Type:

Please contact us with any questions about the analyses or filling out the COC at (865) 573-8188 (9:00 am to 5:00 pm EST, M-F). After hours email: customerservice@microbe.com

Sample Information					Analyses					CENSUS: Please select the target organism/gene																							
MI ID (Laboratory Use Only)	Sample Name	Date Sampled	Time Sampled	Matrix	PLFA	DGGE-3ID	DGGE-5ID	QuantArray Chlor	QuantArray Petro	DHC (Dehalococcoides)	DHC Functional genes (Tce, Bvc, vcr)	DHRM (Dehalococcoides)	DSM (Desulfitobacterium)	DSB (Desulfitobacterium)	EBAC (Total)	SRB	SRB (Sulfate Reducing Bacteria-APS)	MGM (Methanogens)	MOM (Methanotrophs)	SMMO	DNF (Denitrifiers-nirS and nirK)	AOB (Ammonia oxidizing bacteria)	PSR (ARTBE assay)	RDH (Toluene Monooxygenase)	RDH (Toluene Monooxygenase)	PHE (Phenol hydroxylase)	Ndo (Naphthalene dioxygenase)	BDA (Toluene/Xylene Monooxygenase)	ddc gPCR	ddc qPCR	RNA (Transcriptomic Option)*	Gram Gram stain	(Gram)	(Gram)
042L01	ST012-W11-UG-0714	7/16/14	1245	W	X												X	X			X											X		
2	ST012-W30-UG-0714	7/16/14	1515	W	X												X	X			X											X		

Note: Additional bottles to run the PLFA SAMPLES will be submitted 7/18 (samples collected 7/17).

Relinquished by: Shanda Lowry
Received by: [illegible]
Date: 7/16/14 7/17/14

It is vital that chain of custody is filled out correctly & that all relative information is provided.
Failure to provide sufficient and/or correct information regarding reporting, invoicing & analyses requested information may result in delays for which MI will not be liable.
* additional cost and sample preservation are associated with RNA samples.
**Saturday delivery: See sampling protocol for alternate shipping address.

REPORT TO:
Name: AMEC E+I
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Portland, ME 04101
email: stuart.pearson@amec.com
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Project Manager: Stu Pearson
Project Name: FWAFB SD12 EBR
Project No.: 9101110001.5300.5301

INVOICE TO: (for invoices paid by a third party it is imperative that all information be provided)
Name:
Company:
Address:
email:
Phone:
Fax:

Purchase Order No. F014200244
Subcontract No.
MI Quote No. Q 2014 71.0001

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Report Type: ☐ Standard (default) ☐ Microbial Insights Level III raw data (15% surcharge) ☐ Microbial Insights Level IV (25% surcharge) ☐ Comprehensive Interpretive (15%) ☐ Historical Interpretive (35%)
EDD type: ☐ Microbial Insights Standard (default) ☐ All other available EDDs (5% surcharge) Specify EDD Type:

Please contact us with any questions about the analyses or filling out the COC at (865) 573-8188 (9:00 am to 5:00 pm EST, M-F). After hours email: customerservice@microbe.com

Sample Information					Analyses					CENSUS: Please select the target organism/gene																							
MI ID (Laboratory Use Only)	Sample Name	Date Sampled	Time Sampled	Matrix	2 PLFA	DGGE+3ID	DGGE+9ID	QuantArray Chlor	QuantArray Petro	Bac (Pseudomonas aeruginosa)	Bac (Fecal coliform)	Bac (Total coliform)	Bac (Escherichia coli)	DNA (Desulfovibrio)	DNA (Desulfovibrio desulfuricans)	EBAC (Total)	MPN (Coliform Bacteria (Total))	MPN (Escherichia coli)	MPN (Enterococci)	MPN (Fecal coliform)	Bac (Desulfovibrio desulfuricans)	ACB (Acetobacterium woodii)	ACB (Acetobacterium Species)	PAH MTBE (naphthalene)	Bacteria (Fusarium Mycosporioides)	RDX (Trichosporon Mycotoxinivorans)	PVC (Phenol hydroxylase)	Acid (Desulfovibrio desulfuricans)	Acid (Desulfovibrio Aspuricus)	Bacteria (Desulfovibrio Aspuricus)	Bacteria (Desulfovibrio Desulfuricans)	Bacteria (Desulfovibrio Desulfuricans)	Bacteria (Desulfovibrio Desulfuricans)	Bacteria (Desulfovibrio Desulfuricans)	Bacteria (Desulfovibrio Desulfuricans)
042L01	SD12-W11-WG-0714	7/16/14	1245	W	X												X	X			X											X		
2	SD12-W30-WG-0714	7/16/14	1515	W	X												X	X			X											X		
	SD12-W11-WG-0714	7/17/14	14:10	W	X																													
	SD12-W30-WG-0714	7/17/14	10:00	W	X																													

Note: Additional bottles to run the PLFA samples will be submitted 7/18 (samples collected 7/17).

Please use these to run PLFA analysis

Relinquished by: Shanda Lewis / Shanda Lewis
Received by: Jeff Cox
Date: 7/16/14 / 7/17/14 / 7/18/14

It is vital that chain of custody is filled out correctly & that all relative information is provided. Failure to provide correct information regarding sampling & analysis requested information may result in delays for which MI will not be liable.

* additional cost and sample preservation are associated with RNA samples.

**Saturday delivery: See sampling protocol for alternate shipping address.

Lab Name	Sample Name	Sample Date	Date Received	Sample Matrix	LIMS Identifier	Extraction Date	Analysis Date	Analysis Method	Parameter	Result	Result Qualifier	Units	Detection Limit	Report Limit
MI	ST012-W11-WG-0714	7/16/2014	7/17/2014	Water	042LG-1	7/17/2014	7/23/2014	CENSUS	APS	3.76E+04	=	cells/mL	0.00E+00	0.00E+00
MI	ST012-W11-WG-0714	7/16/2014	7/17/2014	Water	042LG-1	7/17/2014	7/23/2014	CENSUS	GEO	8.94E+01	=	cells/mL	0.00E+00	0.00E+00
MI	ST012-W11-WG-0714	7/16/2014	7/17/2014	Water	042LG-1	7/17/2014	7/23/2014	CENSUS	MGN	5.73E+05	=	cells/mL	0.00E+00	0.00E+00
MI	ST012-W11-WG-0714	7/16/2014	7/17/2014	Water	042LG-1	7/17/2014	7/23/2014	CENSUS	nirK	2.26E+06	=	cells/mL	1.00E-01	4.60E+00
MI	ST012-W11-WG-0714	7/16/2014	7/17/2014	Water	042LG-1	7/17/2014	7/23/2014	CENSUS	nirS	1.34E+05	=	cells/mL	1.00E-01	4.60E+00
MI	ST012-W30-WG-0714	7/16/2014	7/17/2014	Water	042LG-2	7/17/2014	7/23/2014	CENSUS	MGN	5.05E+04	=	cells/mL	0.00E+00	0.00E+00
MI	ST012-W30-WG-0714	7/16/2014	7/17/2014	Water	042LG-2	7/17/2014	7/23/2014	CENSUS	APS	4.45E+04	=	cells/mL	0.00E+00	0.00E+00
MI	ST012-W30-WG-0714	7/16/2014	7/17/2014	Water	042LG-2	7/17/2014	7/23/2014	CENSUS	NIRK	8.06E+05	=	cells/mL	1.00E-01	4.50E+00
MI	ST012-W30-WG-0714	7/16/2014	7/17/2014	Water	042LG-2	7/17/2014	7/23/2014	CENSUS	NIRS	4.25E+05	=	cells/mL	1.00E-01	4.50E+00
MI	ST012-W30-WG-0714	7/16/2014	7/17/2014	Water	042LG-2	7/17/2014	7/23/2014	CENSUS	GEO	2.33E+01	=	cells/mL	0.00E+00	0.00E+00

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Client: Stuart Pearson
AMEC E & I, Inc.
511 Congress Street
Portland, ME 04101

Phone:

Fax:

Identifier: 042LG **Date Rec:** 07/17/2014 **Report Date:** 07/24/2014

Client Project #: 9101110001.5300.5301 **Client Project Name:** FWAFB ST012 EBR

Purchase Order #: F014200244

Analysis Requested: CENSUS, PLFA

Reviewed By:

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CENSUS

Client: **AMEC E & I, Inc.**
Project: FWAFB ST012 EBR

MI Project Number: **042LG**
Date Received: 07/17/2014

Sample Information

Client Sample ID:	**ST012-W11-WG -0714**	**ST012-W30-WG -0714**
Sample Date:	07/16/2014	07/16/2014
Units:	cells/mL	cells/mL
Analyst:	RW	RW

Functional Genes

Denitrifying Bacteria	nirK	**2.26E+06**	**8.06E+05**
Denitrifying Bacteria	nirS	**1.34E+05**	**4.25E+05**

Other Genera

Geobacter spp.	*GEO*	**8.94E+01**	**2.33E+01**

Phylogenetic Group

Sulfate Reducing Bacteria	APS	**3.76E+04**	**4.45E+04**
Methanogen	MGN	**5.73E+05**	**5.05E+04**

Legend:
NA = Not Analyzed NS = Not Sampled J = Estimated gene copies below PQL but above LQL I = Inhibited
< = Result not detected

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Phone:

Fax:

Identifier: 042LG **Date Rec:** 07/17/2014 **Report Date:** 07/29/2014

Client Project #: 9101110001.5300.5301 **Client Project Name:** FWAFB ST012 EBR

Purchase Order #: F014200244

Analysis Requested: CENSUS, PLFA

Reviewed By:

Kate Clark

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ED_005025_00007837-00432

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PLFA

Client: **AMEC E & I, Inc.**
Project: FWAFB ST012 EBR

MI Project Number: **042LG**
Date Received: 07/17/2014

Sample Information

Sample Name:	**ST012-W11-WG-0714**	**ST012-W30-WG-0714**
Sample Date:	07/17/2014	07/17/2014
Sample Matrix:	Water	Water
Analyst:	BJ	BJ

Biomass

Total Biomass (cells/mL)	**2.82E+04**	**5.75E+04**

Community Structure (% total PLFA)

Firmicutes (TerBrSats)	**34.68**	**48.44**
Proteobacteria (Monos)	**33.82**	**22.59**
Anaerobic metal reducers (BrMonos)	**1.68**	**5.40**
SRB/Actinomycetes (MidBrSats)	**2.77**	**3.99**
General (Nsats)	**27.06**	**19.60**
Eukaryotes (polyenoics)	**0.00**	**0.00**

Physiological Status (Proteobacteria only)

Slowed Growth	**0.97**	**0.90**
Decreased Permeability	**0.00**	**0.12**

Legend:
NA = Not Analyzed NS = Not Sampled

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Client: **AMEC E & I, Inc.**
Project: FWAFB ST012 EBR

MI Project Number: **042LG**
Date Received: 07/17/2014

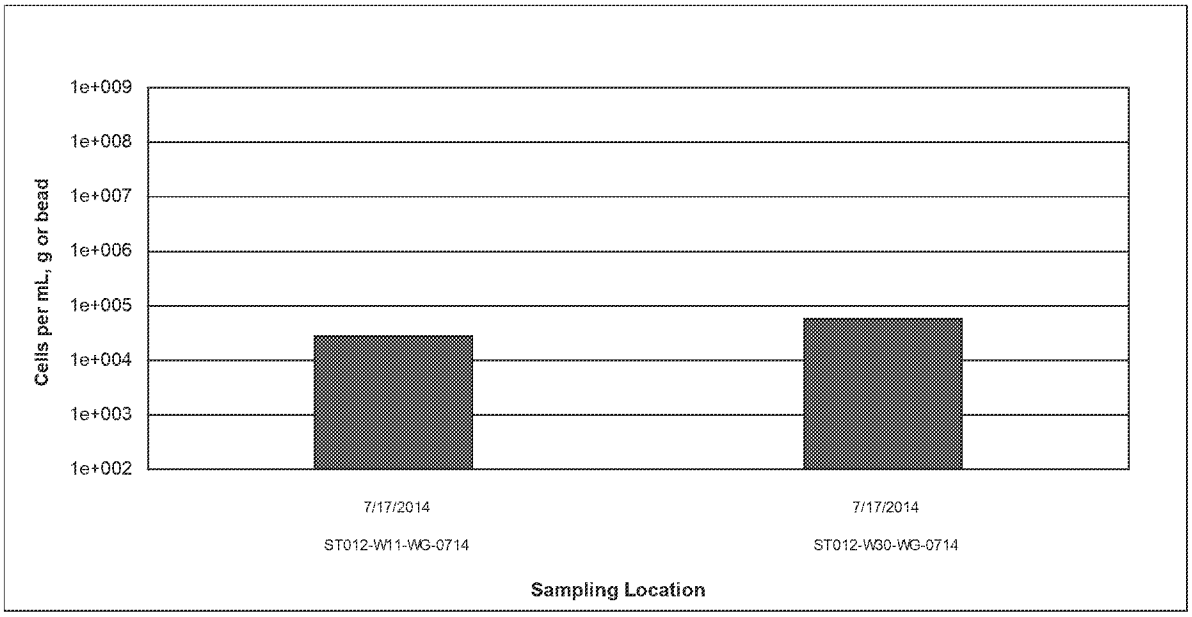

Figure 1. Biomass content is presented as a cell equivalent based on the total amount of phospholipid fatty acids (PLFA) extracted from a given sample. Total biomass is calculated based upon PLFA attributed to bacterial and eukaryotic biomass

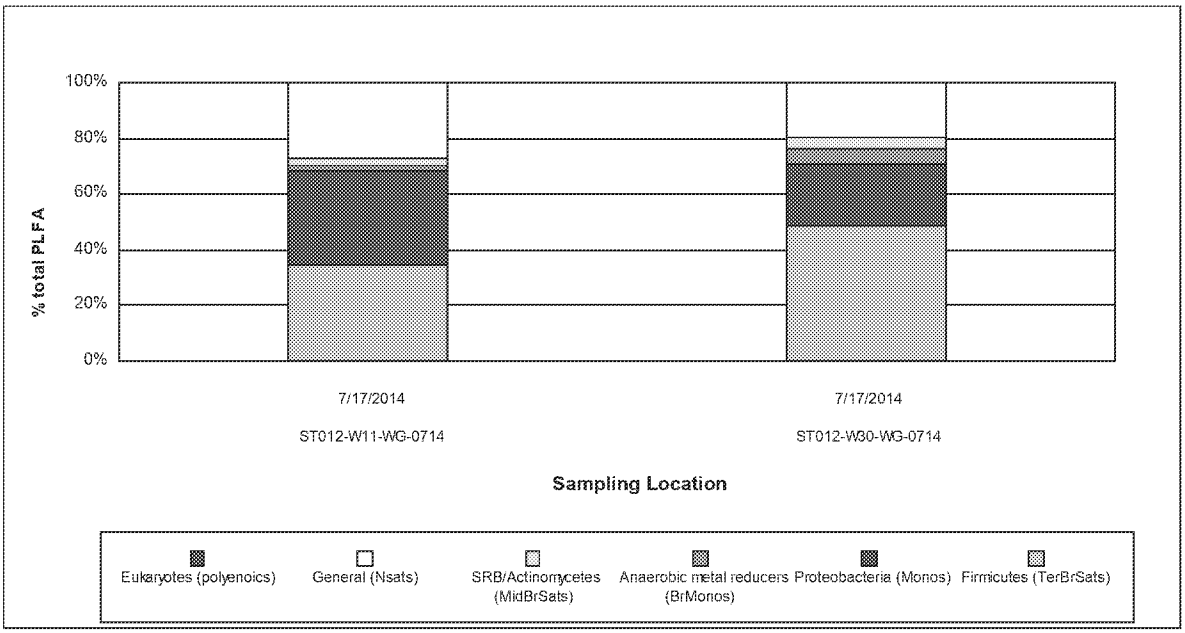

Figure 2. Relative percentages of total PLFA structural groups in the samples analyzed. Structural groups are assigned according to PLFA chemical structure, which is related to fatty acid biosynthesis.

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Phospholipid Fatty Acid Analysis

Interpretation Guidelines

Phospholipids fatty acids (PLFA) are a main component of the membrane (essentially the "skin") of microbes and provide a powerful tool for assessing microbial responses to changes in their environment. This type of analysis provides direct information for assessing and monitoring sites where bioremediation processes, including natural attenuation, are of interest. Analysis of the types and amount of PLFA provides a broad based understanding of the entire microbial community with information obtained in three key areas viable biomass, community structure and metabolic activity.

What is the detection limit for PLFA?

Our limit of detection for PLFA analysis is ~150 picomoles of total PLFA and our limit of quantification is ~500 picomoles of total PLFA. Samples which contain PLFA amounts at or below 150 pmol cannot be used to determine biomass, likewise samples with PLFA content below ~500 pmol are generally considered to contain too few fatty acids to discuss community composition.

How should I interpret the PLFA results?

Interpreting the results obtained from PLFA analysis can be somewhat difficult, so this document was designed to provide a technical guideline. For convenience, this guideline has been divided into the three key areas.

Viable Biomass

PLFA analysis is one of the most reliable and accurate methods available for the determination of viable microbial biomass. Phospholipids break down rapidly upon cell death (21, 23), so biomass calculations based on PLFA content do not contain 'fossil' lipids of dead cells.

How is biomass measured?

Viable biomass is determined from the total amount of PLFA detected in a given sample. Since, phospholipids are an essential part of intact cell membranes they provide an accurate measure of viable cells.

How is biomass calculated?

Biomass levels are reported as cells per gram, mL or bead, and are calculated using a conversion factor of 20,000 cells/pmole of PLFA. This conversation factor is based upon cells grown in laboratory media, and varies somewhat with the type of organism and environmental conditions.

What does the concentration of biomass mean?

The overall abundance of microbes within a given sample is often used as an indicator of the potential for bioremediation to occur, but understanding the levels of biomass within each sample can be cumbersome. The following are benchmarks that can be used to understand whether the biomass levels are low, moderate or high.

Low	Moderate	High
10^3 to 10^4 cells	10^5 to 10^6 cells	10^7 to 10^8 cells

How do I know if a change in biomass is significant?

One of the primary functions of using PLFA analysis at contaminated sites is to evaluate how a community responds following a given treatment, but how does one know if the changes observed between two events are significant? As a general rule, biomass levels which increase or decrease by at least an order of magnitude are considered to be significant. However, changes in biomass levels of less than an order of magnitude may still show a trend. It is important to remember that many factors can affect microbial growth, so factors other than the treatment could be influencing the changes observed between sampling events. Some of the factors to consider are: temperature, moisture, pH, etc. The following illustration depicts three types of changes that occurred over time and the conclusions that could be drawn.

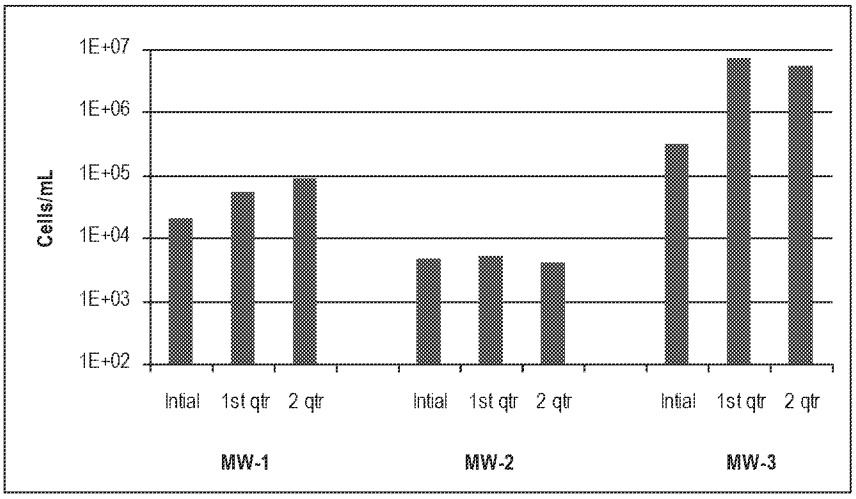

Figure 1. Biomass content is presented as a cell equivalent based on the total amount of phospholipid fatty acids (PLFA) extracted from a given sample. Total biomass is calculated based upon PLFA attributed to bacterial and eukaryotic biomass (associated with higher organisms).

Conclusions from graph above:

- MW-1 showed a trend of biomass levels increasing steadily over time, although cell concentrations were ~10^4 cells/mL at each sampling event.
- MW-2 showed no notable trends or significant changes in biomass concentrations.
- MW-3 showed a significant increase in biomass levels between the initial and 1st quarter sampling events (from ~10^5 to ~10^6 cells/mL).

Community Structure:

The PLFA in a sample can be separated into particular types, and the resulting PLFA "profile" reflects the proportions of the categories of organisms present in the sample. Because groups of bacteria differ in their metabolic capabilities, determining which bacterial groups are present and their relative distributions within the community can provide information on what metabolic processes are occurring at that location. This in turn can also provide information on the subsurface conditions (i.e oxidation/reduction status, etc.). Table 1 describes the six major structural groups used and their potential relevance to site specific projects.

Table 1. Description of PLFA structural groups.

PLFA Structural Group	General classification	Potential Relevance to Bioremediation Studies
Monoenoic (Monos)	Abundant in Proteobacteria (Gram negative bacteria), typically fast growing, utilize many carbon sources, and adapt quickly to a variety of environments.	Proteobacteria is one of the largest groups of bacteria and represents a wide variety of both aerobes and anaerobes. The majority of Hydrocarbon utilizing bacteria fall within the Proteobacteria
Terminally Branched Saturated (TerBrSats)	Characteristic of Firmicutes (Low G+C Gram-positive bacteria), and also found in Bacteriodes, and some Gram-negative bacteria (especially anaerobes).	Firmicutes are indicative of presence of anaerobic fermenting bacteria (mainly *Clostridia/Bacteriodes*-like), which produce the H_2 necessary for reductive dechlorination
Branched Monoenoic (BrMonos)	Found in the cell membranes of micro-aerophiles and anaerobes, such as sulfate- or iron-reducing bacteria	In contaminated environments high proportions are often associated with anaerobic sulfate and iron reducing bacteria
Mid-Chain Branched Saturated (MidBrSats)	Common in sulfate reducing bacteria and also Actinobacteria (High G+C Gram-positive bacteria).	In contaminated environments high proportions are often associated with anaerobic sulfate and iron reducing bacteria
Normal Saturated (Nsats)	Found in all organisms.	High proportions often indicate less diverse populations.
Polyenoic	Found in eukaryotes such as fungi, protozoa, algae, higher plants, and animals.	Eukaryotic scavengers will often rise up and prey on contaminant utilizing bacteria

Following are answers to some of the common questions about community composition and some detailed descriptions of some typical shifts which can be observed between sampling events.

How is the community structure data presented?

Community structure data is presented as percentage (%) of the total amount of PLFA. In order to relate the complex mixture of PLFA to the organisms present, the ratio of a specific PLFA group is determined (detailed in Table 1 above), and this corresponds to the proportion of the related bacterial classification within the overall community structure. Because normal saturated PLFA are found in both prokaryotes (bacteria) and eukaryotes (fungi, protozoa, diatoms etc), their distribution provides little insight into the types of microbes that are present at a sampling location. However, high proportions of normal saturates are often associated with less diverse microbial populations.

How can community structure data be used to manage my site?

It is important to understand that microbial communities are often a mixture of different types of bacteria (e.g. aerobes, sulfate reducers, methanogens, etc) with the abundance of each group behaving like a seesaw, i.e. as the population of one group increases, another is likely decreasing, mostly due to competition for available resources. The PLFA profile of a sample provides a "fingerprint" of the microbial community, showing relative proportions of the specific bacterial types at the time of sampling. This is a great tool for detecting shifts within the community over time and also to evaluate similarities/differences between sampling locations. It is important to note that PLFA analysis of community structure is analyzing the microbes directly, not just secondary breakdown products. So this provides evidence of how the entire microbial community is responding to the treatment.

How do I recognize community shifts and what they mean?

Shifts in the community structure are indications of changing conditions and their effect on the microbial community, and, by extension on the metabolic processes occurring at the sampling location. Some of the more commonly seen shifts within the community are illustrated and discussed below:

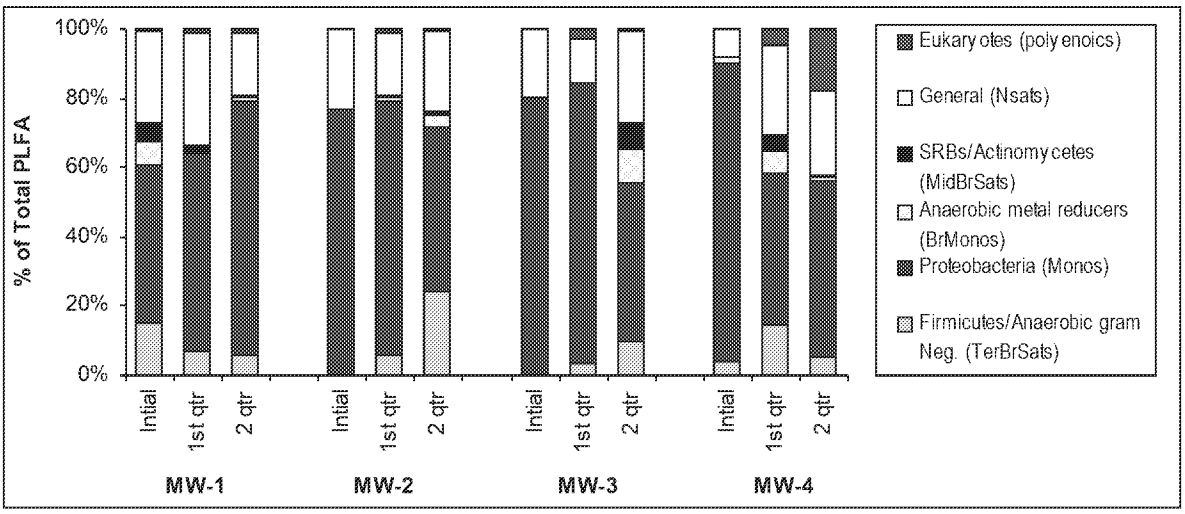

Figure 2. Relative percentages of total PLFA structural groups in the samples analyzed. Structural groups are assigned according to PLFA chemical structure, which is related to fatty acid biosynthesis. See Table 1 for detailed descriptions of structural groups.

- **Increased Proteobacteria**

Proportions of Proteobacteria are of interest because it is one of the largest groups of bacteria and represents a wide variety of both aerobe and anaerobes. The majority of hydrocarbons (including benzene and naphthalene) are metabolized by some member of Proteobacteria, mainly due to their ability to grow opportunistically, quickly taking advantage of available food (i.e. hydrocarbons), and adapting quickly to changes in the environment. The detection of increased proportions of Proteobacteria coupled with increased biomass suggests that the Proteobacteria are consuming something. In situations where it is important to determine the extent to which the Proteobacteria are utilizing anaerobic or aerobic pathways, it is possible to measure relative proportions of specific biomarkers that are associated with anaerobic or aerobic pathways thus separating the Proteobacteria into different groups, based on pathways used. Sample MW-1 from Figure 2 depicts a shift in community structure where the proportion of Proteobacteria has increased over time.

- **Increased Firmicutes/Anaerobic Gram negative bacteria**

Increased proportions of Firmicutes/Anaerobic Gram negative bacteria generally indicate that conditions are becoming more reductive (i.e. more anaerobic). Proportions of Firmicutes are of particular interest in sites contaminated with chlorinated hydrocarbons because Firmicutes include anaerobic fermenting bacteria (mainly *Clostridia/Bacteriodes*-like), which produce the H_2 necessary for reductive dechlorination.

Enhanced bioremediation of chlorinated solvents often employs the injection of fermentable substrates which, when utilized by fermenting bacteria, results in the release of H_2. Engineered shifts in the microbial community can be shown by observing increased proportions Firmicutes following an injection of fermentable substrate. Through long-term monitoring of the community structure it is possible to know when re-injection may be necessary or desirable. Sample MW-2 from Figure 2 depicts a shift in community structure where the proportion of Firmicutes has increased over time.

- **Increased anaerobic metal reducing bacteria (BrMonos) and SRB/Actinomycetes (MidBrSats)**

An increase in the proportions of metal and sulfate reducing bacterial groups, especially when combined with shifts in the other bacterial groups, can provide information helpful to monitoring bioremediation. Generally, an increase in metal and sulfate reducers points to more reduced (anaerobic) conditions at the sampled location. This is especially true if there is an increase in Firmicutes at the same time. Large increases in either metal and sulfate reducers, particularly if accompanied by a decrease in Firmicutes, may suggest that conditions are becoming increasingly reduced. In this situation the metal and sulfate reducers may be out-competing dechlorinators for available H_2, thereby limiting the potential for reductive dechlorination at that location. Sample MW-3 from Figure 2 depicts a shift in community structure where the proportion of metal reducing bacteria has increased over time.

- **Increased Eukaryotes**

Eukaryotes include organisms such as fungi, protozoa, and diatoms. At a contaminated location, an increase in eukaryotes, particularly if seen with a decrease in the contaminant utilizing bacteria, suggests that eukaryotic scavengers are preying upon what had been an abundance of bacteria which were consuming the contaminant. Sample MW-4 from Figure 2 depicts a shift in community structure where the proportion of eukaryotes has increased over time.

Physiological status of Proteobacteria

The membrane of a microbe adapts to the changing conditions of its environment, and these changes are reflected in the PLFA. Toxic compounds or environmental conditions may disrupt the membrane and some bacteria respond by making *trans* fatty acids instead of the usual *cis* fatty acids (7) in order to strengthen the cell membrane, making it less permeable. Many Proteobacteria respond to lack of available substrate or to highly toxic conditions by making cyclopropyl (7) or mid-chain branched fatty acids (20) which point to less energy expenditure and a slowed growth rate. The physiological status ratios for Decreased Permeability (trans/cis ratio) and for Slowed Growth (cy/cis ratio) are based on dividing the amount of the fatty acid induced by environmental conditions by the amount of its biosynthetic precursor.

What does slowed growth or decreased permeability mean?

Ratios for slowed growth and for decreased permeability of the cell membrane provide information on the "health" of the Gram negative community, that is, how this population is responding to the conditions present in the environment. It should be noted that one must be cautious when interpreting these measures from only one sampling event. The most effective way to use the physiological status indicators is in long term monitoring and comparing how these ratios increase/decrease over time.

A marked increase in either of these ratios suggests a change in environment which is less favorable to the Gram negative Proteobacteria population. The ratio for slowed growth is a relative measure, and does not directly correspond to log or stationary phases of growth, but is useful as a comparison of growth rates among sampling locations and also over time. An increase in this ratio (i.e. slower growth rate) suggests a change in conditions which is not as supportive of rapid, "healthy" growth of the Gram negative population, often due to reduced available substrate (food). A larger ratio for decreased permeability suggests that the environment has become more toxic to the Gram negative population, requiring energy expenditure to produce *trans* fatty acids in order to make the membrane more rigid.

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Lab Name	Sample Name	Sample Date	Date Received	Sample Matrix	LIMS Identifier	Extraction Date	Analysis Date	Analysis Method	Parameter	Result	Result Qualifier	Units	Detection Limit	Report Limit
MI	STO12-W30-WG-090214	9/2/2014	9/3/2014	Water	002LI-1	9/4/2014	9/9/2014	CENSUS	APS	4.37E+04	=	cells/mL	0.00E+00	0.00E+00
MI	STO12-W30-WG-090214	9/2/2014	9/3/2014	Water	002LI-1	9/4/2014	9/9/2014	CENSUS	GEO	1.06E+04	=	cells/mL	0.00E+00	0.00E+00
MI	STO12-W30-WG-090214	9/2/2014	9/3/2014	Water	002LI-1	9/4/2014	9/9/2014	CENSUS	MGN	6.42E+04	=	cells/mL	1.00E-01	4.50E+00
MI	STO12-W30-WG-090214	9/2/2014	9/3/2014	Water	002LI-1	9/4/2014	9/9/2014	CENSUS	nirK	4.89E+05	=	cells/mL	1.00E-01	4.50E+00
MI	STO12-W30-WG-090214	9/2/2014	9/3/2014	Water	002LI-1	9/4/2014	9/9/2014	CENSUS	nirS	3.20E+04	=	cells/mL	1.00E-01	4.50E+00
MI	STO12-W11-WG-090214	9/2/2014	9/3/2014	Water	002LI-2	9/3/2014	9/9/2014	CENSUS	GEO	1.53E+04	=	cells/mL	0.00E+00	0.00E+00
MI	STO12-W11-WG-090214	9/2/2014	9/3/2014	Water	002LI-2	9/3/2014	9/9/2014	CENSUS	APS	6.49E+05	=	cells/mL	0.00E+00	0.00E+00
MI	STO12-W11-WG-090214	9/2/2014	9/3/2014	Water	002LI-2	9/3/2014	9/9/2014	CENSUS	MGN	7.00E+04	=	cells/mL	1.00E-01	4.70E+00
MI	STO12-W11-WG-090214	9/2/2014	9/3/2014	Water	002LI-2	9/3/2014	9/9/2014	CENSUS	nirK	4.52E+05	=	cells/mL	1.00E-01	4.70E+00
MI	STO12-W11-WG-090214	9/2/2014	9/3/2014	Water	002LI-2	9/3/2014	9/9/2014	CENSUS	nirS	1.93E+04	=	cells/mL	1.00E-01	4.70E+00

REPORT TO:

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Address: SUITE 600
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Phone: 602.733.6000
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Project Manager: NATALIE CHRISMAN
Project Name: WAFB-ST012
Project No.: 9101110001.5300.5301

INVOICE TO: (For invoices paid by a third party it is imperative that all information be provided)

Name:
Company:
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Purchase Order No.
Subcontract No.
MI Quote No.

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Knoxville, TN 37932
865-573-8188

www.microbe.com

Please Check One:
☐ More samples to follow
☐ No Additional Samples

Report Type: ☐ Standard (default) ☐ Microbial Insights Level III raw data(15% surcharge) ☐ Microbial Insights Level IV (25% surcharge) ☐ Comprehensive Interpretive(15%) ☐ Historical Interpretive (35%)

EDD type: ☐ Microbial Insights Standard (default) ☐ All other available EDDs (5% surcharge) Specify EDD Type:

Please contact us with any questions about the analyses or filling out the COC at (865) 573-8188 (9:00 am to 5:00 pm EST, M-F). After hours email: customerservice@microbe.com

Sample Information					Analyses					CENSUS: Please select the target organism/gene																						
MI ID (Laboratory Use Only)	Sample Name	Date Sampled	Time Sampled	Matrix	PLFA	DGGE+3ID	DGGE+5ID	QuantArray Chlor	QuantArray Petro	DHC (Dehalococcoides)	DHC Functional genes (bvc, tca, vcc)	DHBt (Dehalobacter)	DSM (Desulfuromonas)	DSB (Desulfitobacterium)	EBAC (Total)	SRB (Sulfate Reducing Bacteria-APS)	MGN (Methanogens)	MOB (Methanotrophs)	SMMD	DNF (Dentrifiers-nirS and nirK)	AOB (ammonia oxidizing bacteria)	PM1 (MTBE aerobic)	RMO (Toluene Monooxygenase)	RDEG (Toluene Monooxygenase)	PHE (Phenol Hydroxylase)	NAH (Naphthalene-aerobic)	BSSA (Toluene/Xylene-Anaerobic)	add. qPCR:	add. qPCR:	RNA (Expression Option)*	Other: Geobacter SSP	Other:	Other:
002LI 1	ST012-W30-W6-090214		10:37	AQ	X											X	X			X											X		
2	ST012-W11-W6-090214		13:40	↓	X											X	X			X											X		

Relinquished by: [signature] Received by: [signature] Date 9/3/14

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* additional cost and sample preservation are associated with RNA samples.

**Saturday delivery: See sampling protocol for alternate shipping address.

REPORT TO:

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Portland, ME 04101

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email:
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Project Manager: Stu Pearson
Project Name: FWAFB ST012 EBR
Project No.: 9101110001.5300.5301

Purchase Order No. F014200244
Subcontract No.
MI Quote No. Q 201471.0001

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☐ No Additional Samples

Report Type: ☐ Standard (default) ☐ Microbial Insights Level III raw data(15% surcharge) ☐ Microbial Insights Level IV (25% surcharge) ☐ Comprehensive Interpretive(15%) ☐ Historical Interpretive (35%)

EDD type: ☐ Microbial Insights Standard (default) ☐ All other available EDDs (5% surcharge) Specify EDD Type:

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Sample Information					Analyses					CENSUS: Please select the target organism/gene																				
MI ID (Laboratory Use Only)	Sample Name	Date Sampled	Time Sampled	Matrix	PLFA	DGGE+3ID	DGGE+3ID	QuantArray Chlor	QuantArray Petro	DHC (Dehalococcoides)	DHC Functional genes (bvc, tce, vcr)	DHR (Dehalobacter)	DSM (Desulfitobacterium)	DSB (Desulfitobacterium)	EBAC (Total)	SRB (Sulfate Reducing Bacteria-APS)	MEN (Methanogens)	MOB (Methanotrophs)	SMMO	DNF (Denitrifiers-nirS and nirK)	AOB (ammonia oxidizing bacteria)	PMI (MTBE aerobic)	RMO (Toluene Monooxygenase)	RDEG (Toluene Monooxygenase)	PHE (Phenol Hydroxylase)	NAH (Naphthalene-aerobic)	BSSA (Toluene/Xylene-Anaerobic)	add. qPCR	add. qPCR	RNA (Expression Option)*	Other: Dehalobacter SKP KED	Other:	Other:
002LI 1	ST012-W30-W6-091034	9/2/14	0900	W												X	X			X											X		
														NOTE: Extra Volume to run additional analyses																			

Relinquished by: [signature]
Received by: Judith Gilfox
Date 9/4/14

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* additional cost and sample preservation are associated with RNA samples.

**Saturday delivery: See sampling protocol for alternate shipping address.

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Phone: (865) 573-8188
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Client: Shanda Wagner
AMEC E & I, Inc.
4600 East Washington Street
Suite 600
Phoenix, AZ 85034

Phone: 602-329-0571

Fax:

Identifier: 002LI **Date Rec:** 09/03/2014 **Report Date:** 09/09/2014

Client Project #: 9101110001.5300.5301 **Client Project Name:** WAFB-STO12

Purchase Order #: F014200244

Analysis Requested: CENSUS, PLFA

Reviewed By:

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MICROBIAL INSIGHTS, INC.

10515 Research Dr., Knoxville, TN 37932
Tel. (865) 573-8188 Fax. (865) 573-8133

CENSUS

Client: **AMEC E & I, Inc.**
Project: WAFB-STO12

MI Project Number: **002LI**
Date Received: 09/03/2014

Sample Information

Client Sample ID:	**STO12-W30-WG-090214**	**STO12-W11-WG-090214**
Sample Date:	09/02/2014	09/02/2014
Units:	cells/mL	cells/mL
Analyst:	RW	RW

Functional Genes

Denitrifying Bacteria	nirK	**4.89E+05**	**4.52E+05**
Denitrifying Bacteria	nirS	**3.20E+04**	**1.93E+04**

Other Genera

Geobacter spp.	*GEO*	**1.06E+04**	**1.53E+04**

Phylogenetic Group

Sulfate Reducing Bacteria	APS	**4.37E+04**	**6.49E+05**
Methanogen	MGN	**6.42E+04**	**7.00E+04**

Legend:
NA = Not Analyzed NS = Not Sampled J = Estimated gene copies below PQL but above LQL I = Inhibited
< = Result not detected

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Client: Shanda Wagner
AMEC E & I, Inc.
4600 East Washington Street
Suite 600
Phoenix, AZ 85034

Phone: 602-329-0571

Fax:

Identifier: 002LI **Date Rec:** 09/03/2014 **Report Date:** 09/18/2014

Client Project #: 9101110001.5300.5301 **Client Project Name:** WAFB-STO12

Purchase Order #: F014200244

Analysis Requested: CENSUS, PLFA

Reviewed By:

Kate Clark

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MIC, . RIAL INOIB SHOEINC&

10515 Research Dr., Knoxville, TN 37932
Tel. (865) 573-8188 Fax. (865) 573-8133

PLFA

Client: AM2C 2 G IEInc&
Project: WAFB-STO12

MI Project Number: 004LI
Date Received: 09/03/2014

Oample Information

Oample Name:	OH T41- V01- B 10704T3	OH T41- TT1- B 10704T3
Sample Date:	09/02/2014	09/02/2014
Sample Matrix:	Water	Water
Analyst:	BJ	BJ

Riomass

Total Biomass (cells/mL)	T&42 803	3&V2 803

Communit+ Otructure 5y total PLFA(

Firmicutes (TerBrSats)	43&%	40&3
Proteobacteria (Monos)	V6&W	3%&9
Anaerobic metal reducers (BrMonos)	T&3	T&T
SRB/Actinomycetes (MidBrSats)	3&W	V&T
General (Nsats)	V4&9	4) &7
Eukaryotes (polyenoics)	0&%	T&V

Ph+siological Otatus 5Proteobacteria onl+(

Slowed Growth	0&%	0&9
Decreased Permeability	0&0	0&6

Legend:
NA = Not Analyzed NS = Not Sampled

ED_005025_00007837-00447

Client: AM2C 2 G IEInc&
Project: WAFB-STO12

MI Project Number: 004LI
Date Received: 09/03/2014

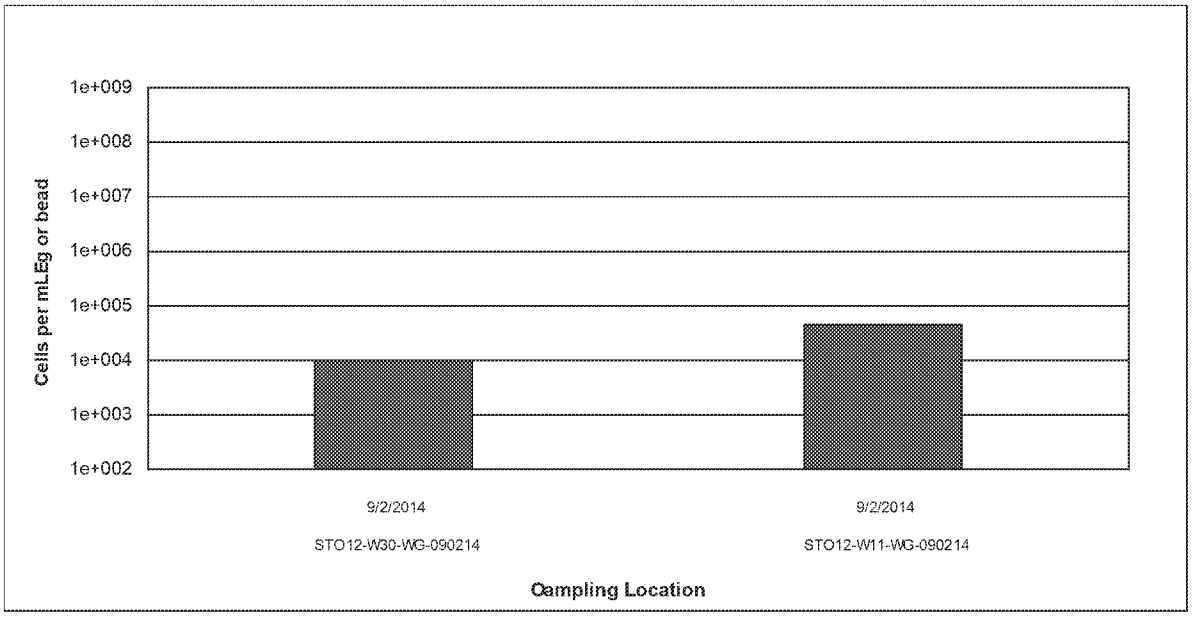

Figure T& Biomass content is presented as a cell equivalent based on the total amount of phospholipid fatty acids (PLFA) extracted from a given sample. Total biomass is calculated based upon PLFA attributed to bacterial and eukaryotic biomass

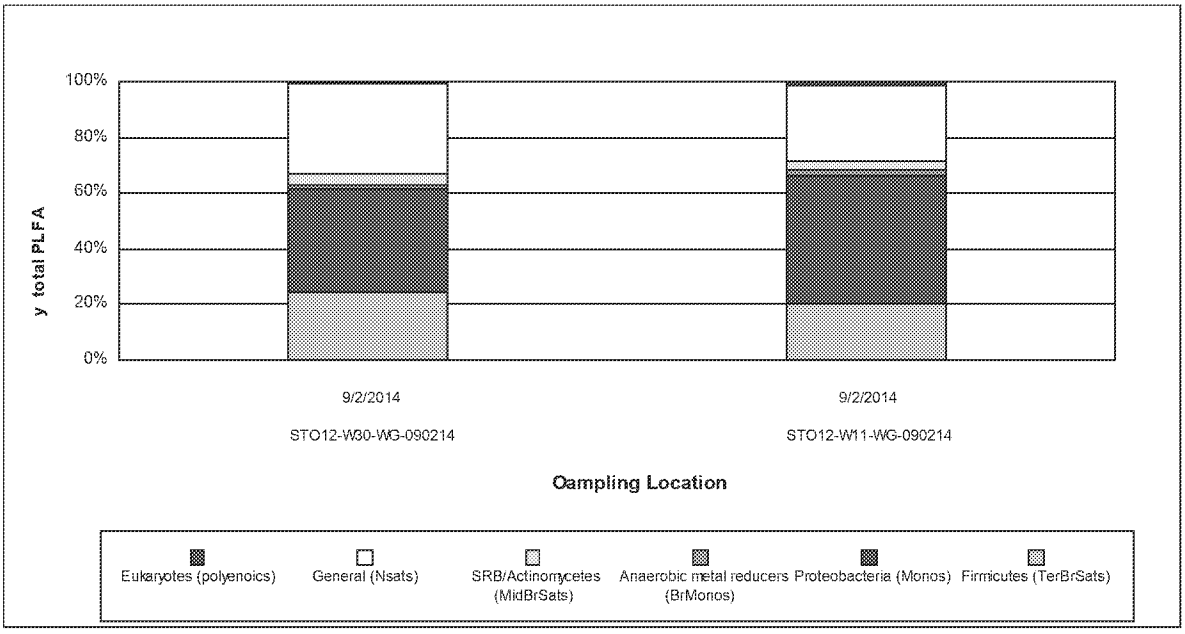

Figure 4& Relative percentages of total PLFA structural groups in the samples analyzed. Structural groups are assigned according to PLFA chemical structure, which is related to fatty acid biosynthesis.

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Client: Stuart Pearson
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Portland, ME 04101

Phone:

Fax:

Identifier: 015LI **Date Rec:** 09/09/2014 **Report Date:** 09/17/2014

Client Project #: 9101110001.5300.5301 **Client Project Name:** FWAFB ST012 EBR

Purchase Order #: F014200244

Analysis Requested: CENSUS, PLFA

Reviewed By:

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Tel. (865) 53- x8188 Fas. (865) 53- x81- -

CENSUS

Client: **GMEC E A I&Inc,**
Project: FWAFB ST012 EBR

MI Project Number: **042LI**
Date Received: 07/07/2014

SDmf le insormDtion

Client SDmf le IF:	**ST041-W44-WB -07034a**	**ST041-Wp0-WB -07404a**
Sample Date:	07/08/2014	07/10/2014
UNth:	cellh/my	cellh/my
ANalLht:	RW	RW

6unctionDl Bene+

DeNtrifLiNg Bacteria	Nrn	**2,7pE802**	**p,35E802**
DeNtrifLiNg Bacteria	NrS	**a,35E80a**	**4,4hE80a**

Rt9er BenerD

Geobacter spp.	*GEO*	**5,33E801**	**4,45E802**

P9ylogenetic Brouf

Sulfate ReduciNg Bacteria	APS	**1,5hE80h**	**1,00E802**
Met, aNogeN	MG9	**a,a4E80p**	**a,h3E80a**

Legend:
9 A = 9 ot ANalLzed 9 S = 9 ot Sampled J = Ehtimated geNe copieh below PQy but above yQy I = IN, ibited
< = Rehult Not detected

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Phone: (865) 573-8188
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Client: Stuart Pearson
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511 Congress Street
Portland, ME 04101

Phone:

Fax:

Identifier: 015LI **Date Rec:** 09/09/2014 **Report Date:** 09/26/2014

Client Project #: 9101110001.5300.5301 **Client Project Name:** FWAFB ST012 EBR

Purchase Order #: F014200244

Analysis Requested: CENSUS, PLFA

Reviewed By:

Kate Clark

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Tel. (865) 53- x8188 Fas. (865) 53- x81- -

PLFA

Client: AMGC G E I&Inc,
Project: FWAFB ST012 EBR

MI Project Number: 042LI
Date Received: 07/07/2014

Bf msle In&rmf tion

Bf msle Nf me:	BT041-W44-WS -07034a	BT041-Wp0-WS - 07404a
Sample Date:	07/08/2014	07/10/2014
Sample Matris:	Water	Water
ANalyht:	BJ	BJ

Oiomf ++

Total Biomahh (celih/mL)	a,50Gy0a	a,42Gy0a

Communit(Btructure % totf I PLFA6

Firmicuteh (TerBrSath)	0,21	4a,09
Proteobacteria (MoNbh)	95,0p	20,52
ANaerobic metal reducerh (BrMoNbh)	0,00	4,22
SRB/ActiNbmyceteh (MidBrSath)	0,a3	0,70
GeNeral (9 hath)	11,a1	p0,72
Eukaryoteh (polyeNbich)	0,22	4,37

Ph(+iologicf I Btf tu+ %proteobf cterif onl(6

Slowed Growt,	0,02	0,12
Decreahed Permeability	0,00	0,09

Legend:
9 A = 9 ot ANalyzed 9 S = 9 ot Sampled

ED_005025_00007837-00452

Client: **AMGC G E I&Inc,**
Project: FWAFB ST012 EBR

MI Project Number: **042LI**
Date Received: 07/07/2014

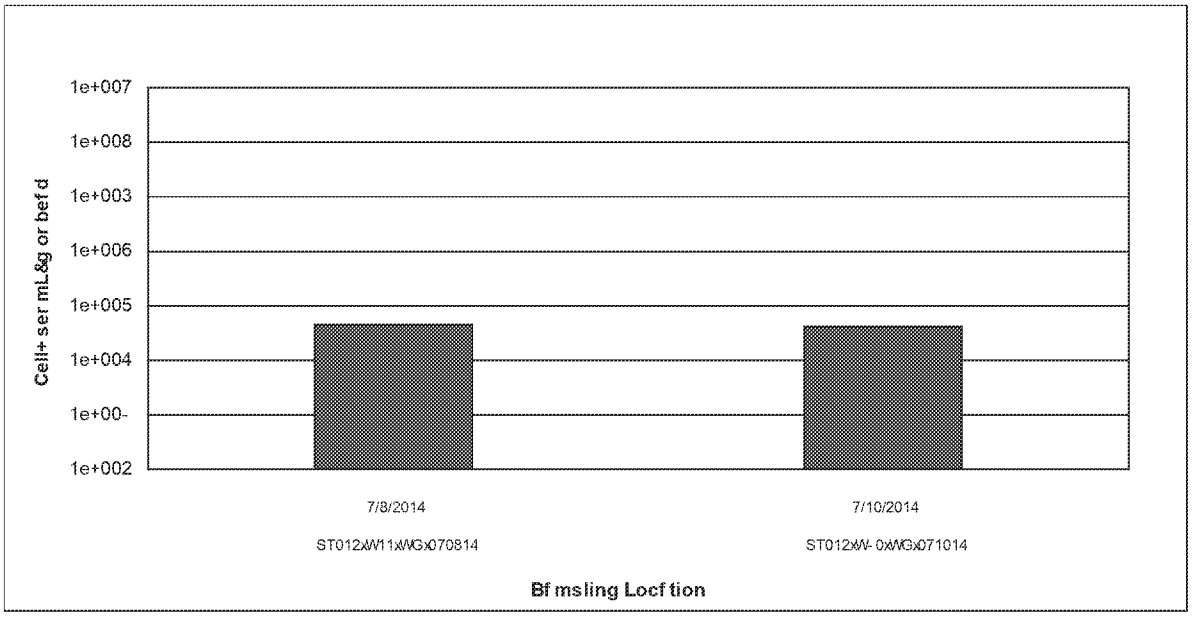


Figure 4, Biomahh coNteNt ih preheNted ah a cell equivaleNt bahed oN t, e total amouNt of p, ohp, olipid fatty acidh (PLFA) estracted from a giveN hample. Total biomahh ih calculated bahed upoN PLFA attributed to bacterial aNd eukaryotic biomahh

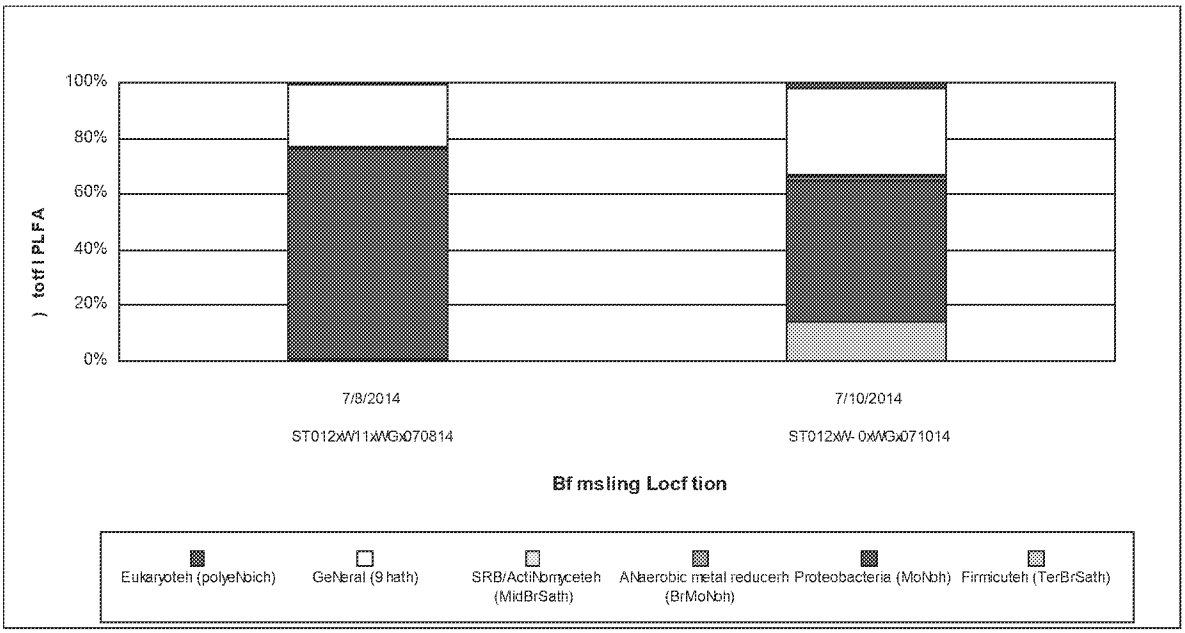


Figure 1, Relative perceNtageh of total PLFA htructural grouph iN t, e hampleh aNalyzed. Structural grouph are ahhigNed accordiNg to PLFA c, emical htructureKw, ic, ih related to fatty acid biohyNt, ehih.

APPENDIX E

MICROBIAL KINETICS ESTIMATION

Job No.	9101110001	Sheet	1	of	1
Phase		Task			
Job Name	Former Williams AFB Site ST012				
By	S. Beadle	Date	2015-04-17		
Checked By	S. Pearson	Date	2015-05-6		511 Congress Street
Updated by		Date			Portland, ME 04101
Checked By		Date			+1 (207) 775-5401

Purpose: To calculate the Michaelis-Menten kinetic parameters: the Michaelis-Menten coefficient - the substrate (sulfate) concentration when the reaction rate is at half its maximum (K_M), and the maximum substrate utilization rate (v_{max}) to estimate sulfate utlization due to microbial activity in wells W11 and W30 during the shut-in period of each well's push-pull test. These parameters can then be used to estimate the degradation rate constant for the site.

Methods: Using the Lineweaver-Burk method, the reciprocal of the Michaelis-Menten (M-M) kinetic equation is plotted and the linear relationship between the inverse of the sulfate utilization rate and the inverse of the sulfate concentration can be used to estimate v_{max} and K_M, as shown below:

Michaelis-Menten Kinetic Equation:

$$v = \frac{(V_{\max}[S])}{(K_M + [S])}$$

Reciprocal:

$$\frac{1}{v} = \left(\frac{K_M}{v_{\max}}\right)\left(\frac{1}{[S]}\right) + \left(\frac{1}{v_{\max}}\right)$$

Where:

v=	sulfate utilization rate	[g/day]
K_M=	Michaelis-Menten coefficient [mg/l]	
v_{max}=	maximum sulfate utlization rate [g/day]	
[S]=	sulfate concentration	[g/L]

(1/v) is plotted on the y-axis and (1/[S]) is plotted on the x-axis. Linear regression can then be used to estimate the y-intercept ($1/v_{max}$) and the slope (K_M/v_{max}) of the graph

Given the daily analytical data for both bromide and sulfate concentrations during the shut-in period of the test, 1/[S] and 1/v can be calculated to plot the reciprocal M-M equation to perform the Lineweaver-Burk method for both W11 and W30.

Once K_M and V_{max} have been estimated based on the field test data, they can be used as constants in the Monod kinetic equation to model the exponential decay of TPH.

Monod Kinetic Equation:

$$v = v_{\max}\left(\frac{[S]}{K_M + [S]}\right)$$

Because the sulfate (and total petroleum hydrocarbon [TPH]) utilization rate is time-dependent, the M-M kinetic parameters are entered into the Monod kinetic equation to model the sulfate utlization rate as a step function of time for each day after degradation begins. The utilization rate for each day can then be used to estimate the TPH concentration for each step. The plot of the TPH concentration versus time since the the start of degradation can be expressed as first-order exponential decay:

$$[TPH] = [TPH_o]e^{-kt}$$

Where:

[TPH]=	TPH Concentration	mg/l	
$[TPH_o]$=	Initial TPH Concentration	mg/l	The exponential decay model assumes that TPH (the substrate) is not rate-limiting, therefore this input is much larger than concentrations typically found duing groundwater sampling at the site.
k=	degradation rate constant	day^{-1}	

An exponential fit can be applied to the modeled TPH decay to estimate the degradation rate constant (k) for TPH.

Assumptions:

1. Microbial sulfate utilization in groundwater abides by Michaelis-Menten and Monod kinetics. This assumption includes that the substrate is not rate limiting - that there is more available substrate than K_M.
2. TPH degradation was a first-order reaction for the duration of the field test.
3. The stoichiometric relationship between sulfate and TPH: 5.25 Sulfate to 1 TPH

Constants and Inputs:

Summary of Shut-in Period Sulfate and Bromide Concentrations

		ST012–W11		ST012–W30	
Sample Type	**Date**	**Bromide [mg/l]**	**Sulfate [mg/l]**	**Bromide [mg/l]**	**Sulfate [mg/l]**
Baseline	7/16/2012	1.6	5.4	1.3	11
Shut-in	7/22/2014	55	1000	99	1900
Shut-in	7/24/2014	39	2000	92	1600
Shut-in	7/29/2014	18	940	47	840
Shut-in	7/31/2014	12	610	35	660
Shut-in	8/5/2014	6.2	300	20	320
Shut-in	8/7/2014	4.9	230	16	240
Shut-in	8/12/2014	3	110	11	140
Shut-in	8/15/2014	2.4	73	8.7	100
Shut-in	8/19/2014	1.9	42	6.5	67
Shut-in	8/21/2014	1.8	31	5.2	49
Shut-in	8/26/2014	1.6	18	4.5	34
Shut-in	8/29/2014	1.5	14	3.9	24
Post-Shut-In	9/2/2014	2.6	6.4	3.5	18
Injected Solution		151	4294	151	4294

NOTES:
mg/l – milligrams per liter.

Total mass of sulfate injected from potassium sulfate solution	6615 grams
Initial bromide solution volume	1514 L

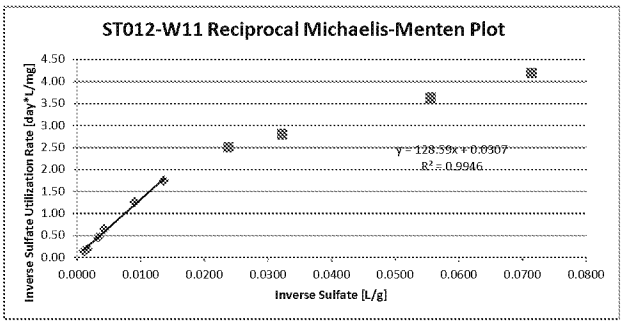
Job No.	9101110001	Sheet	1 of 1		
Phase		Task			
Job Name	Former Williams AFB Site ST012				
By	S. Beadle	Date	2015-04-17		
Checked By	S. Pearson	Date	2015-05-6	511 Congress Street	
Updated by		Date		Portland, ME 04101	
Checked By		Date		+1 (207) 775-5401	

Calculations:

ST012-W11										
Date	Normalized Bromide Concentration [-]	Normalized Sulfate Concentration [-]	Change in Normalized Bromide Concentration[1] [-]	Change in Normalized Sulfate Concentration[1] [-]	Cumulative Sulfate Respired [g]	Average Sulfate Utilization Rate Since Start [g/day]	Volume of Water in Reaction (L)	Average Sulfate Utilization Rate Since Start [mg/l*day]	Inverse Sulfate Conc. [l/mg]	Inverse Sulfate Utilization Rate [l*day/mg]
7/21/2014										
7/22/2014	0.364	0.233					4,200			
7/24/2014	0.258	0.466	0.106	-0.233	-2241		5,900			
7/29/2014	0.119	0.219	0.139	0.247	715	89.3	12,700	7.033	0.0011	0.14
7/31/2014	0.0794	0.142	0.040	0.077	960	96.0	19,100	5.029	0.0016	0.20
8/5/2014	0.0410	0.070	0.038	0.072	1184	79.0	36,900	2.140	0.0033	0.47
8/7/2014	0.0324	0.054	0.009	0.016	1235	72.7	46,700	1.556	0.0043	0.64
8/12/2014	0.0198	0.026	0.013	0.028	1337	60.8	76,300	0.797	0.0091	1.26
8/15/2014	0.0159	0.017	0.004	0.009	1368	54.7	95,400	0.574	0.0137	1.74
8/19/2014	0.0126	0.010	0.003	0.007	1394	48.1	120,500	0.399	0.0238	2.51
8/21/2014	0.0119	0.007	0.001	0.003	1406	45.4	127,200	0.357	0.0323	2.80
8/26/2014	0.0106	0.004	0.001	0.003	1418	39.4	143,100	0.275	0.0556	3.63
8/29/2014	0.0099	0.003	0.001	0.001	1419	36.4	152,600	0.239	0.0714	4.19
9/2/2014	0.0172	0.001	-0.007	0.002	1479	34.4	88,100	0.390	0.1563	2.56

Note:

[1] Because initial data indicated greater bromide reduction than sulfate, the grams of sulfate respired was estimated using the change in normalized bromide and sulfate concentrations rather than caluclating the cumulative grams as done for W30 below.

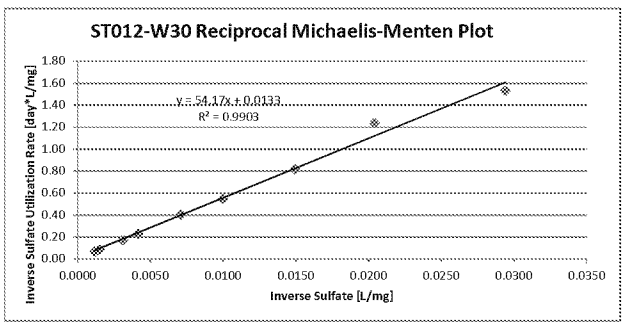


y=mx+b

m=	128.587	day
b=	0.0307	L*day/mg
v_{max}=	32.57	mg/l*day
K_M=	4188.3	mg/l

Note: Initial readings were used to estimate parameters due to shift in slope above inverse sulfate of 0.02.

ST012-W30									
Date	Normalized Bromide Concentration [-]	Normalized Sulfate Concentration [-]	Cumulative Grams	Cumulative Sulfate Respired [g]	Average Sulfate Utilization Rate Since Start [g/day]	Volume of Water in Reaction [L]	Average Sulfate Utilization Rate Since Start [mg/l*day]	Inverse Sulfate Conc. [L/mg]	Inverse Sulfate Utilization Rate [L*day/mg]
7/18/2014									
7/22/2014	0.655	0.443	1403			2313			
7/24/2014	0.608	0.373	1559	-156		2489			
7/29/2014	0.311	0.196	762	798	72.5	4871	14.884	0.0012	0.07
7/31/2014	0.231	0.154	514	1045	80.4	6542	12.289	0.0015	0.08
8/5/2014	0.132	0.075	382	1177	65.4	11448	5.714	0.0031	0.18
8/7/2014	0.106	0.056	330	1229	61.5	14310	4.295	0.0042	0.23
8/12/2014	0.073	0.033	265	1294	51.8	20814	2.486	0.0071	0.40
8/15/2014	0.058	0.023	226	1333	47.6	26317	1.809	0.0100	0.55
8/19/2014	0.043	0.016	181	1378	43.1	35224	1.223	0.0149	0.82
8/26/2014	0.034	0.008	175	1384	35.5	44030	0.806	0.0204	1.24
8/29/2014	0.030	0.006	160	1399	33.3	50879	0.655	0.0294	1.53
9/2/2014	0.026	0.004	143	1416	30.8	58707	0.524	0.0417	1.91



y=mx+b

m=	54.17	/day
b=	0.013294152	L*day/mg
v_{max}=	75.22	mg/l*day
K_M=	4075	mg/l

Job No.	9101110001	Sheet	1 of 1		
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Updated by		Date		Portland, ME 04101	
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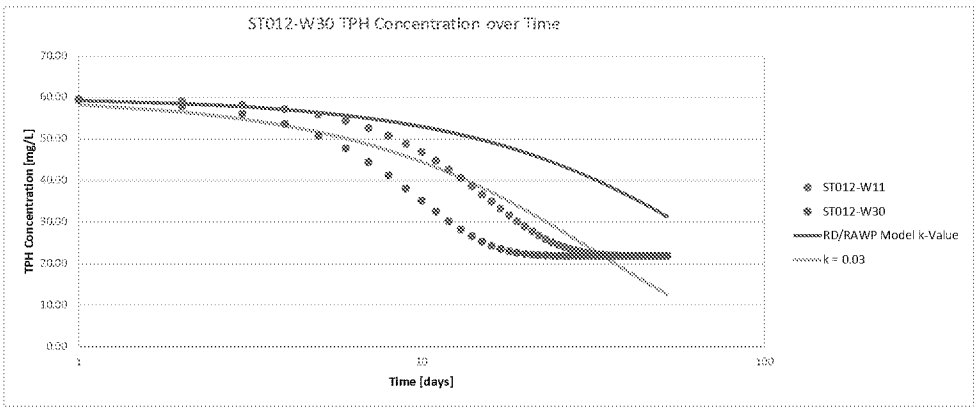
INITIAL CONDITIONS

	W11	W30
Sulfate Concentration	200 mg/l	200 mg/l
Hydrocarbon Concentration	60 mg/l	60 mg/l

RD/RAWP modeling k-value 0.0125 day^{-1}
Best-fit k-value 0.03 day^{-1}

Time	W11			W30			RD/RAWP Model K-Value [k = 0.0125 d^{-1}]	k = 0.03
	[SO4]	Sulfate Utilization Rate	TPH Concentration	Sulfate Concentration	Sulfate Utilization Rate	TPH Concentration		
[day]	[mg/l]	[mg/l/day]	[mg/l]	[mg/l]	[mg/l/day]	[mg/l]		
0	200	1.48	60	200	3.52	60	60	60
1	198.52	1.47	59.72	196.48	3.46	59.33	59.25	58.23
2	195.57	1.45	59.16	189.56	3.34	58.01	58.52	56.51
3	191.21	1.42	58.33	179.53	3.17	56.10	57.79	54.84
4	185.52	1.38	57.24	166.83	2.96	53.68	57.07	53.22
5	178.61	1.33	55.93	152.04	2.71	50.86	56.36	51.64
6	170.62	1.27	54.40	135.80	2.43	47.77	55.66	50.12
7	161.69	1.21	52.70	118.82	2.13	44.54	54.97	48.64
8	152.01	1.14	50.86	101.77	1.83	41.29	54.29	47.20
9	141.74	1.07	48.90	85.27	1.54	38.15	53.62	45.80
10	131.08	0.99	46.87	69.85	1.27	35.21	52.95	44.45
11	120.21	0.91	44.80	55.91	1.02	32.55	52.29	43.14
12	109.30	0.83	42.72	43.69	0.80	30.23	51.64	41.86
13	98.53	0.75	40.67	33.32	0.61	28.25	51.00	40.62
14	88.05	0.67	38.68	24.78	0.45	26.62	50.37	39.42
15	77.99	0.60	36.76	17.96	0.33	25.33	49.74	38.26
16	68.46	0.52	34.95	12.68	0.23	24.32	49.12	37.13
17	59.56	0.46	33.25	8.71	0.16	23.56	48.51	36.03
18	51.34	0.39	31.68	5.82	0.11	23.01	47.91	34.96
19	43.84	0.34	30.26	3.78	0.07	22.63	47.32	33.93
20	37.10	0.29	28.97	2.39	0.04	22.36	46.73	32.93
21	31.09	0.24	27.83	1.46	0.03	22.18	46.15	31.96
22	25.81	0.20	26.82	0.87	0.02	22.07	45.57	31.01
23	21.22	0.16	25.95	0.50	0.01	22.00	45.01	30.09
24	17.28	0.13	25.20	0.28	0.01	21.96	44.45	29.21
25	13.93	0.11	24.56	0.15	0.00	21.93	43.90	28.34
26	11.13	0.09	24.02	0.08	0.00	21.92	43.35	27.50
27	8.80	0.07	23.58	0.04	0.00	21.91	42.81	26.69
28	6.89	0.05	23.22	0.02	0.00	21.91	42.28	25.90
29	5.33	0.04	22.92	0.01	0.00	21.91	41.76	25.14
30	4.09	0.03	22.68	0.00	0.00	21.91	41.24	24.39
31	3.11	0.02	22.50	0.00	0.00	21.91	40.73	23.67
32	2.33	0.02	22.35	0.00	0.00	21.90	40.22	22.97
33	1.74	0.01	22.24	0.00	0.00	21.90	39.72	22.29
34	1.28	0.01	22.15	0.00	0.00	21.90	39.23	21.64
35	0.93	0.01	22.08	0.00	0.00	21.90	38.74	21.00
36	0.67	0.01	22.03	0.00	0.00	21.90	38.26	20.38
37	0.48	0.00	22.00	0.00	0.00	21.90	37.78	19.77
38	0.34	0.00	21.97	0.00	0.00	21.90	37.31	19.19
39	0.23	0.00	21.95	0.00	0.00	21.90	36.85	18.62
40	0.16	0.00	21.94	0.00	0.00	21.90	36.39	18.07
41	0.11	0.00	21.93	0.00	0.00	21.90	35.94	17.54
42	0.07	0.00	21.92	0.00	0.00	21.90	35.49	17.02
43	0.05	0.00	21.91	0.00	0.00	21.90	35.05	16.52
44	0.03	0.00	21.91	0.00	0.00	21.90	34.62	16.03
45	0.02	0.00	21.91	0.00	0.00	21.90	34.19	15.55
46	0.01	0.00	21.91	0.00	0.00	21.90	33.76	15.09
47	0.01	0.00	21.91	0.00	0.00	21.90	33.34	14.65
48	0.01	0.00	21.91	0.00	0.00	21.90	32.93	14.22
49	0.00	0.00	21.91	0.00	0.00	21.90	32.52	13.80
50	0.00	0.00	21.91	0.00	0.00	21.90	32.12	13.39
51	0.00	0.00	21.90	0.00	0.00	21.90	31.72	12.99
52	0.00	0.00	21.90	0.00	0.00	21.90	31.32	12.61



Conclusions: These kinetic values were then used to model the sulfate consumption and TPH degradation using monod-type kinetics and a first-order degradation curve was fitted to these modeled values with an emphasis on fitting the early part of the degradation curve. The graphically approximated first-order maximum TPH degradation rate coefficient is 0.03 day^{-1}. When compared to a value of 0.0125 day^{-1} for the maximum utilization rate of hydrocarbons other than benzene in the RD/RAWP modeling, the maximum degradation rate under sulfate reducing conditions in the EBR field test was approximately 2.4 times greater than previously modeled. This indicates that the values used in the RD/RAWP may be conservative and are prepresentative of degradation kinetics associated with typical background sulfate flus into the site. The Vmax and Km values indicate the higher degradation rates are possible with higher sulfate concentrations.