

CHPRC - REVIEW COMMENT RECORD (RCR)

1. Date 7/2/2018

2. Review No.

3. Project No.

Page 1 of 1

<p>5. Document Number(s)/Title(s) VSR18-011</p>	<p>6. Program/Project/Building Number</p>	<p>7. Reviewer Jadie Kaas</p>	<p>8. Organization/Group SGRP QA</p>	<p>9. Location/Phone MO2216 / 376-2949</p>
11. CLOSED				
<p>17. Comment Submittal Approval</p> <p style="text-align: center;"><i>Jadie Kaas</i></p> <p><u>7/2/2018</u> <u>Jadie Kaas</u> Date Organization Manager (optional) (print and sign)</p>	<p>10. Agreement With Indicated Comment Disposition(s)</p> <p style="text-align: center;">_____ Reviewer/Point of Contact (print and sign)</p> <p style="text-align: center;">_____ Date</p> <p style="text-align: center;">_____ Author/Organizer (print and sign)</p>	<p>14. Reviewer Concurrence Required (Y or N)</p>	<p>15. Disposition (provide justification if NOT accepted)</p>	<p>16. Status</p>
<p>12. Item</p> <p>1 No issues noted</p>	<p>13a. Comments</p>	<p>13b. Basis</p>	<p>13c. Recommendation</p>	<p>closed</p>



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Data Validation Report for CH2M Hill Plateau Remediation Company

VSR18-011
Project CERC18, RCRA18, SURV18

Chemical and Radiochemical Validation - Level C

Validation Performed By: *Eyda Hergenreder* Date: 06-18-2018
Eyda Hergenreder

Technical Review By: *Ellen McEntee* Date: 06-19-2018
Ellen McEntee

Quality Review By: *Mary A. Donovan* Date: 07-05-2018
Mary Donovan
Quality Assurance Manager

TABLE OF CONTENTS

Metals

Memorandum	3
Appendix 1 – Glossary of Data Reporting Qualifiers	7
Appendix 2 – Summary of Data Qualification	9
Appendix 3 – Data Validation Supporting Documentation	11
Appendix 4 – Additional Documentation Requested By Client	18

General Chemistry

Memorandum	38
Appendix 1 – Glossary of Data Reporting Qualifiers	43
Appendix 2 – Summary of Data Qualification	45
Appendix 3 – Data Validation Supporting Documentation	47
Appendix 4 – Additional Documentation Requested By Client	53

Radiochemistry

Memorandum	63
Appendix 1 – Glossary of Data Reporting Qualifiers	67
Appendix 2 – Summary of Data Qualification	69
Appendix 3 – Data Validation Supporting Documentation	71
Appendix 4 – Additional Documentation Requested By Client	78

Date: 03 July 2018
 To: CH2M Hill (technical representative)
 From: Analytical Quality Associates, Inc.
 Project: CERC18, RCRA18, SURV18
 Subject: Inorganics - Sample Data Groups (SDGs) DN0333, GEL445432 and SL2817

INTRODUCTION

This memorandum presents the results of data validation for SDGs DN0333 and SL2817 prepared by TestAmerica Laboratories, Inc and SDG GEL445432 prepared by GEL Laboratories LLC. A list of samples validated along with the analytical methods is provided in the following table.

Sample ID	Sample Date	Media	Validation Level	Analytical Methods
B3HDR9	03/07/18	Water	C	6010D & 6020B
B3HLV1	03/07/18	Water	C	6010D & 6020B
B3HDR8	03/07/18	Water	C	6010D & 6020B
B3HLV0	03/07/18	Water	C	6010D & 6020B
B3HDP5	03/07/18	Water	C	6010D & 6020B
B3HLT0	03/07/18	Water	C	6010D & 6020B
B3HDR0	03/07/18	Water	C	6010D & 6020B
B3HDP6	03/07/18	Water	C	6010D & 6020B
B3HDR1	03/07/18	Water	C	6010D & 6020B
B3HDP7	03/07/18	Water	C	6010D & 6020B
B3HLR7	03/07/18	Water	C	6010C & 6020A
B3HDP2	03/07/18	Water	C	6010C & 6020A

Data validation was conducted in accordance with the CHPRC validation statement of work and the Groundwater Protection Plan for the Environmental Restoration Disposal Facility, WCH-198, Rev. 1 (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 DN0333, the Mg, Ca, K, Sr, Tl and Mn laboratory blank results were detects > the method detection limits (MDLs) but \leq the PQLs. All associated K sample results, Tl results for samples B3HDR9, B3HDR8 and B3HLV0 and Mn results for samples B3HLV1, B3HLV0 and B3HLT0 were detects <20X the blank values and should be qualified as estimates and flagged "J+." All other associated Tl and Mn sample results and all associated Mg, Ca and Sr sample results were either detects >20X the blank values or non-detects and should not be qualified as a result.

For SDG GEL445432, the Mo and Sn laboratory blank results were detects > the MDLs but \leq the PQLs. All associated Mo and Sn sample results were either detects > 20X the blank values or non-detects and should not be qualified as a result.

Trip Blanks

All trip blank results were acceptable with the following exceptions.

For SDG GEL445432, Zn was detected in trip blank B3HDP6, and K and Zn were detected in trip blank B3HDR0.

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 ICP-AES interference check sample results. According to the SAP, the matrix spike sample and the laboratory control sample accuracy limits are 80% to 120%. The limits for reported analytes not listed in the SAP are specified by the DV procedure. The interference check sample limits are ones specified by the DV procedure.

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

All MS/MSD recoveries were acceptable.

For SDG DN0333, the parent sample result for Sr was > the 4x the spike concentration. Data should not be qualified as a result.

For SDG SL2817, the parent sample result for Ca was >4X the spike concentration. Data should not be qualified as a result.

For SDG GEL445432, the MS recovery for Zn was < the lower acceptance limit but $\geq 30\%$; in addition the post-digestion spike was within the acceptance limit. The Zn result for sample B3HDR1 was a non-detect and should be qualified as an estimate and flagged "UJ." All other associated sample results were detects and should be qualified as estimates and flagged "J." See the table in Appendix 2 for a listing of all affected sample results.

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, 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 $\pm 20\%$. The limits for reported analytes not listed in the SAP are specified by 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.

- **Completeness**

SDGs DN0333, GEL445432 and SL2817 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 deficiency leading to qualification of K, Tl and Mn sample results were due to laboratory blank infractions and for Zn due to low matrix spike recovery. 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-198, Rev. 1, *Groundwater Protection Plan for the Environmental Restoration Disposal Facility*, March 2016.

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

Inorganic Data Qualification Summary			
SDGs: DN0333, GEL445432 and SL2817	Reviewer: AQA	Project: CERC18, RCRA18, SURV18	Page 1 of 1
Analyte(s)	Qualifier	Samples Affected	Reason
K	J+	B3HDR9, B3HLV1, B3HDR8, B3HLV0, B3HDP5, B3HLT0	Laboratory blank contamination
Tl	J+	B3HDR9, B3HDR8, B3HLV0	Laboratory blank contamination
Mn	J+	B3HLV1, B3HLV0, B3HLT0	Laboratory blank contamination
Zn	UJ	B3HDR1	Low matrix spike recovery
Zn	J	B3HDR0, B3HDP6, B3HDP7	Low matrix spike recovery

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: CERC18, RCRA18, SURV18			DATA PACKAGE: VSR18-011		
VALIDATOR: Eyda Hergenreder		LAB: TestAmerica , GEL		DATE: 07/03/2018	
			SDG: DN0333, GEL445432, SL2817		
ANALYSES PERFORMED					
SW-846/ICP X	SW-846/GFAA	SW-846/Hg	SW-846 Cyanide	SW-846/ICPMS X	
SAMPLES/MATRIX Water					
DN0333 - B3HDR9, B3HLV1, B3HDR8, B3HLV0, B3HDP5, B3HLT0					
GEL445432 - B3HDR0, B3HDP6, B3HDR1, B3HDP7,					
SL2817 - B3HLR7, B3HDP2					

1. DATA PACKAGE COMPLETENESS AND CASE NARRATIVE

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

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:

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

Comments:

 DN0333 - MB Mg 18.99 ug/L; Ca 73.13 ug/L; K 560.8 ug/L; Sr 0.310 ug/L; TI 0.089 ug/L; Mn 0.417 ug/L

 GEL445432 - MB Mo 0.204 ug/L; Sn 1.36 ug/L

 Trip Blank sample B3HDP6 Zn 11.9 ug/L; Trip Blank sample B3HDR0 K 50.2ug/L; Zn 15.4 ug/L

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:

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:

Appendix 4

Additional Documentation Requested By Client

Page 1 of 2
QC Sample Results

Client: CH2M Hill Plateau Remediation Company
Project/Site: I18-007

TestAmerica Job ID: 280-107260-1
SDG: DN0333

Method: 6010D - Metals (ICP)

Lab Sample ID: MB 280-407758/1-A
Matrix: Water
Analysis Batch: 408303

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 407758

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Calcium	73.13	B	200	34.5	ug/L		03/15/18 08:26	03/17/18 04:01	1
Iron	22.0	U	100	22.0	ug/L		03/15/18 08:26	03/17/18 04:01	1
Magnesium	18.99	B	200	10.7	ug/L		03/15/18 08:26	03/17/18 04:01	1
Sodium	117	U	1000	117	ug/L		03/15/18 08:26	03/17/18 04:01	1
Vanadium	1.1	U	10.0	1.1	ug/L		03/15/18 08:26	03/17/18 04:01	1

Lab Sample ID: MB 280-407758/1-A
Matrix: Water
Analysis Batch: 408554

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 407758

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Boron	4.4	U	100	4.4	ug/L		03/15/18 08:26	03/21/18 01:39	1
Potassium	560.8	B	3000	237	ug/L		03/15/18 08:26	03/21/18 01:39	1

Lab Sample ID: LCS 280-407758/2-A
Matrix: Water
Analysis Batch: 408303

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 407758

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Calcium	50000	48860		ug/L		98	80 - 120
Iron	1000	977.7		ug/L		98	80 - 120
Magnesium	50000	49180		ug/L		98	80 - 120
Sodium	50000	52510		ug/L		105	80 - 120
Vanadium	500	497.8		ug/L		100	80 - 120

Lab Sample ID: LCS 280-407758/2-A
Matrix: Water
Analysis Batch: 408554

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 407758

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Boron	1000	1029		ug/L		103	80 - 120
Potassium	50000	49460		ug/L		99	80 - 120

Lab Sample ID: 280-107260-4 MS
Matrix: Water
Analysis Batch: 408303

Client Sample ID: B3HLV1
Prep Type: Total/NA
Prep Batch: 407758

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Calcium	63700		50000	110500		ug/L		94	75 - 125
Iron	25.7	B	1000	1002		ug/L		98	75 - 125
Magnesium	20600		50000	67530		ug/L		94	75 - 125
Sodium	19500		50000	71990		ug/L		105	75 - 125
Vanadium	23.1		500	502.6		ug/L		96	75 - 125

Page 2 of 2
QC Sample Results

Client: CH2M Hill Plateau Remediation Company
Project/Site: I18-007

TestAmerica Job ID: 280-107260-1
SDG: DN0333

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

Lab Sample ID: 280-107260-4 MS
Matrix: Water
Analysis Batch: 408554

Client Sample ID: B3HLV1
Prep Type: Total/NA
Prep Batch: 407758

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	Limits
Boron	16.7	B	1000	1078		ug/L		106	75 - 125
Potassium	5580	C	50000	58110		ug/L		105	75 - 125

Lab Sample ID: 280-107260-4 MSD
Matrix: Water
Analysis Batch: 408303

Client Sample ID: B3HLV1
Prep Type: Total/NA
Prep Batch: 407758

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	Limits	RPD	Limit
Calcium	63700		50000	116300		ug/L		105	75 - 125	5	20
Iron	25.7	B	1000	1052		ug/L		103	75 - 125	5	20
Magnesium	20600		50000	73030		ug/L		105	75 - 125	8	20
Sodium	19500		50000	76020		ug/L		113	75 - 125	5	20
Vanadium	23.1		500	543.7		ug/L		104	75 - 125	8	20

Lab Sample ID: 280-107260-4 MSD
Matrix: Water
Analysis Batch: 408554

Client Sample ID: B3HLV1
Prep Type: Total/NA
Prep Batch: 407758

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	Limits	RPD	Limit
Boron	16.7	B	1000	1033		ug/L		102	75 - 125	4	20
Potassium	5580	C	50000	55010		ug/L		99	75 - 125	5	20

Method: 6020B - Metals (ICP/MS)

Lab Sample ID: MB 280-407757/1-A
Matrix: Water
Analysis Batch: 408289

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 407757

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	0.40	U	2.0	0.40	ug/L		03/15/18 08:26	03/16/18 00:42	1
Arsenic	0.33	U	5.0	0.33	ug/L		03/15/18 08:26	03/16/18 00:42	1
Beryllium	0.080	U	1.0	0.080	ug/L		03/15/18 08:26	03/16/18 00:42	1
Cadmium	0.27	U	1.0	0.27	ug/L		03/15/18 08:26	03/16/18 00:42	1
Chromium	0.50	U	2.0	0.50	ug/L		03/15/18 08:26	03/16/18 00:42	1
Cobalt	0.054	U	1.0	0.054	ug/L		03/15/18 08:26	03/16/18 00:42	1
Copper	0.56	U	2.0	0.56	ug/L		03/15/18 08:26	03/16/18 00:42	1
Lead	0.18	U	1.0	0.18	ug/L		03/15/18 08:26	03/16/18 00:42	1
Molybdenum	0.14	U	2.0	0.14	ug/L		03/15/18 08:26	03/16/18 00:42	1
Nickel	0.30	U	2.0	0.30	ug/L		03/15/18 08:26	03/16/18 00:42	1
Selenium	0.70	U	5.0	0.70	ug/L		03/15/18 08:26	03/16/18 00:42	1
Silver	0.033	U	5.0	0.033	ug/L		03/15/18 08:26	03/16/18 00:42	1
Strontium	0.310	B	10.0	0.30	ug/L		03/15/18 08:26	03/16/18 00:42	1
Thallium	0.0890	B	1.0	0.050	ug/L		03/15/18 08:26	03/16/18 00:42	1
Thorium	1.2	U	5.0	1.2	ug/L		03/15/18 08:26	03/16/18 00:42	1
Tin	0.77	U	10.0	0.77	ug/L		03/15/18 08:26	03/16/18 00:42	1
Uranium	0.050	U	1.0	0.050	ug/L		03/15/18 08:26	03/16/18 00:42	1
Zinc	2.0	U	10.0	2.0	ug/L		03/15/18 08:26	03/16/18 00:42	1

TestAmerica Denver

Page 21 of 22
QC Sample Results

Client: CH2M Hill Plateau Remediation Company
 Project/Site: I18-007

TestAmerica Job ID: 280-107260-1
 SDG: DN0333

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

Lab Sample ID: MB 280-407757/1-A
Matrix: Water
Analysis Batch: 408407

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 407757

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	9.2	U	50.0	9.2	ug/L		03/15/18 08:26	03/19/18 15:36	1
Barium	0.29	U	1.0	0.29	ug/L		03/15/18 08:26	03/19/18 15:36	1
Manganese	0.417	B	1.0	0.31	ug/L		03/15/18 08:26	03/19/18 15:36	1

Lab Sample ID: LCS 280-407757/2-A
Matrix: Water
Analysis Batch: 408289

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 407757
%Rec.

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	Limits
Antimony	40.0	40.35		ug/L		101	80 - 120
Arsenic	40.0	38.76		ug/L		97	80 - 120
Beryllium	40.0	43.70		ug/L		109	80 - 120
Cadmium	40.0	42.50		ug/L		106	80 - 120
Chromium	40.0	38.26		ug/L		96	80 - 120
Cobalt	40.0	38.94		ug/L		97	80 - 120
Copper	40.0	40.47		ug/L		101	80 - 120
Lead	40.0	41.37		ug/L		103	80 - 120
Molybdenum	40.0	40.84		ug/L		102	80 - 120
Nickel	40.0	42.47		ug/L		106	80 - 120
Selenium	40.0	39.12		ug/L		98	80 - 120
Silver	40.0	40.13		ug/L		100	80 - 120
Strontium	40.0	43.98		ug/L		110	80 - 120
Thallium	40.0	40.87		ug/L		102	80 - 120
Thorium	40.0	41.10		ug/L		103	80 - 120
Tin	40.0	42.69		ug/L		107	80 - 120
Uranium	40.0	40.87		ug/L		102	80 - 120
Zinc	40.0	42.24		ug/L		106	80 - 120

Lab Sample ID: LCS 280-407757/2-A
Matrix: Water
Analysis Batch: 408407

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 407757
%Rec.

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	Limits
Aluminum	400	426.0		ug/L		107	80 - 120
Barium	40.0	41.13		ug/L		103	80 - 120
Manganese	40.0	40.05		ug/L		100	80 - 120

Lab Sample ID: 280-107260-4 MS
Matrix: Water
Analysis Batch: 408289

Client Sample ID: B3HLV1
Prep Type: Total/NA
Prep Batch: 407757
%Rec.

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	Limits
Antimony	0.40	U	40.0	39.73		ug/L		99	75 - 125
Arsenic	1.5	B	40.0	39.37		ug/L		95	75 - 125
Beryllium	0.080	U	40.0	45.81		ug/L		115	75 - 125
Cadmium	0.27	U	40.0	42.67		ug/L		107	75 - 125
Chromium	2.9		40.0	41.61		ug/L		97	75 - 125
Cobalt	0.12	B	40.0	39.64		ug/L		99	75 - 125
Copper	1.9	B	40.0	41.37		ug/L		99	75 - 125

TestAmerica Denver

Page 2 of 2
QC Sample Results

Client: CH2M Hill Plateau Remediation Company
Project/Site: I18-007

TestAmerica Job ID: 280-107260-1
SDG: DN0333

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

Lab Sample ID: 280-107260-4 MS
Matrix: Water
Analysis Batch: 408289

Client Sample ID: B3HLV1
Prep Type: Total/NA
Prep Batch: 407757
%Rec.

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	Limits
Lead	0.18	U	40.0	41.86		ug/L		105	75 - 125
Molybdenum	4.5		40.0	46.89		ug/L		106	75 - 125
Nickel	1.3	B	40.0	41.17		ug/L		100	75 - 125
Selenium	4.6	B	40.0	45.57		ug/L		102	75 - 125
Silver	0.033	U	40.0	40.02		ug/L		100	75 - 125
Strontium	329		40.0	377.3	X	ug/L		122	75 - 125
Thallium	0.050	U	40.0	41.70		ug/L		104	75 - 125
Thorium	1.2	U	40.0	42.01		ug/L		105	75 - 125
Tin	0.77	U	40.0	43.84		ug/L		110	75 - 125
Uranium	1.8		40.0	43.30		ug/L		104	75 - 125
Zinc	2.0	U	40.0	36.97		ug/L		92	75 - 125

Lab Sample ID: 280-107260-4 MS
Matrix: Water
Analysis Batch: 408407

Client Sample ID: B3HLV1
Prep Type: Total/NA
Prep Batch: 407757
%Rec.

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	Limits
Aluminum	12.2	B	400	443.0		ug/L		108	75 - 125
Barium	79.7		40.0	118.9		ug/L		98	75 - 125
Manganese	1.7	C	40.0	44.08		ug/L		106	75 - 125

Lab Sample ID: 280-107260-4 MSD
Matrix: Water
Analysis Batch: 408289

Client Sample ID: B3HLV1
Prep Type: Total/NA
Prep Batch: 407757
%Rec.

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	Limits	RPD	Limit
Antimony	0.40	U	40.0	41.09		ug/L		103	75 - 125	3	20
Arsenic	1.5	B	40.0	40.21		ug/L		97	75 - 125	2	20
Beryllium	0.080	U	40.0	43.89		ug/L		110	75 - 125	4	20
Cadmium	0.27	U	40.0	40.51		ug/L		101	75 - 125	5	20
Chromium	2.9		40.0	42.08		ug/L		98	75 - 125	1	20
Cobalt	0.12	B	40.0	38.13		ug/L		95	75 - 125	4	20
Copper	1.9	B	40.0	40.32		ug/L		96	75 - 125	3	20
Lead	0.18	U	40.0	41.32		ug/L		103	75 - 125	1	20
Molybdenum	4.5		40.0	47.69		ug/L		108	75 - 125	2	20
Nickel	1.3	B	40.0	40.23		ug/L		97	75 - 125	2	20
Selenium	4.6	B	40.0	45.22		ug/L		102	75 - 125	1	20
Silver	0.033	U	40.0	39.97		ug/L		100	75 - 125	0	20
Strontium	329		40.0	378.3	X	ug/L		124	75 - 125	0	20
Thallium	0.050	U	40.0	40.76		ug/L		102	75 - 125	2	20
Thorium	1.2	U	40.0	41.22		ug/L		103	75 - 125	2	20
Tin	0.77	U	40.0	40.80		ug/L		102	75 - 125	7	20
Uranium	1.8		40.0	43.40		ug/L		104	75 - 125	0	20
Zinc	2.0	U	40.0	43.31		ug/L		108	75 - 125	16	20

TestAmerica Denver

QC Sample Results

Client: CH2M Hill Plateau Remediation Company
 Project/Site: I18-007

TestAmerica Job ID: 280-107260-1
 SDG: DN0333

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

Lab Sample ID: 280-107260-4 MSD
 Matrix: Water
 Analysis Batch: 408407

Client Sample ID: B3HLV1
 Prep Type: Total/NA
 Prep Batch: 407757

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum	12.2	B	400	453.0		ug/L		110	75 - 125	2	20
Barium	79.7		40.0	124.6		ug/L		112	75 - 125	5	20
Manganese	1.7	C	40.0	40.67		ug/L		97	75 - 125	8	20

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

Lab Sample ID: MB 280-407978/2
 Matrix: Water
 Analysis Batch: 407978

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			03/14/18 10:05	1

Lab Sample ID: LCS 280-407978/4
 Matrix: Water
 Analysis Batch: 407978

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

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Total Organic Halogens - Dup	100	101.7		ug/L		102	80 - 120

Lab Sample ID: MB 280-409501/2
 Matrix: Water
 Analysis Batch: 409501

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			03/27/18 09:15	1

Lab Sample ID: LCS 280-409501/4
 Matrix: Water
 Analysis Batch: 409501

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

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Total Organic Halogens - Dup	100	103.7		ug/L		104	80 - 120

Lab Sample ID: LCSD 280-409501/5
 Matrix: Water
 Analysis Batch: 409501

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
Total Organic Halogens - Dup	100	105.4		ug/L		105	80 - 120	2	20

Lab Sample ID: 280-107260-4 MS
 Matrix: Water
 Analysis Batch: 409501

Client Sample ID: B3HLV1
 Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Total Organic Halogens - Dup	7.7	U	100	103.5		ug/L		104	75 - 125

TestAmerica Denver

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QC Summary

Report Date: April 4, 2018

Page 1 of 11

CH2M Hill Plateau Remediation Company

MSIN R3-50 CHPRC

PO Box 1600

Richland, Washington

Contact: Mr. Scot Fitzgerald

Workorder: 445432

Parmname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
Metals Analysis - ICPMS											
Batch	1745491										
QC1203986117	LCS										
Aluminum	2000			2060	ug/L		103	(80%-120%)	BAJ	03/19/18	17:26
Antimony	50.0			48.9	ug/L		97.7	(80%-120%)		03/19/18	21:13
Arsenic	50.0			51.3	ug/L		103	(80%-120%)		03/19/18	17:26
Barium	50.0			48.6	ug/L		97.2	(80%-120%)			
Beryllium	50.0			56.4	ug/L		113	(80%-120%)			
Cadmium	50.0			50.3	ug/L		101	(80%-120%)			
Chromium	50.0			50.0	ug/L		100	(80%-120%)			
Cobalt	50.0			49.4	ug/L		98.8	(80%-120%)			
Copper	50.0			51.1	ug/L		102	(80%-120%)			
Lead	50.0			49.2	ug/L		98.3	(80%-120%)			
Manganese	50.0			49.0	ug/L		98	(80%-120%)			
Molybdenum	50.0			51.6	ug/L		103	(80%-120%)			
Nickel	50.0			51.7	ug/L		103	(80%-120%)			

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QC Summary

Workorder: 445432

Page 2 of 11

Parmname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
Metals Analysis - ICPMS											
Batch	1745491										
Selenium	50.0			49.7	ug/L		99.4	(80%-120%)	BAJ	03/19/18	17:26
Silver	50.0			51.3	ug/L		103	(80%-120%)			
Strontium	50.0			50.2	ug/L		100	(80%-120%)			
Thallium	50.0			44.1	ug/L		88.3	(80%-120%)			
Thorium	50.0			45.3	ug/L		90.6	(80%-120%)			
Tin	50.0			50.9	ug/L		102	(80%-120%)			
Uranium	50.0			46.5	ug/L		93.1	(80%-120%)			
QC1203986116	MB										
Aluminum			U	19.3	ug/L					03/19/18	17:23
Antimony			U	1.00	ug/L					03/19/18	21:10
Arsenic			U	2.00	ug/L					03/19/18	17:23
Barium			U	0.670	ug/L						
Beryllium			U	0.200	ug/L						
Cadmium			U	0.300	ug/L						
Chromium			U	3.00	ug/L						
Cobalt			U	0.300	ug/L						

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QC Summary

Workorder: 445432

Page 3 of 11

Parmname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
Metals Analysis - ICPMS											
Batch	1745491										
Copper			U	0.300	ug/L				BAJ	03/19/18	17:23
Lead			U	0.500	ug/L						
Manganese			U	1.00	ug/L						
Molybdenum			B	0.204	ug/L						
Nickel			U	0.600	ug/L						
Selenium			U	2.00	ug/L						
Silver			U	0.300	ug/L						
Strontium			U	2.00	ug/L						
Thallium			U	0.600	ug/L						
Thorium			U	0.700	ug/L						
Tin			B	1.36	ug/L						
Uranium			U	0.067	ug/L						
QC1203986118 445432003 MS											
Aluminum	2000	U	19.3	1990	ug/L		99.3	(75%-125%)		03/19/18	17:33
Antimony	50.0	U	1.00	48.9	ug/L		97.2	(75%-125%)		03/19/18	21:20
Arsenic	50.0	U	2.00	52.5	ug/L		102	(75%-125%)		03/19/18	17:33

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QC Summary

Workorder: 445432

Page 4 of 11

Parmname	NOM		Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
Metals Analysis - ICPMS												
Batch	1745491											
Barium	50.0	U	0.670		49.1	ug/L		98.1	(75%-125%)	BAJ	03/19/18	17:33
Beryllium	50.0	U	0.200		56.5	ug/L		113	(75%-125%)			
Cadmium	50.0	U	0.300		50.0	ug/L		100	(75%-125%)			
Chromium	50.0	U	3.00		49.4	ug/L		96.8	(75%-125%)			
Cobalt	50.0	U	0.300		51.1	ug/L		102	(75%-125%)			
Copper	50.0	U	0.300		51.2	ug/L		102	(75%-125%)			
Lead	50.0	U	0.500		49.3	ug/L		98.5	(75%-125%)			
Manganese	50.0	U	1.00		49.6	ug/L		98.9	(75%-125%)			
Molybdenum	50.0	U	0.200		51.1	ug/L		102	(75%-125%)			
Nickel	50.0	U	0.600		52.1	ug/L		103	(75%-125%)			
Selenium	50.0	U	2.00		51.4	ug/L		103	(75%-125%)			
Silver	50.0	U	0.300		52.3	ug/L		105	(75%-125%)			
Strontium	50.0	U	2.00		49.1	ug/L		98.1	(75%-125%)			
Thallium	50.0	U	0.600		45.9	ug/L		91.7	(75%-125%)			
Thorium	50.0	U	0.700		46.1	ug/L		91.8	(75%-125%)			

QC Summary

Workorder: 445432

Page 5 of 11

Parname	NOM		Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
Metals Analysis - ICPMS												
Batch	1745491											
Tin	50.0	U	1.00		50.1	ug/L		99.7	(75%-125%)	BAJ	03/19/18	17:33
Uranium	50.0	U	0.067		47.5	ug/L		94.9	(75%-125%)			
QC1203986119	445432003 MSD											
Aluminum	2000	U	19.3		2240	ug/L	11.7	112	(0%-20%)		03/19/18	17:36
Antimony	50.0	U	1.00		47.5	ug/L	2.9	94.4	(0%-20%)		03/19/18	21:23
Arsenic	50.0	U	2.00		54.9	ug/L	4.39	107	(0%-20%)		03/19/18	17:36
Barium	50.0	U	0.670		51.5	ug/L	4.82	103	(0%-20%)			
Beryllium	50.0	U	0.200		61.3	ug/L	8.07	123	(0%-20%)			
Cadmium	50.0	U	0.300		52.5	ug/L	4.89	105	(0%-20%)			
Chromium	50.0	U	3.00		54.8	ug/L	10.4	108	(0%-20%)			
Cobalt	50.0	U	0.300		54.3	ug/L	6.08	108	(0%-20%)			
Copper	50.0	U	0.300		56.4	ug/L	9.57	113	(0%-20%)			
Lead	50.0	U	0.500		52.3	ug/L	6.03	105	(0%-20%)			
Manganese	50.0	U	1.00		55.0	ug/L	10.3	110	(0%-20%)			
Molybdenum	50.0	U	0.200		49.2	ug/L	3.77	98	(0%-20%)			
Nickel	50.0	U	0.600		57.0	ug/L	9	113	(0%-20%)			

QC Summary

Workorder: 445432

Page 6 of 11

Parmname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
Metals Analysis - ICPMS											
Batch	1745491										
Selenium	50.0	U	2.00	55.1	ug/L	6.89	110	(0%-20%)	BAJ	03/19/18	17:36
Silver	50.0	U	0.300	55.0	ug/L	5.07	110	(0%-20%)			
Strontium	50.0	U	2.00	53.0	ug/L	7.63	106	(0%-20%)			
Thallium	50.0	U	0.600	49.1	ug/L	6.83	98.1	(0%-20%)			
Thorium	50.0	U	0.700	49.6	ug/L	7.27	98.8	(0%-20%)			
Tin	50.0	U	1.00	47.1	ug/L	6.02	93.8	(0%-20%)			
Uranium	50.0	U	0.067	50.2	ug/L	5.6	100	(0%-20%)			
QC1203986120 445432003 SDILT											
Aluminum		U	4.16 DU	96.5	ug/L	N/A		(0%-20%)		03/19/18	17:43
Antimony		U	0.258 DU	5.00	ug/L	N/A		(0%-20%)		03/19/18	21:29
Arsenic		U	1.46 DU	10.0	ug/L	N/A		(0%-20%)		03/19/18	17:43
Barium		U	0.087 DU	3.35	ug/L	N/A		(0%-20%)			
Beryllium		U	0.009 DU	1.00	ug/L	N/A		(0%-20%)			
Cadmium		U	0.002 DU	1.50	ug/L	N/A		(0%-20%)			
Chromium		U	0.987 DU	15.0	ug/L	N/A		(0%-20%)			
Cobalt		U	0.021 DU	1.50	ug/L	N/A		(0%-20%)			

QC Summary

Workorder: 445432

Page 7 of 11

Parmname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
Metals Analysis - ICPMS											
Batch	1745491										
Copper	U	0.057	DU	1.50	ug/L	N/A		(0%-20%)	BAJ	03/19/18	17:43
Lead	U	0.015	DU	2.50	ug/L	N/A		(0%-20%)			
Manganese	U	0.122	DU	5.00	ug/L	N/A		(0%-20%)			
Molybdenum	U	0.169	DU	1.00	ug/L	N/A		(0%-20%)			
Nickel	U	0.484	DU	3.00	ug/L	N/A		(0%-20%)			
Selenium	U	-0.019	DU	10.0	ug/L	N/A		(0%-20%)			
Silver	U	0.003	DU	1.50	ug/L	N/A		(0%-20%)			
Strontium	U	0.026	DU	10.0	ug/L	N/A		(0%-20%)			
Thallium	U	0.044	DU	3.00	ug/L	N/A		(0%-20%)			
Thorium	U	0.214	DU	3.50	ug/L	N/A		(0%-20%)			
Tin	U	0.213	DU	5.00	ug/L	N/A		(0%-20%)			
Uranium	U	0.025	DU	0.335	ug/L	N/A		(0%-20%)			
<hr/>											
Batch	1748724										
QC1203993120	LCS										
Zinc	50.0			56.6	ug/L		113	(80%-120%)	SKJ	03/21/18	13:21
QC1203993119	MB										
Zinc		U		3.30	ug/L					03/21/18	13:20

QC Summary

Workorder: 445432

Page 8 of 11

Parname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
Metals Analysis - ICPMS											
Batch	1748724										
QC1203993121	445432003	MS									
Zinc	50.0	N	15.4	N	52.4	ug/L	74*	(75%-125%)	SKJ	03/21/18	13:24
QC1203993122	445432003	MSD									
Zinc	50.0	N	15.4		60.8	ug/L	14.9	90.9		(0%-20%)	03/21/18 13:26
QC1203993699	445432003	PS									
Zinc	50.0	N	15.4		64.7	ug/L		98.6		(75%-125%)	03/21/18 13:27
QC1203993123	445432003	SDILT									
Zinc		N	15.4	BD	4.56	ug/L	48.1			(0%-20%)	03/21/18 13:29
Metals Analysis-ICP											
Batch	1745497										
QC1203986127	LCS										
Boron	500				490	ug/L		98		(80%-120%)	HSC 03/15/18 12:19
Calcium	5000				4900	ug/L		98.1		(80%-120%)	
Iron	5000				4770	ug/L		95.4		(80%-120%)	
Magnesium	5000				4820	ug/L		96.4		(80%-120%)	
Potassium	5000				4680	ug/L		93.6		(80%-120%)	
Sodium	5000				4830	ug/L		96.6		(80%-120%)	
Vanadium	500				487	ug/L		97.3		(80%-120%)	
QC1203986126	MB										
Boron			U		15.0	ug/L					03/15/18 12:16
Calcium			U		50.0	ug/L					

QC Summary

Workorder: 445432

Page 9 of 11

Parmname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
Metals Analysis-ICP											
Batch	1745497										
Iron			U	30.0	ug/L				HSC	03/15/18	12:16
Magnesium			U	110	ug/L						
Potassium			B	54.4	ug/L						
Sodium			U	100	ug/L						
Vanadium			U	1.00	ug/L						
QC1203986128 445432003 MS											
Boron	500	U	15.0	493	ug/L		98.4	(75%-125%)		03/15/18	12:24
Calcium	5000	U	50.0	4990	ug/L		99.6	(75%-125%)			
Iron	5000	U	30.0	4940	ug/L		98.6	(75%-125%)			
Magnesium	5000	U	110	4990	ug/L		99.8	(75%-125%)			
Potassium	5000	BC	50.2	4740	ug/L		93.9	(75%-125%)			
Sodium	5000	U	100	4930	ug/L		97.8	(75%-125%)			
Vanadium	500	U	1.00	487	ug/L		97.4	(75%-125%)			
QC1203986129 445432003 MSD											
Boron	500	U	15.0	496	ug/L	0.593	99	(0%-20%)		03/15/18	12:26
Calcium	5000	U	50.0	4950	ug/L	0.883	98.7	(0%-20%)			
Iron	5000	U	30.0	4890	ug/L	1.04	97.5	(0%-20%)			

QC Summary

Workorder: 445432

Page 10 of 11

Parmname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
Metals Analysis-ICP											
Batch	1745497										
Magnesium	5000	U	110	4960	ug/L	0.687	99.2	(0%-20%)	HSC	03/15/18	12:26
Potassium	5000	BC	50.2	4720	ug/L	0.509	93.4	(0%-20%)			
Sodium	5000	U	100	4890	ug/L	0.782	97.1	(0%-20%)			
Vanadium	500	U	1.00	492	ug/L	0.942	98.3	(0%-20%)			
QC1203986130 445432003 SDILT											
Boron		U	0.642	DU	75.0	ug/L	N/A	(0%-20%)		03/15/18	12:28
Calcium		U	15.4	DU	250	ug/L	N/A	(0%-20%)			
Iron		U	11.3	DU	150	ug/L	N/A	(0%-20%)			
Magnesium		U	0.0399	DU	550	ug/L	N/A	(0%-20%)			
Potassium		BC	50.2	DU	250	ug/L	N/A	(0%-20%)			
Sodium		U	40.1	DU	500	ug/L	N/A	(0%-20%)			
Vanadium		U	0.113	DU	5.00	ug/L	N/A	(0%-20%)			

Notes:

The Qualifiers in this report are defined as follows:

- * Duplicate analysis not within control limits
- + Correlation coefficient for Method of Standard Additions (MSA) is < 0.995
- B The analyte was detected at a value less than the contract required detection limit (RDL), but greater than or equal to the IDL/MDL (as appropriate).
- C Target analyte was detected in the sample and the associated blank. The associated blank concentration is \geq EQL or is $>$ 5% of the measured concentration and/or decision level for associated samples.
- D Results are reported from a diluted aliquot of sample.
- E Reported value is estimated due to interferences. See comment in narrative.

Page 3 of 2
QC Sample Results

Client: CH2M Hill Plateau Remediation Company
 Project/Site: I18-007

TestAmerica Job ID: 160-27211-1
 SDG: SL2817

Method: 6010C - Metals (ICP)

Lab Sample ID: MB 160-355260/1-A
Matrix: Water
Analysis Batch: 355710

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 355260

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Calcium	300	U	1000	300	ug/L		03/13/18 10:24	03/14/18 14:19	1
Iron	30.0	U	100	30.0	ug/L		03/13/18 10:24	03/14/18 14:19	1
Magnesium	300	U	1000	300	ug/L		03/13/18 10:24	03/14/18 14:19	1
Potassium	1500	U	5000	1500	ug/L		03/13/18 10:24	03/14/18 14:19	1
Sodium	300	U	1000	300	ug/L		03/13/18 10:24	03/14/18 14:19	1
Boron	25.0	U	100	25.0	ug/L		03/13/18 10:24	03/14/18 14:19	1
Vanadium	4.0	U	50.0	4.0	ug/L		03/13/18 10:24	03/14/18 14:19	1

Lab Sample ID: LCS 160-355260/2-A
Matrix: Water
Analysis Batch: 355710

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 355260

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	Limits
Calcium	10000	10580		ug/L		106	80 - 120
Iron	10000	9657		ug/L		97	80 - 120
Magnesium	10000	9574		ug/L		96	80 - 120
Potassium	10000	9734		ug/L		97	80 - 120
Sodium	10000	9908		ug/L		99	80 - 120
Boron	200	192.5		ug/L		96	80 - 120
Vanadium	1000	947.5		ug/L		95	80 - 120

Lab Sample ID: 160-27211-1 MS
Matrix: Water
Analysis Batch: 355710

Client Sample ID: B3HLR7
Prep Type: Total/NA
Prep Batch: 355260

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	Limits
Calcium	42800		10000	52390	X	ug/L		96	75 - 125
Iron	220		10000	9888		ug/L		97	75 - 125
Magnesium	11400		10000	20850		ug/L		94	75 - 125
Potassium	5090		10000	14790		ug/L		97	75 - 125
Sodium	18900		10000	28670		ug/L		98	75 - 125
Boron	25.0	U	200	201.6		ug/L		101	75 - 125
Vanadium	27.4	B	1000	983.0		ug/L		96	75 - 125

Lab Sample ID: 160-27211-1 MSD
Matrix: Water
Analysis Batch: 355710

Client Sample ID: B3HLR7
Prep Type: Total/NA
Prep Batch: 355260

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	Limits	RPD	RPD Limit
Calcium	42800		10000	51450	X	ug/L		87	75 - 125	2	20
Iron	220		10000	9725		ug/L		95	75 - 125	2	20
Magnesium	11400		10000	20550		ug/L		91	75 - 125	1	20
Potassium	5090		10000	14740		ug/L		96	75 - 125	0	20
Sodium	18900		10000	28330		ug/L		95	75 - 125	1	20
Boron	25.0	U	200	200.6		ug/L		100	75 - 125	0	20
Vanadium	27.4	B	1000	975.4		ug/L		95	75 - 125	1	20

Page 3 of 9
QC Sample Results

Client: CH2M Hill Plateau Remediation Company
 Project/Site: I18-007

TestAmerica Job ID: 160-27211-1
 SDG: SL2817

Method: 6020A - Metals (ICP/MS)

Lab Sample ID: MB 160-355261/1-A
Matrix: Water
Analysis Batch: 356788

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 355261

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	20.0	U D	50.0	20.0	ug/L		03/13/18 10:27	03/20/18 23:37	2
Antimony	2.0	U D	5.0	2.0	ug/L		03/13/18 10:27	03/20/18 23:37	2
Arsenic	4.0	U D	10.0	4.0	ug/L		03/13/18 10:27	03/20/18 23:37	2
Barium	0.90	U D	2.0	0.90	ug/L		03/13/18 10:27	03/20/18 23:37	2
Beryllium	0.20	U D	0.50	0.20	ug/L		03/13/18 10:27	03/20/18 23:37	2
Cadmium	0.20	U D	0.50	0.20	ug/L		03/13/18 10:27	03/20/18 23:37	2
Chromium	4.0	U D	10.0	4.0	ug/L		03/13/18 10:27	03/20/18 23:37	2
Cobalt	0.90	U D	2.0	0.90	ug/L		03/13/18 10:27	03/20/18 23:37	2
Lead	1.0	U D	3.0	1.0	ug/L		03/13/18 10:27	03/20/18 23:37	2
Manganese	0.90	U D	2.0	0.90	ug/L		03/13/18 10:27	03/20/18 23:37	2
Molybdenum	2.0	U D	5.0	2.0	ug/L		03/13/18 10:27	03/20/18 23:37	2
Nickel	2.0	U D	5.0	2.0	ug/L		03/13/18 10:27	03/20/18 23:37	2
Selenium	2.0	U D	5.0	2.0	ug/L		03/13/18 10:27	03/20/18 23:37	2
Silver	0.90	U D	2.0	0.90	ug/L		03/13/18 10:27	03/20/18 23:37	2
Strontium	0.50	U D	5.0	0.50	ug/L		03/13/18 10:27	03/20/18 23:37	2
Thallium	0.90	U D	2.0	0.90	ug/L		03/13/18 10:27	03/20/18 23:37	2
Thorium	0.90	U D	2.0	0.90	ug/L		03/13/18 10:27	03/20/18 23:37	2
Tin	1.2	U D	2.0	1.2	ug/L		03/13/18 10:27	03/20/18 23:37	2
Uranium	0.40	U D	1.0	0.40	ug/L		03/13/18 10:27	03/20/18 23:37	2
Zinc	7.5	U D	20.0	7.5	ug/L		03/13/18 10:27	03/20/18 23:37	2

Lab Sample ID: MB 160-355261/1-A
Matrix: Water
Analysis Batch: 356991

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 355261

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Copper	0.40	U D	1.0	0.40	ug/L		03/13/18 10:27	03/21/18 17:25	2

Lab Sample ID: LCS 160-355261/2-A
Matrix: Water
Analysis Batch: 356788

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 355261

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	Limits
Aluminum	10000	9840	D	ug/L		98	80 - 120
Antimony	500	482.1	D	ug/L		96	80 - 120
Arsenic	1000	971.4	D	ug/L		97	80 - 120
Barium	1000	993.9	D	ug/L		99	80 - 120
Beryllium	100	95.26	D	ug/L		95	80 - 120
Cadmium	1000	969.7	D	ug/L		97	80 - 120
Chromium	1000	1016	D	ug/L		102	80 - 120
Cobalt	1000	1080	D	ug/L		108	80 - 120
Lead	1000	962.2	D	ug/L		96	80 - 120
Manganese	1000	1043	D	ug/L		104	80 - 120
Molybdenum	500	486.7	D	ug/L		97	80 - 120
Nickel	1000	1032	D	ug/L		103	80 - 120
Selenium	500	472.3	D	ug/L		94	80 - 120
Silver	200	198.6	D	ug/L		99	80 - 120
Strontium	1000	977.8	D	ug/L		98	80 - 120

TestAmerica St. Louis

QC Sample Results

Client: CH2M Hill Plateau Remediation Company
 Project/Site: I18-007

TestAmerica Job ID: 160-27211-1
 SDG: SL2817

Method: 6020A - Metals (ICP/MS) (Continued)

Lab Sample ID: LCS 160-355261/2-A
Matrix: Water
Analysis Batch: 356788

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 355261

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	Limits
Thallium	200	203.4	D	ug/L		102	80 - 120
Thorium	1000	982.3	D	ug/L		98	80 - 120
Tin	1000	958.5	D	ug/L		96	80 - 120
Uranium	1000	984.3	D	ug/L		98	80 - 120
Zinc	1000	975.4	D	ug/L		98	80 - 120

Lab Sample ID: LCS 160-355261/2-A
Matrix: Water
Analysis Batch: 356991

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 355261

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	Limits
Copper	1000	1078	D	ug/L		108	80 - 120

Lab Sample ID: 160-27211-1 MS
Matrix: Water
Analysis Batch: 356788

Client Sample ID: B3HLR7
Prep Type: Total/NA
Prep Batch: 355261

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	Limits
Aluminum	47.4	B D	10000	10130	D	ug/L		101	75 - 125
Antimony	2.0	U D	500	485.4	D	ug/L		97	75 - 125
Arsenic	4.0	U D	1000	1003	D	ug/L		100	75 - 125
Barium	36.5	D	1000	1003	D	ug/L		97	75 - 125
Beryllium	0.20	U D	100	94.54	D	ug/L		95	75 - 125
Cadmium	0.20	U D	1000	969.8	D	ug/L		97	75 - 125
Chromium	20.1	D	1000	1065	D	ug/L		104	75 - 125
Cobalt	0.90	U D	1000	1073	D	ug/L		107	75 - 125
Lead	1.8	B D	1000	940.7	D	ug/L		94	75 - 125
Manganese	27.0	D	1000	1083	D	ug/L		106	75 - 125
Molybdenum	10.7	D	500	487.9	D	ug/L		95	75 - 125
Nickel	2.0	U D	1000	1025	D	ug/L		102	75 - 125
Selenium	6.5	D	500	497.5	D	ug/L		98	75 - 125
Silver	0.90	U D	200	191.3	D	ug/L		96	75 - 125
Strontium	179	D	1000	1128	D	ug/L		95	75 - 125
Thallium	0.90	U D	200	201.3	D	ug/L		101	75 - 125
Thorium	1.5	B D	1000	976.8	D	ug/L		98	75 - 125
Tin	1.2	U D	1000	952.4	D	ug/L		95	75 - 125
Uranium	2.2	D	1000	976.1	D	ug/L		97	75 - 125
Zinc	7.5	U D	1000	993.7	D	ug/L		99	75 - 125

Lab Sample ID: 160-27211-1 MS
Matrix: Water
Analysis Batch: 356991

Client Sample ID: B3HLR7
Prep Type: Total/NA
Prep Batch: 355261

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	Limits
Copper	1.4	D	1000	1058	D	ug/L		106	75 - 125

Page 3 of 2
QC Sample Results

Client: CH2M Hill Plateau Remediation Company
Project/Site: I18-007

TestAmerica Job ID: 160-27211-1
SDG: SL2817

Method: 6020A - Metals (ICP/MS) (Continued)

Lab Sample ID: 160-27211-1 MSD
Matrix: Water
Analysis Batch: 356788

Client Sample ID: B3HLR7
Prep Type: Total/NA
Prep Batch: 355261

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD		Unit	D	%Rec	%Rec. RPD		
				Result	Qualifier				Limits	RPD	Limit
Aluminum	47.4	B D	10000	9555	D	ug/L		95	75 - 125	6	20
Antimony	2.0	U D	500	494.2	D	ug/L		99	75 - 125	2	20
Arsenic	4.0	U D	1000	971.8	D	ug/L		97	75 - 125	3	20
Barium	36.5	D	1000	1020	D	ug/L		98	75 - 125	2	20
Beryllium	0.20	U D	100	95.44	D	ug/L		95	75 - 125	1	20
Cadmium	0.20	U D	1000	969.0	D	ug/L		97	75 - 125	0	20
Chromium	20.1	D	1000	1009	D	ug/L		99	75 - 125	5	20
Cobalt	0.90	U D	1000	1035	D	ug/L		103	75 - 125	4	20
Lead	1.8	B D	1000	938.5	D	ug/L		94	75 - 125	0	20
Manganese	27.0	D	1000	1030	D	ug/L		100	75 - 125	5	20
Molybdenum	10.7	D	500	489.2	D	ug/L		96	75 - 125	0	20
Nickel	2.0	U D	1000	981.7	D	ug/L		98	75 - 125	4	20
Selenium	6.5	D	500	490.9	D	ug/L		97	75 - 125	1	20
Silver	0.90	U D	200	193.0	D	ug/L		96	75 - 125	1	20
Strontium	179	D	1000	1127	D	ug/L		95	75 - 125	0	20
Thallium	0.90	U D	200	198.4	D	ug/L		99	75 - 125	1	20
Thorium	1.5	B D	1000	971.8	D	ug/L		97	75 - 125	1	20
Tin	1.2	U D	1000	963.8	D	ug/L		96	75 - 125	1	20
Uranium	2.2	D	1000	970.6	D	ug/L		97	75 - 125	1	20
Zinc	7.5	U D	1000	956.6	D	ug/L		96	75 - 125	4	20

Lab Sample ID: 160-27211-1 MSD
Matrix: Water
Analysis Batch: 356991

Client Sample ID: B3HLR7
Prep Type: Total/NA
Prep Batch: 355261

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD		Unit	D	%Rec	%Rec. RPD		
				Result	Qualifier				Limits	RPD	Limit
Copper	1.4	D	1000	1043	D	ug/L		104	75 - 125	1	20

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

Lab Sample ID: MB 160-358732/1-A
Matrix: Water
Analysis Batch: 358956

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 358732

Analyte	MB MB		RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
	Result	Qualifier							
Halogens, Total Organic	2.1	U	5.0	2.1	ug/L		04/02/18 12:00	04/02/18 15:25	1

Lab Sample ID: LCS 160-358732/2-A
Matrix: Water
Analysis Batch: 358956

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 358732

Analyte	Spike Added	LCS LCS		Unit	D	%Rec	%Rec. Limits	
		Result	Qualifier				Limits	RPD
Halogens, Total Organic	100	97.51		ug/L		98	90 - 116	

Date: 03 July 2018
 To: CH2M Hill (technical representative)
 From: Analytical Quality Associates, Inc.
 Project: CERC18, RCRA18, SURV18
 Subject: General Chemistry - Sample Data Groups (SDGs) DN0333, GEL445432, SL2817 & WC2757

INTRODUCTION

This memorandum presents the results of data validation for SDG GEL445432 prepared by GEL Laboratories LLC and SDGs DN0333, SL2817 and WC2757 prepared by TestAmerica Laboratories, Inc. A list of samples validated along with the analytical methods is provided in the following table.

Sample ID	Sample Date	Media	Validation Level	Analytical Methods
B3HLT6	03/07/18	Water	C	SM2320B
B3HLT2	03/07/18	Water	C	SM2320B
B3HLV1	03/07/18	Water	C	SW9020B
B3HLV0	03/07/18	Water	C	SW9020B
B3HLT0	03/07/18	Water	C	SW9020B, SM2320B
B3HLR8	03/07/18	Water	C	SW9020B
B3HDN9	03/07/18	Water	C	EPA 353.2, SM2540C, SM2320
B3HDP3	03/07/18	Water	C	EPA 353.2, SM2540C
B3HDP6	03/07/18	Water	C	EPA 353.2, SM2540C
B3HDP7	03/07/18	Water	C	EPA 353.2, SM2540C
B3HDR2	03/07/18	Water	C	EPA 353.2, SM2540C, SM2320
B3HDR3	03/07/18	Water	C	EPA 353.2, SM2540C, SM2320
B3HLT4	03/07/18	Water	C	SW9020B
B3HLT8	03/07/18	Water	C	SW9020B
B3HLT5	03/07/18	Water	C	EPA 300.0
B3HLT9	03/07/18	Water	C	EPA 300.0
B3HDR6	03/07/18	Water	C	EPA 300.0
B3HLR9	03/07/18	Water	C	EPA 300.0
B3HLT1	03/07/18	Water	C	EPA 300.0
B3HDR7	03/07/18	Water	C	EPA 300.0

Data validation was conducted in accordance with the CHPRC validation statement of work and the Groundwater Protection Plan for the Environmental Restoration Disposal Facility, WCH-198, Rev. 1 (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:

- All anions except nitrate, nitrite, and phosphate – analysis within 28 days of sample collection
- Nitrate, nitrite, and phosphate – analysis within 48 hours of extraction
- Alkalinity – analysis within 14 days of sample collection
- Total Organic Halides (TOX) and nitrate/nitrite – analysis within 28 days of sample collection
- Total Dissolved Solids (TDS) – analysis within 7 days of sample collection

Sample preservation for the above analyses requires chilling to <6 degrees Celsius. In addition, nitrate/nitrite 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 exception.

For SDG WC2757, samples B3HDR6 and B3HDR7 were analyzed for nitrate beyond but within 2X the holding time. The nitrate sample results were detects and 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.

Trip Blanks

All trip blank 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 matrix spike sample results and laboratory control sample results. According to the SAP, the matrix spike and laboratory control sample accuracy limits are 80% to 120%. The limits for reported analytes not listed in the SAP are 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 DN0333, according to the case narrative the MS/MSD analysis for TOX associated with samples B3HLV0, B3HLT0 and B3HLR8 were performed on non-client samples. The MS and MSD recoveries associated with samples B3HLV0 and B3HLT0 were <30%. The TOX results for these samples were non-detects and should be qualified as unusable and flagged “UR.” The MS and MSD recoveries associated with sample B3HLR8 were <the lower acceptance limit but $\geq 30\%$. The TOX result for sample B3HLR8 was a non-detect and should be qualified as an estimate and flagged “UJ.”

For SDG WC2757, the MS recoveries for nitrate (batch 10592) and nitrite (batch 105852) were < the lower acceptance limit but $\geq 30\%$. The nitrate results for samples B3HDR6 and B3HDR7 were detects and should be qualified as estimates and flagged “J-.” The nitrite results for samples B3HLT5, B3HDR6, B3HLR9, B3HLT1 and B3HDR7 were detects and should be qualified as estimates and flagged “J-.” The nitrite result for sample B3HLT9 was a non-detect and should be qualified as an estimate and flagged “UJ.” It should be noted that according to the case narrative, the MS parent sample for nitrate was a non-client sample. Data should not be qualified as a result.

Laboratory Control Samples (LCSs)

All LCS recoveries were acceptable.

- **Precision**

Precision is evaluated by reviewing MS/MSD 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 $\pm 20\%$. The RPD limits for reported analytes not listed in the SAP are specified by the DV procedure.

MS/MSD Samples

All MS/MSD RPD values were acceptable with the following exception. The MS/MSD RPD for TOX associated with samples B3HLV0 and B3HLT0 was > the above the acceptance limit. The TOX results for these samples were non-detect and would be qualified UJ, but were further qualified as unusable and flagged “UR” due to very low matrix spike recoveries.

Laboratory Duplicate Samples

All laboratory duplicate results 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 with associated non-detected sample results were below the CRDLs with the following exception. The TOX MDL for samples B3HLV1, B3HLV0, B3HLT0 and B3HLR8 was greater than the CRDL.

• Completeness

SDGs DN0333, GEL445432, SL2817 and WC2757 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 for TOX was 67%. The completion percentages for all remaining analyses were 100%.

MAJOR DEFICIENCIES

Major deficiencies leading to qualification of TOX results for samples B3HLV0 and B3HLT0 as unusable were due to very low matrix spike recoveries.

MINOR DEFICIENCIES

Minor deficiencies leading to qualification of nitrate/nitrite and TOX sample results as estimates were due to either holding time infractions and/or low matrix spike recoveries. 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-198, Rev. 1, *Groundwater Protection Plan for the Environmental Restoration Disposal Facility*, March 2016.

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

General Chemistry Data Qualification Summary			
SDGs: DN0333, GEL445432, SL2817, WC2757	Reviewer: AQA	Project: CERC18, RCRA18, SURV18	Page 1 of 1
Analyte(s)	Qualifier	Samples Affected	Reason
Nitrate	J-	B3HDR6, B3HDR7	Analysis beyond but within 2X the holding time and low matrix spike recovery
TOX	UR	B3HLV0, B3HLT0	Very low matrix spike recoveries and poor MS/MSD RPD
TOX	UJ	B3HLR8	Low matrix spike recoveries
Nitrite	J-	B3HLT5, B3HDR6, B3HLR9, B3HLT1, B3HDR7	Low matrix spike recovery
Nitrite	UJ	B3HLT9	Low matrix spike recovery

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	C	D	E
PROJECT: CERC18, RCRA18, SURV18			DATA PACKAGE: VSR18-011		
VALIDATOR: Eyda Hergenreder		LAB: TestAmerica, GEL		DATE: 07/03/2018	
			SDG: DN0333, GEL445432, SL2817, WC2757		
ANALYSES PERFORMED					
Anions/IC X	TOC	TOX X	TPH-418.1	Oil and Grease	Alkalinity X
Ammonia	BOD/COD	Chloride	Chromium-VI	pH	NO ₃ /NO ₂ X
Sulfate	TDS X	TKN	Phosphate		
SAMPLES/MATRIX Water					
DN0333 - B3HLT6, B3HLT2, B3HLV1, B3HLV0, B3HLT0, B3HLR8					
GEL445432 - B3HDN9, B3HDP3, B3HDP6, B3HDP7, B3HDR2, B3HDR3,					
SL2817 - B3HLT4, B3HLT8,					
WC2757 - B3HLT5, B3HLT9, B3HDR6, B3HLR9, B3HLT1, B3HDR7					

1. DATA PACKAGE COMPLETENESS AND CASE NARRATIVE

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

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 type="radio"/> N/A
Initial calibrations acceptable?	Yes No <input type="radio"/> N/A
ICV and CCV checks performed on all instruments?	Yes No <input type="radio"/> N/A
ICV and CCV checks 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:

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

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

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?	Yes <input type="radio"/> 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:

DN0333 - TOX MS/MSD RPD (associated with sample B3HLV0 & B3HLT0) 64%

6. HOLDING TIMES (all levels)

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

Comments:

WC2757 - samples B3HDR6 and B3HDR7 nitrate analyzed beyond holding time.

Appendix 4

Additional Documentation Requested By Client

QC Sample Results

Client: CH2M Hill Plateau Remediation Company
 Project/Site: I18-007

TestAmerica Job ID: 280-107260-1
 SDG: DN0333

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

Lab Sample ID: 280-107260-4 MSD

Matrix: Water
 Analysis Batch: 408407

Client Sample ID: B3HLV1

Prep Type: Total/NA
 Prep Batch: 407757

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum	12.2	B	400	453.0		ug/L		110	75 - 125	2	20
Barium	79.7		40.0	124.6		ug/L		112	75 - 125	5	20
Manganese	1.7	C	40.0	40.67		ug/L		97	75 - 125	8	20

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

Lab Sample ID: MB 280-407978/2

Matrix: Water
 Analysis Batch: 407978

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			03/14/18 10:05	1

Lab Sample ID: LCS 280-407978/4

Matrix: Water
 Analysis Batch: 407978

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Total Organic Halogens - Dup	100	101.7		ug/L		102	80 - 120

Lab Sample ID: MB 280-409501/2

Matrix: Water
 Analysis Batch: 409501

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			03/27/18 09:15	1

Lab Sample ID: LCS 280-409501/4

Matrix: Water
 Analysis Batch: 409501

Client Sample ID: Lab Control Sample

Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Total Organic Halogens - Dup	100	103.7		ug/L		104	80 - 120

Lab Sample ID: LCSD 280-409501/5

Matrix: Water
 Analysis Batch: 409501

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
Total Organic Halogens - Dup	100	105.4		ug/L		105	80 - 120	2	20

Lab Sample ID: 280-107260-4 MS

Matrix: Water
 Analysis Batch: 409501

Client Sample ID: B3HLV1

Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Total Organic Halogens - Dup	7.7	U	100	103.5		ug/L		104	75 - 125

TestAmerica Denver

Page 5 of 9
QC Sample Results

Client: CH2M Hill Plateau Remediation Company
 Project/Site: I18-007

TestAmerica Job ID: 280-107260-1
 SDG: DN0333

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

Lab Sample ID: 280-107260-4 MSD
Matrix: Water
Analysis Batch: 409501

Client Sample ID: B3HLV1
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Total Organic Halogens - Dup	7.7	U	100	107.2		ug/L		107	75 - 125	4	20

Lab Sample ID: MB 280-409503/2
Matrix: Water
Analysis Batch: 409503

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			03/28/18 10:42	1

Lab Sample ID: LCS 280-409503/4
Matrix: Water
Analysis Batch: 409503

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

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Total Organic Halogens - Dup	100	102.3		ug/L		102	80 - 120

Lab Sample ID: LCSD 280-409503/5
Matrix: Water
Analysis Batch: 409503

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
Total Organic Halogens - Dup	100	97.38		ug/L		97	80 - 120	5	20

Method: SM 2320B - Alkalinity

Lab Sample ID: MB 280-408183/6
Matrix: Water
Analysis Batch: 408183

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	1070	U	5000	1070	ug/L			03/15/18 22:57	1

Lab Sample ID: LCS 280-408183/4
Matrix: Water
Analysis Batch: 408183

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	218000		ug/L		109	80 - 120

Lab Sample ID: LCSD 280-408183/5
Matrix: Water
Analysis Batch: 408183

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
Alkalinity as CaCO3	200000	217400		ug/L		109	80 - 120	0	20

TestAmerica Denver

QC Sample Results

Client: CH2M Hill Plateau Remediation Company
 Project/Site: I18-007

TestAmerica Job ID: 280-107260-1
 SDG: DN0333

Method: SM 2320B - Alkalinity (Continued)

Lab Sample ID: 280-107260-1 DU
 Matrix: Water
 Analysis Batch: 408183

Client Sample ID: B3HLT6
 Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Alkalinity as CaCO3	1070	U	1070	U	ug/L		NC	20

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

GEL LABORATORIES LLC

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

QC Summary

Report Date: March 26, 2018

Page 1 of 2

CH2M Hill Plateau Remediation Company

MSIN R3-50 CHPRC

PO Box 1600

Richland, Washington

Contact: Mr. Scot Fitzgerald

Workorder: 445432

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Nutrient Analysis											
Batch	1745313										
QC1203986195	445432001	DUP									
Nitrogen, Nitrate/Nitrite	D	6060	D	5770	ug/L	4.9		(0%-20%)	KLP1	03/09/18	11:41
QC1203985745	LCS										
Nitrogen, Nitrate/Nitrite	1000			1040	ug/L		104	(90%-110%)		03/09/18	11:35
QC1203985744	MB										
Nitrogen, Nitrate/Nitrite			U	17.0	ug/L					03/09/18	11:19
QC1203986199	445432001	PS									
Nitrogen, Nitrate/Nitrite	1.00	D	0.606	D	1.73	mg/L		112* (90%-110%)		03/09/18	11:42
Solids Analysis											
Batch	1746580										
QC1203988420	445432008	DUP									
Total Dissolved Solids			399000	401000	ug/L	1.06		(0%-20%)	KLP1	03/14/18	14:56
QC1203988417	LCS										
Total Dissolved Solids	300000			290000	ug/L		96.7	(80%-120%)		03/14/18	14:56
QC1203988416	MB										
Total Dissolved Solids			U	3400	ug/L					03/14/18	14:56
Titration and Ion Analysis											
Batch	1745547										
QC1203986247	445538010	DUP									
Alkalinity, Total as CaCO3			134000	132000	ug/L	1.36		(0%-20%)	RXB5	03/14/18	15:57
QC1203986246	LCS										
Alkalinity, Total as CaCO3	100000			107000	ug/L		107	(80%-120%)		03/14/18	15:05

Notes:

Page 19 of 22
QC Sample Results

Client: CH2M Hill Plateau Remediation Company
 Project/Site: I18-007

TestAmerica Job ID: 160-27211-1
 SDG: SL2817

Method: 6020A - Metals (ICP/MS) (Continued)

Lab Sample ID: 160-27211-1 MSD
 Matrix: Water
 Analysis Batch: 356788

Client Sample ID: B3HLR7
 Prep Type: Total/NA
 Prep Batch: 355261

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	Limits	RPD	Limit
Aluminum	47.4	B D	10000	9555	D	ug/L		95	75 - 125	6	20
Antimony	2.0	U D	500	494.2	D	ug/L		99	75 - 125	2	20
Arsenic	4.0	U D	1000	971.8	D	ug/L		97	75 - 125	3	20
Barium	36.5	D	1000	1020	D	ug/L		98	75 - 125	2	20
Beryllium	0.20	U D	100	95.44	D	ug/L		95	75 - 125	1	20
Cadmium	0.20	U D	1000	969.0	D	ug/L		97	75 - 125	0	20
Chromium	20.1	D	1000	1009	D	ug/L		99	75 - 125	5	20
Cobalt	0.90	U D	1000	1035	D	ug/L		103	75 - 125	4	20
Lead	1.8	B D	1000	938.5	D	ug/L		94	75 - 125	0	20
Manganese	27.0	D	1000	1030	D	ug/L		100	75 - 125	5	20
Molybdenum	10.7	D	500	489.2	D	ug/L		96	75 - 125	0	20
Nickel	2.0	U D	1000	981.7	D	ug/L		98	75 - 125	4	20
Selenium	6.5	D	500	490.9	D	ug/L		97	75 - 125	1	20
Silver	0.90	U D	200	193.0	D	ug/L		96	75 - 125	1	20
Strontium	179	D	1000	1127	D	ug/L		95	75 - 125	0	20
Thallium	0.90	U D	200	198.4	D	ug/L		99	75 - 125	1	20
Thorium	1.5	B D	1000	971.8	D	ug/L		97	75 - 125	1	20
Tin	1.2	U D	1000	963.8	D	ug/L		96	75 - 125	1	20
Uranium	2.2	D	1000	970.6	D	ug/L		97	75 - 125	1	20
Zinc	7.5	U D	1000	956.6	D	ug/L		96	75 - 125	4	20

Lab Sample ID: 160-27211-1 MSD
 Matrix: Water
 Analysis Batch: 356991

Client Sample ID: B3HLR7
 Prep Type: Total/NA
 Prep Batch: 355261

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	Limits	RPD	Limit
Copper	1.4	D	1000	1043	D	ug/L		104	75 - 125	1	20

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

Lab Sample ID: MB 160-358732/1-A
 Matrix: Water
 Analysis Batch: 358956

Client Sample ID: Method Blank
 Prep Type: Total/NA
 Prep Batch: 358732

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Halogens, Total Organic	2.1	U	5.0	2.1	ug/L		04/02/18 12:00	04/02/18 15:25	1

Lab Sample ID: LCS 160-358732/2-A
 Matrix: Water
 Analysis Batch: 358956

Client Sample ID: Lab Control Sample
 Prep Type: Total/NA
 Prep Batch: 358732

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	Limits
Halogens, Total Organic	100	97.51		ug/L		98	90 - 116

Page 5 of 22
QC Sample Results

Client: CH2M Hill Plateau Remediation Company
 Project/Site: I18-007

TestAmerica Job ID: 160-27211-1
 SDG: SL2817

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

Lab Sample ID: 160-27163-A-13-C MS
Matrix: Water
Analysis Batch: 358956

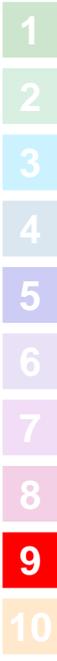
Client Sample ID: Matrix Spike
Prep Type: Total/NA
Prep Batch: 358732
 %Rec.

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	Limits
Halogens, Total Organic	5.0		100	103.8		ug/L		99	85 - 117

Lab Sample ID: 160-27163-A-13-B DU
Matrix: Water
Analysis Batch: 358956

Client Sample ID: Duplicate
Prep Type: Total/NA
Prep Batch: 358732

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	Limit
Halogens, Total Organic	5.0		5.32		ug/L		7	20



Page 60 of 92
QC Sample Results

Client: CH2M Hill Plateau Remediation Company
Project/Site: I18-007

TestAmerica Job ID: 300-6853-1
SDG: WC2757

Method: 300.0 - Anions, Ion Chromatography

Lab Sample ID: MB 300-10581/11
Matrix: Water
Analysis Batch: 10581

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

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	0.10	U	0.20	0.10	mg/L			03/08/18 18:04	1
Fluoride	0.025	U	0.050	0.025	mg/L			03/08/18 18:04	1
Sulfate	0.13	U	0.25	0.13	mg/L			03/08/18 18:04	1
Bromide	0.063	U	0.13	0.063	mg/L			03/08/18 18:04	1

Lab Sample ID: LCS 300-10581/12
Matrix: Water
Analysis Batch: 10581

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

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	16.0	15.6		mg/L		97	80 - 120
Fluoride	4.00	3.95		mg/L		99	80 - 120
Sulfate	20.0	19.6		mg/L		98	80 - 120
Bromide	10.0	9.87		mg/L		99	80 - 120

Lab Sample ID: 300-6853-4 MS
Matrix: Water
Analysis Batch: 10581

Client Sample ID: B3HLR9
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	12	D	3.20	15.1	D	mg/L		93	75 - 125
Fluoride	0.32	D	0.800	1.05	D	mg/L		91	75 - 125
Sulfate	27	D	4.00	31.3	D	mg/L		97	75 - 125
Bromide	0.18	B D	2.00	1.80	D	mg/L		81	75 - 125

Lab Sample ID: 300-6853-4 DU
Matrix: Water
Analysis Batch: 10581

Client Sample ID: B3HLR9
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Chloride	12	D	11.8	D	mg/L		2	20
Fluoride	0.32	D	0.309	D	mg/L		3	20
Sulfate	27	D	26.7	D	mg/L		3	20
Bromide	0.18	B D	0.191	B D	mg/L		8	20

Lab Sample ID: MB 300-10582/11
Matrix: Water
Analysis Batch: 10582

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

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Nitrate as N	0.014	U	0.028	0.014	mg/L			03/08/18 18:04	1
Nitrite as N	0.019	U	0.038	0.019	mg/L			03/08/18 18:04	1
Orthophosphate as P	0.041	U	0.082	0.041	mg/L			03/08/18 18:04	1

Page 61 of 92
QC Sample Results

Client: CH2M Hill Plateau Remediation Company
 Project/Site: I18-007

TestAmerica Job ID: 300-6853-1
 SDG: WC2757

Method: 300.0 - Anions, Ion Chromatography (Continued)

Lab Sample ID: LCS 300-10582/12
Matrix: Water
Analysis Batch: 10582

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

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Nitrate as N	2.26	2.22		mg/L		98	80 - 120
Nitrite as N	3.04	3.00		mg/L		99	80 - 120
Orthophosphate as P	6.53	6.42		mg/L		98	80 - 120

Lab Sample ID: 300-6853-4 MS
Matrix: Water
Analysis Batch: 10582

Client Sample ID: B3HLR9
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Nitrite as N	0.053	B D	0.609	0.526	D	mg/L		78	75 - 125
Orthophosphate as P	0.082	U D	1.31	1.08	D	mg/L		83	75 - 125

Lab Sample ID: 300-6853-4 MS
Matrix: Water
Analysis Batch: 10582

Client Sample ID: B3HLR9
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Nitrate as N	5.5	D	1.13	6.61	D X	mg/L		102	75 - 125

Lab Sample ID: 300-6853-4 DU
Matrix: Water
Analysis Batch: 10582

Client Sample ID: B3HLR9
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Nitrite as N	0.053	B D		0.0530	B D	mg/L		0.9	20
Orthophosphate as P	0.082	U D		0.082	U D	mg/L		NC	20

Lab Sample ID: 300-6853-4 DU
Matrix: Water
Analysis Batch: 10582

Client Sample ID: B3HLR9
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Nitrate as N	5.5	D		5.24	D	mg/L		4	20

Lab Sample ID: MB 300-10592/5
Matrix: Water
Analysis Batch: 10592

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

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Nitrate as N	0.014	U	0.028	0.014	mg/L			03/09/18 13:54	1
Nitrite as N	0.019	U	0.038	0.019	mg/L			03/09/18 13:54	1
Orthophosphate as P	0.041	U	0.082	0.041	mg/L			03/09/18 13:54	1

Lab Sample ID: LCS 300-10592/6
Matrix: Water
Analysis Batch: 10592

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

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Nitrate as N	2.26	2.23		mg/L		99	80 - 120

TestAmerica Richland

Page 62 of 92
QC Sample Results

Client: CH2M Hill Plateau Remediation Company
Project/Site: I18-007

TestAmerica Job ID: 300-6853-1
SDG: WC2757

Method: 300.0 - Anions, Ion Chromatography (Continued)

Lab Sample ID: LCS 300-10592/6
Matrix: Water
Analysis Batch: 10592

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

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Nitrite as N	3.04	3.09		mg/L		101	80 - 120
Orthophosphate as P	6.53	6.43		mg/L		98	80 - 120

Lab Sample ID: 300-6847-A-1 MS
Matrix: Water
Analysis Batch: 10592

Client Sample ID: Matrix Spike
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Nitrate as N	6.4	D	0.452	6.73	D	mg/L		72	75 - 125

Lab Sample ID: 300-6847-A-1 DU
Matrix: Water
Analysis Batch: 10592

Client Sample ID: Duplicate
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Nitrate as N	6.4	D	6.25	D	mg/L		2	20

Date: 18 June 2018
 To: CH2M Hill (technical representative)
 From: Analytical Quality Associates, Inc.
 Project: CERC18, RCRA18, SURV18
 Subject: Radiochemical - Sample Data Groups (SDGs) GEL445432 and W08026

INTRODUCTION

This memorandum presents the results of data validation for SDG GEL445432 prepared by GEL Laboratories LLC and SDG W08026 prepared by TestAmerica Laboratories, Inc. A list of samples validated along with the analytical methods is provided in the following table.

Sample ID	Sample Date	Media	Validation Level	Analytical Methods
B3HDN9	03/07/18	Water	C	Ra-226, alpha, beta, Ra-228,
B3HDP3	03/07/18	Water	C	Alpha, beta, Tc-99, C-14,
B3HDP6	03/07/18	Water	C	Alpha, beta, I-129
B3HDP7	03/07/18	Water	C	Alpha, beta, I-129,
B3HDR2	03/07/18	Water	C	Ra-226, alpha, beta, Ra-228, Tc-99
B3HDR3	03/07/18	Water	C	Ra-226, alpha, beta, Ra-228, Tc-99
B3H302	03/05/18	Water	C	Tc-99
B3H481	03/06/18	Water	C	I-129, Tc-99
B3HDH8	03/08/18	Water	C	Tritium, I-129
B3HDP0	03/07/18	Water	C	C-14
B3HDP1	03/07/18	Water	C	Tc-99
B3HDP4	03/07/18	Water	C	Ra-226, Ra-228
B3HDP8	03/07/18	Water	C	Ra-226, Ra-228, Tc-99
B3HDP9	03/07/18	Water	C	Ra-226, Ra-228, Tc-99
B3HDR4	03/07/18	Water	C	C-14
B3HDR5	03/07/18	Water	C	C-14
B3HHX8	03/07/18	Water	C	I-129
B3HHY3	03/07/18	Water	C	tritium
B3HHY4	03/07/18	Water	C	tritium
B3HHY8	03/07/18	Water	C	I-129
B3HHY9	03/07/18	Water	C	I-129
B3HJD2	03/06/18	Water	C	alpha
B3HJD3	03/06/18	Water	C	alpha
B3HLR5	03/07/18	Water	C	tritium
B3HLT3	03/07/18	Water	C	C-14
B3HLT7	03/07/18	Water	C	C-14

Data validation was conducted in accordance with the CHPRC validation statement of work and the Groundwater Protection Plan for the Environmental Restoration Disposal Facility, WCH-

198, Rev. 1, (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

All trip blank results were acceptable with the following exception.

For SDG W08026, the tritium result for trip blank sample B3HHY3 was a detect > the MDL.

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 matrix spike and laboratory control sample accuracy limits are 80% to 120%. The limits for reported analytes not listed in the SAP are specified by the DV procedure.

Matrix Spike (MS) Samples

All MS recoveries were acceptable with the following exception.

For SDG W08026, the MS recovery for tritium was $<$ the lower acceptance limit but $\geq 10\%$. All associated sample results were detects and should be qualified as estimates and flagged “J-.” See the table in Appendix 2 for a listing of all affected sample results.

Laboratory Control Samples (LCSs)

All LCS recoveries were acceptable with the following exception.

For SDG W08026, the LCS recovery for I-129 was $>$ the upper acceptance limit. The I-129 results for samples B3HDH8, B3HHX8, B3HHY8 and B3HHY9 were detects and should be qualified as estimates and flagged “J+.” All other associated sample results were non-detects and should not be qualified as a result.

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 $\pm 25\%$. The RPD limits for reported analytes not listed in the SAP are specified by the DV procedure.

Laboratory Duplicate Samples

All laboratory duplicate results were acceptable with the following exception.

For SDG GEL445432, the Ra-226 RPD was $>$ the acceptance limit. The Ra-226 results for samples B3HDN9, B3HDR2 and B3HDR3 were detects and should be qualified as estimates and flagged “J.”

Field Duplicate Samples

All field duplicate results were acceptable with the following exception.

For SDG GEL445432, the Ra-226 RPD for samples B3HDR2 and B3HDR3 was 37%. 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.

All reported sample MDCs were below the CRDLs with the following exception.

The Tc-99 MDCs for samples B3HDP3, B3HDR2, B3HDR3, B3H302, B3H481, B3HDP1, B3HDP8 and B3HDP9 and the I-129 MDC for sample B3HDP8 were > CRDLs.

- **Completeness**

SDGs GEL445432 and W08026 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 sample results as estimates were due to low matrix spike recovery for tritium, high LCS recovery for I-129 and poor duplicate precision for Ra-226. See the table in Appendix 2 for a listing of all affected sample results.

REFERENCES

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

WCH-198, Rev. 1, *Groundwater Protection Plan for the Environmental Restoration Disposal Facility*, March 2016.

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

Radiochemical Data Qualification Summary			
SDGs: GEL445432, W08026	Reviewer: AQA	Project: CERC18, RCRA18, SURV18	Page 1 of 1
Analyte(s)	Qualifier	Samples Affected	Reason
Tritium	J-	B3HDH8, B3HHY3, B3HHY4, B3HLR5	Low matrix spike recovery
I-129	J+	B3HDH8, B3HHX8, B3HHY8, B3HHY9	High LCS recovery
Ra-226	J	B3HDN9, B3HDR2, B3HDR3	Poor duplicate precision

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	C	D	E
Project: CERC18, RCRA18, SURV18			Data Package: VSR18-11		
Validator: Eyda Hergenreder		Lab: GEL, TestAmerica		Date: 06/18/2018	
			SDG: GEL445432, W08026		

Analyses Performed

<input checked="" type="checkbox"/> Gross Alpha/Beta	<input type="checkbox"/> Strontium-90	<input type="checkbox"/> Technetium-99	<input type="checkbox"/> Alpha Spectroscopy	<input type="checkbox"/> Gamma Spectroscopy	<input checked="" type="checkbox"/> Tritium
<input type="checkbox"/> Total Uranium	<input checked="" type="checkbox"/> Radium-226	<input checked="" type="checkbox"/> I-129	<input checked="" type="checkbox"/> Ra-228	<input checked="" type="checkbox"/> Tc-99	<input checked="" type="checkbox"/> C-14

Samples/Matrix Water

GEL445432 - B3HDN9, B3HDP3, B3HDP6, B3HDP7, B3HDR2, B3HDR3,

W08026 - B3H302, B3H481, B3HDH8, B3HDP0, B3HDP1, B3HDP4, B3HDP8, B3HDP9, B3HDR4, B3HDR5, B3HHX8, B3HHY3, B3HHY4, B3HHY8, B3HHY9, B3HJD2, B3HJD3, B3HLR5, B3HLT3, B3HLT7,

1. Completeness and Case Narrative

 N/A

Technical verification forms present?

 Yes No N/A

Comments:

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

Comments:

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
Comments:	

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
Comments:	

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?	<input checked="" type="radio"/> Yes No N/A
Field blank results acceptable?	Yes <input checked="" type="radio"/> No N/A
Analytes detected in field blank(s)?	<input checked="" type="radio"/> Yes No N/A
Transcription/Calculation Errors? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A

Comments:

SDG W08026- trip blank sample B3HHY3 tritium 1600 pCi/L

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?	Yes <input checked="" type="radio"/> 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:

W08026 - LCS I-129 121%

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:

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:

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?	Yes <input checked="" type="radio"/> 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:

W08026 - MS tritium 28%

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?	Yes <input checked="" type="radio"/> No N/A
Transcription/Calculation errors? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A

Comments:

GEL445432 - Ra-226 40%RPD

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 <input checked="" type="radio"/> No 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:

GEL445432: primary sample/duplicate sample B3HDR2/B3HDR3: Ra-226 4.16 pCi/L/2.86 pCi/L RPD 37%

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: MDLs > PQLs

SDG GEL445432 - sample B3HDP3, B3HDR2, B3HDR3, Tc-99

SDG W08026 - Tc-99 - B3H302, B3H481, B3HDP1, B3HDP8, B3HDP9
I-129 - B3HDH8

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: March 30, 2018

Page 1 of 4

Client : **CH2MHill Plateau Remediation Company**
MSIN R3-50 CHPRC
PO Box 1600
Richland, Washington 99352

Contact: **Mr. Scot Fitzgerald**

Workorder: **445432**

Parmname	NOM	Sample	Qual	QC	Units	QC Criteria	Range	Analyst	Date Time
Rad Gamma Spec									
Batch	1745261								
QC1203985644	MB								
Iodine-129			U	-0.121	pCi/L			BSW1	03/14/1815:57
				Uncert: +/-0.310					
				TPU: +/-0.315					
QC1203985645	445297001	DUP							
Iodine-129		U	-0.311	U	-0.117	pCi/L			03/15/1806:16
				Uncert: +/-0.405	+/-0.356	RPD: 0	N/A		
				TPU: +/-0.430	+/-0.360	RER: 0.678	(0-2)		
QC1203985646	445297001	MS							
Iodine-129		U	-0.311		31.6	pCi/L	REC: 92 (75%-125%)		03/15/1806:32
				Uncert: +/-0.405	+/-3.66				
				TPU: +/-0.430	+/-4.83				
QC1203985647	LCS								
Iodine-129					38.5	pCi/L	REC: 111 (80%-120%)		03/15/1806:33
				Uncert: +/-4.93					
				TPU: +/-6.26					
Rad Gas Flow									
Batch	1745835								
QC1203986880	MB								
Alpha			U	-0.18	pCi/L			AXH4	03/17/1815:25
				Uncert: +/-1.21					
				TPU: +/-1.22					
Beta			U	-0.292	pCi/L				
				Uncert: +/-1.53					
				TPU: +/-1.53					
QC1203986881	444987002	DUP							
Alpha		12.3			11.2	pCi/L			03/17/1815:22
				Uncert: +/-3.68	+/-3.25	RPD: 9	(0% - 100%)		
				TPU: +/-4.20	+/-3.74	RER: 0.385	(0-2)		
Beta		9.90			10.4	pCi/L			
				Uncert: +/-1.97	+/-1.75	RPD: 5	(0%-20%)		
				TPU: +/-2.56	+/-2.47	RER: 0.257	(0-2)		
QC1203986882	444987002	MS							
Alpha		242	12.3		267	pCi/L	REC: 106 (75%-125%)		03/17/1815:25
				Uncert: +/-3.68	+/-25.9				
				TPU: +/-4.20	+/-50.8				
Beta		940	9.90		949	pCi/L	REC: 100 (75%-125%)		
				Uncert: +/-1.97	+/-34.0				
				TPU: +/-2.56	+/-158				
QC1203986883	444987002	MSD							
Alpha		242	12.3		228	pCi/L	REC: 89 (75%-125%)		
				Uncert: +/-3.68	+/-24.6	RPD: 16	(0%-20%)		
				TPU: +/-4.20	+/-44.9	RER: 1.13	(0-2)		
Beta		940	9.90		926	pCi/L	REC: 97 (75%-125%)		
				Uncert: +/-1.97	+/-33.5	RPD: 2	(0%-20%)		

GEL LABORATORIES LLC

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QC Summary

Workorder: 445432

Page 2 of 4

Parmname	NOM	Sample	Qual	QC	Units	QC Criteria	Range	Analyst	Date Time
Rad Gas Flow									
Batch	1745835								
		TPU:	+/-2.56	+/-156					
						RER:	0.207 (0-2)		
QC1203986884	LCS								
Alpha	80.6			77.8	pCi/L	REC:	97 (80%-120%)		03/17/1815:25
		Uncert:		+/-7.12					
		TPU:		+/-14.6					
Beta	313			324	pCi/L	REC:	103 (80%-120%)		
		Uncert:		+/-11.2					
		TPU:		+/-53.8					
Batch	1745884								
QC1203986961	MB								
Radium-228			U	0.888	pCi/L			JXC9	03/23/1813:41
		Uncert:		+/-1.15					
		TPU:		+/-1.17					
**Barium-133 Tracer	202			179	CPM	REC:	89 (30%-105%)		
QC1203986962	445432008	DUP							
Radium-228		U	1.41	U	-0.20	pCi/L			03/23/1814:54
		Uncert:	+/-1.05	+/-1.37		RPD:	0 N/A		
		TPU:	+/-1.11	+/-1.37		RER:	1.8 (0-2)		
**Barium-133 Tracer	202		185	185	CPM	REC:	91 (30%-105%)		
QC1203986963	LCS								
Radium-228	18.5			22.0	pCi/L	REC:	119 (80%-120%)		03/23/1813:41
		Uncert:		+/-2.99					
		TPU:		+/-6.46					
**Barium-133 Tracer	202			132	CPM	REC:	66 (30%-105%)		
Rad Liquid Scintillation									
Batch	1745596								
QC1203986370	MB								
Technetium-99			U	-12	pCi/L			CXS7	03/28/1811:22
		Uncert:		+/-15.6					
		TPU:		+/-15.6					
**Technetium-99m Tracer	1.16E+05			1.04E+05	CPM	REC:	90 (30%-105%)		
QC1203986371	445294001	DUP							
Technetium-99		U	0.208	U	-14.6	pCi/L			03/28/1811:38
		Uncert:	+/-15.3	+/-15.4		RPD:	0 N/A		
		TPU:	+/-15.3	+/-15.4		RER:	1.34 (0-2)		
**Technetium-99m Tracer	1.16E+05	1.10E+05		1.05E+05	CPM	REC:	91 (30%-105%)		
QC1203986372	LCS								
Technetium-99	888			883	pCi/L	REC:	99 (80%-120%)		03/28/1811:54
		Uncert:		+/-44.6					
		TPU:		+/-107					
**Technetium-99m Tracer	1.16E+05			1.07E+05	CPM	REC:	93 (30%-105%)		
Batch	1745608								
QC1203986388	MB								
Carbon-14			U	10.9	pCi/L			BXM4	03/12/1814:52
		Uncert:		+/-20.3					
		TPU:		+/-20.4					
QC1203986389	445297005	DUP							

GEL LABORATORIES LLC

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

QC Summary

Workorder: 445432

Page 3 of 4

Parmname	NOM	Sample	Qual	QC	Units	QC Criteria	Range	Analyst	Date Time
Rad Liquid Scintillation									
Batch	1745608								
Carbon-14		U	-1.2	U	24.5	pCi/L			
		Uncert:	+/-19.6		+/-19.5		RPD:	0	N/A
		TPU:	+/-19.6		+/-20.0		RER:	1.8	(0-2)
QC1203986390	445297005	MS							
Carbon-14	751	U	-1.2		706	pCi/L	REC:	94 (75%-125%)	03/12/1815:29
		Uncert:	+/-19.6		+/-38.8				
		TPU:	+/-19.6		+/-137				
QC1203986391	LCS								
Carbon-14	751				634	pCi/L	REC:	84 (80%-120%)	03/12/1815:46
		Uncert:			+/-37.5				
		TPU:			+/-123				
Rad Ra-226									
Batch	1745751								
QC1203986714	MB								
Radium-226				U	0.00	pCi/L		PCW	03/15/1807:40
		Uncert:			+/-0.401				
		TPU:			+/-0.401				
QC1203986715	445432001	DUP							
Radium-226			2.86		4.31	pCi/L			
		Uncert:	+/-0.675		+/-0.899		RPD:	40* (0%-20%)	
		TPU:	+/-0.801		+/-1.35		RER:	1.81 (0-2)	
QC1203986716	445432001	MS							
Radium-226	130		2.86		126	pCi/L	REC:	95 (75%-125%)	
		Uncert:	+/-0.675		+/-9.91				
		TPU:	+/-0.801		+/-25.4				
QC1203986717	LCS								
Radium-226	26.0				21.7	pCi/L	REC:	84 (80%-120%)	
		Uncert:			+/-1.78				
		TPU:			+/-3.73				

Notes:

TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

The Qualifiers in this report are defined as follows:

- * Duplicate analysis not within control limits
- + Correlation coefficient for Method of Standard Additions (MSA) is < 0.995
- < Sample is below the EPA guidance level for Reactive Releasable Cyanide and/or Reactive Releasable Sulfide
- > Result greater than quantifiable range or greater than upper limit of the analysis range
- B The analyte was detected at a value less than the contract required detection limit (RDL), but greater than or equal to the IDL/MDL (as appropriate).
- B The analyte was detected in the associated method blank >= MDC or >5% sample activity.
- C Target analyte was detected in the sample and the associated blank. The associated blank concentration is >= EQL or is > 5% of the measured concentration and/or decision level for associated samples.
- D Results are reported from a diluted aliquot of sample.
- E Reported value is estimated due to interferences. See comment in narrative.
- M Duplicate precision not met.
- N Spike Sample recovery is outside control limits.
- S Reported value determined by the Method of Standard Additions (MSA)
- U Analyzed for but not detected above limiting criteria. Includes MDL, MDA, PQL, zero, counting error, and total analytical error.

FORM II

Date: 06-Apr-18

DUPLICATE RESULTS

Lab Name: TestAmerica Inc
 Lot-Sample No.: J8C060404-1
 Client Sample ID: B3H302 DUP

SDG: W08026
 Report No.: 72579
 COC No.: I18-005-031

Collection Date: 3/5/2018 11:45:00 AM
 Received Date: 3/6/2018 2:25:00 PM
 Matrix: WATER

Parameter	Result, Orig Rst	Qual	Count Error (2 s)	CSU (2 s)	MDL, Action Lev	Rpt Unit, CRDL	Yield	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 8081010	TC99_ETVDSK_LSC								Orig Sa DB ID: 9NANXL20			
TC-99	9.67E+02		2.1E+01	3.3E+01	1.13E+01	pCi/L	100%	(85.6)	3/23/18 12:03 a		0.12519	LSC10
	1.00E+03		RPD 3.5			5.00E+01		(59.3)			L	

No. of Results: 1 Comments:

FORM II

Date: 06-Apr-18

DUPLICATE RESULTS

Lab Name: TestAmerica Inc SDG: W08026 Collection Date: 3/8/2018 2:26:00 PM
 Lot-Sample No.: J8C120402-1 Report No.: 72579 Received Date: 3/9/2018 9:15:00 AM
 Client Sample ID: B3HHDH8 DUP COC No.: I18-006-057 Matrix: WATER

Parameter	Result, Orig Rst	Qual	Count Error (2 s)	CSU (2 s)	MDL, Action Lev	Rpt Unit, CRDL	Yield	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 8073037	906.0_H3_LSC								Orig Sa DB ID: 9NAN5L10			
H-3	7.80E+03	N	3.6E+02	5.1E+02	4.34E+02	pCi/L	100%	(18.)	4/2/18 10:42 p		0.00502	LSC4
	7.38E+03	N	RPD 5.5			7.00E+02		(30.3)			L	
Batch: 8073038	1129LL_SEP_LEPS_GS								Orig Sa DB ID: 9NAN5L10			
1129	6.58E+00		1.5E+00	1.5E+00	8.11E-01	pCi/L	93%	(8.1)	3/30/18 08:35 a		1.8357	LEP4\$1
	5.01E+00		RPD 27.0			1.00E+00		(8.9)			L	

No. of Results: 2 Comments:

TestAmerica Inc RPD - Relative Percent Difference.
 rptSTLRchDupV5. MDC(MDA).Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.
 8.5 A2002 N Qual - MS, MSD: Spike recovery exceeds upper or lower control limit.

FORM II

Date: 06-Apr-18

DUPLICATE RESULTS

Lab Name: TestAmerica Inc **SDG:** W08026 **Collection Date:** 3/7/2018 7:30:00 AM
Lot-Sample No.: J8C080403-2 **Report No.:** 72579 **Received Date:** 3/7/2018 2:35:00 PM
Client Sample ID: B3HDP8 DUP **COC No.:** I18-007-010 **Matrix:** WATER

Parameter	Result, Orig Rst	Qual	Count Error (2 s)	CSU (2 s)	MDL, Action Lev	Rpt Unit, CRDL	Yield	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 8073039	903.1_RA226_LUC											
Ra-226	1.23E-01	U	1.6E-01	1.6E-01	2.59E-01	pCi/L	83%	NANZR1GR	Orig Sa DB ID: 9NAN2R10 4/3/18 03:03 p		1.00057	ASC2RC
	-5.86E-02	U	RPD	564.1		1.00E+00	(1.6)				L	
Batch: 8073040	RAISO_SEP_GPC											
Ra-228	-3.06E-01	U	3.7E-01	3.7E-01	6.94E-01	pCi/L	82%	NANZR1HR	Orig Sa DB ID: 9NAN2R10 3/28/18 02:44 p		1.00057	GPC30
	4.34E-01	U	RPD	1152.3		1.00E+00	-(1.6)				L	

No. of Results: 2 Comments:

FORM II

Date: 06-Apr-18

DUPLICATE RESULTS

Lab Name: TestAmerica Inc **SDG:** W08026 **Collection Date:** 3/7/2018 11:49:00 AM
Lot-Sample No.: J8C080403-5 **Report No.:** 72579 **Received Date:** 3/7/2018 2:35:00 PM
Client Sample ID: B3HDR5 DUP **COC No.:** I18-007-015 **Matrix:** WATER

Parameter	Result, Orig Rst	Qual	Count Error (2 s)	CSU (2 s)	MDL, Action Lev	Rpt Unit, CRDL	Yield	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 8073036	C14_LSC								Orig Sa DB ID: 9NAN2W10			
C-14	4.64E+00	U	7.8E+00	9.2E+00	1.83E+01	pCi/L	100%	0.25	3/30/18 02:23 a		0.075	LSC4
	6.44E-01	U	RPD 151.2			5.00E+01	(1.)				L	

No. of Results: 1 Comments:

TestAmerica Inc RPD - Relative Percent Difference.
MDC(MDA),Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.
U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.

FORM II

Date: 06-Apr-18

DUPLICATE RESULTS

Lab Name: TestAmerica Inc
 Lot-Sample No.: J8C060402-1
 Client Sample ID: B3HJD3 DUP

SDG: W08026
 Report No.: 72579
 COC No.: W18-003-137

Collection Date: 3/6/2018 10:24:00 AM
 Received Date: 3/6/2018 2:25:00 PM
 Matrix: WATER

Parameter	Result, Orig Rst	Qual	Count Error (2 s)	CSU (2 s)	MDL, Action Lev	Rpt Unit, CRDL	Yield	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 8081012	9310_ALPHABETA_GPC								Orig Sa DB ID: 9NANXH20			
Alpha	1.51E+00	U	1.4E+00	1.5E+00	2.23E+00	pCi/L	100%	0.67	3/27/18 01:56 p		0.11971	GPC23C
	7.34E-01	U	RPD 69.0			3.00E+00		(2.1)			L	

No. of Results: 1 Comments:

TestAmerica Inc RPD - Relative Percent Difference.
 rptSTLrchDupV5. MDC(MDA),Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.
 8.5 A2002 U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.

FORM II

Date: 06-Apr-18

BLANK RESULTS

Lab Name: TestAmerica Inc

SDG: W08026

Matrix: WATER

Report No.: 72579

Parameter	Result	Qual	Count Error (2 s)	CSU (2 s)	MDL, Lc	Rpt Unit, CRDL	Yield	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 8073036 C14_LSC Work Order: NAN941AA Report DB ID: NAN941AB												
C-14	-3.29E+00	U	7.5E+00	8.9E+00	1.81E+01 pCi/L		100%	-0.18	3/30/18 08:59 a		0.075	LSC4
					8.69E+00	5.00E+01		-0.74			L	
Batch: 8073037 906.0_H3_LSC Work Order: NAN951AA Report DB ID: NAN951AB												
H-3	2.13E+02	U N	1.9E+02	2.3E+02	4.33E+02 pCi/L		100%	0.49	4/3/18 12:07 a		0.00502	LSC4
					2.07E+02	7.00E+02		(1.9)			L	
Batch: 8081012 9310_ALPHABETA_GPC Work Order: NAPLH1AA Report DB ID: NAPLH1AB												
Alpha	2.72E-01	U	3.4E-01	3.4E-01	5.62E-01 pCi/L		100%	0.48	3/27/18 01:56 p		0.20169	GPC24B
					2.37E-01	3.00E+00		(1.6)			L	
Batch: 8073038 I129LL_SEP_LEPS_GS Work Order: NAN961AA Report DB ID: NAN961AB												
I129	3.04E-02	U	2.6E-01	2.6E-01	5.04E-01 pCi/L		89%	0.06	3/30/18 08:35 a		2.00079	LEP5\$1
					1.00E+00			0.23			L	
Batch: 8073039 903.1_RA226_LUC Work Order: NAN971AA Report DB ID: NAN971AB												
Ra-226	8.47E-02	U	1.7E-01	1.7E-01	3.00E-01 pCi/L		77%	0.28	4/3/18 03:04 p		1.0007	ASC8RE
					1.25E-01	1.00E+00		0.99			L	
Batch: 8073040 RAISO_SEP_GPC Work Order: NAN981AA Report DB ID: NAN981AB												
Ra-228	1.49E-01	U	2.9E-01	3.1E-01	5.46E-01 pCi/L		83%	0.27	3/28/18 02:44 p		1.0007	GPC31
					2.46E-01	1.00E+00		0.95			L	
Batch: 8073041 TC99_ETVDSK_LSC Work Order: NAN991AA Report DB ID: NAN991AB												
Tc-99	4.93E+00	U	5.0E+00	5.6E+00	1.16E+01 pCi/L		100%	0.43	3/20/18 07:45 p		0.12533	LSC9
					5.46E+00	5.00E+01		(1.8)			L	

TestAmerica Inc MDC|MDA,Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.
 rptSTLRchBlank N Qual - MS, MSD: Spike recovery exceeds upper or lower control limit.
 V5.8.5 A2002 U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.

FORM II

Date: 06-Apr-18

BLANK RESULTS

Lab Name: TestAmerica Inc SDG: W08026 Report No.: 72579
Matrix: WATER

Parameter	Result	Qual	Count Error (2 s)	CSU (2 s)	MDL, Lc	Rpt Unit, CRDL	Yield	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
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No. of Results: 7 Comments:

FORM II

LCS RESULTS

Date: 06-Apr-18

Lab Name: TestAmerica Inc

SDG: W08026

Matrix: WATER

Report No.: 72579

Parameter	Result	Qual	Count Error (2 s)	CSU (2 s)	MDL	Report Unit	Yield	Expected	Expected Uncert	Recovery, Bias	Analysis, Prep Date	Aliquot Size	Primary Detector
Batch: 8073036 C14_LSC													
C-14	4.78E+02		1.7E+01	3.2E+01	1.82E+01	pCi/L	100%	4.80E+02	9.6E+00	100%	3/30/18 10:05 a	0.075	LSC4
							Rec Limits:	80	120	0.0			
Batch: 8073037 906.0_H3_LSC													
H-3	2.66E+03	N	2.5E+02	3.2E+02	4.33E+02	pCi/L	100%	2.75E+03	8.3E+01	96%	4/3/18 01:33 a	0.00502	LSC4
							Rec Limits:	80	120	0.0			
Batch: 8081012 9310_ALPHABETA_GPC													
Alpha	2.21E+01		1.6E+00	5.7E+00	5.65E-01	pCi/L	100%	2.26E+01	2.3E-01	98%	3/27/18 01:56 p	0.20037	GPC24
							Rec Limits:	80	120	0.0			
Batch: 8073038 1129LL_SEP_LEPS_GS													
1129	2.32E+01		3.1E+00	3.1E+00	9.08E-01	pCi/L	85%	1.92E+01	1.0E-01	121%	3/30/18 10:21 a	2.00006	LEP4\$1
							Rec Limits:	80	120	0.2			
Batch: 8073039 903.1_RA226_LUC													
Ra-226	1.01E+01		8.2E-01	2.2E+00	3.87E-01	pCi/L	86%	9.95E+00	1.0E-01	102%	4/3/18 03:04 p	1.00026	ASCESD
							Rec Limits:	80	120	0.0			
Batch: 8073040 RAISO_SEP_GPC													
Ra-228	7.91E+00		5.9E-01	9.7E-01	5.17E-01	pCi/L	87%	9.83E+00	9.9E-02	80%	3/28/18 02:44 p	1.00026	GPC31
							Rec Limits:	80	120	-0.2			
Batch: 8073041 TC99_ETVDSK_LSC													
Tc-99	9.47E+01		8.0E+00	8.7E+00	1.17E+01	pCi/L	100%	1.08E+02	6.2E-01	88%	3/20/18 08:28 p	0.12544	LSC9
							Rec Limits:	80	120	-0.1			

No. of Results: 7 Comments:

TestAmerica Inc Bias - (Result/Expected)-1 as defined by ANSI N13.30.
 rptSTLRchLcs N Qual - MS, MSD: Spike recovery exceeds upper or lower control limit.
 V5.8.5 A2002

FORM II

Date: 06-Apr-18

MATRIX SPIKE RESULTS

Lab Name: TestAmerica Inc SDG: W08026 Matrix: WATER
 Lot-Sample No.: J8C080403-1, B3HDP1 Report No.: 72579

Parameter	SpikeResult, Orig Rst	Count Error (2 s)	CSU (2 s)	MDC MDA	Rpt Unit	Yield	Rec-covery	Expected, Uncert	Analysis, Prep Date	Aliquot Size	Analy Method, Primary Detector
Batch: 8081010	Work Order: NAN2Q2AC	Report DB ID: NAN2Q2CW	Orig Sa DB ID: 9NAN2Q20								
TC-99	5.56E+02	1.6E+01	2.4E+01	1.13E+01 pCi/L	100%	103.49%	5.38E+02	3/23/18 01:32 a	0.12589	L	TC99_ETVDSK_LSC
	4.59E+01						3.1E+00				LSC10

Number of Results: 1

Comments:

FORM II

Date: 06-Apr-18

MATRIX SPIKE RESULTS

Lab Name: TestAmerica Inc SDG: W08026 Matrix: WATER
 Lot-Sample No.: J8C080403-6, B3HDP0 Report No.: 72579

Parameter	SpikeResult, Orig Rst	Count Error (2 s)	CSU (2 s)	MDC MDA	Rpt Unit	Yield	Rec-covery	Expected, Uncert	Analysis, Prep Date	Aliquot Size	Analy Method, Primary Detector
Batch: 8073036											
C-14	4.70E+02	1.7E+01	3.4E+01	1.80E+01 pCi/L		100%	97.91%	4.81E+02	3/30/18 04:35 a	0.075	C14_LSC
	1.82E+01							9.6E+00		L	LSC4

Number of Results: 1

Comments:

TestAmerica Inc RER - Replicate Error Ratio = (S-D)/[sqrt(sq(TPUs)+sq(TPUd))] as defined by ICPT BOA.

rptSTLrChMs Bias - (Result/Expected)-1 as defined by ANSI N13.30.

V5.8.5 A2002

FORM II

Date: 06-Apr-18

MATRIX SPIKE RESULTS

Lab Name: TestAmerica Inc SDG: W08026 Matrix: WATER
 Lot-Sample No.: J8C080404-1, B3HHY3 Report No.: 72579

Parameter	SpikeResult, Orig Rst	Qual	Count Error (2 s)	CSU (2 s)	MDC/JMDA	Rpt Unit	Yield	Rec-covery	Expected, Uncert	Analysis, Prep Date	Aliquot Size	Analy Method, Primary Detector
Batch: 8073037	Work Order: NAN221AC		Report DB ID: NAN221CW	Orig Sa DB ID: 9NAN2210								
H-3	4.51E+02	U N	2.7E+02	4.4E+02	5.06E+02	pCi/L	100%	27.68%	1.63E+03	4/2/18 04:59 p	0.00429	906.0_H3_LSC
	1.60E+03								4.9E+01		L	LSC4

Number of Results: 1

Comments:

TestAmerica Inc RER - Replicate Error Ratio = (S-D)/[sqrt(sq(TPUs)+sq(TPUd))] as defined by ICPT BOA.
 rptSTLRLchMs Bias - (Result/Expected)-1 as defined by ANSI N13.30.
 V5.8.5 A2002 N Qual - MS, MSD: Spike recovery exceeds upper or lower control limit.
 U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.