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## Data Validation Report for CH2M Hill Plateau Remediation Company

### VSR18-008 Project ERDF Leachate

### Chemical and Radiochemical Validation - Level C

Validation Performed By:

*Eyda Hergenreder*  
Eyda Hergenreder

Date: 03-28-2018

Technical Review By:

*Ellen McEntee*  
Ellen McEntee

Date: 03-28-2018

Quality Review By:

*Mary A. Donovan*  
Mary Donovan  
Quality Assurance Manager

Date: 04-26-2018

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Date: 28 March 2018  
 To: CH2M Hill (technical representative)  
 From: Analytical Quality Associates, Inc.  
 Project: ERDF Leachate  
 Subject: Volatile Organics - Sample Data Group (SDG) DN0288

## **INTRODUCTION**

This memorandum presents the results of data validation for SDG DN0288 prepared by TestAmerica Laboratories. A list of samples validated along with the analytical methods is provided in the following table.

<b>Sample ID</b>	<b>Sample Date</b>	<b>Media</b>	<b>Validation Level</b>	<b>Analytical Methods</b>
B3H0D9	12/12/17	Water	C	8260B
B3H0F3	12/12/17	Water	C	8260B
B3H0F0	12/12/17	Water	C	8260B

Data validation was conducted in accordance with the CHPRC validation statement of work and the Environmental Restoration Disposal Facility Leachate Sampling and Analysis Plan, WCH-173, Rev. 2 (SAP). Appendices 1 through 4 provide the following information as indicated below:

- Appendix 1. Glossary of Data Reporting Qualifiers
- Appendix 2. Summary of Data Qualification
- Appendix 3. Data Validation Supporting Documentation
- Appendix 4. Additional Documentation Requested by Client

## **DATA QUALITY OBJECTIVES**

- **Holding Times and Sample Preservation**

Holding times are calculated from Chain-of-Custody forms to determine the validity of the results. The holding time requirements for volatile organics are analysis within 14 days of sample collection. Sample preservation requires chilling to  $\leq 6$  degrees Celsius and acid preservation with hydrochloric or sulfuric acid to pH  $< 2$ .

The samples were analyzed within the prescribed holding time and properly preserved.

- **Blanks**

The blank data results are reviewed to assess the extent of contamination introduced through sampling, sample preparation, and analysis.

### **Laboratory Blanks**

All laboratory blank results were acceptable.

### **Trip Blanks**

All trip blanks results were acceptable.

### **Field Blanks**

No field blanks were submitted for validation.

### **Equipment Blanks**

No equipment blanks were submitted for validation.

- **Accuracy**

Accuracy is evaluated by reviewing surrogate results, matrix spike sample results, and laboratory control sample results. According to the SAP, the laboratory control sample and the matrix spike sample accuracy limits are 70% to 130% as specified by the DV procedure.

### **Surrogates**

All surrogate recoveries were acceptable.

### **Matrix Spike/Matrix Spike Duplicate (MS/MSD) Samples**

All MS/MSD recoveries were acceptable.

### **Laboratory Control Samples (LCSs)**

All LCS recoveries were acceptable.

- **Precision**

Precision is evaluated by reviewing MS/MSD results, field duplicate sample results and field split sample results. These QC results provide information on the laboratory reproducibility and whether sampling activities are adequate to acquire consistent sample results. According to the SAP, the relative percent difference (RPD) limits are  $\leq 20\%$  as specified by the DV procedure.

### **MS/MSD Samples**

All MS/MSD relative percent difference values were acceptable.

### **Field Duplicate Samples**

All field duplicate results were acceptable.

### **Field Split Samples**

No field splits were submitted for validation.

- **Internal Standards**

Internal standard performance criteria ensure that GC/MS sensitivity and response are stable during each analysis. Internal standards are added to all samples, including QC samples, prior to analysis.

Internal standards data was not included in the data package. Sample results should not be qualified based on this.

- **Detection Limits**

Reported MDLs are compared against the contractually required detection limits (CRDLs) to ensure that laboratory detection limits meet the required criteria.

All reported sample MDLs were below the CRDLs.

- **Completeness**

SDG DN0288 was submitted for validation and verified for completeness. Completeness is based on the percentage of data determined to be valid (i.e., not rejected). The completion percentage was 100%.

### **MAJOR DEFICIENCIES**

None found.

### **MINOR DEFICIENCIES**

None found.

### **REFERENCES**

GRP-GD-003, Rev. 2, Change 0, *Data Validation for Chemical Analyses*, October 2016.

WCH-173, Rev. 2, *Environmental Restoration Disposal Facility Leachate Sampling and Analysis Plan*, November 2015.

## **Appendix 1**

### **Glossary of Data Reporting Qualifiers**

Qualifiers that may be applied by data validators in compliance with the CHPRC statement of work are as follows:

- **U** — The constituent was analyzed for, but was not detected. The data should be considered usable for decision-making purposes.
- **UJ** — The constituent was analyzed for and was not detected. Due to a quality control deficiency identified during data validation the value reported may not accurately reflect the RL. The data should be considered usable for decision-making purposes.
- **J** — Indicates the constituent was analyzed for and detected. The associated value is estimated due to a quality control deficiency identified during data validation. The data should be considered usable for decision-making purposes.
- **J+** — Indicates the constituent was analyzed for and detected. The associated value is estimated with a suspected positive bias due to a quality control deficiency identified during data validation. The data should be considered usable for decision-making purposes.
- **J-** — Indicates the constituent was analyzed for and detected. The associated value is estimated with a suspected negative bias due to a quality control deficiency identified during data validation. The data should be considered usable for decision-making purposes.
- **N** — The analysis indicates the presence of an analyte that has been tentatively identified.
- **NJ** — The analysis indicates the presence of an analyte that has been tentatively identified and the associated numerical value represents its approximate concentration.
- **NJ+** — The analysis indicates the presence of an analyte that has been tentatively identified. The associated value is estimated with a suspected positive bias due to a quality control deficiency identified during data validation.
- **NJ-** — The analysis indicates the presence of an analyte that has been tentatively identified. The associated value is estimated with a suspected negative bias due to a quality control deficiency identified during data validation.
- **UR** — Indicates the constituent was analyzed for and not detected; however, due to an identified quality control deficiency the data should be considered unusable for decision-making purposes.
- **R** — Indicates the constituent was analyzed for and detected; however, due to an identified quality control deficiency the data should be considered unusable for decision-making purposes.

**Appendix 2**  
**Summary of Data Qualification**

<b>Volatile Organics Data Qualification Summary</b>			
SDG: DN0288	Reviewer: AQA	Project: ERDF Leachate	Page 1 of 1
<b>Analyte(s)</b>	<b>Qualifier</b>	<b>Samples Affected</b>	<b>Reason</b>
VOCs	None	N/A	N/A

Comments: None

## **Appendix 3**

### **Data Validation Supporting Documentation**

**Data Validation for Chemical Analyses**

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

**Appendix A - Chemical Data Validation Checklist**

VALIDATION LEVEL:	A	B	<input checked="" type="radio"/> C	D	E
PROJECT: ERDF Leachate			DATA PACKAGE: VSR18-008		
VALIDATOR: Eyda Hergenreder		LAB: TestAmerica		DATE: 03/28/18	
			SDG: DN0288		
ANALYSES PERFORMED					
SW-846 8260 X		SW-846 8260 (TCLP)	SW-846 8270		SW-846 8270 (TCLP)
SAMPLES/MATRIX Water					
SDG DN0288: B3H0D9, B3H0F3, B3H0F0					

**1. DATA PACKAGE COMPLETENESS AND CASE NARRATIVE**

Technical verification documentation present?	<input checked="" type="radio"/> Yes No N/A
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Comments:

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## Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

### Appendix A - (Cont.) Chemical Data Validation Checklist

#### 2. INSTRUMENT TUNING AND CALIBRATION (Levels D and E)

GC/MS tuning/performance check acceptable?	Yes No <input type="radio"/> N/A
Initial calibrations acceptable?	Yes No <input type="radio"/> N/A
Continuing calibrations acceptable?	Yes No <input type="radio"/> N/A
Standards traceable?	Yes No <input type="radio"/> N/A
Standards expired?	Yes No <input type="radio"/> N/A
Calculation check acceptable?	Yes No <input type="radio"/> N/A

Comments:

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#### 3. BLANKS (Levels B, C, D, and E)

Calibration blanks analyzed? (Levels D, E)	Yes No <input type="radio"/> N/A
Calibration blank results acceptable? (Levels D, E)	Yes No <input type="radio"/> N/A
Laboratory blanks analyzed?	<input checked="" type="radio"/> Yes No N/A
Laboratory blank results acceptable?	<input checked="" type="radio"/> Yes No N/A
Field/trip blanks analyzed? (Levels C, D, E)	<input checked="" type="radio"/> Yes No N/A
Field/trip blank results acceptable? (Levels C, D, E)	<input checked="" type="radio"/> Yes No N/A
Transcription/calculation errors? (Levels D, E)	Yes No <input type="radio"/> N/A

Comments:

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## Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

## Appendix A - (Cont.) Chemical Data Validation Checklist

## 4. ACCURACY (Levels C, D, and E)

Surrogates/system monitoring compounds analyzed?	<input checked="" type="radio"/> Yes No <input type="radio"/> N/A
Surrogate/system monitoring compound recoveries acceptable?	<input checked="" type="radio"/> Yes No <input type="radio"/> N/A
Surrogates traceable? (Levels D, E)	Yes No <input type="radio"/> N/A
Surrogates expired? (Levels D, E)	Yes No <input type="radio"/> N/A
MS/MSD samples analyzed?	<input checked="" type="radio"/> Yes No <input type="radio"/> N/A
MS/MSD results acceptable?	<input checked="" type="radio"/> Yes No <input type="radio"/> N/A
MS/MSD standards NIST traceable? (Levels D, E)	Yes No <input type="radio"/> N/A
MS/MSD standards? (Levels D, E)	Yes No <input type="radio"/> N/A
LCS/BSS samples analyzed?	<input checked="" type="radio"/> Yes No <input type="radio"/> N/A
LCS/BSS results acceptable?	<input checked="" type="radio"/> Yes No <input type="radio"/> N/A
Standards traceable? (Levels D, E)	Yes No <input type="radio"/> N/A
Standards expired? (Levels D, E)	Yes No <input type="radio"/> N/A
Transcription/calculation errors? (Levels D, E)	Yes No <input type="radio"/> N/A
Performance audit sample(s) analyzed?	Yes No <input type="radio"/> N/A
Performance audit sample results acceptable?	Yes No <input type="radio"/> N/A

Comments:

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## Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

### Appendix A - (Cont.) Chemical Data Validation Checklist

#### 5. PRECISION (Levels C, D, and E)

MS/MSD samples analyzed?	<input checked="" type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> N/A
MS/MSD RPD values acceptable?	<input checked="" type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> N/A
MS/MSD standards NIST traceable? (Levels D, E)	<input type="radio"/> Yes	<input type="radio"/> No	<input checked="" type="radio"/> N/A
MS/MSD standards expired? (Levels D, E)	<input type="radio"/> Yes	<input type="radio"/> No	<input checked="" type="radio"/> N/A
LCS/LCSD duplicates run due to insufficient sample material?	<input type="radio"/> Yes	<input checked="" type="radio"/> No	<input type="radio"/> N/A
Field duplicate RPD values acceptable?	<input checked="" type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> N/A
Field split RPD values acceptable?	<input type="radio"/> Yes	<input type="radio"/> No	<input checked="" type="radio"/> N/A
Transcription/calculation errors? (Levels D, E)	<input type="radio"/> Yes	<input type="radio"/> No	<input checked="" type="radio"/> N/A

Comments:

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#### 6. SYSTEM PERFORMANCE (Levels D and E)

Internal standards analyzed?	<input type="radio"/> Yes	<input type="radio"/> No	<input checked="" type="radio"/> N/A
Internal standard areas acceptable?	<input type="radio"/> Yes	<input type="radio"/> No	<input checked="" type="radio"/> N/A
Internal standard retention times acceptable?	<input type="radio"/> Yes	<input type="radio"/> No	<input checked="" type="radio"/> N/A
Standards traceable?	<input type="radio"/> Yes	<input type="radio"/> No	<input checked="" type="radio"/> N/A
Standards expired?	<input type="radio"/> Yes	<input type="radio"/> No	<input checked="" type="radio"/> N/A
Transcription/calculation errors?	<input type="radio"/> Yes	<input type="radio"/> No	<input checked="" type="radio"/> N/A

Comments:

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## Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

### Appendix A - (Cont.) Chemical Data Validation Checklist

#### 7. HOLDING TIMES (all levels )

Samples properly preserved?	<input checked="" type="radio"/> Yes No N/A
Sample holding times acceptable?	<input checked="" type="radio"/> Yes No N/A

Comments:

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#### 8. COMPOUND IDENTIFICATION, QUANTITATION, AND DETECTION LIMITS (all levels)

Compound identification acceptable? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
Compound quantitation acceptable? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
Results reported for all requested analyses?	<input checked="" type="radio"/> Yes No N/A
Results supported in the raw data? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
Samples properly prepared? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
Laboratory properly identified and coded all TIC? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
Detection limits meet RDL?	<input checked="" type="radio"/> Yes No N/A
Transcription/calculation errors? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A

Comments:

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## **Appendix 4**

### **Additional Documentation Requested By Client**

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**QC Sample Results**

Client: CH2M Hill Plateau Remediation Company  
Project/Site: FRC16-03

TestAmerica Job ID: 280-104668-1  
SDG: DN0288

**Method: 8260B - Volatile Organic Compounds (GC/MS)**

**Lab Sample ID: MB 280-399529/6**

**Matrix: Water**

**Analysis Batch: 399529**

**Client Sample ID: Method Blank**

**Prep Type: Total/NA**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Carbon tetrachloride	0.19	U	1.0	0.19	ug/L			12/21/17 10:46	1
Trichloroethene	0.16	U	1.0	0.16	ug/L			12/21/17 10:46	1

Tentatively Identified Compound	MB Est. Result	MB Qualifier	Unit	D	RT	CAS No.	Prepared	Analyzed	Dil Fac
Propane	1.25	N J	ug/L		4.36	74-98-6		12/21/17 10:46	1
Cyclotrisiloxane, hexamethyl-	1.39	N J	ug/L		8.89	541-05-9		12/21/17 10:46	1
Benzeneacetic acid, .alpha.,4-bis[(trimethylsilyl)oxy]-, met	2.54	N J	ug/L		12.10	55334-40-2		12/21/17 10:46	1
Hexane, 2-methyl-4-methylene-	1.59	N J	ug/L		12.71	3404-80-6		12/21/17 10:46	1
Guaifenesin di-tms derivative	2.33	N J	ug/L		14.12	1000137-06-7		12/21/17 10:46	1

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	104		70 - 130		12/21/17 10:46	1
4-Bromofluorobenzene (Surr)	100		70 - 130		12/21/17 10:46	1
Dibromofluoromethane (Surr)	111		70 - 130		12/21/17 10:46	1
Toluene-d8 (Surr)	103		70 - 130		12/21/17 10:46	1

**Lab Sample ID: LCS 280-399529/4**

**Matrix: Water**

**Analysis Batch: 399529**

**Client Sample ID: Lab Control Sample**

**Prep Type: Total/NA**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Carbon tetrachloride	5.00	4.54		ug/L		91	65 - 135
Trichloroethene	5.00	4.55		ug/L		91	65 - 135

Surrogate	LCS %Recovery	LCS Qualifier	Limits
1,2-Dichloroethane-d4 (Surr)	101		70 - 130
4-Bromofluorobenzene (Surr)	96		70 - 130
Dibromofluoromethane (Surr)	108		70 - 130
Toluene-d8 (Surr)	103		70 - 130

**Lab Sample ID: 280-104668-1 MS**

**Matrix: Water**

**Analysis Batch: 399529**

**Client Sample ID: B3H0D9**

**Prep Type: Total/NA**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Carbon tetrachloride	0.19	U	5.00	4.05		ug/L		81	65 - 135
Trichloroethene	0.16	U	5.00	4.18		ug/L		84	65 - 135

Surrogate	MS %Recovery	MS Qualifier	Limits
1,2-Dichloroethane-d4 (Surr)	94		70 - 130
4-Bromofluorobenzene (Surr)	96		70 - 130
Dibromofluoromethane (Surr)	106		70 - 130
Toluene-d8 (Surr)	100		70 - 130

TestAmerica Denver

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**QC Sample Results**

Client: CH2M Hill Plateau Remediation Company  
 Project/Site: FRC16-03

TestAmerica Job ID: 280-104668-1  
 SDG: DN0288

**Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)**

Lab Sample ID: 280-104668-1 MSD

Matrix: Water

Analysis Batch: 399529

Client Sample ID: B3H0D9

Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Carbon tetrachloride	0.19	U	5.00	4.28		ug/L		86	65 - 135	6	21
Trichloroethene	0.16	U	5.00	4.47		ug/L		89	65 - 135	7	20
MSD MSD											
Surrogate	%Recovery	Qualifier	Limits								
1,2-Dichloroethane-d4 (Surr)	96		70 - 130								
4-Bromofluorobenzene (Surr)	98		70 - 130								
Dibromofluoromethane (Surr)	103		70 - 130								
Toluene-d8 (Surr)	101		70 - 130								

**Method: 8270D - Semivolatile Organic Compounds (GC/MS)**

Lab Sample ID: MB 280-399102/1-A

Matrix: Water

Analysis Batch: 400548

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 399102

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Diphenylhydrazine	0.23	U	10	0.23	ug/L		12/18/17 12:32	01/02/18 15:13	1
MB MB									
Tentatively Identified Compound	Est. Result	Qualifier	Unit	D	RT	CAS No.	Prepared	Analyzed	Dil Fac
Cyclohexane	14.4	N J	ug/L		1.59	110-82-7	12/18/17 12:32	01/02/18 15:13	1
Butane, 2-methoxy-2-methyl-	12.2	N J	ug/L		1.66	994-05-8	12/18/17 12:32	01/02/18 15:13	1
2-Pentanone, 4-hydroxy-4-methyl-	20.9	N J	ug/L		3.04	123-42-2	12/18/17 12:32	01/02/18 15:13	1
2,2-Dichlorocyclopropylacetone	11.9	N J	ug/L		4.00	5365-25-3	12/18/17 12:32	01/02/18 15:13	1
Ethanol, 2-(2-ethoxyethoxy)-	20.6	N J	ug/L		4.35	111-90-0	12/18/17 12:32	01/02/18 15:13	1
Bis(2-ethylhexyl) phthalate	1.62	J	ug/L		13.05	117-81-7	12/18/17 12:32	01/02/18 15:13	1
MB MB									
Surrogate	%Recovery	Qualifier	Limits		Prepared	Analyzed	Dil Fac		
2-Fluorobiphenyl (Surr)	75		48 - 130		12/18/17 12:32	01/02/18 15:13	1		
2-Fluorophenol (Surr)	69		41 - 130		12/18/17 12:32	01/02/18 15:13	1		
2,4,6-Tribromophenol (Surr)	54		42 - 130		12/18/17 12:32	01/02/18 15:13	1		
Nitrobenzene-d5 (Surr)	74		42 - 130		12/18/17 12:32	01/02/18 15:13	1		
Phenol-d5 (Surr)	77		45 - 130		12/18/17 12:32	01/02/18 15:13	1		
Terphenyl-d14 (Surr)	83		20 - 130		12/18/17 12:32	01/02/18 15:13	1		

Lab Sample ID: LCS 280-399102/2-A

Matrix: Water

Analysis Batch: 400548

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 399102

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,2-Diphenylhydrazine	80.9	76.9		ug/L		95	55 - 130
LCS LCS							
Surrogate	%Recovery	Qualifier	Limits				
2-Fluorobiphenyl (Surr)	75		48 - 130				
2-Fluorophenol (Surr)	78		41 - 130				
2,4,6-Tribromophenol (Surr)	78		42 - 130				
Nitrobenzene-d5 (Surr)	80		42 - 130				

TestAmerica Denver

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**Surrogate Summary**

Client: CH2M Hill Plateau Remediation Company  
Project/Site: FRC16-03

TestAmerica Job ID: 280-104668-1  
SDG: DN0288

**Method: 8260B - Volatile Organic Compounds (GC/MS)**

Matrix: Water

Prep Type: Total/NA

Percent Surrogate Recovery (Acceptance Limits)

Lab Sample ID	Client Sample ID	DCA	BFB	DBFM	TOL
		(70-130)	(70-130)	(70-130)	(70-130)
280-104668-1	B3H0D9	95	103	105	101
280-104668-1 MS	B3H0D9	94	96	106	100
280-104668-1 MSD	B3H0D9	96	98	103	101
280-104668-2	B3H0F3	98	92	105	94
280-104668-3	B3H0F0	98	93	105	94
LCS 280-399529/4	Lab Control Sample	101	96	108	103
MB 280-399529/6	Method Blank	104	100	111	103

**Surrogate Legend**

DCA = 1,2-Dichloroethane-d4 (Surr)  
BFB = 4-Bromofluorobenzene (Surr)  
DBFM = Dibromofluoromethane (Surr)  
TOL = Toluene-d8 (Surr)

**Method: 8270D - Semivolatile Organic Compounds (GC/MS)**

Matrix: Water

Prep Type: Total/NA

Percent Surrogate Recovery (Acceptance Limits)

Lab Sample ID	Client Sample ID	FBP	2FP	TBP	NBZ	PHL	TPHL
		(48-130)	(41-130)	(42-130)	(42-130)	(45-130)	(20-130)
280-104668-1	B3H0D9	74	77	71	83	85	39
280-104668-1 MS	B3H0D9	73	74	66	96	81	60
280-104668-1 MSD	B3H0D9	62	64	55	70	65	40
280-104668-2	B3H0F3	72	78	64	73	85	29
LCS 280-399102/2-A	Lab Control Sample	75	78	78	80	81	86
MB 280-399102/1-A	Method Blank	75	69	54	74	77	83

**Surrogate Legend**

FBP = 2-Fluorobiphenyl (Surr)  
2FP = 2-Fluorophenol (Surr)  
TBP = 2,4,6-Tribromophenol (Surr)  
NBZ = Nitrobenzene-d5 (Surr)  
PHL = Phenol-d5 (Surr)  
TPHL = Terphenyl-d14 (Surr)

Date: 28 March 2018  
 To: CH2M Hill (technical representative)  
 From: Analytical Quality Associates, Inc.  
 Project: ERDF Leachate  
 Subject: Semivolatile Organics - Sample Data Group (SDG) DN0288

## **INTRODUCTION**

This memorandum presents the results of data validation for SDG DN0288 prepared by TestAmerica Laboratories. A list of samples validated along with the analytical methods is provided in the following table.

<b>Sample ID</b>	<b>Sample Date</b>	<b>Media</b>	<b>Validation Level</b>	<b>Analytical Methods</b>
B3H0D9	12/12/17	Water	C	8270D
B3H0F3	12/12/17	Water	C	8270D

Data validation was conducted in accordance with the CHPRC validation statement of work and the Environmental Restoration Disposal Facility Leachate Sampling and Analysis Plan, WCH-173, Rev. 2 (SAP). Appendices 1 through 4 provide the following information as indicated below:

- Appendix 1. Glossary of Data Reporting Qualifiers
- Appendix 2. Summary of Data Qualification
- Appendix 3. Data Validation Supporting Documentation
- Appendix 4. Additional Documentation Requested by Client

## **DATA QUALITY OBJECTIVES**

- **Holding Times and Sample Preservation**

Holding times are calculated from Chain-of-Custody forms to determine the validity of the results. The holding time requirements for semivolatile organics in water are extraction within 7 days of sample collection and analysis within 40 days of sample extraction. Sample preservation requires chilling to  $\leq 6$  degrees Celsius.

The samples were extracted and analyzed within the prescribed holding times and properly preserved.

- **Blanks**

The blank data results are reviewed to assess the extent of contamination introduced through sampling, sample preparation, and analysis.

### **Laboratory Blanks**

All laboratory blank results were acceptable.

**Trip Blanks**

No trip blanks were submitted for validation.

**Field Blanks**

No field blanks were submitted for validation.

**Equipment Blanks**

No equipment blanks were submitted for validation.

• **Accuracy**

Accuracy is evaluated by reviewing surrogate results, matrix spike sample results, and laboratory control sample results. According to the SAP, the laboratory control sample accuracy limits are 70% to 130% and the matrix spike sample accuracy limits are the ones established by the analytical laboratory as specified by the DV procedure.

**Surrogates**

All surrogate recoveries were acceptable.

**Matrix Spike/Matrix Spike Duplicate (MS/MSD) Samples**

All MS/MSD recoveries were acceptable.

**Laboratory Control Samples (LCSs)**

All LCS recoveries were acceptable.

• **Precision**

Precision is evaluated by reviewing MS/MSD results, field duplicate sample results and field split sample results. These QC results provide information on the laboratory reproducibility and whether sampling activities are adequate to acquire consistent sample results. According to the SAP, the relative percent difference (RPD) limits are  $\leq 20\%$  as specified by the DV procedure.

**MS/MSD Samples**

All MS/MSD relative percent difference values were acceptable.

**Field Duplicate Samples**

All field duplicate results were acceptable.

### **Field Split Samples**

No field splits were submitted for validation.

- **Internal Standards**

Internal standard performance criteria ensure that GC/MS sensitivity and response are stable during each analysis. Internal standards are added to all samples, including QC samples, prior to analysis.

Internal standards data was not included in the data package. Sample results should not be qualified based on this.

- **Detection Limits**

Reported MDLs are compared against the contractually required detection limits (CRDLs) to ensure that laboratory detection limits meet the required criteria.

All reported sample MDLs were below the CRDLs.

- **Completeness**

SDG DN0288 was submitted for validation and verified for completeness. Completeness is based on the percentage of data determined to be valid (i.e., not rejected). The completion percentage was 100%.

### **MAJOR DEFICIENCIES**

None found.

### **MINOR DEFICIENCIES**

None found.

### **REFERENCES**

GRP-GD-003, Rev. 2, Change 0, *Data Validation for Chemical Analyses*, October 2016.

WCH-173, Rev. 2, *Environmental Restoration Disposal Facility Leachate Sampling and Analysis Plan*, November 2015.

## **Appendix 1**

### **Glossary of Data Reporting Qualifiers**

Qualifiers that may be applied by data validators in compliance with the CHPRC statement of work are as follows:

- **U** — The constituent was analyzed for, but was not detected. The data should be considered usable for decision-making purposes.
- **UJ** — The constituent was analyzed for and was not detected. Due to a quality control deficiency identified during data validation the value reported may not accurately reflect the RL. The data should be considered usable for decision-making purposes.
- **J** — Indicates the constituent was analyzed for and detected. The associated value is estimated due to a quality control deficiency identified during data validation. The data should be considered usable for decision-making purposes.
- **J+** — Indicates the constituent was analyzed for and detected. The associated value is estimated with a suspected positive bias due to a quality control deficiency identified during data validation. The data should be considered usable for decision-making purposes.
- **J-** — Indicates the constituent was analyzed for and detected. The associated value is estimated with a suspected negative bias due to a quality control deficiency identified during data validation. The data should be considered usable for decision-making purposes.
- **N** — The analysis indicates the presence of an analyte that has been tentatively identified.
- **NJ** — The analysis indicates the presence of an analyte that has been tentatively identified and the associated numerical value represents its approximate concentration.
- **NJ+** — The analysis indicates the presence of an analyte that has been tentatively identified. The associated value is estimated with a suspected positive bias due to a quality control deficiency identified during data validation.
- **NJ-** — The analysis indicates the presence of an analyte that has been tentatively identified. The associated value is estimated with a suspected negative bias due to a quality control deficiency identified during data validation.
- **UR** — Indicates the constituent was analyzed for and not detected; however, due to an identified quality control deficiency the data should be considered unusable for decision-making purposes.
- **R** — Indicates the constituent was analyzed for and detected; however, due to an identified quality control deficiency the data should be considered unusable for decision-making purposes.

**Appendix 2**  
**Summary of Data Qualification**

<b>Semivolatile Organics Data Qualification Summary</b>			
SDG: DN0288	Reviewer: AQA	Project: ERDF Leachate	Page 1 of 1
<b>Analyte(s)</b>	<b>Qualifier</b>	<b>Samples Affected</b>	<b>Reason</b>
SVOC	None	N/A	N/A

Comments: None

## **Appendix 3**

### **Data Validation Supporting Documentation**

Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

Appendix A - Chemical Data Validation Checklist

VALIDATION LEVEL:	A	B	<input checked="" type="radio"/> C	D	E
PROJECT: ERDF Leachate			DATA PACKAGE: VSR18-008		
VALIDATOR: Eyda Hergenreder		LAB: TestAmerica		DATE: 03/28/18	
			SDG: DN0288		
ANALYSES PERFORMED					
SW-846 8260		SW-846 8260 (TCLP)	SW-846 8270 X		SW-846 8270 (TCLP)
SAMPLES/MATRIX Water					
SDG DN0288: B3H0D9, B3H0F3					

1. DATA PACKAGE COMPLETENESS AND CASE NARRATIVE

Technical verification documentation present?	<input checked="" type="radio"/> Yes No N/A
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Comments:

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## Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

### Appendix A - (Cont.) Chemical Data Validation Checklist

#### 2. INSTRUMENT TUNING AND CALIBRATION (Levels D and E)

GC/MS tuning/performance check acceptable?	Yes No <input checked="" type="radio"/> N/A
Initial calibrations acceptable?	Yes No <input checked="" type="radio"/> N/A
Continuing calibrations acceptable?	Yes No <input checked="" type="radio"/> N/A
Standards traceable?	Yes No <input checked="" type="radio"/> N/A
Standards expired?	Yes No <input checked="" type="radio"/> N/A
Calculation check acceptable?	Yes No <input checked="" type="radio"/> N/A

Comments:

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#### 3. BLANKS (Levels B, C, D, and E)

Calibration blanks analyzed? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
Calibration blank results acceptable? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
Laboratory blanks analyzed?	<input checked="" type="radio"/> Yes No N/A
Laboratory blank results acceptable?	<input checked="" type="radio"/> Yes No N/A
Field/trip blanks analyzed? (Levels C, D, E)	Yes <input checked="" type="radio"/> No N/A
Field/trip blank results acceptable? (Levels C, D, E)	Yes No <input checked="" type="radio"/> N/A
Transcription/calculation errors? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A

Comments:

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## Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

## Appendix A - (Cont.) Chemical Data Validation Checklist

## 4. ACCURACY (Levels C, D, and E)

Surrogates/system monitoring compounds analyzed?	<input checked="" type="radio"/> Yes No <input type="radio"/> N/A
Surrogate/system monitoring compound recoveries acceptable?	<input checked="" type="radio"/> Yes No <input type="radio"/> N/A
Surrogates traceable? (Levels D, E)	Yes No <input type="radio"/> N/A
Surrogates expired? (Levels D, E)	Yes No <input type="radio"/> N/A
MS/MSD samples analyzed?	<input checked="" type="radio"/> Yes No <input type="radio"/> N/A
MS/MSD results acceptable?	<input checked="" type="radio"/> Yes No <input type="radio"/> N/A
MS/MSD standards NIST traceable? (Levels D, E)	Yes No <input type="radio"/> N/A
MS/MSD standards? (Levels D, E)	Yes No <input type="radio"/> N/A
LCS/BSS samples analyzed?	<input checked="" type="radio"/> Yes No <input type="radio"/> N/A
LCS/BSS results acceptable?	<input checked="" type="radio"/> Yes No <input type="radio"/> N/A
Standards traceable? (Levels D, E)	Yes No <input type="radio"/> N/A
Standards expired? (Levels D, E)	Yes No <input type="radio"/> N/A
Transcription/calculation errors? (Levels D, E)	Yes No <input type="radio"/> N/A
Performance audit sample(s) analyzed?	Yes No <input type="radio"/> N/A
Performance audit sample results acceptable?	Yes No <input type="radio"/> N/A

Comments:

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## Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

## Appendix A - (Cont.) Chemical Data Validation Checklist

## 5. PRECISION (Levels C, D, and E)

MS/MSD samples analyzed?	<input checked="" type="radio"/> Yes	No	N/A
MS/MSD RPD values acceptable?	<input checked="" type="radio"/> Yes	No	N/A
MS/MSD standards NIST traceable? (Levels D, E)	Yes	No	<input checked="" type="radio"/> N/A
MS/MSD standards expired? (Levels D, E)	Yes	No	<input checked="" type="radio"/> N/A
LCS/LCSD duplicates run due to insufficient sample material?	Yes	<input checked="" type="radio"/> No	N/A
Field duplicate RPD values acceptable?	<input checked="" type="radio"/> Yes	No	N/A
Field split RPD values acceptable?	Yes	No	<input checked="" type="radio"/> N/A
Transcription/calculation errors? (Levels D, E)	Yes	No	<input checked="" type="radio"/> N/A

Comments:

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## 6. SYSTEM PERFORMANCE (Levels D and E)

Internal standards analyzed?	Yes	No	<input checked="" type="radio"/> N/A
Internal standard areas acceptable?	Yes	No	<input checked="" type="radio"/> N/A
Internal standard retention times acceptable?	Yes	No	<input checked="" type="radio"/> N/A
Standards traceable?	Yes	No	<input checked="" type="radio"/> N/A
Standards expired?	Yes	No	<input checked="" type="radio"/> N/A
Transcription/calculation errors?	Yes	No	<input checked="" type="radio"/> N/A

Comments:

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## Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

### Appendix A - (Cont.) Chemical Data Validation Checklist

#### 7. HOLDING TIMES (all levels )

Samples properly preserved?	<input checked="" type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> N/A
Sample holding times acceptable?	<input checked="" type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> N/A

Comments:

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#### 8. COMPOUND IDENTIFICATION, QUANTITATION, AND DETECTION LIMITS (all levels)

Compound identification acceptable? (Levels D, E)	<input type="radio"/> Yes	<input type="radio"/> No	<input checked="" type="radio"/> N/A
Compound quantitation acceptable? (Levels D, E)	<input type="radio"/> Yes	<input type="radio"/> No	<input checked="" type="radio"/> N/A
Results reported for all requested analyses?	<input checked="" type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> N/A
Results supported in the raw data? (Levels D, E)	<input type="radio"/> Yes	<input type="radio"/> No	<input checked="" type="radio"/> N/A
Samples properly prepared? (Levels D, E)	<input type="radio"/> Yes	<input type="radio"/> No	<input checked="" type="radio"/> N/A
Laboratory properly identified and coded all TIC? (Levels D, E)	<input type="radio"/> Yes	<input type="radio"/> No	<input checked="" type="radio"/> N/A
Detection limits meet RDL?	<input checked="" type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> N/A
Transcription/calculation errors? (Levels D, E)	<input type="radio"/> Yes	<input type="radio"/> No	<input checked="" type="radio"/> N/A

Comments:

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## **Appendix 4**

### **Additional Documentation Requested By Client**

Page 36 of 101  
**QC Sample Results**

Client: CH2M Hill Plateau Remediation Company  
 Project/Site: FRC16-03

TestAmerica Job ID: 280-104668-1  
 SDG: DN0288

**Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)**

Lab Sample ID: 280-104668-1 MSD

Matrix: Water

Analysis Batch: 399529

Client Sample ID: B3H0D9

Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Carbon tetrachloride	0.19	U	5.00	4.28		ug/L		86	65 - 135	6	21
Trichloroethene	0.16	U	5.00	4.47		ug/L		89	65 - 135	7	20
Surrogate	%Recovery	MSD Qualifier	MSD Limits								
1,2-Dichloroethane-d4 (Surr)	96		70 - 130								
4-Bromofluorobenzene (Surr)	98		70 - 130								
Dibromofluoromethane (Surr)	103		70 - 130								
Toluene-d8 (Surr)	101		70 - 130								

**Method: 8270D - Semivolatile Organic Compounds (GC/MS)**

Lab Sample ID: MB 280-399102/1-A

Matrix: Water

Analysis Batch: 400548

Client Sample ID: Method Blank

Prep Type: Total/NA

Prep Batch: 399102

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Diphenylhydrazine	0.23	U	10	0.23	ug/L		12/18/17 12:32	01/02/18 15:13	1
Tentatively Identified Compound	Est. Result	MB Qualifier	Unit	D	RT	CAS No.	Prepared	Analyzed	Dil Fac
Cyclohexane	14.4	N J	ug/L		1.59	110-82-7	12/18/17 12:32	01/02/18 15:13	1
Butane, 2-methoxy-2-methyl-	12.2	N J	ug/L		1.66	994-05-8	12/18/17 12:32	01/02/18 15:13	1
2-Pentanone, 4-hydroxy-4-methyl-	20.9	N J	ug/L		3.04	123-42-2	12/18/17 12:32	01/02/18 15:13	1
2,2-Dichlorocyclopropylacetone	11.9	N J	ug/L		4.00	5365-25-3	12/18/17 12:32	01/02/18 15:13	1
Ethanol, 2-(2-ethoxyethoxy)-	20.6	N J	ug/L		4.35	111-90-0	12/18/17 12:32	01/02/18 15:13	1
Bis(2-ethylhexyl) phthalate	1.62	J	ug/L		13.05	117-81-7	12/18/17 12:32	01/02/18 15:13	1
Surrogate	%Recovery	MB Qualifier	Limits						
2-Fluorobiphenyl (Surr)	75		48 - 130						
2-Fluorophenol (Surr)	69		41 - 130						
2,4,6-Tribromophenol (Surr)	54		42 - 130						
Nitrobenzene-d5 (Surr)	74		42 - 130						
Phenol-d5 (Surr)	77		45 - 130						
Terphenyl-d14 (Surr)	83		20 - 130						

Lab Sample ID: LCS 280-399102/2-A

Matrix: Water

Analysis Batch: 400548

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Prep Batch: 399102

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,2-Diphenylhydrazine	80.9	76.9		ug/L		95	55 - 130
Surrogate	%Recovery	LCS Qualifier	Limits				
2-Fluorobiphenyl (Surr)	75		48 - 130				
2-Fluorophenol (Surr)	78		41 - 130				
2,4,6-Tribromophenol (Surr)	78		42 - 130				
Nitrobenzene-d5 (Surr)	80		42 - 130				

TestAmerica Denver

Client: CH2M Hill Plateau Remediation Company  
 Project/Site: FRC16-03

TestAmerica Job ID: 280-104668-1  
 SDG: DN0288

**Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)**

**Lab Sample ID: LCS 280-399102/2-A**  
**Matrix: Water**  
**Analysis Batch: 400548**

**Client Sample ID: Lab Control Sample**  
**Prep Type: Total/NA**  
**Prep Batch: 399102**

Surrogate	LCS		Limits
	%Recovery	Qualifier	
Phenol-d5 (Surr)	81		45 - 130
Terphenyl-d14 (Surr)	86		20 - 130

**Lab Sample ID: 280-104668-1 MS**  
**Matrix: Water**  
**Analysis Batch: 400548**

**Client Sample ID: B3H0D9**  
**Prep Type: Total/NA**  
**Prep Batch: 399102**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	Limits
	1,2-Diphenylhydrazine	0.23	U	81.9	64.9		ug/L		79

Surrogate	MS		Limits
	%Recovery	Qualifier	
2-Fluorobiphenyl (Surr)	73		48 - 130
2-Fluorophenol (Surr)	74		41 - 130
2,4,6-Tribromophenol (Surr)	66		42 - 130
Nitrobenzene-d5 (Surr)	96		42 - 130
Phenol-d5 (Surr)	81		45 - 130
Terphenyl-d14 (Surr)	60		20 - 130

**Lab Sample ID: 280-104668-1 MSD**  
**Matrix: Water**  
**Analysis Batch: 400548**

**Client Sample ID: B3H0D9**  
**Prep Type: Total/NA**  
**Prep Batch: 399102**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	Limits	RPD	Limit
	1,2-Diphenylhydrazine	0.23	U	81.6	55.0		ug/L		67	55 - 120	17

Surrogate	MSD		Limits
	%Recovery	Qualifier	
2-Fluorobiphenyl (Surr)	62		48 - 130
2-Fluorophenol (Surr)	64		41 - 130
2,4,6-Tribromophenol (Surr)	55		42 - 130
Nitrobenzene-d5 (Surr)	70		42 - 130
Phenol-d5 (Surr)	65		45 - 130
Terphenyl-d14 (Surr)	40		20 - 130

**Method: 6010D - Metals (ICP)**

**Lab Sample ID: MB 280-400503/1-A**  
**Matrix: Water**  
**Analysis Batch: 400922**

**Client Sample ID: Method Blank**  
**Prep Type: Total/NA**  
**Prep Batch: 400503**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
	Calcium	34.5	U	200	34.5	ug/L		01/03/18 14:32	01/05/18 22:48
Potassium	483.5	B	3000	237	ug/L		01/03/18 14:32	01/05/18 22:48	1
Silicon	34.7	U	500	34.7	ug/L		01/03/18 14:32	01/05/18 22:48	1
Sodium	224.2	B	1000	117	ug/L		01/03/18 14:32	01/05/18 22:48	1

TestAmerica Denver

Page 38 of 101  
**Surrogate Summary**

Client: CH2M Hill Plateau Remediation Company  
Project/Site: FRC16-03

TestAmerica Job ID: 280-104668-1  
SDG: DN0288

**Method: 8260B - Volatile Organic Compounds (GC/MS)**

Matrix: Water

Prep Type: Total/NA

Percent Surrogate Recovery (Acceptance Limits)

Lab Sample ID	Client Sample ID	DCA (70-130)	BFB (70-130)	DBFM (70-130)	TOL (70-130)
280-104668-1	B3H0D9	95	103	105	101
280-104668-1 MS	B3H0D9	94	96	106	100
280-104668-1 MSD	B3H0D9	96	98	103	101
280-104668-2	B3H0F3	98	92	105	94
280-104668-3	B3H0F0	98	93	105	94
LCS 280-399529/4	Lab Control Sample	101	96	108	103
MB 280-399529/6	Method Blank	104	100	111	103

**Surrogate Legend**

DCA = 1,2-Dichloroethane-d4 (Surr)  
BFB = 4-Bromofluorobenzene (Surr)  
DBFM = Dibromofluoromethane (Surr)  
TOL = Toluene-d8 (Surr)

**Method: 8270D - Semivolatile Organic Compounds (GC/MS)**

Matrix: Water

Prep Type: Total/NA

Percent Surrogate Recovery (Acceptance Limits)

Lab Sample ID	Client Sample ID	FBP (48-130)	2FP (41-130)	TBP (42-130)	NBZ (42-130)	PHL (45-130)	TPHL (20-130)
280-104668-1	B3H0D9	74	77	71	83	85	39
280-104668-1 MS	B3H0D9	73	74	66	96	81	60
280-104668-1 MSD	B3H0D9	62	64	55	70	65	40
280-104668-2	B3H0F3	72	78	64	73	85	29
LCS 280-399102/2-A	Lab Control Sample	75	78	78	80	81	86
MB 280-399102/1-A	Method Blank	75	69	54	74	77	83

**Surrogate Legend**

FBP = 2-Fluorobiphenyl (Surr)  
2FP = 2-Fluorophenol (Surr)  
TBP = 2,4,6-Tribromophenol (Surr)  
NBZ = Nitrobenzene-d5 (Surr)  
PHL = Phenol-d5 (Surr)  
TPHL = Terphenyl-d14 (Surr)

Date: 28 March 2018  
 To: CH2M Hill (technical representative)  
 From: Analytical Quality Associates, Inc.  
 Project: ERDF Leachate  
 Subject: Inorganics - Sample Data Group (SDG) DN0288

## **INTRODUCTION**

This memorandum presents the results of data validation for SDG DN0288 prepared by TestAmerica Laboratories. A list of samples validated along with the analytical methods is provided in the following table.

<b>Sample ID</b>	<b>Sample Date</b>	<b>Media</b>	<b>Validation Level</b>	<b>Analytical Methods</b>
B3H0D9	12/12/17	Water	C	6010D, 6020B
B3H0F3	12/12/17	Water	C	6010D, 6020B

Data validation was conducted in accordance with the CHPRC validation statement of work and the Environmental Restoration Disposal Facility Leachate Sampling and Analysis Plan, WCH-173, Rev. 2 (SAP). Appendices 1 through 4 provide the following information as indicated below:

- Appendix 1. Glossary of Data Reporting Qualifiers
- Appendix 2. Summary of Data Qualification
- Appendix 3. Data Validation Supporting Documentation
- Appendix 4. Additional Documentation Requested by Client

## **DATA QUALITY OBJECTIVES**

- **Holding Times and Sample Preservation**

Holding times are calculated from Chain-of-Custody forms to determine the validity of the results. The holding time requirement for ICP metals are analysis within 180 days of sample collection. Sample preservation requires acid preservation with nitric acid to pH <2.

The samples were analyzed within the prescribed holding times and properly preserved.

- **Blanks**

The blank data results are reviewed to assess the extent of contamination introduced through sampling, sample preparation, and analysis.

### **Laboratory Blanks**

All laboratory blank results were acceptable with the following exceptions.

For SDG DN0288, the K and Na laboratory blank result were > the method detection limits (MDLs) but < the reporting limits (RLs). The K and Na results for samples B3H0D9 and B3H0F3 were  $\geq 20X$  the blank values and should not be qualified.

### **Trip Blanks**

No trip blanks were submitted for validation.

### **Field Blanks**

No field blanks were submitted for validation.

### **Equipment Blanks**

No equipment blanks were submitted for validation.

- **Accuracy**

Accuracy is evaluated by reviewing matrix spike sample results, laboratory control sample and ICP-AES interference check sample results. According to the SAP, the laboratory control sample accuracy limits are 80% to 120% and the matrix spike sample accuracy limits are 75% to 125% as specified by the DV procedure.

### **Matrix Spike/Matrix Spike Duplicate (MS/MSD) Samples**

All MS/MSD recoveries were acceptable with the following exception.

For SDG DN0288, the MS recovery for U was >125%; however the parent sample result was >4X the spike concentration, therefore data should not be qualified as a result.

### **Laboratory Control Samples (LCSs)**

All LCS recoveries were acceptable.

### **ICP-AES Interference Check Samples (ICSs)**

ICS data was not included in the data package. Sample results should not be qualified based on this.

- **Precision**

Precision is evaluated by reviewing MS/MSD results, laboratory duplicate sample results, field duplicate sample results, field split sample results, and ICP serial dilution results. These QC results provide information on the laboratory reproducibility and whether sampling activities are adequate to acquire consistent sample results. According to the SAP, the relative percent difference (RPD) limits are  $\leq 20\%$  as specified in the DV procedure.

### **MS/MSD Samples**

All MS/MSD RPD values were acceptable.

### **Field Duplicate Samples**

All field duplicate results were acceptable.

### **Field Split Samples**

No field splits were submitted for validation.

### **ICP Serial Dilution Samples**

ICS serial dilution data was not included in the data package. Sample results should not be qualified based on this.

- **ICP-MS Internal Standards**

The analysis of ICP-MS internal standards is used to determine the existences and magnitude of instrument drift and physical interferences. The criteria for evaluation of internal standard results apply to all samples (including QC) analyzed during the analytical run, beginning with the calibration.

ICP-MS internal standards data was not included in the data package. Sample results should not be qualified based on this.

- **Detection Limits**

Reported MDLs are compared against the contractually required detection limits (CRDLs) to ensure that laboratory detection limits meet the required criteria.

All reported sample MDLs were below the CRDLs with the exception of silicon.

- **Completeness**

SDG DN0288 was submitted for validation and verified for completeness. Completeness is based on the percentage of data determined to be valid (i.e., not rejected). The completion percentage was 100%.

### **MAJOR DEFICIENCIES**

None found.

**MINOR DEFICIENCIES**

None found.

**REFERENCES**

GRP-GD-003, Rev. 2, Change 0, *Data Validation for Chemical Analyses*, October 2016.

WCH-173, Rev. 2, *Environmental Restoration Disposal Facility Leachate Sampling and Analysis Plan*, November 2015.

## **Appendix 1**

### **Glossary of Data Reporting Qualifiers**

Qualifiers that may be applied by data validators in compliance with the CHPRC statement of work are as follows:

- **U** — The constituent was analyzed for, but was not detected. The data should be considered usable for decision-making purposes.
- **UJ** — The constituent was analyzed for and was not detected. Due to a quality control deficiency identified during data validation the value reported may not accurately reflect the RL. The data should be considered usable for decision-making purposes.
- **J** — Indicates the constituent was analyzed for and detected. The associated value is estimated due to a quality control deficiency identified during data validation. The data should be considered usable for decision-making purposes.
- **J+** — Indicates the constituent was analyzed for and detected. The associated value is estimated with a suspected positive bias due to a quality control deficiency identified during data validation. The data should be considered usable for decision-making purposes.
- **J-** — Indicates the constituent was analyzed for and detected. The associated value is estimated with a suspected negative bias due to a quality control deficiency identified during data validation. The data should be considered usable for decision-making purposes.
- **N** — The analysis indicates the presence of an analyte that has been tentatively identified.
- **NJ** — The analysis indicates the presence of an analyte that has been tentatively identified and the associated numerical value represents its approximate concentration.
- **NJ+** — The analysis indicates the presence of an analyte that has been tentatively identified. The associated value is estimated with a suspected positive bias due to a quality control deficiency identified during data validation.
- **NJ-** — The analysis indicates the presence of an analyte that has been tentatively identified. The associated value is estimated with a suspected negative bias due to a quality control deficiency identified during data validation.
- **UR** — Indicates the constituent was analyzed for and not detected; however, due to an identified quality control deficiency the data should be considered unusable for decision-making purposes.
- **R** — Indicates the constituent was analyzed for and detected; however, due to an identified quality control deficiency the data should be considered unusable for decision-making purposes.

**Appendix 2**  
**Summary of Data Qualification**

<b>Inorganic Data Qualification Summary</b>			
SDG: DN0288	Reviewer: AQA	Project: ERDF Leachate	Page 1 of 1
<b>Analyte(s)</b>	<b>Qualifier</b>	<b>Samples Affected</b>	<b>Reason</b>
Metals	None	N/A	N/A

Comments: None

## **Appendix 3**

### **Data Validation Supporting Documentation**

**Data Validation for Chemical Analyses**

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

**Appendix A - (Cont.) Chemical Data Validation Checklist**

VALIDATION LEVEL:	A	B	<input checked="" type="radio"/> C	D	E
PROJECT: ERDF Leachate			DATA PACKAGE: VSR18-008		
VALIDATOR: Eyda Hergenreder		LAB: TestAmerica		DATE: 03/28/18	
			SDG: DN0288		
ANALYSES PERFORMED					
SW-846/ICP X	SW-846/GFAA	SW-846/Hg	SW-846 Cyanide	SW-846/ICP-MS X	
SAMPLES/MATRIX Water					
SDG DN0288: B3H0D9, B3H0F3					

**1. DATA PACKAGE COMPLETENESS AND CASE NARRATIVE**

Technical verification documentation present?	<input checked="" type="radio"/> Yes No N/A
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Comments:

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## Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

### Appendix A - (Cont.) Chemical Data Validation Checklist

#### 2. INSTRUMENT PERFORMANCE AND CALIBRATIONS (Levels D and E)

Initial calibrations performed on all instruments?	Yes No <input checked="" type="radio"/> N/A
Initial calibrations acceptable?	Yes No <input checked="" type="radio"/> N/A
ICP interference checks acceptable?	Yes No <input checked="" type="radio"/> N/A
ICV and CCV checks performed on all instruments?	Yes No <input checked="" type="radio"/> N/A
ICV and CCV checks acceptable?	Yes No <input checked="" type="radio"/> N/A
Standards traceable?	Yes No <input checked="" type="radio"/> N/A
Standards expired?	Yes No <input checked="" type="radio"/> N/A
Calculation check acceptable?	Yes No <input checked="" type="radio"/> N/A

Comments:

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#### 3. BLANKS (Levels B, C, D, and E)

ICB and CCB checks performed for all applicable analyses? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
ICB and CCB results acceptable? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
Laboratory blanks analyzed?	<input checked="" type="radio"/> Yes No N/A
Laboratory blank results acceptable?	Yes <input checked="" type="radio"/> No N/A
Field blanks analyzed? (Levels C, D, E)	Yes <input checked="" type="radio"/> No N/A
Field blank results acceptable? (Levels C, D, E)	Yes No <input checked="" type="radio"/> N/A
Transcription/calculation errors? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A

Comments:

Method blank K 483.5 ug/L; Na 224.2 ug/L

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**Data Validation for Chemical Analyses**

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

**Appendix A - (Cont.) Chemical Data Validation Checklist**

**6. ICP QUALITY CONTROL (Levels D and E)**

ICP serial dilution samples analyzed?	Yes No <input checked="" type="radio"/> N/A
ICP serial dilution %D values acceptable?	Yes No <input checked="" type="radio"/> N/A
ICP post digestion spike required?	Yes No <input checked="" type="radio"/> N/A
ICP post digestion spike values acceptable?	Yes No <input checked="" type="radio"/> N/A
Standards traceable?	Yes No <input checked="" type="radio"/> N/A
Standards expired?	Yes No <input checked="" type="radio"/> N/A
Transcription/calculation errors?	Yes No <input checked="" type="radio"/> N/A

Comments:

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**7. HOLDING TIMES (all levels)**

Samples properly preserved?	<input checked="" type="radio"/> Yes No N/A
Sample holding times acceptable?	<input checked="" type="radio"/> Yes No N/A

Comments:

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## **Appendix 4**

### **Additional Documentation Requested By Client**

Client: CH2M Hill Plateau Remediation Company  
 Project/Site: FRC16-03

TestAmerica Job ID: 280-104668-1  
 SDG: DN0288

**Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)**

**Lab Sample ID: LCS 280-399102/2-A**  
**Matrix: Water**  
**Analysis Batch: 400548**

**Client Sample ID: Lab Control Sample**  
**Prep Type: Total/NA**  
**Prep Batch: 399102**

Surrogate	LCS %Recovery	LCS Qualifier	Limits
Phenol-d5 (Surr)	81		45 - 130
Terphenyl-d14 (Surr)	86		20 - 130

**Lab Sample ID: 280-104668-1 MS**  
**Matrix: Water**  
**Analysis Batch: 400548**

**Client Sample ID: B3H0D9**  
**Prep Type: Total/NA**  
**Prep Batch: 399102**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	Limits
1,2-Diphenylhydrazine	0.23	U	81.9	64.9		ug/L		79	55 - 120

Surrogate	MS %Recovery	MS Qualifier	Limits
2-Fluorobiphenyl (Surr)	73		48 - 130
2-Fluorophenol (Surr)	74		41 - 130
2,4,6-Tribromophenol (Surr)	66		42 - 130
Nitrobenzene-d5 (Surr)	96		42 - 130
Phenol-d5 (Surr)	81		45 - 130
Terphenyl-d14 (Surr)	60		20 - 130

**Lab Sample ID: 280-104668-1 MSD**  
**Matrix: Water**  
**Analysis Batch: 400548**

**Client Sample ID: B3H0D9**  
**Prep Type: Total/NA**  
**Prep Batch: 399102**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	Limits	RPD	Limit
1,2-Diphenylhydrazine	0.23	U	81.6	55.0		ug/L		67	55 - 120	17	30

Surrogate	MSD %Recovery	MSD Qualifier	Limits
2-Fluorobiphenyl (Surr)	62		48 - 130
2-Fluorophenol (Surr)	64		41 - 130
2,4,6-Tribromophenol (Surr)	55		42 - 130
Nitrobenzene-d5 (Surr)	70		42 - 130
Phenol-d5 (Surr)	65		45 - 130
Terphenyl-d14 (Surr)	40		20 - 130

**Method: 6010D - Metals (ICP)**

**Lab Sample ID: MB 280-400503/1-A**  
**Matrix: Water**  
**Analysis Batch: 400922**

**Client Sample ID: Method Blank**  
**Prep Type: Total/NA**  
**Prep Batch: 400503**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Calcium	34.5	U	200	34.5	ug/L		01/03/18 14:32	01/05/18 22:48	1
Potassium	483.5	B	3000	237	ug/L		01/03/18 14:32	01/05/18 22:48	1
Silicon	34.7	U	500	34.7	ug/L		01/03/18 14:32	01/05/18 22:48	1
Sodium	224.2	B	1000	117	ug/L		01/03/18 14:32	01/05/18 22:48	1

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**QC Sample Results**

Client: CH2M Hill Plateau Remediation Company  
Project/Site: FRC16-03

TestAmerica Job ID: 280-104668-1  
SDG: DN0288

**Method: 6010D - Metals (ICP) (Continued)**

**Lab Sample ID: LCS 280-400503/2-A**  
**Matrix: Water**  
**Analysis Batch: 400922**

**Client Sample ID: Lab Control Sample**  
**Prep Type: Total/NA**  
**Prep Batch: 400503**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	Limits
Calcium	50000	50940		ug/L		102	80 - 120
Potassium	50000	51230		ug/L		102	80 - 120
Silicon	10000	10440		ug/L		104	80 - 120
Sodium	50000	53730		ug/L		107	80 - 120

**Lab Sample ID: 280-104668-1 MS**  
**Matrix: Water**  
**Analysis Batch: 400922**

**Client Sample ID: B3H0D9**  
**Prep Type: Total/NA**  
**Prep Batch: 400503**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	Limits
Calcium	317000		50000	368900	X	ug/L		104	75 - 125
Potassium	20800		50000	73910		ug/L		106	75 - 125
Silicon	21400		10000	30570		ug/L		91	75 - 125
Sodium	202000		50000	254700	X	ug/L		106	75 - 125

**Lab Sample ID: 280-104668-1 MSD**  
**Matrix: Water**  
**Analysis Batch: 400922**

**Client Sample ID: B3H0D9**  
**Prep Type: Total/NA**  
**Prep Batch: 400503**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	Limits	RPD	Limit
Calcium	317000		50000	366800	X	ug/L		99	75 - 125	1	20
Potassium	20800		50000	73970		ug/L		106	75 - 125	0	20
Silicon	21400		10000	30080		ug/L		86	75 - 125	2	20
Sodium	202000		50000	251800	X	ug/L		100	75 - 125	1	20

**Method: 6020B - Metals (ICP/MS)**

**Lab Sample ID: MB 280-400504/1-A**  
**Matrix: Water**  
**Analysis Batch: 400713**

**Client Sample ID: Method Blank**  
**Prep Type: Total/NA**  
**Prep Batch: 400504**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	0.33	U	5.0	0.33	ug/L		01/03/18 14:32	01/04/18 03:19	1
Barium	0.29	U	1.0	0.29	ug/L		01/03/18 14:32	01/04/18 03:19	1
Beryllium	0.080	U	1.0	0.080	ug/L		01/03/18 14:32	01/04/18 03:19	1
Chromium	0.50	U	2.0	0.50	ug/L		01/03/18 14:32	01/04/18 03:19	1
Lead	0.18	U	1.0	0.18	ug/L		01/03/18 14:32	01/04/18 03:19	1
Thallium	0.050	U	1.0	0.050	ug/L		01/03/18 14:32	01/04/18 03:19	1
Tin	0.77	U	10.0	0.77	ug/L		01/03/18 14:32	01/04/18 03:19	1
Uranium	0.050	U	1.0	0.050	ug/L		01/03/18 14:32	01/04/18 03:19	1
Vanadium	0.50	U	5.0	0.50	ug/L		01/03/18 14:32	01/04/18 03:19	1
Zinc	2.0	U	10.0	2.0	ug/L		01/03/18 14:32	01/04/18 03:19	1
Tungsten	0.20	U	5.0	0.20	ug/L		01/03/18 14:32	01/04/18 03:19	1

TestAmerica Denver

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**QC Sample Results**

Client: CH2M Hill Plateau Remediation Company  
 Project/Site: FRC16-03

TestAmerica Job ID: 280-104668-1  
 SDG: DN0288

**Method: 6020B - Metals (ICP/MS) (Continued)**

Lab Sample ID: MB 280-400504/1-A  
 Matrix: Water  
 Analysis Batch: 400821

Client Sample ID: Method Blank  
 Prep Type: Total/NA  
 Prep Batch: 400504

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Selenium	0.70	U	5.0	0.70	ug/L		01/03/18 14:32	01/04/18 15:16	1

Lab Sample ID: LCS 280-400504/2-A  
 Matrix: Water  
 Analysis Batch: 400713

Client Sample ID: Lab Control Sample  
 Prep Type: Total/NA  
 Prep Batch: 400504

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	Limits
Arsenic	40.0	37.73		ug/L		94	80 - 120
Barium	40.0	40.83		ug/L		102	80 - 120
Beryllium	40.0	39.38		ug/L		98	80 - 120
Chromium	40.0	41.41		ug/L		104	80 - 120
Lead	40.0	40.98		ug/L		102	80 - 120
Thallium	40.0	41.23		ug/L		103	80 - 120
Tin	40.0	39.49		ug/L		99	80 - 120
Uranium	40.0	39.90		ug/L		100	80 - 120
Vanadium	40.0	40.03		ug/L		100	80 - 120
Zinc	40.0	42.25		ug/L		106	80 - 120
Tungsten	40.0	40.19		ug/L		100	80 - 120

Lab Sample ID: LCS 280-400504/2-A  
 Matrix: Water  
 Analysis Batch: 400821

Client Sample ID: Lab Control Sample  
 Prep Type: Total/NA  
 Prep Batch: 400504

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	Limits
Selenium	40.0	39.41		ug/L		99	80 - 120

Lab Sample ID: 280-104668-1 MS  
 Matrix: Water  
 Analysis Batch: 400713

Client Sample ID: B3H0D9  
 Prep Type: Total/NA  
 Prep Batch: 400504

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	Limits
Arsenic	4.8	B	40.0	44.65		ug/L		100	75 - 125
Barium	74.3		40.0	114.7		ug/L		101	75 - 125
Beryllium	0.080	U	40.0	41.35		ug/L		103	75 - 125
Chromium	160		40.0	204.7	X	ug/L		112	75 - 125
Lead	0.18	U	40.0	40.04		ug/L		100	75 - 125
Thallium	0.050	U	40.0	40.27		ug/L		101	75 - 125
Tin	0.77	U	40.0	39.76		ug/L		99	75 - 125
Uranium	1030		40.0	1094	X	ug/L		161	75 - 125
Vanadium	13.0		40.0	54.67		ug/L		104	75 - 125
Zinc	2.0	U	40.0	44.84		ug/L		112	75 - 125
Tungsten	0.32	B	40.0	40.96		ug/L		102	75 - 125

Lab Sample ID: 280-104668-1 MS  
 Matrix: Water  
 Analysis Batch: 400821

Client Sample ID: B3H0D9  
 Prep Type: Total/NA  
 Prep Batch: 400504

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	Limits
Selenium	1.6	B	40.0	39.59		ug/L		95	75 - 125

TestAmerica Denver

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**QC Sample Results**

Client: CH2M Hill Plateau Remediation Company  
 Project/Site: FRC16-03

TestAmerica Job ID: 280-104668-1  
 SDG: DN0288

**Lab Sample ID: 280-104668-1 MSD**  
**Matrix: Water**  
**Analysis Batch: 400713**

**Client Sample ID: B3H0D9**  
**Prep Type: Total/NA**  
**Prep Batch: 400504**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Arsenic	4.8	B	40.0	43.45		ug/L		97	75 - 125	3	20
Barium	74.3		40.0	117.0		ug/L		107	75 - 125	2	20
Beryllium	0.080	U	40.0	43.21		ug/L		108	75 - 125	4	20
Chromium	160		40.0	201.9	X	ug/L		104	75 - 125	1	20
Lead	0.18	U	40.0	39.15		ug/L		98	75 - 125	2	20
Thallium	0.050	U	40.0	39.53		ug/L		99	75 - 125	2	20
Tin	0.77	U	40.0	39.56		ug/L		99	75 - 125	1	20
Uranium	1030		40.0	1063	X	ug/L		85	75 - 125	3	20
Vanadium	13.0		40.0	54.58		ug/L		104	75 - 125	0	20
Zinc	2.0	U	40.0	39.27		ug/L		98	75 - 125	13	20
Tungsten	0.32	B	40.0	41.30		ug/L		102	75 - 125	1	30

**Lab Sample ID: 280-104668-1 MSD**  
**Matrix: Water**  
**Analysis Batch: 400821**

**Client Sample ID: B3H0D9**  
**Prep Type: Total/NA**  
**Prep Batch: 400504**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Selenium	1.6	B	40.0	38.73		ug/L		93	75 - 125	2	20

**Method: 350.1 - Nitrogen, Ammonia**

**Lab Sample ID: MB 280-400784/20**  
**Matrix: Water**  
**Analysis Batch: 400784**

**Client Sample ID: Method Blank**  
**Prep Type: Total/NA**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ammonia as N	22.0	U	100	22.0	ug/L			01/04/18 12:01	1

**Lab Sample ID: LCS 280-400784/18**  
**Matrix: Water**  
**Analysis Batch: 400784**

**Client Sample ID: Lab Control Sample**  
**Prep Type: Total/NA**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Ammonia as N	2500	2348		ug/L		94	80 - 120

**Lab Sample ID: LCSD 280-400784/19**  
**Matrix: Water**  
**Analysis Batch: 400784**

**Client Sample ID: Lab Control Sample Dup**  
**Prep Type: Total/NA**

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Ammonia as N	2500	2348		ug/L		94	80 - 120	0	20

**Lab Sample ID: 280-104668-1 DU**  
**Matrix: Water**  
**Analysis Batch: 400784**

**Client Sample ID: B3H0D9**  
**Prep Type: Total/NA**

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Ammonia as N	22.0	U	22.0	U	ug/L		NC	10

TestAmerica Denver

Date: 25 April 2018  
 To: CH2M Hill (technical representative)  
 From: Analytical Quality Associates, Inc.  
 Project: ERDF Leachate  
 Subject: General Chemistry - Sample Data Groups (SDGs) DN0288 and WC2611

## **INTRODUCTION**

This memorandum presents the results of data validation for SDGs DN0288 and WC2611 prepared by TestAmerica Laboratories. A list of samples validated along with the analytical methods is provided in the following table.

<b>Sample ID</b>	<b>Sample Date</b>	<b>Media</b>	<b>Validation Level</b>	<b>Analytical Methods</b>
B3H0D9	12/12/17	Water	C	EPA350.1, EPA353.2, EPA410.4, SW9020B, SW9040C, SW9050A, SM2320B, SM2540C, SM2540D,
B3H0F3	12/12/17	Water	C	EPA350.1, EPA353.2, EPA410.4, SW9020B, SW9040C, SW9050A, SM2320B, SM2540C, SM2540D
B3H0D7	12/12/17	Water	C	SW7196A
B3H0F1	12/12/17	Water	C	SW7196A

Data validation was conducted in accordance with the CHPRC validation statement of work and the Environmental Restoration Disposal Facility Leachate Sampling and Analysis Plan, WCH-173, Rev. 2 (SAP). Appendices 1 through 4 provide the following information as indicated below:

- Appendix 1. Glossary of Data Reporting Qualifiers
- Appendix 2. Summary of Data Qualification
- Appendix 3. Data Validation Supporting Documentation
- Appendix 4. Additional Documentation Requested by Client

## **DATA QUALITY OBJECTIVES**

### **• Holding Times and Sample Preservation**

Holding times are calculated from Chain-of-Custody forms to determine the validity of the results. The holding time requirements are as follows:

- Ammonia, nitrate/nitrite, chemical oxygen demand (COD), specific conductance, TOX – analysis within 28 days of sample collection.
- Hexavalent chromium – analysis within 24 hours of sample collection

- pH – analysis as soon as possible after sample collection
- Alkalinity – analysis within 14 days of sample collection
- Total dissolved solids, total suspended solids – analysis within 7 days of sample collection

Sample preservation for the above analyses requires chilling to <6 degrees Celsius. In addition, ammonia, nitrate/nitrite, COD and TOX are brought to pH<2 with sulfuric acid,

The samples were analyzed within the prescribed holding times and properly preserved with the following exceptions.

For SDG WC2611, the temperature for samples B3H0D7 and B3H0F1 upon receipt at the laboratory was >6 degrees Celsius. The samples were received within seven hours of sample collection; therefore data should not be qualified as a result.

For SDG DN0288, the pH analysis for samples B3H0D9 and B3H0F3 were performed 27 days after sample collection. Based on professional judgment the pH, sample results should be qualified as estimates and flagged “J.”

- **Blanks**

The blank data results are reviewed to assess the extent of contamination introduced through sampling, sample preparation, and analysis.

**Laboratory Blanks**

All laboratory blank results were acceptable with the following exception.

For DN0288, the alkalinity laboratory blank results were > the method detection limit (MDL) but < the reporting limit (RL). The alkalinity results for samples B3H0D9 and B3H0F3 were detects >20X the blank values and should not be qualified as a result.

**Trip Blanks**

No trip blanks were submitted for validation.

**Field Blanks**

No field blanks were submitted for validation.

**Equipment Blanks**

No equipment blanks were submitted for validation.

- **Accuracy**

Accuracy is evaluated by reviewing matrix spike sample results and laboratory control sample results. According to the SAP, the matrix spike sample accuracy limits are 75% to 125% and the laboratory control sample accuracy limits are 80% to 120% as specified by the DV procedure.

**Matrix Spike/Matrix Spike Duplicate (MS/MSD) Samples**

All MS/MSD recoveries were acceptable with the following exceptions.

For SDG DN0288, MS analyses were not performed for ammonia and TOX. The TOX results for samples B3H0D9 and B3H0F3 were detects and based on professional judgment data should be qualified as estimates and flagged “J” due to lack of matrix-specific accuracy data.

According to the case narrative, the MS/MSD analyses for ammonia were performed on a non-client sample and the MS and MSD recoveries were within the acceptance limit; therefore, data should not be qualified as a result.

**Laboratory Control Samples/Laboratory Control Sample Duplicate (LCS/LCSD)**

All LCS/LCSD recoveries were acceptable.

- **Precision**

Precision is evaluated by reviewing MS/MSD results, LCS/LCSD results, laboratory duplicate sample results, field duplicate sample results and field split sample results. These QC results provide information on the laboratory reproducibility and whether sampling activities are adequate to acquire consistent sample results. According to the SAP, the relative percent difference (RPD) limits are  $\leq 20\%$  as specified by the DV procedure.

**MS/MSD Samples**

All MS/MSD RPD values were acceptable.

**Laboratory Duplicate Samples**

The laboratory duplicate results were acceptable.

For SDG DN0288, a laboratory duplicate sample was not analyzed with TOX. The TOX results for samples B3H0D9 and B3H0F3 were detects and should be qualified as estimates and flagged “J” due to lack of precision data.

**LCS/LCSD Samples**

All LCS/LCSD RPD values were acceptable.

### **Field Duplicate Samples**

All field duplicate results were acceptable.

### **Field Split Samples**

No field splits were submitted for validation.

- **Detection Limits**

Reported MDLs are compared against the contractually required detection limits (CRDLs) to ensure that laboratory detection limits meet the required criteria.

All reported sample MDLs were below the CRDLs with the exception of TOX.

- **Completeness**

SDGs DN0288 and WC2611 were submitted for validation and verified for completeness. Completeness is based on the percentage of data determined to be valid (i.e., not rejected). The completion percentage was 100%.

### **MAJOR DEFICIENCIES**

None found.

### **MINOR DEFICIENCIES**

Minor deficiencies leading to qualification of pH and TOX sample results as estimates were due to holding time infractions, lack of matrix-specific accuracy data and lack of precision data. See the table in Appendix 2 for a listing of all affected sample results.

### **REFERENCES**

GRP-GD-003, Rev. 2, Change 0, *Data Validation for Chemical Analyses*, October 2016.

WCH-173, Rev. 2, *Environmental Restoration Disposal Facility Leachate Sampling and Analysis Plan*, November 2015.

## **Appendix 1**

### **Glossary of Data Reporting Qualifiers**

Qualifiers that may be applied by data validators in compliance with the CHPRC statement of work are as follows:

- **U** — The constituent was analyzed for, but was not detected. The data should be considered usable for decision-making purposes.
- **UJ** — The constituent was analyzed for and was not detected. Due to a quality control deficiency identified during data validation the value reported may not accurately reflect the RL. The data should be considered usable for decision-making purposes.
- **J** — Indicates the constituent was analyzed for and detected. The associated value is estimated due to a quality control deficiency identified during data validation. The data should be considered usable for decision-making purposes.
- **J+** — Indicates the constituent was analyzed for and detected. The associated value is estimated with a suspected positive bias due to a quality control deficiency identified during data validation. The data should be considered usable for decision-making purposes.
- **J-** — Indicates the constituent was analyzed for and detected. The associated value is estimated with a suspected negative bias due to a quality control deficiency identified during data validation. The data should be considered usable for decision-making purposes.
- **N** — The analysis indicates the presence of an analyte that has been tentatively identified.
- **NJ** — The analysis indicates the presence of an analyte that has been tentatively identified and the associated numerical value represents its approximate concentration.
- **NJ+** — The analysis indicates the presence of an analyte that has been tentatively identified. The associated value is estimated with a suspected positive bias due to a quality control deficiency identified during data validation.
- **NJ-** — The analysis indicates the presence of an analyte that has been tentatively identified. The associated value is estimated with a suspected negative bias due to a quality control deficiency identified during data validation.
- **UR** — Indicates the constituent was analyzed for and not detected; however, due to an identified quality control deficiency the data should be considered unusable for decision-making purposes.
- **R** — Indicates the constituent was analyzed for and detected; however, due to an identified quality control deficiency the data should be considered unusable for decision-making purposes.

**Appendix 2**  
**Summary of Data Qualification**

<b>General Chemistry Data Qualification Summary</b>			
SDG: DN0288, WC2611	Reviewer: AQA	Project: ERDF Leachate	Page 1 of 1
<b>Analyte(s)</b>	<b>Qualifier</b>	<b>Samples Affected</b>	<b>Reason</b>
pH	J	B3H0D9, B3H0F3	Analysis beyond 2X holding time.
TOX	J	B3H0D9, B3H0F3	Lack of matrix-specific accuracy and precision data

Comments: None

## **Appendix 3**

### **Data Validation Supporting Documentation**

**Data Validation for Chemical Analyses**

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

**Appendix A - (Cont.) Chemical Data Validation Checklist**

VALIDATION LEVEL:	A	B	<b>C</b>	D	E
PROJECT: ERDF Leachate			DATA PACKAGE: VSR18-008		
VALIDATOR: Eyda Hergenreder		LAB: TestAmerica		DATE: 03/28/18	
			SDG: DN0288, WC2611		
ANALYSES PERFORMED					
Anions/IC	TOC	TOX X	TPH-418.1	Oil and Grease	Alkalinity X
Ammonia X	<del>BOD</del> /COD X	Chloride	Chromium-VI X	pH X	NO <sub>3</sub> /NO <sub>2</sub> X
Sulfate	TDS X	TKN	Phosphate	Specific Cond X	TSS X
SAMPLES/MATRIX Water					
SDG DN0288: B3H0D9, B3H0F3					
SDG WC2611: B3H0D7, B3H0F1					

**1. DATA PACKAGE COMPLETENESS AND CASE NARRATIVE**

Technical verification documentation present?	<b>Yes</b> No N/A
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Comments:

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## Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

### Appendix A - (Cont.) Chemical Data Validation Checklist

#### 2. INSTRUMENT PERFORMANCE AND CALIBRATIONS (Levels D and E)

Initial calibrations performed on all instruments?	Yes No <input checked="" type="radio"/> N/A
Initial calibrations acceptable?	Yes No <input checked="" type="radio"/> N/A
ICV and CCV checks performed on all instruments?	Yes No <input checked="" type="radio"/> N/A
ICV and CCV checks acceptable?	Yes No <input checked="" type="radio"/> N/A
Standards traceable?	Yes No <input checked="" type="radio"/> N/A
Standards expired?	Yes No <input checked="" type="radio"/> N/A
Calculation check acceptable?	Yes No <input checked="" type="radio"/> N/A

Comments:

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#### 3. BLANKS (Levels B, C, D, and E)

ICB and CCB checks performed for all applicable analyses? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
ICB and CCB results acceptable? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
Laboratory blanks analyzed?	<input checked="" type="radio"/> Yes No N/A
Laboratory blank results acceptable?	Yes <input checked="" type="radio"/> No N/A
Field blanks analyzed? (Levels C, D, E)	Yes <input checked="" type="radio"/> No N/A
Field blank results acceptable? (Levels C, D, E)	Yes No <input checked="" type="radio"/> N/A
Transcription/calculation errors? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A

Comments:

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SDG DN0288: alkalinity 2070 ug/L and 3260 ug/L

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## Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

### Appendix A - (Cont.) Chemical Data Validation Checklist

#### 5. PRECISION (Levels C, D, and E)

Duplicate RPD values acceptable?	<input checked="" type="radio"/> Yes No N/A
Duplicate results acceptable?	<input checked="" type="radio"/> Yes No N/A
MS/MSD standards NIST traceable? (Levels D, E)	Yes No <input type="radio"/> N/A
MS/MSD standards expired? (Levels D, E)	Yes No <input type="radio"/> N/A
LCS/LCSD duplicates run due to insufficient sample material?	<input checked="" type="radio"/> Yes No N/A
Field duplicate RPD values acceptable?	<input checked="" type="radio"/> Yes No N/A
Field split RPD values acceptable?	Yes No <input type="radio"/> N/A
Transcription/calculation errors? (Levels D, E)	Yes No <input type="radio"/> N/A

Comments:

SDG DN0288 - Duplicate for TOX was not available.

#### 6. HOLDING TIMES (all levels)

Samples properly preserved?	Yes <input type="radio"/> No <input checked="" type="radio"/> N/A
Sample holding times acceptable?	Yes <input type="radio"/> No <input checked="" type="radio"/> N/A

Comments:

DN0288 - pH analyzed 27 days after collection

SDG WC2611 - sample temperatures were 7.8 degree C.



## **Appendix 4**

### **Additional Documentation Requested By Client**

Page 74 of 101  
**QC Sample Results**

Client: CH2M Hill Plateau Remediation Company  
 Project/Site: FRC16-03

TestAmerica Job ID: 280-104668-1  
 SDG: DN0288

**Lab Sample ID: 280-104668-1 MSD**  
**Matrix: Water**  
**Analysis Batch: 400713**

**Client Sample ID: B3H0D9**  
**Prep Type: Total/NA**  
**Prep Batch: 400504**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Arsenic	4.8	B	40.0	43.45		ug/L		97	75 - 125	3	20
Barium	74.3		40.0	117.0		ug/L		107	75 - 125	2	20
Beryllium	0.080	U	40.0	43.21		ug/L		108	75 - 125	4	20
Chromium	160		40.0	201.9	X	ug/L		104	75 - 125	1	20
Lead	0.18	U	40.0	39.15		ug/L		98	75 - 125	2	20
Thallium	0.050	U	40.0	39.53		ug/L		99	75 - 125	2	20
Tin	0.77	U	40.0	39.56		ug/L		99	75 - 125	1	20
Uranium	1030		40.0	1063	X	ug/L		85	75 - 125	3	20
Vanadium	13.0		40.0	54.58		ug/L		104	75 - 125	0	20
Zinc	2.0	U	40.0	39.27		ug/L		98	75 - 125	13	20
Tungsten	0.32	B	40.0	41.30		ug/L		102	75 - 125	1	30

**Lab Sample ID: 280-104668-1 MSD**  
**Matrix: Water**  
**Analysis Batch: 400821**

**Client Sample ID: B3H0D9**  
**Prep Type: Total/NA**  
**Prep Batch: 400504**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Selenium	1.6	B	40.0	38.73		ug/L		93	75 - 125	2	20

**Method: 350.1 - Nitrogen, Ammonia**

**Lab Sample ID: MB 280-400784/20**  
**Matrix: Water**  
**Analysis Batch: 400784**

**Client Sample ID: Method Blank**  
**Prep Type: Total/NA**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ammonia as N	22.0	U	100	22.0	ug/L			01/04/18 12:01	1

**Lab Sample ID: LCS 280-400784/18**  
**Matrix: Water**  
**Analysis Batch: 400784**

**Client Sample ID: Lab Control Sample**  
**Prep Type: Total/NA**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Ammonia as N	2500	2348		ug/L		94	80 - 120

**Lab Sample ID: LCSD 280-400784/19**  
**Matrix: Water**  
**Analysis Batch: 400784**

**Client Sample ID: Lab Control Sample Dup**  
**Prep Type: Total/NA**

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Ammonia as N	2500	2348		ug/L		94	80 - 120	0	20

**Lab Sample ID: 280-104668-1 DU**  
**Matrix: Water**  
**Analysis Batch: 400784**

**Client Sample ID: B3H0D9**  
**Prep Type: Total/NA**

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Ammonia as N	22.0	U	22.0	U	ug/L		NC	10

TestAmerica Denver

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**QC Sample Results**

Client: CH2M Hill Plateau Remediation Company  
 Project/Site: FRC16-03

TestAmerica Job ID: 280-104668-1  
 SDG: DN0288

**Method: 353.2 - Nitrogen, Nitrate-Nitrite**

Lab Sample ID: MB 280-400281/22  
 Matrix: Water  
 Analysis Batch: 400281

Client Sample ID: Method Blank  
 Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Nitrate Nitrite as N	19.0	U	100	19.0	ug/L			12/28/17 18:07	1

Lab Sample ID: LCS 280-400281/21  
 Matrix: Water  
 Analysis Batch: 400281

Client Sample ID: Lab Control Sample  
 Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Nitrate Nitrite as N	5000	4896		ug/L		98	80 - 120

Lab Sample ID: 280-104668-1 MS  
 Matrix: Water  
 Analysis Batch: 400281

Client Sample ID: B3H0D9  
 Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Nitrate Nitrite as N	62200		200000	261500		ug/L		100	75 - 125

Lab Sample ID: 280-104668-1 MSD  
 Matrix: Water  
 Analysis Batch: 400281

Client Sample ID: B3H0D9  
 Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Nitrate Nitrite as N	62200		200000	260300		ug/L		99	75 - 125	0	20

Lab Sample ID: 280-104668-1 DU  
 Matrix: Water  
 Analysis Batch: 400281

Client Sample ID: B3H0D9  
 Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Nitrate Nitrite as N	62200		62420		ug/L		0.4	20

**Method: 410.4 - COD**

Lab Sample ID: MB 280-401030/5  
 Matrix: Water  
 Analysis Batch: 401030

Client Sample ID: Method Blank  
 Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chemical Oxygen Demand	4060	U	20000	4060	ug/L			01/08/18 09:57	1

Lab Sample ID: LCS 280-401030/3  
 Matrix: Water  
 Analysis Batch: 401030

Client Sample ID: Lab Control Sample  
 Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Chemical Oxygen Demand	100000	99140		ug/L		99	80 - 120

TestAmerica Denver

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**QC Sample Results**

Client: CH2M Hill Plateau Remediation Company  
 Project/Site: FRC16-03

TestAmerica Job ID: 280-104668-1  
 SDG: DN0288

**Method: 410.4 - COD (Continued)**

Lab Sample ID: LCSD 280-401030/4  
 Matrix: Water  
 Analysis Batch: 401030

Client Sample ID: Lab Control Sample Dup  
 Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Chemical Oxygen Demand	100000	99470		ug/L		99	80 - 120	0	20

Lab Sample ID: 280-104668-1 MS  
 Matrix: Water  
 Analysis Batch: 401030

Client Sample ID: B3H0D9  
 Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Chemical Oxygen Demand	28300		50000	77660		ug/L		99	75 - 125		

Lab Sample ID: 280-104668-1 MSD  
 Matrix: Water  
 Analysis Batch: 401030

Client Sample ID: B3H0D9  
 Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Chemical Oxygen Demand	28300		50000	76990		ug/L		97	75 - 125	1	20

**Method: 9020B - Organic Halides, Total (TOX)**

Lab Sample ID: MB 280-399517/2  
 Matrix: Water  
 Analysis Batch: 399517

Client Sample ID: Method Blank  
 Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Organic Halogens - Dup	7.7	U	30.0	7.7	ug/L			12/20/17 06:29	1

Lab Sample ID: LCS 280-399517/4  
 Matrix: Water  
 Analysis Batch: 399517

Client Sample ID: Lab Control Sample  
 Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Total Organic Halogens - Dup	100	98.48		ug/L		98	80 - 120		

**Method: 9040C - pH**

Lab Sample ID: LCS 280-401104/4  
 Matrix: Water  
 Analysis Batch: 401104

Client Sample ID: Lab Control Sample  
 Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
pH	7.00	7.010		SU		100	99 - 101		

Lab Sample ID: 280-104668-1 DU  
 Matrix: Water  
 Analysis Batch: 401104

Client Sample ID: B3H0D9  
 Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
pH	8.02		8.020		SU		0	5

TestAmerica Denver

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**QC Sample Results**

Client: CH2M Hill Plateau Remediation Company  
 Project/Site: FRC16-03

TestAmerica Job ID: 280-104668-1  
 SDG: DN0288

**Method: 9050A - Specific Conductance**

Lab Sample ID: MB 280-398825/5  
 Matrix: Water  
 Analysis Batch: 398825

Client Sample ID: Method Blank  
 Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Specific Conductance	2.00	U	2.00	2.00	umhos/cm			12/14/17 20:36	1

Lab Sample ID: LCS 280-398825/3  
 Matrix: Water  
 Analysis Batch: 398825

Client Sample ID: Lab Control Sample  
 Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Specific Conductance	1410	1379		umhos/cm		98	90 - 110

Lab Sample ID: LCSD 280-398825/4  
 Matrix: Water  
 Analysis Batch: 398825

Client Sample ID: Lab Control Sample Dup  
 Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Specific Conductance	1410	1384		umhos/cm		98	90 - 110	0	10

Lab Sample ID: 280-104668-1 DU  
 Matrix: Water  
 Analysis Batch: 398825

Client Sample ID: B3H0D9  
 Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Specific Conductance	2860		2886		umhos/cm		0.8	10

**Method: SM 2320B - Alkalinity**

Lab Sample ID: MB 280-399485/31  
 Matrix: Water  
 Analysis Batch: 399485

Client Sample ID: Method Blank  
 Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Alkalinity as CaCO3	2070	B	5000	1070	ug/L			12/20/17 19:16	1

Lab Sample ID: MB 280-399485/5  
 Matrix: Water  
 Analysis Batch: 399485

Client Sample ID: Method Blank  
 Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Alkalinity as CaCO3	3260	B	5000	1070	ug/L			12/20/17 15:14	1

Lab Sample ID: LCS 280-399485/30  
 Matrix: Water  
 Analysis Batch: 399485

Client Sample ID: Lab Control Sample  
 Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Alkalinity as CaCO3	200000	188900		ug/L		94	80 - 120

TestAmerica Denver

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**QC Sample Results**

Client: CH2M Hill Plateau Remediation Company  
 Project/Site: FRC16-03

TestAmerica Job ID: 280-104668-1  
 SDG: DN0288

**Method: SM 2320B - Alkalinity (Continued)**

Lab Sample ID: LCS 280-399485/4  
 Matrix: Water  
 Analysis Batch: 399485

Client Sample ID: Lab Control Sample  
 Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Alkalinity as CaCO3	200000	189200		ug/L		95	80 - 120

Lab Sample ID: 280-104668-1 DU  
 Matrix: Water  
 Analysis Batch: 399485

Client Sample ID: B3H0D9  
 Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Alkalinity as CaCO3	261000		262200		ug/L		0.4	20

**Method: SM 2540C - Solids, Total Dissolved (TDS)**

Lab Sample ID: MB 280-398897/1  
 Matrix: Water  
 Analysis Batch: 398897

Client Sample ID: Method Blank  
 Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids	4700	U	10000	4700	ug/L			12/15/17 12:28	1

Lab Sample ID: LCS 280-398897/2  
 Matrix: Water  
 Analysis Batch: 398897

Client Sample ID: Lab Control Sample  
 Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Total Dissolved Solids	500000	492000		ug/L		98	80 - 120

Lab Sample ID: 280-104668-1 DU  
 Matrix: Water  
 Analysis Batch: 398897

Client Sample ID: B3H0D9  
 Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Total Dissolved Solids	2170000		2136000		ug/L		2	20

**Method: SM 2540D - Solids, Total Suspended (TSS)**

Lab Sample ID: MB 280-399137/2  
 Matrix: Water  
 Analysis Batch: 399137

Client Sample ID: Method Blank  
 Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Total Suspended Solids	1100	U	4000	1100	ug/L			12/18/17 18:40	1

Lab Sample ID: LCS 280-399137/1  
 Matrix: Water  
 Analysis Batch: 399137

Client Sample ID: Lab Control Sample  
 Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Total Suspended Solids	100000	102800		ug/L		103	80 - 120

TestAmerica Denver

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**QC Sample Results**

Client: CH2M Hill Plateau Remediation Company  
 Project/Site: FRC16-03

TestAmerica Job ID: 280-104668-1  
 SDG: DN0288

**Method: SM 2540D - Solids, Total Suspended (TSS) (Continued)**

**Lab Sample ID: 280-104668-1 DU**  
**Matrix: Water**  
**Analysis Batch: 399137**

**Client Sample ID: B3H0D9**  
**Prep Type: Total/NA**

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Total Suspended Solids	1200	B	1200	B	ug/L		0	20

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11

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**QC Sample Results**

Client: CH2M Hill Plateau Remediation Company  
Project/Site: FRC16-03

TestAmerica Job ID: 300-6568-1  
SDG: WC2611

**Method: 7196A - Chromium, Hexavalent**

**Lab Sample ID: MB 300-9944/3**  
**Matrix: Water**  
**Analysis Batch: 9944**

**Client Sample ID: Method Blank**  
**Prep Type: Total/NA**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cr (VI)	0.0015	U	0.0040	0.0015	mg/L	-		12/12/17 17:25	1

**Lab Sample ID: LCS 300-9944/4**  
**Matrix: Water**  
**Analysis Batch: 9944**

**Client Sample ID: Lab Control Sample**  
**Prep Type: Total/NA**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Cr (VI)	0.250	0.259		mg/L	-	104	80 - 120

**Lab Sample ID: 300-6568-1 MS**  
**Matrix: Water**  
**Analysis Batch: 9944**

**Client Sample ID: B3H0D7**  
**Prep Type: Total/NA**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Cr (VI)	0.18		0.0501	0.228		mg/L	-	100	75 - 125

**Lab Sample ID: 300-6568-1 DU**  
**Matrix: Water**  
**Analysis Batch: 9944**

**Client Sample ID: B3H0D7**  
**Prep Type: Total/NA**

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Cr (VI)	0.18		0.180		mg/L	-	1	20

Date: 28 March 2018  
 To: CH2M Hill (technical representative)  
 From: Analytical Quality Associates, Inc.  
 Project: ERDF Leachate  
 Subject: Radiochemical - Sample Data Group (SDG) GEL439971

## **INTRODUCTION**

This memorandum presents the results of data validation for SDG GEL439971 prepared by GEL Laboratories, LLC. A list of samples validated along with the analytical methods is provided in the following table.

<b>Sample ID</b>	<b>Sample Date</b>	<b>Media</b>	<b>Validation Level</b>	<b>Analytical Methods</b>
B3H0D8	12/12/17	Water	C	Total-Sr, Alpha, Beta, Total Alpha Radium, Gamma, I-129, Tritium, Tc-99, C-14
B3H0F2	12/12/17	Water	C	Total-Sr, Alpha, Beta, Total Alpha Radium, Gamma, I-129, Tritium, Tc-99, C-14

Data validation was conducted in accordance with the CHPRC validation statement of work and the Environmental Restoration Disposal Facility Leachate Sampling and Analysis Plan, WCH-173, Rev. 2 (SAP). Appendices 1 through 4 provide the following information as indicated below:

- Appendix 1. Glossary of Data Reporting Qualifiers
- Appendix 2. Summary of Data Qualification
- Appendix 3. Data Validation Supporting Documentation
- Appendix 4. Additional Documentation Requested by Client

## **DATA QUALITY OBJECTIVES**

- **Holding Times and Sample Preservation**

Holding times are calculated from Chain-of-Custody forms to determine the validity of the results. The maximum holding time for radiochemical analysis is 180 days. Sample preservation for water samples for all analyses except tritium, C-14 and I-129 requires acid preservation with nitric acid to pH <2.

The samples were analyzed within the prescribed holding time and properly preserved.

- **Blanks**

The blank data results are reviewed to assess the extent of contamination introduced through sampling, sample preparation, and analysis.

### **Laboratory Blanks**

All laboratory blank results were acceptable.

### **Trip Blanks**

No trip blanks were submitted for validation.

### **Field Blanks**

No field blanks were submitted for validation.

### **Equipment Blanks**

No equipment blanks were submitted for validation.

- **Accuracy**

Accuracy is evaluated by reviewing matrix spike sample results, laboratory control sample results, and chemical recovery factors. Chemical recovery factors are determined through use of a carrier or tracer and provide assessment of the chemical separation process that is affected by the laboratory procedure, sample matrix, and/or interference. Chemical recovery factors are used to correct sample concentration, uncertainty, and MDC results. According to the SAP, the laboratory control sample accuracy limits are 80% to 120% and the matrix spike sample accuracy limits are 75% to 125% as specified by the DV procedure.

### **Matrix Spike (MS) Samples**

All MS recoveries were acceptable.

### **Laboratory Control Samples (LCSs)**

All LCS recoveries were acceptable.

### **Carrier/Tracer Recovery Factors**

All carrier/tracer recovery factors were acceptable.

- **Precision**

Precision is evaluated by reviewing laboratory duplicate, field duplicate, and field split sample results. These QC results provide information on the laboratory reproducibility and whether sampling activities are adequate to acquire consistent sample results. According to the SAP, the relative percent difference (RPD) limits are  $\leq 20\%$  as specified on the DV procedure. When

duplicate RPDs exceed the limits and have associated results <5X the MDCs the precision limits are ones specified by the DV procedure.

### **Laboratory Duplicate Samples**

All laboratory duplicate results were acceptable.

### **Field Duplicate Samples**

All field duplicate results were acceptable with the following exceptions. Primary sample B3H0F2 and replicate sample B3H0D8 had a Tc-99 relative percent difference (RPD) of 26%. The C-14 result for sample B3H0F2 was 41 pCi/L and the result for sample B3H0D8 was < the MDC. The primary sample MDC was 28.3 pCi/L. No sample data were qualified as a result per data validation procedure guidance.

### **Field Split Samples**

No field splits were submitted for validation.

- **Detection Limits**

Reported MDCs are compared against the contractually required detection limits (CRDLs) to ensure that laboratory detection limits meet the required criteria.

The MDCs for alpha, beta, Am-241, tritium and Tc-99 for sample B3H0D8, and alpha, beta, tritium and Tc-99 for sample B3H0F2 were > the CRDLs.

- **Completeness**

SDG GEL439971 was submitted for validation and verified for completeness. Completeness is based on the percentage of data determined to be valid (i.e., not rejected). The completion percentage was 100%.

### **MAJOR DEFICIENCIES**

None found.

### **MINOR DEFICIENCIES**

None found.

### **REFERENCES**

GRP-GD-002, Rev. 2, Change 0, *Data Validation for Radiochemical Analyses*, September 2016.

WCH-173, Rev. 2, *Environmental Restoration Disposal Facility Leachate Sampling and Analysis Plan*, November 2015.

## **Appendix 1**

### **Glossary of Data Reporting Qualifiers**

Qualifiers that may be applied by data validators in compliance with the CHPRC statement of work are as follows:

- **U** — The constituent was analyzed for and was not detected. The data should be considered usable for decision-making purposes.
- **UJ** — The constituent was analyzed for and was not detected. Due to a quality control deficiency identified during data validation the value reported may not accurately reflect the MDC. The data should be considered usable for decision-making purposes.
- **J** — Indicates the constituent was analyzed for and detected. The associated value is estimated due to a quality control deficiency identified during data validation. The data should be considered usable for decision-making purposes.
- **J+** — Indicates the constituent was analyzed for and detected. The associated value is estimated with a suspected positive bias due to a quality control deficiency identified during data validation. The data should be considered usable for decision-making purposes.
- **J-** — Indicates the constituent was analyzed for and detected. The associated value is estimated with a suspected negative bias due to a quality control deficiency identified during data validation. The data should be considered usable for decision-making purposes.
- **UR** — Indicates the constituent was analyzed for and not detected; however, due to an identified quality control deficiency the data should be considered unusable for decision-making purposes.
- **R** — Indicates the constituent was analyzed for and detected; however, due to an identified quality control deficiency the data should be considered unusable for decision-making purposes.

**Appendix 2**  
**Summary of Data Qualification**

<b>Radiochemical Data Qualification Summary</b>			
SDG: GEL439971	Reviewer: AQA	Project: ERDF Leachate	Page 1 of 1
<b>Analyte(s)</b>	<b>Qualifier</b>	<b>Samples Affected</b>	<b>Reason</b>
Radiochemical	None	N/A	N/A

Comments: None

## **Appendix 3**

### **Data Validation Supporting Documentation**

## Data Validation for Radiochemical Analyses

Published Date: 09/13/16

SGRP-GD-SMP-50116

Effective Date: 09/13/16

## Appendix B - Radiochemical Data Validation Checklist

Validation Level:	A	B	Ⓒ	D	E
Project: ERDF Leachate			Data Package: VSR18-008		
Validator: Eyda Hergenreder		Lab: GEL		Date: 03/28/18	
			SDG: GEL439971		
Analyses Performed					
<input checked="" type="checkbox"/> Gross Alpha/Beta	<input checked="" type="checkbox"/> Strontium-90	<input checked="" type="checkbox"/> Technetium-99	<input type="checkbox"/> Alpha Spectroscopy	<input checked="" type="checkbox"/> Gamma Spectroscopy	<input checked="" type="checkbox"/> Tritium
<input type="checkbox"/> Total Uranium	<input type="checkbox"/> Radium-22	<input checked="" type="checkbox"/> I-129	<input checked="" type="checkbox"/> T-alpha Radium	<input checked="" type="checkbox"/> C14	
Samples/Matrix Water					
SDG GEL439971 - B3H0D8, B3H0F2					

1. Completeness and Case Narrative	<input type="checkbox"/> N/A
Technical verification forms present?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A

**Comments:**


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2. Initial Calibration (Levels D, E)	<input checked="" type="checkbox"/> N/A
Instruments/detectors calibrated?	Yes No <input checked="" type="checkbox"/> N/A
Initial calibration acceptable?	Yes No <input checked="" type="checkbox"/> N/A
Standards NIST traceable?	Yes No <input checked="" type="checkbox"/> N/A
Standards expired?	Yes No <input checked="" type="checkbox"/> N/A
Calculation check acceptable?	Yes No <input checked="" type="checkbox"/> N/A

**Comments:**


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Data Validation for Radiochemical Analyses

Published Date: 09/13/16

SGRP-GD-SMP-50116

Effective Date: 09/13/16

Appendix B - (Cont.) Radiochemical Data Validation Checklist

3. Continuing Calibration (Levels D, E)	<input checked="" type="checkbox"/> N/A
Calibration checked within required frequency?	Yes No <input type="radio"/> N/A
Calibration check acceptable?	Yes No <input type="radio"/> N/A
Calibration check standards traceable?	Yes No <input type="radio"/> N/A
Calibration check standards expired?	Yes No <input type="radio"/> N/A
Calculation check acceptable?	Yes No <input type="radio"/> N/A
<b>Comments:</b>	

4. Background Counts (Levels D, E)	<input checked="" type="checkbox"/> N/A
Background counts checked within required frequency?	Yes No <input type="radio"/> N/A
Background counts acceptable?	Yes No <input type="radio"/> N/A
Calculation check acceptable?	Yes No <input type="radio"/> N/A
<b>Comments:</b>	

## Data Validation for Radiochemical Analyses

Published Date: 09/13/16

SGRP-GD-SMP-50116

Effective Date: 09/13/16

## Appendix B - (Cont.) Radiochemical Data Validation Checklist

5. Blanks (Levels B, C, D, E)	<input type="checkbox"/> N/A
Method blank analyzed within required frequency?	<input checked="" type="radio"/> Yes No N/A
Method blank results acceptable?	<input checked="" type="radio"/> Yes No N/A
Analytes detected in method blank?	Yes <input checked="" type="radio"/> No N/A
Field blank(s) analyzed?	Yes <input checked="" type="radio"/> No N/A
Field blank results acceptable?	Yes No <input checked="" type="radio"/> N/A
Analytes detected in field blank(s)?	Yes No <input checked="" type="radio"/> N/A
Transcription/Calculation Errors? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A

**Comments:**


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6. Laboratory Control Samples or Blank Spike Samples (Levels C, D, E)	<input type="checkbox"/> N/A
LCS /BSS analyzed within required frequency?	<input checked="" type="radio"/> Yes No N/A
LCS/BSS recoveries acceptable?	<input checked="" type="radio"/> Yes No N/A
LCS/BSS traceable? (Levels D,E)	Yes No <input checked="" type="radio"/> N/A
LCS/BSS expired? (Levels D,E)	Yes No <input checked="" type="radio"/> N/A
LCS/BSS levels correct? (Levels D,E)	Yes No <input checked="" type="radio"/> N/A
Transcription/Calculation errors? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A

**Comments:**


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Data Validation for Radiochemical Analyses

Published Date: 09/13/16

SGRP-GD-SMP-50116

Effective Date: 09/13/16

Appendix B - (Cont.) Radiochemical Data Validation Checklist

7. Chemical Carrier Recovery (Levels C, D, E)	<input type="checkbox"/> N/A
Chemical carrier added?	<input checked="" type="radio"/> Yes No N/A
Chemical recovery acceptable?	<input checked="" type="radio"/> Yes No N/A
Chemical carrier traceable? (Levels D, E )	Yes No <input checked="" type="radio"/> N/A
Chemical carrier expired? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
Transcription/Calculation errors? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A

Comments:

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8. Tracer Recovery (Levels C, D, E )	<input type="checkbox"/> N/A
Tracer added?	<input checked="" type="radio"/> Yes No N/A
Tracer recovery acceptable?	<input checked="" type="radio"/> Yes No N/A
Tracer traceable? (Levels D, E )	Yes No <input checked="" type="radio"/> N/A
Tracer expired? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
Transcription/Calculation errors? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A

Comments:

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Data Validation for Radiochemical Analyses

Published Date: 09/13/16

SGRP-GD-SMP-50116

Effective Date: 09/13/16

Appendix B - (Cont.) Radiochemical Data Validation Checklist

9. Matrix Spikes (Levels C, D, E)	<input type="checkbox"/> N/A
Matrix spike analyzed?	<input checked="" type="radio"/> Yes No N/A
Spike recoveries acceptable?	<input checked="" type="radio"/> Yes No N/A
Spike source traceable? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
Spike source expired? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
Transcription/Calculation errors? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A

Comments:

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10. Duplicates (Levels C, D, E)	<input type="checkbox"/> N/A
Duplicates analyzed at required frequency?	<input checked="" type="radio"/> Yes No N/A
RPD values acceptable?	<input checked="" type="radio"/> Yes No N/A
Transcription/Calculation errors? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A

Comments:

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## Data Validation for Radiochemical Analyses

Published Date: 09/13/16

SGRP-GD-SMP-50116

Effective Date: 09/13/16

## Appendix B - (Cont.) Radiochemical Data Validation Checklist

11. Field QC Samples (Levels C, D, E)	<input type="checkbox"/> N/A
Field duplicate sample(s) analyzed?	<input checked="" type="radio"/> Yes No N/A
Field duplicate RPD values acceptable?	Yes <input checked="" type="radio"/> No N/A
Field split sample(s) analyzed?	Yes No <input checked="" type="radio"/> N/A
Field split RPD values acceptable?	Yes No <input checked="" type="radio"/> N/A
Performance audit sample(s) analyzed?	Yes No <input checked="" type="radio"/> N/A
Performance audit sample results acceptable?	Yes No <input checked="" type="radio"/> N/A

**Comments:**

SDG GEL439971 - Primary sample B3H0F2/replicate sample B3H0D8 Tc-99 292 pCi/L/225 pCi/L (26%);  
C-14 41 pCi/L/Non-detect (MDC 28.3 pCi/L)

12. Holding Times (All levels)	<input type="checkbox"/> N/A
Are sample holding times acceptable?	<input checked="" type="radio"/> Yes No N/A

**Comments:**

13. Results and MDCs (All Levels )	<input type="checkbox"/> N/A
Results reported for all required sample analyses?	<input checked="" type="radio"/> Yes No N/A
Results supported in raw data?(Levels D, E)	Yes No <input checked="" type="radio"/> N/A
Results acceptable? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
MDC's meet required reporting limits?	Yes <input checked="" type="radio"/> No N/A
Transcription/Calculation errors? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A

**Comments:**

MDCs > CRDL

Sample B3H0D8 - alpha, beta, Am-241, tritium, Tc-99

Sample B3H0F2 - alpha, beta, tritium, Tc-99

## **Appendix 4**

### **Additional Documentation Requested By Client**

# GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

## QC Summary

Report Date: January 4, 2018  
Page 1 of 5

Client : CH2MHill Plateau Remediation Company  
MSIN R3-50 CHPRC  
PO Box 1600  
Richland, Washington 99352  
Contact: Mr. Scot Fitzgerald  
Workorder: 439971

Parmname	NOM	Sample	Qual	QC	Units	QC Criteria	Range	Analyst	Date Time
<b>Rad Gamma Spec</b>									
Batch	1726219								
QC1203938562	MB								
Americium-241			U	4.79	pCi/L			BSW1	12/14/1708:51
				Uncert: +/-19.5					
				TPU: +/-19.6					
Cesium-137			U	0.699	pCi/L				
				Uncert: +/-3.78					
				TPU: +/-3.80					
Cobalt-60			U	-2.04	pCi/L				
				Uncert: +/-3.94					
				TPU: +/-4.05					
Europium-152			U	-3.33	pCi/L				
				Uncert: +/-8.91					
				TPU: +/-9.04					
Europium-154			U	-5.31	pCi/L				
				Uncert: +/-10.0					
				TPU: +/-10.3					
Europium-155			U	0.766	pCi/L				
				Uncert: +/-10.5					
				TPU: +/-10.5					
QC1203938563	439971001	DUP							
Americium-241		U	1.40	U	-5.03	pCi/L			12/14/1711:33
				Uncert: +/-35.7		RPD: 0	N/A		
				TPU: +/-35.7		RER: 0.284	(0-2)		
Cesium-137		U	4.46	U	0.0815	pCi/L			
				Uncert: +/-12.3		RPD: 0	N/A		
				TPU: +/-12.3		RER: 0.652	(0-2)		
Cobalt-60		U	-0.122	U	2.78	pCi/L			
				Uncert: +/-5.82		RPD: 0	N/A		
				TPU: +/-5.82		RER: 0.82	(0-2)		
Europium-152		U	-3.15	U	-2.33	pCi/L			
				Uncert: +/-11.9		RPD: 0	N/A		
				TPU: +/-12.0		RER: 0.0826	(0-2)		
Europium-154		U	-15.4	U	2.51	pCi/L			
				Uncert: +/-19.4		RPD: 0	N/A		
				TPU: +/-20.6		RER: 1.49	(0-2)		
Europium-155		U	6.99	U	4.75	pCi/L			
				Uncert: +/-14.6		RPD: 0	N/A		
				TPU: +/-15.0		RER: 0.21	(0-2)		
QC1203938564	LCS								
Americium-241	1.10E+05			1.13E+05	pCi/L	REC: 103	(80%-120%)		12/14/1709:32
				Uncert: +/-1740					
				TPU: +/-9100					
Cesium-137	41600			44000	pCi/L	REC: 106	(80%-120%)		
				Uncert: +/-766					
				TPU: +/-3980					

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## QC Summary

Workorder: 439971

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Parmname	NOM	Sample	Qual	QC	Units	QC Criteria	Range	Analyst	Date Time
<b>Rad Gamma Spec</b>									
Batch	1726219								
Cobalt-60	35700			37500	pCi/L	REC: 105	(80%-120%)		
	Uncert:			+/-816					
	TPU:			+/-3480					
Europium-152			U	-132	pCi/L				
	Uncert:			+/-328					
	TPU:			+/-334					
Europium-154			U	-103	pCi/L				
	Uncert:			+/-211					
	TPU:			+/-216					
Europium-155			U	-252	pCi/L				
	Uncert:			+/-326					
	TPU:			+/-346					
Batch	1726223								
QC1203938576	MB								
Iodine-129			U	0.274	pCi/L			BSW1	12/21/1711:35
	Uncert:			+/-0.312					
	TPU:			+/-0.337					
QC1203938577	439971001	DUP							
Iodine-129		U	-0.0162	U	0.0989				12/21/1711:36
	Uncert:		+/-0.438		+/-0.451	RPD: 0	N/A		
	TPU:		+/-0.438		+/-0.453	RER: 0.358	(0-2)		
QC1203938578	439971001	MS							
Iodine-129		U	-0.0162		37.7	REC: 109	(75%-125%)		12/21/1711:36
	Uncert:		+/-0.438		+/-4.92				
	TPU:		+/-0.438		+/-6.20				
QC1203938579	LCS								
Iodine-129			34.7		36.4	REC: 105	(80%-120%)		12/21/1711:37
	Uncert:				+/-3.37				
	TPU:				+/-4.94				
<b>Rad Gas Flow</b>									
Batch	1726116								
QC1203938245	MB								
Total Strontium			U	-3.14	pCi/L			LXB3	12/20/1714:52
	Uncert:			+/-0.660					
	TPU:			+/-0.660					
**Strontium Carrier			7.85		8.00	REC: 102	(40%-110%)		
QC1203938246	439819001	DUP							
Total Strontium		U	0.00115	U	-0.191				12/21/1708:00
	Uncert:		+/-0.658		+/-0.480	RPD: 0	N/A		
	TPU:		+/-0.658		+/-0.480	RER: 0.463	(0-2)		
**Strontium Carrier			7.85	8.00	8.20	REC: 104	(40%-110%)		
QC1203938247	LCS								
Total Strontium			78.8		69.0	REC: 88	(80%-120%)		12/20/1716:54
	Uncert:				+/-3.86				
	TPU:				+/-16.4				
**Strontium Carrier			7.85		7.90	REC: 101	(40%-110%)		
Batch	1727033								
QC1203940557	MB								
Alpha			U	-0.195	pCi/L			BXG2	12/19/1717:39

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## QC Summary

Workorder: 439971

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Parmname	NOM	Sample	Qual	QC	Units	QC Criteria	Range	Analyst	Date Time
<b>Rad Gas Flow</b>									
Batch	1727033								
Beta			U	0.0271	pCi/L				
				Uncert: +/-0.456					
				TPU: +/-0.456					
				Uncert: +/-0.865					
				TPU: +/-0.865					
QC1203940558	439971001	DUP							
Alpha		366		436	pCi/L				
				Uncert: +/-15.6		RPD: 17	(0%-20%)		
				TPU: +/-62.3		RER: 1.38	(0-2)		
Beta		372		389	pCi/L				
				Uncert: +/-8.42		RPD: 4	(0%-20%)		
				TPU: +/-61.5		RER: 0.36	(0-2)		
QC1203940559	439971001	MS							
Alpha	2420	366		2460	pCi/L	REC: 87	(75%-125%)		12/19/1717:40
				Uncert: +/-15.6					
				TPU: +/-62.3					
Beta	9460	372		10000	pCi/L	REC: 102	(75%-125%)		
				Uncert: +/-8.42					
				TPU: +/-61.5					
QC1203940560	439971001	MSD							
Alpha	2420	366		2520	pCi/L	REC: 89	(75%-125%)		
				Uncert: +/-15.6		RPD: 2	(0%-20%)		
				TPU: +/-62.3		RER: 0.154	(0-2)		
Beta	9460	372		10200	pCi/L	REC: 104	(75%-125%)		
				Uncert: +/-8.42		RPD: 2	(0%-20%)		
				TPU: +/-61.5		RER: 0.125	(0-2)		
QC1203940561	LCS								
Alpha	80.6			92.9	pCi/L	REC: 115	(80%-120%)		
				Uncert: +/-8.44					
				TPU: +/-18.0					
Beta	315			327	pCi/L	REC: 104	(80%-120%)		
				Uncert: +/-11.1					
				TPU: +/-56.5					
Batch	1727112								
QC1203940715	MB								
Total Alpha Radium			U	0.252	pCi/L			JXC9	12/28/1713:36
				Uncert: +/-0.508					
				TPU: +/-0.510					
**Barium Carrier	26.5			26.6	mg	REC: 100	(40%-110%)		
QC1203940716	439971002	DUP							
Total Alpha Radium		U	0.651	U	0.789	pCi/L			12/28/1713:35
				Uncert: +/-0.624		RPD: 0	N/A		
				TPU: +/-0.638		RER: 0.286	(0-2)		
**Barium Carrier	26.5	25.7		25.8	mg	REC: 97	(40%-110%)		
QC1203940717	LCS								
Total Alpha Radium	555			497	pCi/L	REC: 90	(80%-120%)		12/29/1709:16
				Uncert: +/-11.3					
				TPU: +/-85.9					
**Barium Carrier	26.5			26.3	mg	REC: 99	(40%-110%)		
<b>Rad Liquid Scintillation</b>									

# GEL LABORATORIES LLC

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## QC Summary

Workorder: 439971

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Parmname	NOM	Sample	Qual	QC	Units	QC Criteria	Range	Analyst	Date Time
<b>Rad Liquid Scintillation</b>									
Batch	1726188								
QC1203938435	MB								
Tritium			U	-363	pCi/L			BXM4	12/16/1722:46
				Uncert: +/-202					
				TPU: +/-202					
QC1203938436	439822002	DUP							
Tritium		U	55.2	U	132				12/19/1717:22
				Uncert: +/-167		RPD: 0	N/A		
				TPU: +/-167		RER: 0.627	(0-2)		
QC1203938437	439822002	MS							
Tritium	4360	U	55.2		3430	REC: 79	(75%-125%)		12/17/1700:30
				Uncert: +/-167					
				TPU: +/-167					
QC1203938438	LCS								
Tritium	2180				1760	REC: 81	(80%-120%)		12/18/1707:51
				Uncert: +/-260					
				TPU: +/-428					
Batch	1726476								
QC1203939209	MB								
Technetium-99			U	19.8	pCi/L			CXS7	12/26/1714:53
				Uncert: +/-25.3					
				TPU: +/-25.4					
**Technetium-99m Tracer	5.33E+05				4.21E+05	REC: 79	(30%-105%)		
QC1203939210	439816001	DUP							
Technetium-99		U	5.88	U	14.4				12/26/1715:15
				Uncert: +/-19.4		RPD: 0	N/A		
				TPU: +/-19.4		RER: 0.566	(0-2)		
**Technetium-99m Tracer	5.33E+05	5.25E+05			4.74E+05	REC: 89	(30%-105%)		
QC1203939211	LCS								
Technetium-99	888				785	REC: 88	(80%-120%)		12/26/1715:37
				Uncert: +/-41.1					
				TPU: +/-96.0					
**Technetium-99m Tracer	5.33E+05				5.02E+05	REC: 94	(30%-105%)		
Batch	1726510								
QC1203939294	MB								
Carbon-14			U	-10.2	pCi/L			BXM4	12/21/1717:25
				Uncert: +/-15.4					
				TPU: +/-15.4					
QC1203939295	440085001	DUP							
Carbon-14			1170		1190				12/21/1717:42
				Uncert: +/-47.0		RPD: 1	(0%-20%)		
				TPU: +/-223		RER: 0.0874	(0-2)		
QC1203939296	440085001	MS							
Carbon-14	3680		1170		4300	REC: 85	(75%-125%)		12/21/1717:58
				Uncert: +/-47.0					
				TPU: +/-223					
QC1203939297	LCS								
Carbon-14	745				737	REC: 99	(80%-120%)		12/21/1718:14
				Uncert: +/-38.4					
				TPU: +/-142					

Notes:

**QC Summary**

**Workorder: 439971**

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<b>Parname</b>	<b>NOM</b>	<b>Sample</b>	<b>Qual</b>	<b>QC</b>	<b>Units</b>	<b>QC Criteria</b>	<b>Range</b>	<b>Analyst</b>	<b>Date</b>	<b>Time</b>
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TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

The Qualifiers in this report are defined as follows:

- B The analyte was detected in the associated method blank >= MDC or >5% sample activity.
- D Results are reported from a diluted aliquot of sample.
- N Spike Sample recovery is outside control limits.
- U Analyzed for but not detected above limiting criteria. Includes MDL, MDA, PQL, zero, counting error, and total analytical error.
- UX Gamma Spectroscopy--Uncertain identification
- X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Y Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Z Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more or %RPD not applicable.

\*\* Indicates analyte is a surrogate compound.

^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.

For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.