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## Data Validation Report for CH2M Hill Plateau Remediation Company

**VSR17-008**  
**Project CERC17**

### Chemical and Radiochemical Validation - Level C

Validation Performed By:

  
Eyda Hergenreder

Date: 08-01-2017

Technical Review By:

  
Ellen McEntee

Date: 08-01-2017

Quality Review By:

  
Mary Donovan  
Quality Assurance Manager

Date: 08-14-2017

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Date: 14 August 2017  
 To: CH2M Hill (technical representative)  
 From: Analytical Quality Associates, Inc.  
 Project: CERC17  
 Subject: Inorganics - Sample Data Groups (SDG) GEL418248

## **INTRODUCTION**

This memorandum presents the results of data validation for SDG GEL418248 prepared by GEL Laboratories LLC. A list of samples validated along with the analytical methods is provided in the following table.

<b>Sample ID</b>	<b>Sample Date</b>	<b>Media</b>	<b>Validation Level</b>	<b>Analytical Methods</b>
B38RX0	03/09/17	Water	C	6010D & 6020B
B38RW5	03/09/17	Water	C	6010D & 6020B
B38RX1	03/09/17	Water	C	6010D & 6020B
B38RW6	03/09/17	Water	C	6010D & 6020B
B38RX8	03/09/17	Water	C	6010D & 6020B
B38RX3	03/09/17	Water	C	6010D & 6020B
B38RX9	03/09/17	Water	C	6010D & 6020B
B38RX4	03/09/17	Water	C	6010D & 6020B
B38RY1	03/09/17	Water	C	6010D & 6020B
B38RY3	03/09/17	Water	C	6010D & 6020B
B38RY5	03/08/17	Water	C	6010D & 6020B
B38RY9	03/08/17	Water	C	6010D & 6020B

Data validation was conducted in accordance with the CHPRC validation statement of work and the Groundwater Protection Plan for 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 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 with the following exceptions.

For SDG GEL418248, the Co and Pb laboratory blank results were > the method detection limit (MDL) but < the reporting limit (RL). The Co result for sample B38RW5, B38RX1, B38RW6, B38RY3, B38RY5 and B38RY9 were detects < the RL and <5X the blank value; therefore should be qualified as estimates and flagged “J+.” All other Co sample results and all Pb sample results were non-detects and should not be qualified as a result.

**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, laboratory control sample results, and ICP-AES interference check sample results. According to the SAP, the matrix spike sample accuracy limits are 75% to 125% and the laboratory control sample accuracy limits are 80% to 120% and 50% to 150% for antimony and silver, which are specified by the DV procedure.

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

All MS/MSD recoveries were acceptable.

For SDG418248, the parent sample results for Sr and Ca were >4X the spike concentration. In addition, it should be noted that the MS analysis for method 6020B were performed on a sample not associated with this SDG. Data should not be qualified as a result.

**Laboratory Control Samples (LCSs)**

All LCS recoveries were acceptable.

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

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

- **Precision**

Precision is evaluated by reviewing MS/MSD results, 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 should be within the DV procedure established limit of  $\leq 20\%$ .

### **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**

SDG GEL418248 was submitted for validation and verified for completeness. Completeness is based on the percentage of data determined to be valid (i.e., not rejected). The completion percentage was 100%.

**MAJOR DEFICIENCIES**

None found.

**MINOR DEFICIENCIES**

A minor deficiency leading to qualification of Co sample results as estimates were due to a laboratory blank infraction. 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**

<b>Inorganic Data Qualification Summary</b>			
SDG: GEL418248	Reviewer: AQA	Project: CERC17	Page 1 of 1
<b>Analyte(s)</b>	<b>Qualifier</b>	<b>Samples Affected</b>	<b>Reason</b>
Co	J+	B38RW5, B38RX1, B38RW6, B38RY3, B38RY5, B38RY9	Laboratory blank contamination

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	Ⓒ	D	E
PROJECT: CERC17			DATA PACKAGE: VSR17-008		
VALIDATOR: Eyda Hergenreder		LAB: GEL		DATE: 07/31/2017	
			SDG: GEL418248		
ANALYSES PERFORMED					
SW-846/ICP X	SW-846/GFAA	SW-846/Hg	SW-846 Cyanide	SW-846/ICPMS X	
SAMPLES/MATRIX Water					
GEL418248: B38RX0, B38RW5, B38RX1, B38RW6, B38RX8, B38RX3, B38RX9, B38RX4, B38RY1, B38RY3, B38RY5, B38RY9					

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

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

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## Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

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

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

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

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

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

Comments:

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GEL418248: Co 0.120 ug/L, Pb 0.753 ug/L

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Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

Appendix A - (Cont.) Chemical Data Validation Checklist

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

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

Comments:

Parent sample results for Sr and Ca were >4X spike concentration.

MS/MSD analyses for ICPMS were performed on a non-SDG sample.

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Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

Appendix A - (Cont.) Chemical Data Validation Checklist

6. ICP QUALITY CONTROL (Levels D and E)

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

Comments:

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7. HOLDING TIMES (all levels)

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

Comments:

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**Appendix 4**

**Additional Documentation Requested By Client**

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**GEL LABORATORIES LLC**

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

**QC Summary**

Report Date: March 27, 2017

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CH2M Hill Plateau Remediation Company

MSIN R3-50 CHPRC

PO Box 1600

Richland, Washington

Contact: Mr. Scot Fitzgerald

Workorder: 418248

Parmname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
<b>Metals Analysis - ICPMS</b>											
Batch	1646456										
QC1203744989	LCS										
Aluminum	2000			2110	ug/L		106	(80%-120%)	BAJ	03/24/17	14:16
Antimony	50.0			46.5	ug/L		93.1	(80%-120%)		03/24/17	12:25
Arsenic	50.0			52.0	ug/L		104	(80%-120%)		03/24/17	14:16
Barium	50.0			47.5	ug/L		95.1	(80%-120%)	SKJ	03/23/17	20:31
Beryllium	50.0			55.1	ug/L		110	(80%-120%)	BAJ	03/24/17	14:16
Cadmium	50.0			51.6	ug/L		103	(80%-120%)	SKJ	03/23/17	20:31
Chromium	50.0			51.3	ug/L		103	(80%-120%)			
Cobalt	50.0			51.7	ug/L		103	(80%-120%)			
Copper	50.0			52.9	ug/L		106	(80%-120%)			
Lead	50.0			49.0	ug/L		97.9	(80%-120%)			
Manganese	50.0			52.6	ug/L		105	(80%-120%)	BAJ	03/24/17	14:16
Molybdenum	50.0			52.1	ug/L		104	(80%-120%)	SKJ	03/23/17	20:31
Nickel	50.0			52.1	ug/L		104	(80%-120%)	BAJ	03/24/17	14:16

### QC Summary

Workorder: 418248

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Parmname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
<b>Metals Analysis - ICPMS</b>											
Batch	1646456										
Selenium	50.0			52.5	ug/L		105	(80%-120%)	SKJ	03/23/17	20:31
Silver	50.0			54.9	ug/L		110	(80%-120%)			
Strontium	50.0			51.9	ug/L		104	(80%-120%)	BAJ	03/24/17	14:16
Thallium	50.0			48.7	ug/L		97.5	(80%-120%)	SKJ	03/23/17	20:31
Thorium	50.0			41.9	ug/L		83.8	(80%-120%)			
Tin	50.0			53.3	ug/L		107	(80%-120%)			
Uranium	50.0			53.5	ug/L		107	(80%-120%)	BAJ	03/24/17	16:17
Zinc	50.0			52.1	ug/L		104	(80%-120%)	SKJ	03/23/17	20:31
QC1203744988 MB											
Aluminum			U	15.0	ug/L				BAJ	03/24/17	14:13
Antimony			U	1.00	ug/L					03/24/17	12:24
Arsenic			U	1.70	ug/L					03/24/17	14:13
Barium			U	0.600	ug/L				SKJ	03/23/17	20:29
Beryllium			U	0.200	ug/L				BAJ	03/24/17	14:13
Cadmium			U	0.300	ug/L				SKJ	03/23/17	20:29
Chromium			U	3.00	ug/L						

### QC Summary

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Parmname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
<b>Metals Analysis - ICPMS</b>											
Batch	1646456										
Cobalt			B	0.120	ug/L				SKJ	03/23/17	20:29
Copper			U	0.350	ug/L						
Lead			B	0.753	ug/L						
Manganese			U	1.00	ug/L				BAJ	03/24/17	14:13
Molybdenum			U	0.300	ug/L				SKJ	03/23/17	20:29
Nickel			U	0.500	ug/L				BAJ	03/24/17	14:13
Selenium			U	2.00	ug/L				SKJ	03/23/17	20:29
Silver			U	0.400	ug/L						
Strontium			U	2.00	ug/L				BAJ	03/24/17	14:13
Thallium			U	0.600	ug/L				SKJ	03/23/17	20:29
Thorium			U	0.600	ug/L						
Tin			U	1.00	ug/L						
Uranium			U	0.067	ug/L				BAJ	03/24/17	16:15
Zinc			U	3.50	ug/L				SKJ	03/23/17	20:29
QC1203744990 418244014 MS											
Aluminum	2000	U	15.0	2030	ug/L		101	(75%-125%)	BAJ	03/24/17	14:20

### QC Summary

Workorder: 418248

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Parmname	NOM		Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
<b>Metals Analysis - ICPMS</b>												
Batch	1646456											
Antimony	50.0	U	1.00		46.8	ug/L		93.4	(75%-125%)	BAJ	03/24/17	12:28
Arsenic	50.0	U	1.70		53.7	ug/L		106	(75%-125%)		03/24/17	14:20
Barium	50.0		102		154	ug/L		103	(75%-125%)	SKJ	03/23/17	20:37
Beryllium	50.0	U	0.200		53.8	ug/L		108	(75%-125%)	BAJ	03/24/17	14:20
Cadmium	50.0	U	0.300		49.9	ug/L		99.8	(75%-125%)	SKJ	03/23/17	20:37
Chromium	50.0		30.4		80.7	ug/L		101	(75%-125%)			
Cobalt	50.0	BC	0.157		50.2	ug/L		100	(75%-125%)			
Copper	50.0		6.94		54.4	ug/L		95	(75%-125%)			
Lead	50.0	U	0.500		47.3	ug/L		94.4	(75%-125%)			
Manganese	50.0		5.33		55.4	ug/L		100	(75%-125%)	BAJ	03/24/17	14:20
Molybdenum	50.0		3.27		57.1	ug/L		108	(75%-125%)	SKJ	03/23/17	20:37
Nickel	50.0		6.41		54.1	ug/L		95.4	(75%-125%)	BAJ	03/24/17	14:20
Selenium	50.0	U	2.00		52.5	ug/L		102	(75%-125%)	SKJ	03/23/17	20:37
Silver	50.0	U	0.400		51.0	ug/L		102	(75%-125%)			
Strontium	50.0		645		703	ug/L		N/A	(75%-125%)	BAJ	03/24/17	14:20

### QC Summary

Workorder: 418248

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Parmname	NOM		Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
<b>Metals Analysis - ICPMS</b>												
Batch	1646456											
Thallium	50.0	U	0.600		48.5	ug/L		96.9	(75%-125%)	SKJ	03/23/17	20:37
Thorium	50.0	U	0.600		46.6	ug/L		93.1	(75%-125%)			
Tin	50.0	U	1.00		53.8	ug/L		107	(75%-125%)			
Uranium	50.0		4.01		57.5	ug/L		107	(75%-125%)	BAJ	03/24/17	16:21
Zinc	50.0	U	3.50		50.1	ug/L		97.3	(75%-125%)	SKJ	03/23/17	20:37
QC1203744991 418244014 MSD												
Aluminum	2000	U	15.0		2000	ug/L	1.62	99.3	(0%-20%)	BAJ	03/24/17	14:22
Antimony	50.0	U	1.00		46.7	ug/L	0.178	93.2	(0%-20%)		03/24/17	12:30
Arsenic	50.0	U	1.70		52.7	ug/L	1.86	104	(0%-20%)		03/24/17	14:22
Barium	50.0		102		149	ug/L	3.14	93.3	(0%-20%)	SKJ	03/23/17	20:39
Beryllium	50.0	U	0.200		54.3	ug/L	0.845	109	(0%-20%)	BAJ	03/24/17	14:22
Cadmium	50.0	U	0.300		50.3	ug/L	0.699	101	(0%-20%)	SKJ	03/23/17	20:39
Chromium	50.0		30.4		81.3	ug/L	0.77	102	(0%-20%)			
Cobalt	50.0	BC	0.157		49.9	ug/L	0.484	99.5	(0%-20%)			
Copper	50.0		6.94		54.3	ug/L	0.258	94.7	(0%-20%)			
Lead	50.0	U	0.500		46.9	ug/L	0.662	93.7	(0%-20%)			

**QC Summary**

Workorder: 418248

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Parmname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
<b>Metals Analysis - ICPMS</b>											
Batch	1646456										
Manganese	50.0	5.33		54.9	ug/L	0.881	99.1	(0%-20%)	BAJ	03/24/17	14:22
Molybdenum	50.0	3.27		57.1	ug/L	0.0403	108	(0%-20%)	SKJ	03/23/17	20:39
Nickel	50.0	6.41		53.7	ug/L	0.703	94.6	(0%-20%)	BAJ	03/24/17	14:22
Selenium	50.0	U	2.00	53.1	ug/L	1.17	103	(0%-20%)	SKJ	03/23/17	20:39
Silver	50.0	U	0.400	50.7	ug/L	0.456	101	(0%-20%)			
Strontium	50.0		645	681	ug/L	3.12	N/A	(0%-20%)	BAJ	03/24/17	14:22
Thallium	50.0	U	0.600	47.6	ug/L	1.92	95.1	(0%-20%)	SKJ	03/23/17	20:39
Thorium	50.0	U	0.600	45.6	ug/L	2.05	91.2	(0%-20%)			
Tin	50.0	U	1.00	53.1	ug/L	1.37	106	(0%-20%)			
Uranium	50.0		4.01	57.6	ug/L	0.15	107	(0%-20%)	BAJ	03/24/17	16:22
Zinc	50.0	U	3.50	51.5	ug/L	2.71	100	(0%-20%)	SKJ	03/23/17	20:39
QC1203744992 418244014 SDILT											
Aluminum		U	13.1	DU	75.0	ug/L	N/A	(0%-20%)	BAJ	03/24/17	14:25
Antimony		U	0.069	DU	5.00	ug/L	N/A	(0%-20%)		03/24/17	12:32
Arsenic		U	0.483	DU	8.50	ug/L	N/A	(0%-20%)		03/24/17	14:25
Barium			102	D	20.7	ug/L	1.49	(0%-20%)	SKJ	03/23/17	20:44

### QC Summary

Workorder: 418248

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Parmname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
<b>Metals Analysis - ICPMS</b>											
Batch	1646456										
Beryllium	U	0.008	DU	1.00	ug/L	N/A		(0%-20%)	BAJ	03/24/17	14:25
Cadmium	U	0.003	DU	1.50	ug/L	N/A		(0%-20%)	SKJ	03/23/17	20:44
Chromium		30.4	BD	6.40	ug/L	5.45		(0%-20%)			
Cobalt	BC	0.157	DU	0.500	ug/L	N/A		(0%-20%)			
Copper		6.94	D	1.54	ug/L	10.8		(0%-20%)			
Lead	U	0.076	DU	2.50	ug/L	N/A		(0%-20%)			
Manganese		5.33	BD	1.17	ug/L	9.62		(0%-20%)	BAJ	03/24/17	14:25
Molybdenum		3.27	D	0.612	ug/L	6.36		(0%-20%)	SKJ	03/23/17	20:44
Nickel		6.41	BD	1.40	ug/L	9.09		(0%-20%)	BAJ	03/24/17	14:25
Selenium	U	1.55	DU	10.0	ug/L	N/A		(0%-20%)	SKJ	03/23/17	20:44
Silver	U	0.021	DU	2.00	ug/L	N/A		(0%-20%)			
Strontium		645	D	135	ug/L	4.32		(0%-20%)	BAJ	03/24/17	14:25
Thallium	U	0.039	DU	3.00	ug/L	N/A		(0%-20%)	SKJ	03/23/17	20:44
Thorium	U	0.013	DU	3.00	ug/L	N/A		(0%-20%)			
Tin	U	0.156	DU	5.00	ug/L	N/A		(0%-20%)			

**QC Summary**

Workorder: 418248

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Parmname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
<b>Metals Analysis - ICPMS</b>											
Batch	1646456										
Uranium		4.01	D	0.822	ug/L	2.62		(0%-20%)	BAJ	03/24/17	16:26
Zinc	U	1.48	DU	17.5	ug/L	N/A		(0%-20%)	SKJ	03/23/17	20:44
<b>Metals Analysis-ICP</b>											
Batch	1646454										
QC1203744984	LCS										
Boron	500			496	ug/L		99.1	(80%-120%)	HSC	03/24/17	07:32
Calcium	5000			5160	ug/L		103	(80%-120%)			
Iron	5000			5170	ug/L		103	(80%-120%)			
Magnesium	5000			5060	ug/L		101	(80%-120%)			
Potassium	5000			5540	ug/L		111	(80%-120%)		03/23/17	16:03
Sodium	5000			4990	ug/L		99.9	(80%-120%)		03/24/17	07:32
Vanadium	500			543	ug/L		109	(80%-120%)		03/23/17	16:03
QC1203744983	MB										
Boron			U	15.0	ug/L					03/24/17	07:29
Calcium			U	50.0	ug/L						
Iron			U	30.0	ug/L						
Magnesium			U	110	ug/L						
Potassium			U	50.0	ug/L					03/23/17	16:00

**QC Summary**

Workorder: 418248

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Parmname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
<b>Metals Analysis-ICP</b>											
Batch	1646454										
Sodium			U	100	ug/L				HSC	03/24/17	07:29
Vanadium			U	1.00	ug/L					03/23/17	16:00
QC1203744985 418248007 MS											
Boron	500	B	19.6	515	ug/L		99.1	(75%-125%)		03/24/17	07:38
Calcium	5000		41400	45200	ug/L		N/A	(75%-125%)			
Iron	5000	U	30.0	5070	ug/L		101	(75%-125%)			
Magnesium	5000		11600	16400	ug/L		96.4	(75%-125%)			
Potassium	5000		5720	10900	ug/L		104	(75%-125%)		03/23/17	16:10
Sodium	5000		19000	23300	ug/L		86.4	(75%-125%)		03/24/17	07:38
Vanadium	500		30.8	568	ug/L		107	(75%-125%)		03/23/17	16:10
QC1203744986 418248007 MSD											
Boron	500	B	19.6	517	ug/L	0.465	99.5	(0%-20%)		03/24/17	07:40
Calcium	5000		41400	45500	ug/L	0.849	N/A	(0%-20%)			
Iron	5000	U	30.0	5110	ug/L	0.776	102	(0%-20%)			
Magnesium	5000		11600	16600	ug/L	1.28	101	(0%-20%)			
Potassium	5000		5720	10800	ug/L	0.855	102	(0%-20%)		03/23/17	16:13
Sodium	5000		19000	23200	ug/L	0.392	84.5	(0%-20%)		03/24/17	07:40

### QC Summary

Workorder: 418248

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Parmname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
<b>Metals Analysis-ICP</b>											
Batch	1646454										
Vanadium	500	30.8		566	ug/L	0.296	107	(0%-20%)	HSC	03/23/17	16:13
QC1203744987 418248007 SDILT											
Boron	B	19.6	DU	75.0	ug/L	N/A		(0%-20%)		03/24/17	07:42
Calcium		41400	D	8530	ug/L	2.95		(0%-20%)			
Iron	U	12.6	DU	150	ug/L	N/A		(0%-20%)			
Magnesium		11600	D	2410	ug/L	4.09		(0%-20%)			
Potassium		5720	D	1220	ug/L	6.48		(0%-20%)		03/23/17	16:16
Sodium		19000	D	3920	ug/L	3.45		(0%-20%)		03/24/17	07:42
Vanadium		30.8	D	5.85	ug/L	5.15		(0%-20%)		03/23/17	16:16

**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 >= 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.
- W Post-digestion spike recovery for GFAA out of control limit. Sample absorbency < 50% of spike absorbency.
- X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier

Date: 14 August 2017  
 To: CH2M Hill (technical representative)  
 From: Analytical Quality Associates, Inc.  
 Project: CERC17  
 Subject: General Chemistry - Sample Data Groups (SDGs) DN0101 and GEL418248

## **INTRODUCTION**

This memorandum presents the results of data validation for SDG DN0101 prepared by TestAmerica Laboratories and SDG GEL418248 prepared by GEL Laboratories LLC. A list of samples validated along with the analytical methods is provided in the following table.

<b>Sample ID</b>	<b>Sample Date</b>	<b>Media</b>	<b>Validation Level</b>	<b>Analytical Methods</b>
B38RY6	03/08/17	Water	C	SW846 9020B
B38W07	03/08/17	Water	C	SW846 9056
B38W08	03/09/17	Water	C	SW846 9056
B38W09	03/09/17	Water	C	SW846 9056
B38W10	03/09/17	Water	C	SW846 9056
B38W11	03/09/17	Water	C	SW846 9056
B38W12	03/09/17	Water	C	SW846 9056
B38RW5	03/09/17	Water	C	SW846 9020, EPA 353.1, SM2540C, SM2320
B38RW6	03/09/17	Water	C	SW846 9020, EPA 353.1, SM2540C, SM2320
B38RX3	03/09/17	Water	C	SW846 9020, EPA 353.1, SM2540C, SM2320
B38RX4	03/09/17	Water	C	SW846 9020, EPA 353.1, SM2540C, SM2320
B38RY1	03/09/17	Water	C	SW846 9020, EPA 353.1, SM2540C, SM2320
B38RY5	03/08/17	Water	C	SW846 9020, EPA 353.1, SM2540C, SM2320

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:

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

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

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

For SDG GEL418248, samples B38W09, B38W11 and B38W12 were reanalyzed beyond but within 2X the prescribed holding time for nitrate-N. All 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 with the following exception. For SDG GEL418248, chloride was detected in trip blank B38W10. The chloride result for associated sample B38W09 was a detect > the practical quantitation limit and > 5X the blank value and should not be qualified as a result.

**Field Blanks**

No field blanks were submitted for validation.

**Equipment Blanks**

No equipment blanks were submitted for validation.

- **Accuracy**

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

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

All MS/MSD recoveries were acceptable. It should be noted that the MS for TOX associated with SDG GEL418248 was performed on a sample from another SDG. No sample data were 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  $\leq 20\%$  as specified by the DV procedure.

**MS/MSD Samples**

The MS/MSD RPD value was acceptable.

**Laboratory Duplicate Samples**

All laboratory duplicate results were acceptable.

**Field Duplicate Samples**

All field duplicate results were acceptable.

**Field Split Samples**

All field split results were acceptable. It should be noted that the primary split sample B38RY6 was included in SDG DN0101 and the split sample B38RY5 was included in SDG GEL418248.

- **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 DN0101 and GEL418248 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**

A minor deficiency leading to qualification of sample results as estimates occurred due to analysis beyond but within 2X the holding time. 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**

<b>General Chemistry Data Qualification Summary</b>			
SDGs: DN0101 and GEL418248	Reviewer: AQA	Project: CERC17	Page 1 of 1
<b>Analyte(s)</b>	<b>Qualifier</b>	<b>Samples Affected</b>	<b>Reason</b>
Nitrate-N	J-	B38W09, B38W11, B38W12	Analyzed beyond but within 2X holding time.

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: CERC17			DATA PACKAGE: VSR17-008		
VALIDATOR: Eyda Hergenreder		LAB: TestAmerica, GEL		DATE: 08/14/2017	
			SDG: DN0101, GEL418248		
ANALYSES PERFORMED					
Anions/IC X	TOC	TOX X	TPH-418.1	Oil and Grease	Alkalinity X
Ammonia	BOD/COD	Chloride	Chromium-VI	pH	NO <sub>3</sub> /NO <sub>2</sub> X
Sulfate	TDS X	TKN	Phosphate		
SAMPLES/MATRIX Water					
SDG DN0101: B38RY6					
SDG GEL418248: B38W07, B38W08, B38W09, B38W10, B38W11, B38W12, B38RW5, B38RW6, B38RX3, B39RX4, B38RY1, B38RY5					

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

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

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## Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

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

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

Initial calibrations performed on all instruments?	Yes No <input 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:

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

ICB and CCB checks performed for all applicable analyses? (Levels D, E)	Yes No <input 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)	Yes <input type="radio"/> No N/A
Transcription/calculation errors? (Levels D, E)	Yes No <input type="radio"/> N/A

Comments:

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SDG GEL418248: Trip Blank B38W10: Cl 99.1 ug/L

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## Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

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

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

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

Comments:

GEL418248 split sample B38RY5/primary split sample SDG DN0101 sample B38RY6

## 6. HOLDING TIMES (all levels)

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

Comments:

SDG GEL418248: samples B38W09, B38W11 and B38W12 were analyzed beyond but within 2X holding time for nitrate-N.



**Appendix 4**

**Additional Documentation Requested By Client**

Page 44 of 79  
**QC Sample Results**

Client: CH2M Hill Plateau Remediation Company  
 Project/Site: X17-038

TestAmerica Job ID: 280-94733-1  
 SDG: DN0101

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

Lab Sample ID: MB 280-365887/2  
 Matrix: Water  
 Analysis Batch: 365887

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			03/16/17 11:57	1

Lab Sample ID: LCS 280-365887/4  
 Matrix: Water  
 Analysis Batch: 365887

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	93.38		ug/L		93	80 - 120

Lab Sample ID: LCSD 280-365887/5  
 Matrix: Water  
 Analysis Batch: 365887

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	99.14		ug/L		99	80 - 120	6	23

Lab Sample ID: 280-94733-1 MS  
 Matrix: Water  
 Analysis Batch: 365887

Client Sample ID: B38RY6  
 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	97.77		ug/L		98	75 - 125

Lab Sample ID: 280-94733-1 MSD  
 Matrix: Water  
 Analysis Batch: 365887

Client Sample ID: B38RY6  
 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	97.47		ug/L		97	75 - 125	0	23

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**GEL LABORATORIES LLC**

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

**QC Summary**

Report Date: April 4, 2017

Page 1 of 5

CH2M Hill Plateau Remediation Company

MSIN R3-50 CHPRC

PO Box 1600

Richland, Washington

Contact: Mr. Scot Fitzgerald

Workorder: 418248

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
<b>Halogen Analysis</b>											
Batch	1650337										
QC1203754155	417866006	DUP									
Total Organic Halogens		10.8	B	6.64	ug/L	47.5 ^		(+/-10.0)	RMJ	03/30/17	19:40
QC1203754154	LCS										
Total Organic Halogens	100			105	ug/L		105	(80%-120%)		03/30/17	19:07
QC1203754153	MB										
Total Organic Halogens			U	3.33	ug/L					03/30/17	18:48
QC1203754156	417866006	PS									
Total Organic Halogens	100	10.8		119	ug/L		108	(75%-125%)		03/30/17	20:19
<b>Ion Chromatography</b>											
Batch	1646255										
QC1203744583	418248006	DUP									
Bromide	U	67.0	U	67.0	ug/L	N/A			MXL2	03/10/17	16:08
Chloride	D	11100	D	11900	ug/L	6.97		(0%-20%)		03/11/17	16:31
Fluoride	B	336	B	332	ug/L	1.2 ^		(+/-500)		03/10/17	16:08
Nitrate-N	DX	5110	DX	5180	ug/L	1.38		(0%-20%)		03/11/17	16:31
Nitrite-N	U	33.0	U	33.0	ug/L	N/A				03/10/17	16:08
Phosphorus in phosphate	U	67.0	U	67.0	ug/L	N/A					
Sulfate	D	26200	D	26500	ug/L	0.818		(0%-20%)		03/11/17	16:31

### QC Summary

Workorder: 418248

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
<b>Ion Chromatography</b>											
Batch	1646255										
QC1203744582	LCS										
Bromide	1250			1210	ug/L		96.7	(80%-120%)	MXL2	03/10/17	11:44
Chloride	5000			4620	ug/L		92.4	(80%-120%)			
Fluoride	2500			2420	ug/L		96.8	(80%-120%)			
Nitrate-N	2500			2380	ug/L		95.4	(80%-120%)			
Nitrite-N	2500			2400	ug/L		96.2	(80%-120%)			
Phosphorus in phosphate	1250			1240	ug/L		98.8	(80%-120%)			
Sulfate	10000			9620	ug/L		96.2	(80%-120%)			
QC1203744581	MB										
Bromide			U	67.0	ug/L					03/10/17	11:15
Chloride			U	67.0	ug/L						
Fluoride			U	33.0	ug/L						
Nitrate-N			U	33.0	ug/L						
Nitrite-N			U	33.0	ug/L						
Phosphorus in phosphate			U	67.0	ug/L						
Sulfate			U	133	ug/L						

**QC Summary**

Workorder: 418248

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Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
<b>Ion Chromatography</b>											
Batch 1646255											
QC1203744584 418248006 PS											
Bromide	1.25	U	0.0544		1.26	mg/L	96.1	(75%-125%)	MXL2	03/11/17	13:35
Chloride	5.00	D	2.21	D	7.16	mg/L	98.9	(75%-125%)		03/11/17	17:00
Fluoride	2.50	B	0.336		2.68	mg/L	93.8	(75%-125%)		03/11/17	13:35
Nitrate-N	2.50	DX	1.02	DX	3.50	mg/L	99	(75%-125%)		03/11/17	17:00
Nitrite-N	2.50	U	0.00	X	2.37	mg/L	94.9	(75%-125%)		03/11/17	13:35
Phosphorus in phosphate	1.25	U	0.0341	X	1.37	mg/L	107	(75%-125%)			
Sulfate	10.0	D	5.25	D	15.4	mg/L	102	(75%-125%)		03/11/17	17:00

**Nutrient Analysis**

Batch 1646677											
QC1203745502 418248017 DUP											
Nitrogen, Nitrate/Nitrite		D	31300	D	31400	ug/L	0.319	(0%-20%)	AXH3	03/15/17	11:17
QC1203745500 LCS											
Nitrogen, Nitrate/Nitrite	1000				1000	ug/L	100	(90%-110%)		03/15/17	10:58
QC1203745499 MB											
Nitrogen, Nitrate/Nitrite				U	7.00	ug/L				03/15/17	10:57
QC1203745505 418248017 PS											
Nitrogen, Nitrate/Nitrite	1.00	D	0.626	D	1.58	mg/L	95.4	(90%-110%)		03/15/17	11:23

**Solids Analysis**

Batch 1647396											
QC1203747132 418248008 DUP											
Total Dissolved Solids			217000		219000	ug/L	0.656	(0%-20%)	KLP1	03/15/17	11:01

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**QC Summary**

**Workorder: 418248**

Page 4 of 5

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
<b>Solids Analysis</b>											
Batch	1647396										
QC1203747130	LCS										
Total Dissolved Solids	300000			289000	ug/L		96.2	(80%-120%)	KLP1	03/15/17	11:01
QC1203747129	MB										
Total Dissolved Solids			U	3400	ug/L					03/15/17	11:01
<b>Titration and Ion Analysis</b>											
Batch	1647931										
QC1203748419	417709003		DUP								
Alkalinity, Total as CaCO3		108000		107000	ug/L	0.93		(0%-20%)	RXB5	03/16/17	18:03
QC1203748418	LCS										
Alkalinity, Total as CaCO3	100000			109000	ug/L		109	(80%-120%)		03/16/17	17:55
Batch	1649762										
QC1203752694	418248008		DUP								
Alkalinity, Total as CaCO3		138000		138000	ug/L	0		(0%-20%)	RXB5	03/23/17	20:31
QC1203752693	LCS										
Alkalinity, Total as CaCO3	100000			109000	ug/L		109	(80%-120%)		03/23/17	20:28

**Notes:**

The Qualifiers in this report are defined as follows:

- < 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).
- 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.
- N Spike Sample recovery is outside control limits.
- U Analyzed for but not detected above limiting criteria. Includes MDL, MDA, PQL, zero, counting error, and total analytical error.
- X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Y Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Z Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier

Date: 31 July 2017

To: CH2M Hill (technical representative)

From: Analytical Quality Associates, Inc.

Project: CERC17

Subject: Radiochemical - Sample Data Groups (SDGs) GEL418248, GEL422048 and W07797

## **INTRODUCTION**

This memorandum presents the results of data validation for SDGs GEL418248 and GEL422048 prepared by GEL Laboratories LLC and W07797 prepared by TestAmerica Inc. A couple of samples associated with SDG GEL422048 were reanalyzed to meet project detection limit for Tc-99. Reanalysis results are associated with SDG GEL418248. A list of samples validated along with the analytical methods is provided in the following table.

<b>Sample ID</b>	<b>Sample Date</b>	<b>Media</b>	<b>Validation Level</b>	<b>Analytical Methods</b>
B38RW5	03/09/17	Water	C	I-129
B38RW6	03/09/17	Water	C	I-129
B38RX3	03/09/17	Water	C	Tc-99, C-14
B38RX4	03/09/17	Water	C	Tc-99, C-14
B38RY1	03/09/17	Water	C	I-129, C-14
B38RY5	03/08/17	Water	C	Tc-99
B38RX7	03/09/17	Water	C	I-129, Alpha, Beta, Ra-226, Ra-228
B38RY8	03/08/17	Water	C	I-129, Alpha, Beta, Ra-226, Ra-228
B38RX6	03/09/17	Water	C	I-129, Alpha, Beta, Ra-226, Ra-228
B38RW9	03/09/17	Water	C	Tc-99, Alpha, Beta, Ra-226, Ra-228
B38RW8	03/09/17	Water	C	Tc-99, Alpha, Beta, Ra-226, Ra-228
B38RY2	03/09/17	Water	C	Tc-99, Alpha, Beta, Ra-226, Ra-228
B38RY7	03/08/17	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 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.

### **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 sample accuracy limits are 75% to 125% and the laboratory control sample accuracy limits 80% to 120% as specified by the DV procedure.

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

All MS recoveries were acceptable.

For SDG GEL418248, the parent sample for the I-129 and C-14 MS analysis was a sample from another SDG. Data should not be qualified as a result.

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

All LCS recoveries were acceptable with the following exception.

For SDG W07797, the LCS recovery for beta was > 120%. The beta result for samples B38RX7, B38RY8, B38RW9, B38RW8 and B38RY2 were > the MDCs and should be qualified as estimates and flagged “J+.”

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

All carrier/tracer recovery factors were acceptable.

- **Precision**

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

### **Laboratory Duplicate Samples**

All laboratory duplicate results were acceptable.

For SDG GEL418248, the duplicate analyses for I-129, Tc-99 and C-14 were performed on samples associated with another SDG. Data should not be qualified as a result.

### **Field Duplicate Samples**

All field duplicate results were acceptable.

### **Field Split Samples**

Field split precision could not be assessed since the parent split sample was not selected 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.

- **Completeness**

SDGs GEL418248, GEL422048 and W07797 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 for Beta as estimates were due to high LCS recovery. 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**

<b>Radiochemical Data Qualification Summary</b>			
SDGs: GEL418248, GEL422048, W07797	Reviewer: AQA	Project: CERC17	Page 1 of 1
<b>Analyte(s)</b>	<b>Qualifier</b>	<b>Samples Affected</b>	<b>Reason</b>
Beta	J+	B38RX7, B38RY8, B38RW9, B38RW8, B38RY2	High LCS recovery

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	<input checked="" type="radio"/> C	D	E
Project: CERC17			Data Package: VSR17-008		
Validator: Eyda Hergenreder		Lab: TestAmerica, GEL		Date: 07/31/2017	
			SDG: GEL418248, GEL422048, W07797		
Analyses Performed					
<input checked="" type="checkbox"/> Gross Alpha/Beta	<input type="checkbox"/> Strontium-90	<input checked="" type="checkbox"/> Technetium-99	<input type="checkbox"/> Alpha Spectroscopy	<input type="checkbox"/> Gamma Spectroscopy	<input type="checkbox"/> Tritium
<input type="checkbox"/> Total Uranium	<input type="checkbox"/> Radium-22	<input checked="" type="checkbox"/> I129	<input checked="" type="checkbox"/> Ra-226	<input checked="" type="checkbox"/> C14	<input checked="" type="checkbox"/> Ra-228
Samples/Matrix Water					
GEL418248: B38RW5, B38RW6, R38RX3, B38RX4, B38RY1, B38RY5					
GEL422048: B38RX3, B38RY5					
W07797: B38RX7, B38RY8, B38RX6, B38RW9, B38RW8, B38RY2, B38RY7					

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

**Comments:**

RDR 170427GEL-R9917: Client required that samples B38RX3 and B38RY5 associated with SDG GEL418248 were to be reanalyzed for lower detection limit for Tc-99. Reanalysis results are associated SDG GEL422048.

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

Data Validation for Radiochemical Analyses

Published Date: 09/13/16

SGRP-GD-SMP-50116

Effective Date: 09/13/16

Appendix B - (Cont.) Radiochemical Data Validation Checklist

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

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

**Data Validation for Radiochemical Analyses**

Published Date: 09/13/16

SGRP-GD-SMP-50116

Effective Date: 09/13/16

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

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

**Comments:**

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

SDG W07797: Beta LCS 121%

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Data Validation for Radiochemical Analyses

Published Date: 09/13/16

SGRP-GD-SMP-50116

Effective Date: 09/13/16

Appendix B - (Cont.) Radiochemical Data Validation Checklist

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

Comments:

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

Comments:

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**Data Validation for Radiochemical Analyses**

Published Date: 09/13/16

SGRP-GD-SMP-50116

Effective Date: 09/13/16

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

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

**Comments:**

SDG GEL418248: MS for I-129 and C-14 were performed on samples associated with another SDG

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

**Comments:**

SDG GEL418248: Duplicate analysis were performed on samples associated with another SDG.

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

Primary split sample associated with B38RY5 was not included for validation

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

**Comments:**

**Appendix 4**

**Additional Documentation Requested By Client**

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## QC Summary

Report Date: April 4, 2017  
Page 1 of 2

**Client :** CH2MHill Plateau Remediation Company  
**MSIN R3-50 CHPRC**  
**PO Box 1600**  
**Richland, Washington 99352**  
**Contact:** Mr. Scot Fitzgerald  
**Workorder:** 418248

Parmname	NOM	Sample	Qual	QC	Units	QC Criteria	Range	Analyst	Date Time
<b>Rad Gamma Spec</b>									
Batch	1647150								
QC1203746638	MB								
Iodine-129			UX	0.00	pCi/L			MJH1	03/21/1706:45
				Uncert:					
				TPU:					
QC1203746639	418122001	DUP							
Iodine-129		U	0.0345	U	-0.257	pCi/L			03/21/1708:23
				Uncert:	+/-0.356		RPD: 0	N/A	
				TPU:	+/-0.356		RER: 1.12	(0-2)	
QC1203746640	418122001	MS							
Iodine-129		U	0.0345		32.7	pCi/L	REC: 102	(75%-125%)	03/21/1708:24
				Uncert:	+/-0.356				
				TPU:	+/-0.356				
QC1203746641	LCS								
Iodine-129			27.7		26.4	pCi/L	REC: 95	(80%-120%)	03/21/1708:24
				Uncert:	+/-2.97				
				TPU:	+/-3.94				
<b>Rad Liquid Scintillation</b>									
Batch	1646546								
QC1203745228	MB								
Technetium-99			U	-11.7	pCi/L			LXT2	03/20/1719:48
				Uncert:	+/-21.7				
				TPU:	+/-21.7				
**Technetium-99m Tracer		56700		55100	CPM	REC: 97	(30%-105%)		
QC1203745229	417968001	DUP							
Technetium-99			296		294	pCi/L			03/20/1720:10
				Uncert:	+/-32.8		RPD: 1	(0% - 20%)	
				TPU:	+/-46.4		RER: 0.0481	(0-2)	
**Technetium-99m Tracer		56700	52800	52000	CPM	REC: 92	(30%-105%)		
QC1203745230	LCS								
Technetium-99			861		901	pCi/L	REC: 105	(80%-120%)	03/20/1720:31
				Uncert:	+/-43.9				
				TPU:	+/-109				
**Technetium-99m Tracer		56700		56100	CPM	REC: 99	(30%-105%)		
Batch	1646558								
QC1203745259	MB								
Carbon-14			U	5.71	pCi/L			TXJ1	03/13/1720:57
				Uncert:	+/-20.3				
				TPU:	+/-20.3				
QC1203745260	417968001	DUP							
Carbon-14		U	9.43	U	20.5	pCi/L			03/13/1721:44
				Uncert:	+/-20.4		RPD: 0	N/A	
				TPU:	+/-20.4		RER: 0.74	(0-2)	
QC1203745261	417968001	MS							
Carbon-14		U	9.43		1240	pCi/L	REC: 99	(75%-125%)	03/13/1722:31

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## QC Summary

Workorder: 418248

Page 2 of 2

Parmname	NOM	Sample	Qual	QC	Units	QC Criteria	Range	Analyst	Date Time
<b>Rad Liquid Scintillation</b>									
Batch	1646558								
		Uncert:	+/-20.4	+/-39.4					
		TPU:	+/-20.4	+/-234					
QC1203745262	LCS								
Carbon-14	1250			1300	pCi/L	REC: 104	(80%-120%)		03/13/1723:18
		Uncert:		+/-40.2					
		TPU:		+/-244					

**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 associated QC sample blank has a result  $\geq 2X$  the MDA and, after corrections, result is  $\geq$  MDA for this sample
- 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.
- 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.
- UX Gamma Spectroscopy--Uncertain identification
- W Post-digestion spike recovery for GFAA out of control limit. Sample absorbency  $< 50\%$  of spike absorbency.
- X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Y Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Z Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier

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

\*\* Indicates analyte is a surrogate compound.

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

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

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

# GEL LABORATORIES LLC

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

## QC Summary

Report Date: May 5, 2017  
Page 1 of 1

**Client :** CH2MHill Plateau Remediation Company  
**MSIN R3-50 CHPRC**  
**PO Box 1600**  
**Richland, Washington 99352**  
**Contact: Mr. Scot Fitzgerald**  
**Workorder: 422048**

Parmname	NOM	Sample	Qual	QC	Units	QC Criteria	Range	Analyst	Date Time
<b>Rad Liquid Scintillation</b>									
Batch	1646546								
QC1203745228	MB								
Technetium-99			U	-11.7	pCi/L			GXR1	03/20/1719:48
				Uncert: +/-21.7					
				TPU: +/-21.7					
**Technetium-99m Tracer	56700			55100	CPM	REC: 97	(30%-105%)		
QC1203745229	417968001	DUP							
Technetium-99		296		294	pCi/L				03/20/1720:10
				Uncert: +/-32.8		RPD: 1	(0% - 20%)		
				TPU: +/-46.4		RER: 0.0481	(0-2)		
**Technetium-99m Tracer	56700	52800		52000	CPM	REC: 92	(30%-105%)		
QC1203745230	LCS								
Technetium-99		861		901	pCi/L	REC: 105	(80%-120%)		03/20/1720:31
				Uncert: +/-43.9					
				TPU: +/-109					
**Technetium-99m Tracer	56700			56100	CPM	REC: 99	(30%-105%)		

**Notes:**

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

The Qualifiers in this report are defined as follows:

- B The associated QC sample blank has a result  $\geq 2X$  the MDA and, after corrections, result is  $\geq$  MDA for this sample
- D Results are reported from a diluted aliquot of sample.
- N Spike Sample recovery is outside control limits.
- U Analyzed for but not detected above limiting criteria. Includes MDL, MDA, PQL, zero, counting error, and total analytical error.
- UX Gamma Spectroscopy--Uncertain identification
- X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Y Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Z Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier

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

\*\* Indicates analyte is a surrogate compound.

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

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

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

Date: 17-May-17

DUPLICATE RESULTS

Lab Name: TestAmerica Inc

SDG: W07797

Collection Date: 3/9/2017 10:05:00 AM

Lot-Sample No.: J7C100401-4

Report No. : 70971

Received Date: 3/9/2017 2:25:00 PM

Client Sample ID: B38RW9 DUP

COC No. : X17-038-013

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: 7086024	TC99_ETVDSK_LSC				Work Order: M9X9F1AG			Report DB ID: M9X9F1GR		Orig Sa DB ID: 9M9X9F10		
TC-99	1.43E+02		1.3E+01	1.7E+01	1.79E+01	pCi/L	100%	(8.)	4/22/17 01:06 a		0.12885	LSC4
	1.48E+02				RPD 3.6			5.00E+01			L	

No. of Results: 1    Comments:

TestAmerica Inc    RPD - Relative Percent Difference.

rptSTLRchDupV5.8.3 A2002    MDC|MDA,Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.



Date: 17-May-17

DUPLICATE RESULTS

Lab Name: TestAmerica Inc

SDG: W07797

Collection Date: 3/9/2017 8:48:00 AM

Lot-Sample No.: J7C100401-1

Report No. : 70971

Received Date: 3/9/2017 2:25:00 PM

Client Sample ID: B38RX7 DUP

COC No. : X17-038-017

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: 7086023	I129LL_SEP_LEPS_GS				Work Order: M9X9C1AJ			Report DB ID: M9X9C1JR		Orig Sa DB ID: 9M9X9C10		
I129	2.84E+00	U	6.8E-01	6.9E-01	1.34E+00	pCi/L	82%	(2.1)	4/21/17 07:27 p		2.0022	LEP5\$1
	3.31E+00				RPD 15.4			(8.3)			L	

No. of Results: 1    Comments:

TestAmerica Inc  
rptSTLRchDupV5.  
8.3 A2002

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.

Date: 17-May-17

DUPLICATE RESULTS

Lab Name: TestAmerica Inc

SDG: W07797

Collection Date: 3/9/2017 12:43:00 PM

Lot-Sample No.: J7C100401-6

Report No. : 70971

Received Date: 3/9/2017 2:25:00 PM

Client Sample ID: B38RY2 DUP

COC No. : X17-038-018

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: 7086027	903.1_RA226_LUC				Work Order: M9X9H1AG	Report DB ID: M9X9H1GR			Orig Sa DB ID: 9M9X9H10			
Ra-226	0.00E+00	U	0.0E+00	1.1E-01	2.15E-01	pCi/L	94%	0.	5/10/17 07:43 p		1.01186	ASCBMD
	5.89E-02	U		<b>RPD 200.0</b>		1.00E+00		0.			L	
Batch: 7086028	RAISO_SEP_GPC				Work Order: M9X9H1AH	Report DB ID: M9X9H1HR			Orig Sa DB ID: 9M9X9H10			
Ra-228	8.02E-01		2.8E-01	2.9E-01	3.68E-01	pCi/L	87%	(2.2)	5/12/17 04:48 p		1.01186	GPC2D
	2.27E-01	U		<b>RPD 111.8</b>		3.00E+00		(5.5)			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.  
 8.3 A2002    U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.

Date: 17-May-17

DUPLICATE RESULTS

Lab Name: TestAmerica Inc

SDG: W07797

Collection Date: 3/8/2017 10:59:00 AM

Lot-Sample No.: J7C100401-7

Report No. : 70971

Received Date: 3/9/2017 2:25:00 PM

Client Sample ID: B38RY7 DUP

COC No. : X17-038-020

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: 7086020	C14_LSC				Work Order: M9X9J1AD			Report DB ID: m9x9j1dR		Orig Sa DB ID: 9m9x9j10		
C-14	7.71E+00	U	7.3E+00	9.0E+00	1.72E+01	pCi/L	100%	0.45	4/12/17 09:28 p		0.075	LSC4
	5.56E+00	U		RPD 32.4				5.00E+01			L	

No. of Results: 1    Comments:

TestAmerica Inc  
rptSTLRchDupV5.  
8.3 A2002

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.

Date: 17-May-17

DUPLICATE RESULTS

Lab Name: TestAmerica Inc

SDG: W07797

Collection Date: 3/8/2017 10:59:00 AM

Lot-Sample No.: J7C100401-2

Report No. : 70971

Received Date: 3/9/2017 2:25:00 PM

Client Sample ID: B38RY8 DUP

COC No. : X17-038-019

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: 7123011	9310_ALPHABETA_GPC		Work Order: M9X9D2AJ		Report DB ID: M9X9D2JR			Orig Sa DB ID: 9M9X9D20				
Alpha	5.07E-01	U	1.1E+00	1.1E+00	1.87E+00	pCi/L	100%	0.27	5/11/17 04:24 p		0.20167	GPC24B
	5.74E-01	U	RPD 12.3			3.00E+00		0.93			L	

No. of Results: 1    Comments:

## FORM II

Date: 17-May-17

## BLANK RESULTS

Lab Name: TestAmerica Inc

SDG: W07797

Matrix: WATER

Report No. : 70971

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
<b>Batch:</b> 7086020	C14_LSC											
C-14	8.82E+00	U	7.4E+00	9.1E+00	1.72E+01	pCi/L	100%	0.51	4/12/17 10:31 p		0.075	LSC4
					8.27E+00	5.00E+01		(1.9)			L	
<b>Batch:</b> 7086025	9310_ALPHABETA_GPC											
Alpha	3.69E-01	U	4.0E-01	4.1E-01	6.45E-01	pCi/L	100%	0.57	5/1/17 12:45 p		0.20138	GPC24A
					2.80E-01	3.00E+00		(1.8)			L	
<b>Batch:</b> 7123011	9310_ALPHABETA_GPC											
Alpha	-2.78E-01	U	4.1E-01	4.2E-01	8.19E-01	pCi/L	100%	-0.34	5/11/17 08:56 p		0.20764	GPC24B
					3.68E-01	3.00E+00		-(1.3)			L	
<b>Batch:</b> 7086026	9310_ALPHABETA_GPC											
Beta	1.48E-01	U	9.2E-01	9.2E-01	1.58E+00	pCi/L	100%	0.09	4/28/17 10:28 a		0.2024	GPC27A
					7.52E-01	4.00E+00		0.32			L	
<b>Batch:</b> 7086023	I129LL_SEP_LEPS_GS											
I129	4.21E-01	U	4.6E-01	4.6E-01	8.93E-01	pCi/L	90%	0.47	4/21/17 11:22 p		2.00114	LEP4\$1
					5.00E-01	1.00E+00		(1.8)			L	
<b>Batch:</b> 7086027	903.1_RA226_LUC											
Ra-226	-2.10E-02	U	9.8E-02	9.8E-02	2.05E-01	pCi/L	100%	-0.1	5/10/17 07:43 p		1.02087	ASCCSB
					8.47E-02	1.00E+00		-0.43			L	
<b>Batch:</b> 7086028	RAISO_SEP_GPC											
Ra-228	2.65E-01	U	2.0E-01	2.1E-01	3.46E-01	pCi/L	92%	0.77	5/12/17 04:48 p		1.02087	GPC3A
					1.41E-01	3.00E+00		(2.5)			L	

TestAmerica Inc  
rptSTLRchBlank  
V5.8.3 A2002MDC|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: 17-May-17

BLANK RESULTS

Lab Name: TestAmerica Inc

SDG: W07797

Matrix: WATER

Report No. : 70971

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
<b>Batch:</b> 7086024	TC99_ETVDSK_LSC											
				<b>Work Order:</b> M91E61AA				<b>Report DB ID:</b> M91E61AB				
TC-99	-4.43E+00	U	6.7E+00	8.2E+00	1.75E+01	pCi/L	100%	-0.25	4/22/17 02:39 a		0.12554	LSC4
					8.11E+00	5.00E+01		-(1.1)			L	

No. of Results: 8      Comments:

## FORM II

Date: 17-May-17

## LCS RESULTS

Lab Name: TestAmerica Inc

SDG: W07797

Matrix: WATER

Report No. : 70971

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: 7086020	C14_LSC					Work Order: M91E41AC		Report DB ID: m91e41cS					
C-14	4.54E+02		1.6E+01	3.2E+01	1.72E+01	pCi/L	100%	4.76E+02	9.5E+00	96%	4/12/17 11:35 p	0.075	LSC4
							Rec Limits:	80	120	0.0		L	
Batch: 7086025	9310_ALPHABETA_GPC					Work Order: M91E71AC		Report DB ID: M91E71CS					
Alpha	2.25E+01		1.7E+00	5.7E+00	7.07E-01	pCi/L	100%	2.30E+01	2.3E-01	98%	5/1/17 12:45 p	0.20118	GPC24B
							Rec Limits:	80	120	0.0		L	
Batch: 7123011	9310_ALPHABETA_GPC					Work Order: M91E72AC		Report DB ID: M91E72CS					
Alpha	2.16E+01		1.6E+00	5.5E+00	7.66E-01	pCi/L	100%	2.16E+01	2.2E-01	100%	5/11/17 08:56 p	0.20917	GPC24C
							Rec Limits:	80	120	0.0		L	
Batch: 7086026	9310_ALPHABETA_GPC					Work Order: M91E81AC		Report DB ID: M91E81CS					
Beta	2.05E+01		1.8E+00	3.1E+00	1.77E+00	pCi/L	100%	1.69E+01	2.1E-01	121%	4/28/17 10:28 a	0.2028	GPC27C
							Rec Limits:	80	120	0.2		L	
Batch: 7086023	I129LL_SEP_LEPS_GS					Work Order: M91E52AC		Report DB ID: M91E52CS					
I129	2.16E+01		2.9E+00	2.9E+00	1.13E+00	pCi/L	90%	1.92E+01	3.1E-01	113%	4/28/17 09:08 a	2.0019	LEP4\$1
							Rec Limits:	80	120	0.1		L	
Batch: 7086027	903.1_RA226_LUC					Work Order: M91E91AC		Report DB ID: M91E91CS					
Ra-226	1.03E+01		7.6E-01	2.4E+00	3.17E-01	pCi/L	88%	9.84E+00	1.0E-01	105%	5/10/17 07:43 p	1.00578	ASCESD
							Rec Limits:	80	120	0.0		L	
Batch: 7086028	RAISO_SEP_GPC					Work Order: M91FA1AC		Report DB ID: M91FA1CS					
Ra-228	1.17E+01		8.3E-01	1.5E+00	4.29E-01	pCi/L	81%	9.87E+00	1.1E-01	118%	5/12/17 04:48 p	1.00578	GPC3B
							Rec Limits:	80	120	0.2		L	
Batch: 7086024	TC99_ETVDSK_LSC					Work Order: M91E61AC		Report DB ID: M91E61CS					

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

rptSTLRchLcs  
V5.8.3 A2002

FORM II

Date: 17-May-17

LCS RESULTS

Lab Name: TestAmerica Inc

SDG: W07797

Matrix: WATER

Report No. : 70971

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
TC-99	1.21E+02		1.2E+01	1.5E+01	1.71E+01	pCi/L	100%	1.08E+02	6.2E-01	112%	4/22/17 03:02 a	0.12614	LSC4
							Rec Limits:	80	120	0.1			L

No. of Results: 8

Comments:

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

rptSTLRchLcs  
V5.8.3 A2002

FORM II

Date: 17-May-17

MATRIX SPIKE RESULTS

Lab Name: TestAmerica Inc

SDG: W07797

Lot-Sample No.: J7C100401-5, B38RW8

Report No. : 70971

Matrix: WATER

Parameter	SpikeResult, Orig Rst	Qual	Count Error (2 s)	CSU (2 s)	MDC MDA	Rpt Unit	Yield	Rec- overy	Expected, Uncert	Analysis, Prep Date	Aliquot Size	Analy Method, Primary Detector
Batch: 7086024	Work Order: M9X9G1AG			Report DB ID: M9X9G1GW		Orig Sa DB ID: 9M9X9G10						
TC-99	4.84E+02		2.4E+01	4.7E+01	1.70E+01	pCi/L	100%	91.01%	5.32E+02	4/22/17 01:53 a	0.1275	TC99_ETVDSK_LSC
	1.43E+02								3.0E+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.  
 V5.8.3 A2002

FORM II

Date: 17-May-17

MATRIX SPIKE RESULTS

Lab Name: TestAmerica Inc

SDG: W07797

Lot-Sample No.: J7C100401-7, B38RY7

Report No. : 70971

Matrix: WATER

Parameter	SpikeResult, Orig Rst	Qual	Count Error (2 s)	CSU (2 s)	MDC MDA	Rpt Unit	Yield	Rec- overy	Expected, Uncert	Analysis, Prep Date	Aliquot Size	Analy Method, Primary Detector
Batch: 7086020	Work Order: M9X9J1AC			Report DB ID: m9x9j1cW		Orig Sa DB ID: 9m9x9j10						
C-14	3.90E+02		1.5E+01	3.0E+01	1.72E+01	pCi/L	100%	81.86%	4.76E+02	4/12/17 08:24 p	0.075	C14_LSC
	5.56E+00								9.5E+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.  
 V5.8.3 A2002