

8/1/2016



August 01, 2016

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

Re: CHPRC SAF I16-021  
Work Order: 400884  
SDG: GEL400884

Dear Mr. Fitzgerald:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on July 06, 2016. This original data report has been prepared and reviewed in accordance with GEL's standard operating procedures.

Our policy is to provide high quality, personalized analytical services to enable you to meet your analytical needs on time every time. We trust that you will find everything in order and to your satisfaction. If you have any questions, please do not hesitate to call me at (843) 556-8171, ext. 4505.

Sincerely,

*B Luthman*  
Brielle Luthman for  
Heather Shaffer  
Project Manager

Purchase Order: 300071JDBA 7H  
Chain of Custody: I16-021-009  
Enclosures



## Table of Contents

Case Narrative.....	1
Chain of Custody and Supporting Documentation.....	7
Data Review Qualifier Definitions.....	10
Laboratory Certifications.....	12
Metals Analysis.....	14
Case Narrative.....	15
Sample Data Summary.....	18
Quality Control Summary.....	20
Radiological Analysis.....	23
Case Narrative.....	24
Sample Data Summary.....	32
Quality Control Summary.....	43

# Case Narrative

**General Narrative  
for  
CH2MHill Plateau Remediation Company  
CHPRC SAF I16-021  
SDG: GEL400884**

**August 01, 2016**

**Laboratory Identification:**

GEL Laboratories LLC  
2040 Savage Road  
Charleston, South Carolina 29407  
(843) 556-8171

**Summary**

**Sample receipt**

The sample(s) arrived at GEL Laboratories, LLC, Charleston, South Carolina on July 06, 2016, for analysis. The sample was delivered with proper chain of custody documentation and signatures. All sample containers arrived without any visible signs of tampering or breakage. There are no additional comments concerning sample receipt.

**Items of Note** All efforts were made by the lab to meet any short hold times. Samples that were analyzed outside of the initial hold time but still within 2X hold time will be noted in the lab case narrative and DER.

**Sample Identification**

The laboratory received the following sample:

<b>Laboratory Identification</b>	<b>Sample Description</b>
400884001	B34XX9

**Case Narrative**

Sample analyses were conducted using methodology as outlined in GEL Laboratories, LLC (GEL) Standard Operating Procedures. Any technical or administrative problems during analysis, data review, and reduction are contained in the analytical case narratives in the enclosed data package.

**Data Package**

The enclosed data package contains the following sections: General Narrative, Chain of Custody and Supporting Documentation, and data from the following fractions: Metals and Radiochemistry.

We certify that this package is in compliance with the SOW, both technically and for completeness, including a full description of, explanation of, and corrective actions for, any and all deviations, from either the analyses requested or the case narrative requested. Release of the data contained in this hard copy data package has been authorized by the Laboratory Analytical Manager (or designee) and the laboratory's client services representative as verified by their signatures on this report.

8/1/2016

*B. Luthman*  
Brielle Luthman for  
Heather Shaffer  
Project Manager

**Technical Case Narrative**  
**CH2MHill Plateau Remediation Company (CPRC)**  
**SDG #: GEL400884**  
**Work Order #: 400884**

## **Metals**

### **Determination of Metals by ICP-MS**

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

## **Radiochemistry**

### **AMCMISO\_EIE\_PRECIP\_AEA: COMMON**

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

### **PUISO\_PRECIP\_AEA:COMMON**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

### **Technical Information**

#### **Recounts**

Sample 400884001 (B34XX9) was recounted due to a peak shift. The recount is reported.

### **UIISO\_IE\_PRECIP\_AEA:COMMON**

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

### **GAMMA\_GS:COMMON + GW 01**

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

**SRISO\_SEP\_PRECIP\_GPC: COMMON**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

**Technical Information****Recounts**

Sample 1203580406 (Non SDG 400517005DUP) was verified by recounting at least five days from the separation date. The recount is reported.

**PU241\_IE\_LSC: COMMON**

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

**C14\_LSC: COMMON**

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

**SE79\_SEP\_IE\_LSC: COMMON**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

**Technical Information****Recounts**

Samples were recounted due to the quench number being outside the calibration range. The recounts are reported.

**TC99\_EIE\_LSC: COMMON**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

**Technical Information**

**Recounts**

Samples 1203585993 (B34XX9DUP) and 400884001 (B34XX9) were recounted to verify sample results.

Recounts are reported.

**TRITIUM\_DIST\_LSC: COMMON**

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

**Certification Statement**

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.

# **Chain of Custody and Supporting Documentation**

82-165

CH2M Hill Plateau Remediation Company  
 C.O.C.# **II6-021-009**  
 Page 1 of 1

**CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST**

Collector: **Juan Aguilar** *CHPRC*  
 SAF No. **II6-021**  
 Project Title: **200 UPI, MAY 2016**  
 Shipped To (Lab): **GEL Laboratories, LLC**  
 Protocol: **CERCLA**  
 Contact/Requester: **Karen Waters-Husted**  
 Sampling Origin: **Hanford Site**  
 Logbook No.: **HNF-N-506 86/42**  
 Method of Shipment: **Commercial Carrier**  
 Priority: **30 Days**  
 Telephone No.: **509-376-4650**  
 Purchase Order/Charge Code: **300071**  
 Ice Chest No.: **6WS-500**  
 Bill of Lading/Air Bill No.: **7766 6978 5089**  
 Offsite Property No.: **67916**

**POSSIBLE SAMPLE HAZARDS/REMARKS**  
 \*\*\* Contains Radioactive Material at concentrations that are not regulated for transportation per 49 CFR / IATA Dangerous Goods Regulations but are not releasable per DOE Order 458.1

Sample No.	Filter	* Date	Time	No/Type Container	Sample Analysis	Holding Time	Preservative
B34XX9	N	W JUL 05 2016	0854	1x500-mL G/P	6020_METALS_ICPMS: Uranium (1)	6 Months	HNO3 to pH <2
B34XX9	N	W		1x1-L G/P	AMCMISO_EIE_PRECIP_AEA: COMMON	180 Days	HNO3 to pH <2
B34XX9	N	W		1x500-mL G/P	C14_LSC: COMMON	6 Months	None
B34XX9	N	W		1x4-L G/P	GAMMA_GS: COMMON; GAMMA_GS: GW 01	6 Months	HNO3 to pH <2
B34XX9	N	W		1x1-L G/P	PU241_IE_LSC: COMMON	6 Months	HNO3 to pH <2
B34XX9	N	W		1x1-L G/P	PUISO_PLATE_AEA: COMMON	6 Months	HNO3 to pH <2
B34XX9	N	W		1x1-L G/P	SE79_SEP_IE_LSC: COMMON	6 Months	HNO3 to pH <2
B34XX9	N	W		3x1-L G/P	SRISO_SEP_PRECIP_GPC: COMMON	6 Months	HNO3 to pH <2
B34XX9	N	W		1x500-mL G/P	TC99_EIE_LSC: COMMON	6 Months	HNO3 to pH <2
B34XX9	N	W		1x500-mL P	TRITIUM_DIST_LSC: COMMON	6 Months	None
B34XX9	N	W JUL 05 2016	0854	3x1-L G/P	UIISO_IE_PRECIP_AEA: COMMON	6 Months	HNO3 to pH <2

Relinquished By	Print	Sign	Date/Time	Received By	Print	Sign	Date/Time	Matrix *
Juan Aguilar	<i>CHPRC</i>		JUL 05 2016 0930	Janelle Zunker	<i>CHPRC</i>		JUL 05 2016 0930	S = Soil, SE = Sediment, SO = Solid, SL = Sludge, W = Water, O = Oil, A = Air, DS = Drum Solids, DL = Drum Liquids, T = Tissue, WI = Wipe, L = Liquid, V = Vegetation, X = Other
Janelle Zunker	<i>CHPRC</i>		JUL 05 2016 1000	FEDEX				
				Sara Gamball	<i>Sara Gamball</i>		7/6/16 0910	

**FINAL SAMPLE DISPOSITION**  
 Disposal Method (e.g., Return to customer, per lab procedure, used in process)  
 Disposed By  
 Date/Time

**SAMPLE RECEIPT & REVIEW FORM**

Client: <u>CPRC</u>		SDG/AR/COC/Work Order: /	
Received By: <u>Jadhav</u>		Date Received: <u>7/6/16</u>	
Suspected Hazard Information	Yes	No	*If Net Counts > 100cpm on samples not marked "radioactive", contact the Radiation Safety Group for further investigation.
COC/Samples marked as radioactive?		<input checked="" type="checkbox"/>	Maximum Net Counts Observed* (Observed Counts - Area Background Counts): <u>Open</u>
Classified Radioactive II or III by RSO?		<input checked="" type="checkbox"/>	If yes, Were swipes taken of sample containers < action levels?
COC/Samples marked containing PCBs?		<input checked="" type="checkbox"/>	
Package, COC, and/or Samples marked as beryllium or asbestos containing?		<input checked="" type="checkbox"/>	If yes, samples are to be segregated as Safety Controlled Samples, and opened by the GEL Safety Group.
Shipped as a DOT Hazardous?		<input checked="" type="checkbox"/>	Hazard Class Shipped: UN#: .
Samples identified as Foreign Soil?		<input checked="" type="checkbox"/>	

Sample Receipt Criteria		Yes	NA	No	Comments/Qualifiers (Required for Non-Conforming Items)
1	Shipping containers received intact and sealed?	<input checked="" type="checkbox"/>			Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
2	Samples requiring cold preservation within (0 ≤ 6 deg. C)?*	<input checked="" type="checkbox"/>			Preservation Method: <u>Ice bags</u> Blue ice Dry ice None Other (describe) *all temperatures are recorded in Celsius <u>3°C</u>
2a	Daily check performed and passed on IR temperature gun?	<input checked="" type="checkbox"/>			Temperature Device Serial #: Secondary Temperature Device Serial # (If Applicable): <u>E5102009184</u>
3	Chain of custody documents included with shipment?	<input checked="" type="checkbox"/>			
4	Sample containers intact and sealed?	<input checked="" type="checkbox"/>			Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
5	Samples requiring chemical preservation at proper pH?	<input checked="" type="checkbox"/>			Sample ID's, containers affected and observed pH: If Preservation added, Lot#:
6	Do Low Level Perchlorate samples have headspace as required?	<input checked="" type="checkbox"/>			Sample ID's and containers affected:
7	VOA vials contain acid preservation?	<input checked="" type="checkbox"/>			(If unknown, select No)
8	VOA vials free of headspace (defined as < 6mm bubble)?	<input checked="" type="checkbox"/>			Sample ID's and containers affected:
9	Are Encore containers present?	<input checked="" type="checkbox"/>			(If yes, immediately deliver to Volatiles laboratory)
10	Samples received within holding time?	<input checked="" type="checkbox"/>			ID's and tests affected:
11	Sample ID's on COC match ID's on bottles?	<input checked="" type="checkbox"/>			Sample ID's and containers affected:
12	Date & time on COC match date & time on bottles?	<input checked="" type="checkbox"/>			Sample ID's affected:
13	Number of containers received match number indicated on COC?	<input checked="" type="checkbox"/>			Sample ID's affected:
14	Are sample containers identifiable as GEL provided?	<input checked="" type="checkbox"/>			
15	COC form is properly signed in relinquished/received sections?	<input checked="" type="checkbox"/>			
16	Carrier and tracking number.				Circle Applicable: <u>FedEx Air</u> FedEx Ground UPS Field Services Courier Other  <u>7766 6978 5089</u>

Comments (Use Continuation Form if needed):

# **Data Review Qualifier Definitions**

## Project Specific Qualifier Definitions for GEL Client Code: CPRC

Qualifier	Qualifier Definition	Department	Fraction
U	Analyzed for but not detected above limiting criteria. Includes MDL, MDA, PQL, zero, counting error, and total analytical error.		
J	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). Value is estimated	Organics	
P	Aroclor target analyte with greater than 25% difference between column analyses.	Organics	
C	Analyte has been confirmed by GC/MS analysis	Organics	Pesticide
B	The analyte was detected in both the associated QC blank and in the sample.	Organics	
E	Concentration exceeds the calibration range of the instrument	Organics	
A	The TIC is a suspected aldol-condensation product	Organics	Semi-Volatile
X	Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier		
N	Spike Sample recovery is outside control limits.		
*	Duplicate analysis not within control limits	Inorganics	
>	Result greater than quantifiable range or greater than upper limit of the analysis range	General Chemistry	
Z	Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier		
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).	Inorganics	Metals
D	Results are reported from a diluted aliquot of sample.		
E	Reported value is estimated due to interferences. See comment in narrative.	Inorganics	Metals
M	Duplicate precision not met.	Inorganics	Metals
o	Analyte failed to recover within LCS limits (Organics only)	Organics	
S	Reported value determined by the Method of Standard Additions (MSA)	Inorganics	
T	Spike and/or spike duplicate sample recovery is outside control limits.	Organics	
W	Post-digestion spike recovery for GFAA out of control limit. Sample absorbency < 50% of spike absorbency.	Inorganics	
B	The associated QC sample blank has a result $\geq 2X$ the MDA and, after corrections, result is $\geq$ MDA for this sample	Radiological	
Y	Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier		
+	Correlation coefficient for Method of Standard Additions (MSA) is < 0.995	Inorganics	
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).	General Chemistry	
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.	Inorganics	Metals
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.	General Chemistry	
<	Sample is below the EPA guidance level for Reactive Releasable Cyanide and/or Reactive Releasable Sulfide	General Chemistry	
UX	Gamma Spectroscopy--Uncertain identification	Radiological	

# Laboratory Certifications

## List of current GEL Certifications as of 01 August 2016

State	Certification
Alaska	UST-0110
Arkansas	88-0651
CLIA	42D0904046
California	2940
Colorado	SC00012
Connecticut	PH-0169
Delaware	SC00012
DoD ELAP/ ISO17025 A2LA	2567.01
Florida NELAP	E87156
Foreign Soils Permit	P330-15-00283, P330-15-00253
Georgia	SC00012
Georgia SDWA	967
Hawaii	SC00012
Idaho Chemistry	SC00012
Idaho Radiochemistry	SC00012
Illinois NELAP	200029
Indiana	C-SC-01
Kansas NELAP	E-10332
Kentucky SDWA	90129
Kentucky Wastewater	90129
Louisiana NELAP	03046 (AI33904)
Louisiana SDWA	LA160006
Maryland	270
Massachusetts	M-SC012
Michigan	9976
Mississippi	SC00012
Nebraska	NE-OS-26-13
Nevada	SC000122016-1
New Hampshire NELAP	205415
New Jersey NELAP	SC002
New Mexico	SC00012
New York NELAP	11501
North Carolina	233
North Carolina SDWA	45709
North Dakota	R-158
Oklahoma	9904
Pennsylvania NELAP	68-00485
S.Carolina Radchem	10120002
South Carolina Chemistry	10120001
Tennessee	TN 02934
Texas NELAP	T104704235-16-11
Utah NELAP	SC000122016-20
Vermont	VT87156
Virginia NELAP	460202
Washington	C780
West Virginia	997404

# Metals Analysis

# Case Narrative

**Metals**  
**Technical Case Narrative**  
**CH2MHill Plateau Remediation Company (CPRC)**  
**SDG #: GEL400884**  
**Work Order #: 400884**

**Product:** Determination of Metals by ICP-MS

**Analytical Method:** 6020\_METALS\_ICPMS

**Analytical Procedure:** GL-MA-E-014 REV# 28

**Analytical Batch:** 1579604

**Preparation Method:** SW846 3005A

**Preparation Procedure:** GL-MA-E-006 REV# 13

**Preparation Batch:** 1579603

The following samples were analyzed using the above methods and analytical procedure(s).

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
400884001	B34XX9
1203579827	Method Blank (MB)ICP-MS
1203579828	Laboratory Control Sample (LCS)
1203579831	400884001(B34XX9L) Serial Dilution (SD)
1203579829	400884001(B34XX9S) Matrix Spike (MS)
1203579830	400884001(B34XX9SD) Matrix Spike Duplicate (MSD)

The samples in this SDG were analyzed on an "as received" basis.

**Data Summary:**

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

**Certification Statement**

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.

**GEL LABORATORIES LLC**

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

**Qualifier Definition Report  
for**

CPRC001 CH2MHill Plateau Remediation Company

Client SDG: GEL400884 GEL Work Order: 400884

**The Qualifiers in this report are defined as follows:**

- \* Duplicate analysis not within control limits
- 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).
- D Results are reported from a diluted aliquot of sample.
- U Analyzed for but not detected above limiting criteria. Includes MDL, MDA, PQL, zero, counting error, and total analytical error.

**Review/Validation**

GEL requires all analytical data to be verified by a qualified data reviewer. In addition, all CLP-like deliverables receive a third level review of the fractional data package.

The following data validator verified the information presented in this data report:

**Signature:** 

**Name:** Nik-Cole Elmore

**Date:** 01 AUG 2016

**Title:** Data Validator

# Sample Data Summary

**METALS**  
-1-  
**INORGANICS ANALYSIS DATA PACKAGE**

**SDG No:** GEL400884

**CONTRACT:** CPRC0116021

**METHOD TYPE:** SW846

**SAMPLE ID:**400884001

**BASIS:** As Received

**DATE COLLECTED** 05-JUL-16

**CLIENT ID:** B34XX9

**LEVEL:** Low

**DATE RECEIVED** 06-JUL-16

**MATRIX:** WATER

**%SOLIDS:** 0

CAS No.	Analyte	Result	Units	Qual	MDL	PQL	CRDL	DF	M*	Analyst	Run Date	Analytical Run	Analytical Batch
7440-61-1	Uranium	1.1	ug/L		0.067	0.2	0.2	1	MS	BAJ	07/08/16 09:37	160707-4	1579604

**Prep Information:**

Analytical Batch	Prep Batch	Prep Method	Initial wt./vol.	Units	Final wt./vol.	Units	Date	Analyst
1579604	1579603	SW846 3005A	50	mL	50	mL	07/06/16	JP1

**\*Analytical Methods:**

MS SW846 3005A/6020A

# Quality Control Summary

**GEL LABORATORIES LLC**

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

**QC Summary**

Report Date: August 1, 2016

CH2MHill Plateau Remediation Company

MSIN R3-50 CHPRC

PO Box 1600

Richland, Washington

Contact: Mr. Scot Fitzgerald

Workorder: 400884

Parmname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
<b>Metals Analysis - ICPMS</b>											
Batch	1579604										
QC1203579828	LCS										
Uranium	50.0			50.3	ug/L		101	(80%-120%)	BAJ	07/08/16	09:36
QC1203579827	MB										
Uranium			U	0.067	ug/L					07/08/16	09:35
QC1203579829	400884001	MS									
Uranium	50.0	1.10		52.1	ug/L		102	(75%-125%)		07/08/16	09:39
QC1203579830	400884001	MSD									
Uranium	50.0	1.10		52.9	ug/L	1.44	104	(0%-20%)		07/08/16	09:40
QC1203579831	400884001	SDILT									
Uranium		1.10	D	0.225	ug/L	2.65		(0%-10%)		07/08/16	09:41

**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
- 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

**GEL LABORATORIES LLC**

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

**QC Summary**

Workorder: 400884

Page 2 of 2

<b>Parmname</b>	<b>NOM</b>	<b>Sample Qual</b>	<b>QC</b>	<b>Units</b>	<b>RPD/D%</b>	<b>REC%</b>	<b>Range</b>	<b>Anlst</b>	<b>Date</b>	<b>Time</b>
-----------------	------------	--------------------	-----------	--------------	---------------	-------------	--------------	--------------	-------------	-------------

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.

^ 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.

\* Indicates that a Quality Control parameter was not within specifications.

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.

# Radiological Analysis

# Case Narrative

**Radiochemistry  
 Technical Case Narrative  
 CH2MHill Plateau Remediation Company (CPRC)  
 SDG #: GEL400884  
 Work Order #: 400884**

**Product:** AMCMISO\_EIE\_PRECIP\_AEA: COMMON

**Analytical Method:** AMCMISO\_EIE\_PREC\_AEA

**Analytical Procedure:** GL-RAD-A-011 REV# 26

**Analytical Batch:** 1579506

The following samples were analyzed using the above methods and analytical procedure(s).

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
400884001	B34XX9
1203579651	Method Blank (MB)
1203579652	400884001(B34XX9) Sample Duplicate (DUP)
1203579653	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on an "as received" basis.

**Data Summary:**

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

**Product:** PUISO\_PRECIP\_AEA:COMMON

**Analytical Method:** PUISO\_PRECIP\_AEA

**Analytical Procedure:** GL-RAD-A-011 REV# 26

**Analytical Batch:** 1579507

The following samples were analyzed using the above methods and analytical procedure(s).

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
400884001	B34XX9
1203579654	Method Blank (MB)
1203579655	400884001(B34XX9) Sample Duplicate (DUP)
1203579656	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on an "as received" basis.

**Data Summary:**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

**Technical Information**

**Recounts**

Sample 400884001 (B34XX9) was recounted due to a peak shift. The recount is reported.

**Product:** UISO\_IE\_PRECIP\_AEA:COMMON

**Analytical Method:** UISO\_IE\_PRECIP\_AEA

**Analytical Procedure:** GL-RAD-A-011 REV# 26

**Analytical Batch:** 1579508

The following samples were analyzed using the above methods and analytical procedure(s).

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
400884001	B34XX9
1203579657	Method Blank (MB)
1203579658	400884001(B34XX9) Sample Duplicate (DUP)
1203579659	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on an "as received" basis.

**Data Summary:**

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

**Product:** GAMMA\_GS:COMMON + GW 01

**Analytical Method:** 901.1\_GAMMA\_GS

**Analytical Procedure:** GL-RAD-A-013 REV# 25

**Analytical Batch:** 1577515

The following samples were analyzed using the above methods and analytical procedure(s).

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
400884001	B34XX9
1203575112	Method Blank (MB)
1203575113	400138001(NonSDG) Sample Duplicate (DUP)
1203575114	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on an "as received" basis.

**Data Summary:**

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

**Product:** SRISO\_SEP\_PRECIP\_GPC: COMMON

**Analytical Method:** SRISO\_SEP\_PRECIP\_GPC

**Analytical Procedure:** GL-RAD-A-004 REV# 17

**Analytical Batch:** 1579902

The following samples were analyzed using the above methods and analytical procedure(s).

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
400884001	B34XX9
1203580405	Method Blank (MB)
1203580406	400517005(NonSDG) Sample Duplicate (DUP)
1203580407	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on an "as received" basis.

**Data Summary:**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

**Technical Information**

**Recounts**

Sample 1203580406 (Non SDG 400517005DUP) was verified by recounting at least five days from the separation date. The recount is reported.

**Product:** PU241\_IE\_LSC: COMMON

**Analytical Method:** PU241\_IE\_LSC

**Analytical Procedure:** GL-RAD-A-035 REV# 17

**Analytical Batch:** 1579509

The following samples were analyzed using the above methods and analytical procedure(s).

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
400884001	B34XX9
1203579660	Method Blank (MB)
1203579661	400884001(B34XX9) Sample Duplicate (DUP)
1203579662	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on an "as received" basis.

**Data Summary:**

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration,

continuing calibration, instrument controls and process controls where applicable.

**Product: C14\_LSC: COMMON**

**Analytical Method: C14\_LSC**

**Analytical Procedure: GL-RAD-A-003 REV# 15**

**Analytical Batch: 1580362**

The following samples were analyzed using the above methods and analytical procedure(s).

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
400884001	B34XX9
1203581480	Method Blank (MB)
1203581481	400415001(NonSDG) Sample Duplicate (DUP)
1203581482	400415001(NonSDG) Matrix Spike (MS)
1203581483	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on an "as received" basis.

**Data Summary:**

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

**Product: SE79\_SEP\_IE\_LSC: COMMON**

**Analytical Method: SE79\_SEP\_IE\_LSC**

**Analytical Procedure: GL-RAD-A-031 REV# 11**

**Analytical Batch: 1582184**

The following samples were analyzed using the above methods and analytical procedure(s).

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
400884001	B34XX9
1203585985	Method Blank (MB)
1203585986	400884001(B34XX9) Sample Duplicate (DUP)
1203585987	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on an "as received" basis.

**Data Summary:**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

**Technical Information**

**Recounts**

Samples were recounted due to the quench number being outside the calibration range. The recounts are reported.

**Product:** TC99\_EIE\_LSC: COMMON

**Analytical Method:** TC99\_EIE\_LSC

**Analytical Procedure:** GL-RAD-A-059 REV# 4

**Analytical Batch:** 1582186

The following samples were analyzed using the above methods and analytical procedure(s).

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
400884001	B34XX9
1203585992	Method Blank (MB)
1203585993	400884001(B34XX9) Sample Duplicate (DUP)
1203585994	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on an "as received" basis.

**Data Summary:**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

**Technical Information****Recounts**

Samples 1203585993 (B34XX9DUP) and 400884001 (B34XX9) were recounted to verify sample results. Recounts are reported.

**Product:** TRITIUM\_DIST\_LSC: COMMON

**Analytical Method:** TRITIUM\_DIST\_LSC

**Analytical Procedure:** GL-RAD-A-002 REV# 21

**Analytical Batch:** 1582195

The following samples were analyzed using the above methods and analytical procedure(s).

<b><u>GEL Sample ID#</u></b>	<b><u>Client Sample Identification</u></b>
400884001	B34XX9
1203586023	Method Blank (MB)
1203586024	400884001(B34XX9) Sample Duplicate (DUP)
1203586025	400884001(B34XX9) Matrix Spike (MS)
1203586026	Laboratory Control Sample (LCS)

The samples in this SDG were analyzed on an "as received" basis.

**Data Summary:**

There are no exceptions, anomalies or deviations from the specified methods. All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable.

**Certification Statement**

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.

**GEL LABORATORIES LLC**

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

**Qualifier Definition Report  
for**

CPRC001 CH2MHill Plateau Remediation Company

Client SDG: GEL400884 GEL Work Order: 400884

**The Qualifiers in this report are defined as follows:**

U Analyzed for but not detected above limiting criteria. Includes MDL, MDA, PQL, zero, counting error, and total analytical error.

**Review/Validation**

GEL requires all analytical data to be verified by a qualified data reviewer. In addition, all CLP-like deliverables receive a third level review of the fractional data package.

The following data validator verified the information presented in this data report:

**Signature:** 

**Name:** Theresa Austin

**Date:** 28 JUL 2016

**Title:** Group Leader

# Sample Data Summary

**Rad**  
**Certificate of Analysis**  
**Sample Summary**

SDG Number: GEL400884	Client: CPRC001	Project: CPRC0116021
Lab Sample ID: 400884001	Date Collected: 07/05/2016 08:54	Matrix: WATER
	Date Received: 07/06/2016 09:10	
Client ID: B34XX9	Method: AMCMISO_EIE_PREC_AEA	Prep Basis: "As Received"
Batch ID: 1579506	Analyst: MXS2	SOP Ref: GL-RAD-A-011
Run Date: 07/07/2016 15:14	Aliquot: 0.4 L	Instrument: 1067
Data File: S0400884001_AM.1A.gcnf	Prep Method: DOE EML HASL-300, Am-05	Count Time: 239.9998 min
Prep Batch: 1579506		
Prep Date: 07/07/2016 00:00		

CAS No.	Parmname	Qual	Result	Units	Uncert	TPU	MDC	RDL
14596-10-2	Americium-241	U	0.0104	pCi/L	+/-0.0577	0.0578	0.111	1.00

Surrogate/Tracer recovery	Result	Nominal	Units	Recovery%	Acceptable Limits
Americium-243 Tracer	3.97	5.34	pCi/L	74.2	(30%-105%)

**Comments:**

U Analyzed for but not detected above limiting criteria. Includes MDL, MDA, PQL, zero, counting error, and total analytical error.  
 TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).  
 The MDC is a sample specific MDC.

**Rad**  
**Certificate of Analysis**  
**Sample Summary**

SDG Number: GEL400884	Client: CPRC001	Project: CPRC0116021
Lab Sample ID: 400884001	Date Collected: 07/05/2016 08:54	Matrix: WATER
	Date Received: 07/06/2016 09:10	
Client ID: B34XX9	Method: PUIISO_PRECIP_AEA	Prep Basis: "As Received"
Batch ID: 1579507	Analyst: MXS2	SOP Ref: GL-RAD-A-011
Run Date: 07/09/2016 10:56	Aliquot: 0.4 L	Instrument: 1090
Data File: S0400884001_PU.2A.gcnf	Prep Method: DOE EML HASL-300, Pu-11-	Count Time: 240 min
Prep Batch: 1579507		
Prep Date: 07/07/2016 00:00		

CAS No.	Parmname	Qual	Result	Units	Uncert	TPU	MDC	RDL
I3981-16-3	Plutonium-238	U	-0.0121	pCi/L	+/-0.0367	0.0367	0.103	1.00
OER-100-70	Plutonium-239/240	U	-0.0283	pCi/L	+/-0.0399	0.040	0.131	1.00

Surrogate/Tracer recovery	Result	Nominal	Units	Recovery%	Acceptable Limits
Plutonium-242 Tracer	4.11	4.93	pCi/L	83.4	(30%-105%)

**Comments:**

U Analyzed for but not detected above limiting criteria. Includes MDL, MDA, PQL, zero, counting error, and total analytical error.  
 TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).  
 The MDC is a sample specific MDC.

**Rad**  
**Certificate of Analysis**  
**Sample Summary**

SDG Number: GEL400884	Client: CPRC001	Project: CPRC0116021
Lab Sample ID: 400884001	Date Collected: 07/05/2016 08:54	Matrix: WATER
	Date Received: 07/06/2016 09:10	
Client ID: B34XX9	Method: UIISO_IE_PRECIP_AEA	Prep Basis: "As Received"
Batch ID: 1579508	Analyst: MXS2	SOP Ref: GL-RAD-A-011
Run Date: 07/08/2016 09:54	Aliquot: 0.4 L	Instrument: 1155
Data File: S0400884001_UU.1A.gcnf	Prep Method: DOE EML HASL-300, U-02-R	Count Time: 240 min
Prep Batch: 1579508		
Prep Date: 07/07/2016 00:00		

CAS No.	Parmname	Qual	Result	Units	Uncert	TPU	MDC	RDL
U-233/234 <small>13968-55-3/13966-29-5</small>	Uranium-233/234		0.839	pCi/L	+/-0.262	0.288	0.0987	1.00
15117-96-1/13982-7	Uranium-235/236	U	0.0448	pCi/L	+/-0.088	0.0883	0.122	1.00
7440-61-1	Uranium-238		0.453	pCi/L	+/-0.194	0.204	0.0618	1.00

Surrogate/Tracer recovery	Result	Nominal	Units	Recovery%	Acceptable Limits
Uranium-232 Tracer	4.49	5.21	pCi/L	86.2	(30%-105%)

**Comments:**

U Analyzed for but not detected above limiting criteria. Includes MDL, MDA, PQL, zero, counting error, and total analytical error. TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma). The MDC is a sample specific MDC.

**Rad**  
**Certificate of Analysis**  
**Sample Summary**

SDG Number: GEL400884	Client: CPRC001	Project: CPRC0116021
Lab Sample ID: 400884001	Date Collected: 07/05/2016 08:54	Matrix: WATER
	Date Received: 07/06/2016 09:10	
Client ID: B34XX9	Method: PU241_IE_LSC	Prep Basis: "As Received"
Batch ID: 1579509	Analyst: MXS2	SOP Ref: GL-RAD-A-035
Run Date: 07/12/2016 22:07	Aliquot: 0.4 L	Instrument: LSCGREEN
Data File: PU1579509.xls	Prep Method: DOE EML HASL-300, Pu-11-	Count Time: 15 min
Prep Batch: 1579509		
Prep Date: 07/07/2016 00:00		

CAS No.	Parmname	Qual	Result	Units	Uncert	TPU	MDC	RDL
14119-32-5	Plutonium-241	U	-3.55	pCi/L	+/-8.98	8.98	16.5	25.0

Surrogate/Tracer recovery	Result	Nominal	Units	Recovery%	Acceptable Limits
Plutonium-242 Tracer	4.11	4.93	pCi/L	83.4	(30%-105%)

**Comments:**

U Analyzed for but not detected above limiting criteria. Includes MDL, MDA, PQL, zero, counting error, and total analytical error.  
 TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).  
 The MDC is a sample specific MDC.

**Rad**  
**Certificate of Analysis**  
**Sample Summary**

SDG Number: GEL400884	Client: CPRC001	Project: CPRC0116021
Lab Sample ID: 400884001	Date Collected: 07/05/2016 08:54	Matrix: WATER
	Date Received: 07/06/2016 09:10	
Client ID: B34XX9	Method: SRISO_SEP_PRECIP_GPC	Prep Basis: "As Received"
Batch ID: 1579902	Analyst: KSD1	SOP Ref: GL-RAD-A-004
Run Date: 07/12/2016 13:01	Aliquot: 300 mL	Instrument: PIC8B
Data File: S1579902r2.xls	Prep Method: EPA 905.0 Modified/DOE RP5	Count Time: 60 min
Prep Batch: 1579902		
Prep Date: 07/11/2016 00:00		

CAS No.	Parmname	Qual	Result	Units	Uncert	TPU	MDC	RDL
10098-97-2	Strontium-90	U	-0.84	pCi/L	+/-0.561	0.561	1.47	2.00

Surrogate/Tracer recovery	Result	Nominal	Units	Recovery%	Acceptable Limits
Strontium Carrier	5.40	7.37	mg	73.3	(40%-110%)

**Comments:**

U Analyzed for but not detected above limiting criteria. Includes MDL, MDA, PQL, zero, counting error, and total analytical error.  
 TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).  
 The MDC is a sample specific MDC.

**Rad  
Certificate of Analysis  
Sample Summary**

**SDG Number:** GEL400884  
**Lab Sample ID:** 400884001  
  
**Client ID:** B34XX9  
**Batch ID:** 1577515  
**Run Date:** 07/15/2016 10:12  
**Data File:** G400884001.CNF;1  
**Prep Batch:** 1577515  
**Prep Date:** 07/14/2016 00:00

**Client:** CPRC001  
**Date Collected:** 07/05/2016 08:54  
**Date Received:** 07/06/2016 09:10  
  
**Method:** 901.1\_GAMMA\_GS  
**Analyst:** MJH1  
**Aliquot:** 2 L  
**Prep Method:** EPA 901.1

**Project:** CPRC0116021  
**Matrix:** WATER  
  
**Prep Basis:** "As Received"  
**SOP Ref:** GL-RAD-A-013  
**Instrument:** GAM14  
**Count Time:** 120 min

CAS No.	Parmname	Qual	Result	Units	Uncert	TPU	MDC	RDL
14234-35-6	Antimony-125	U	-3.38	pCi/L	+/-7.37	7.53	12.7	
13967-70-9	Cesium-134	U	-0.00945	pCi/L	+/-2.74	2.74	4.99	
10045-97-3	Cesium-137	U	1.21	pCi/L	+/-2.85	2.91	5.69	15.0
10198-40-0	Cobalt-60	U	-0.216	pCi/L	+/-2.45	2.45	4.90	
14683-23-9	Europium-152	U	-1.32	pCi/L	+/-7.84	7.86	14.1	
15585-10-1	Europium-154	U	3.72	pCi/L	+/-7.31	7.51	16.0	
14391-16-3	Europium-155	U	4.82	pCi/L	+/-10.2	10.5	18.6	
13966-00-2	Potassium-40	U	15.1	pCi/L	+/-36.4	37.0	75.0	

Surrogate/Tracer recovery	Result	Nominal	Units	Recovery%	Acceptable Limits
---------------------------	--------	---------	-------	-----------	-------------------

**Comments:**

U Analyzed for but not detected above limiting criteria. Includes MDL, MDA, PQL, zero, counting error, and total analytical error. TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma). The MDC is a sample specific MDC.

**Rad**  
**Certificate of Analysis**  
**Sample Summary**

SDG Number: GEL400884	Client: CPRC001	Project: CPRC0116021
Lab Sample ID: 400884001	Date Collected: 07/05/2016 08:54	Matrix: WATER
	Date Received: 07/06/2016 09:10	
Client ID: B34XX9	Method: C14_LSC	Prep Basis: "As Received"
Batch ID: 1580362	Analyst: TXJ1	SOP Ref: GL-RAD-A-003
Run Date: 07/19/2016 20:48	Aliquot: 60 mL	Instrument: LSCSILVER
Data File: C1580362.xls	Prep Method: EPA EERF C-01 Modified	Count Time: 30 min
Prep Batch: 1580362		
Prep Date: 07/19/2016 08:44		

CAS No.	Parmname	Qual	Result	Units	Uncert	TPU	MDC	RDL
14762-75-5	Carbon-14	U	-4.93	pCi/L	+/-22.8	22.8	39.5	50.0

Surrogate/Tracer recovery	Result	Nominal	Units	Recovery%	Acceptable Limits

**Comments:**

U Analyzed for but not detected above limiting criteria. Includes MDL, MDA, PQL, zero, counting error, and total analytical error.  
 TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).  
 The MDC is a sample specific MDC.

**Rad**  
**Certificate of Analysis**  
**Sample Summary**

SDG Number: GEL400884  
Lab Sample ID: 400884001

Client: CPRC001  
Date Collected: 07/05/2016 08:54  
Date Received: 07/06/2016 09:10

Project: CPRC0116021  
Matrix: WATER

Client ID: B34XX9  
Batch ID: 1582184  
Run Date: 07/26/2016 10:05  
Data File: SE1582184R.xls  
Prep Batch: 1582184  
Prep Date: 07/20/2016 00:00

Method: SE79\_SEP\_IE\_LSC  
Analyst: CXS7  
Aliquot: 0.1 L  
Prep Method: NERC ORD

Prep Basis: "As Received"  
SOP Ref: GL-RAD-A-031  
Instrument: LSCBLUE  
Count Time: 90 min

CAS No.	Parmname	Qual	Result	Units	Uncert	TPU	MDC	RDL
15758-45-9	Selenium-79	U	-5.91	pCi/L	+/-9.19	9.19	15.8	50.0

Surrogate/Tracer recovery	Result	Nominal	Units	Recovery%	Acceptable Limits
Selenium Carrier	16.4	20.0	mg	82	(40%-110%)

**Comments:**

U Analyzed for but not detected above limiting criteria. Includes MDL, MDA, PQL, zero, counting error, and total analytical error.  
TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).  
The MDC is a sample specific MDC.

**Rad**  
**Certificate of Analysis**  
**Sample Summary**

SDG Number: GEL400884  
Lab Sample ID: 400884001

Client: CPRC001  
Date Collected: 07/05/2016 08:54  
Date Received: 07/06/2016 09:10

Project: CPRC0116021  
Matrix: WATER

Client ID: B34XX9  
Batch ID: 1582186  
Run Date: 07/27/2016 09:12  
Data File: E1582186R.xls  
Prep Batch: 1582186  
Prep Date: 07/22/2016 13:25

Method: TC99\_EIE\_LSC  
Analyst: GXR1  
Aliquot: 100 mL  
Prep Method: DOE EML HASL-300, Tc-02-

Prep Basis: "As Received"  
SOP Ref: GL-RAD-A-059  
Instrument: LSCBROWN  
Count Time: 30 min

CAS No.	Parmname	Qual	Result	Units	Uncert	TPU	MDC	RDL
14133-76-7	Technetium-99		41.3	pCi/L	+/-22.8	23.2	37.2	50.0

Surrogate/Tracer recovery	Result	Nominal	Units	Recovery%	Acceptable Limits
Technetium-99m Tracer	24500	28900	CPM	84.6	(30%-105%)

**Comments:**

U Analyzed for but not detected above limiting criteria. Includes MDL, MDA, PQL, zero, counting error, and total analytical error.  
TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).  
The MDC is a sample specific MDC.

**Rad**  
**Certificate of Analysis**  
**Sample Summary**

SDG Number: GEL400884  
 Lab Sample ID: 400884001

Client: CPRC001  
 Date Collected: 07/05/2016 08:54  
 Date Received: 07/06/2016 09:10

Project: CPRC0116021  
 Matrix: WATER

Client ID: B34XX9  
 Batch ID: 1582195  
 Run Date: 07/25/2016 08:55  
 Data File: T1582195.xls  
 Prep Batch: 1582195  
 Prep Date: 07/22/2016 12:17

Method: TRITIUM\_DIST\_LSC  
 Analyst: TXJ1  
 Aliquot: 50 mL  
 Prep Method: EPA 906.0 Modified

Prep Basis: "As Received"  
 SOP Ref: GL-RAD-A-002  
 Instrument: LSCRED  
 Count Time: 40 min

CAS No.	Parmname	Qual	Result	Units	Uncert	TPU	MDC	RDL
10028-17-8	Tritium	U	39.3	pCi/L	+/-195	195	341	400

Surrogate/Tracer recovery	Result	Nominal	Units	Recovery%	Acceptable Limits
---------------------------	--------	---------	-------	-----------	-------------------

**Comments:**

U Analyzed for but not detected above limiting criteria. Includes MDL, MDA, PQL, zero, counting error, and total analytical error.  
 TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).  
 The MDC is a sample specific MDC.

# Quality Control Summary

## GEL LABORATORIES LLC

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

QC Summary

Report Date: July 28, 2016

Page 1 of 7

Client : CH2MHill Plateau Remediation Company

MSIN R3-50 CHPRC

PO Box 1600

Richland, Washington 99352

Contact: Mr. Scot Fitzgerald

Workorder: 400884

Parmname	NOM	Sample	Qual	QC	Units	QC Criteria	Range	Analyst	Date Time
<b>Rad Alpha Spec</b>									
Batch	1579506								
QC1203579651	MB								
Americium-241			U	0.000666	pCi/L			MXS2	07/07/1615:14
				Uncert: +/-0.0494					
				TPU: +/-0.0494					
**Americium-243 Tracer	5.34			5.63	pCi/L	REC: 105	(30%-105%)		
				Uncert: +/-0.582					
				TPU: +/-0.895					
QC1203579652	400884001	DUP							
Americium-241		U	0.0104	U	-0.0127	pCi/L			07/07/1615:14
				Uncert: +/-0.0577	+/-0.0384	RPD: 0	N/A		
				TPU: +/-0.0578	+/-0.0385	RER: 0.652	(0-2)		
**Americium-243 Tracer	5.34		3.97		4.47	pCi/L	REC: 84	(30%-105%)	
				Uncert: +/-0.638	+/-0.599				
				TPU: +/-0.968	+/-0.917				
QC1203579653	LCS								
Americium-241					4.96	pCi/L	REC: 101	(80%-120%)	
				Uncert: +/-0.561					
				TPU: +/-0.843					
**Americium-243 Tracer	5.34				4.84	pCi/L	REC: 91	(30%-105%)	
				Uncert: +/-0.578					
				TPU: +/-0.890					
Batch	1579507								
QC1203579654	MB								
Plutonium-238			U	-0.0387	pCi/L			MXS2	07/07/1615:06
				Uncert: +/-0.0404					
				TPU: +/-0.0405					
Plutonium-239/240			U	-0.0232	pCi/L				
				Uncert: +/-0.0375					
				TPU: +/-0.0375					
**Plutonium-242 Tracer	4.93				4.10	pCi/L	REC: 83	(30%-105%)	
				Uncert: +/-0.555					
				TPU: +/-0.830					
QC1203579655	400884001	DUP							
Plutonium-238		U	-0.0121	U	-0.0113	pCi/L			
				Uncert: +/-0.0367	+/-0.034	RPD: 0	N/A		
				TPU: +/-0.0367	+/-0.0341	RER: 0.0343	(0-2)		
Plutonium-239/240		U	-0.0283	U	0.0438	pCi/L			
				Uncert: +/-0.0399	+/-0.0709	RPD: 0	N/A		
				TPU: +/-0.040	+/-0.0711	RER: 1.73	(0-2)		
**Plutonium-242 Tracer	4.93		4.11		4.79	pCi/L	REC: 97	(30%-105%)	
				Uncert: +/-0.567	+/-0.547				
				TPU: +/-0.847	+/-0.819				
QC1203579656	LCS								
Plutonium-238			U	0.0507	pCi/L				07/07/1615:06
				Uncert: +/-0.0667					

## GEL LABORATORIES LLC

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

QC Summary

Workorder: 400884

Page 2 of 7

Parname	NOM	Sample	Qual	QC	Units	QC Criteria	Range	Analyst	Date Time
<b>Rad Alpha Spec</b>									
Batch		1579507							
Plutonium-239/240		TPU: 4.94		+/-0.067 4.43	pCi/L	REC: 90	(80%-120%)		
		Uncert:		+/-0.538					
		TPU: 4.93		+/-0.781 4.35	pCi/L	REC: 88	(30%-105%)		
**Plutonium-242 Tracer		Uncert:		+/-0.567					
		TPU: 1579508		+/-0.847					
QC1203579657 MB									
Uranium-233/234			U	0.0145	pCi/L			MXS2	07/08/1609:46
		Uncert:		+/-0.0648					
		TPU: 0.101	U	+/-0.0649 0.101	pCi/L				
Uranium-235/236		Uncert:		+/-0.109					
		TPU: 0.0861	U	+/-0.110 0.0861	pCi/L				
Uranium-238		Uncert:		+/-0.0876					
		TPU: 5.21		+/-0.0884 3.94	pCi/L	REC: 76	(30%-105%)		
**Uranium-232 Tracer		Uncert:		+/-0.606					
		TPU: 400884001 DUP		+/-0.938					
QC1203579658 400884001 DUP									
Uranium-233/234		0.839		0.870	pCi/L				07/08/1609:54
		Uncert: +/-0.262		+/-0.272		RPD: 4	(0% - 20%)		
		TPU: +/-0.288		+/-0.300		RER: 0.146	(0-2)		
Uranium-235/236		U 0.0448	U	0.0137	pCi/L				
		Uncert: +/-0.088		+/-0.0762		RPD: 0	N/A		
		TPU: +/-0.0883		+/-0.0763		RER: 0.522	(0-2)		
Uranium-238		0.453		0.540	pCi/L				
		Uncert: +/-0.194		+/-0.218		RPD: 18	(0% - 20%)		
		TPU: +/-0.204		+/-0.232		RER: 0.55	(0-2)		
**Uranium-232 Tracer		5.21		4.44	pCi/L	REC: 85	(30%-105%)		
		Uncert: +/-0.645		+/-0.657					
		TPU: +/-0.988		+/-1.00					
QC1203579659 LCS									
Uranium-233/234				6.75	pCi/L				07/08/1609:54
		Uncert: +/-0.909		+/-0.909					
		TPU: +/-1.46		+/-1.46					
Uranium-235/236				0.584	pCi/L				
		Uncert: +/-0.306		+/-0.306					
		TPU: +/-0.322		+/-0.322					
Uranium-238		6.73		6.98	pCi/L	REC: 104	(80%-120%)		
		Uncert: +/-0.923		+/-0.923					
		TPU: +/-1.50		+/-1.50					
**Uranium-232 Tracer		5.21		2.98	pCi/L	REC: 57	(30%-105%)		
		Uncert: +/-0.799		+/-0.799					
		TPU: +/-1.19		+/-1.19					
Batch		1579509							
QC1203579660 MB									

## GEL LABORATORIES LLC

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

QC Summary

Workorder: 400884

Page 3 of 7

Parname	NOM	Sample	Qual	QC	Units	QC Criteria	Range	Analyst	Date Time
<b>Rad Alpha Spec</b>									
Batch	1579509								
Plutonium-241			U	5.05	pCi/L			MXS2	07/12/1622:23
				Uncert: +/-9.60					
				TPU: +/-9.65					
**Plutonium-242 Tracer	4.93			4.10	pCi/L	REC: 83 (30%-105%)			
				Uncert: +/-0.555					
				TPU: +/-0.830					
QC1203579661 400884001 DUP									
Plutonium-241		U -3.55	U	1.50	pCi/L				07/12/1622:39
				Uncert: +/-8.98		RPD: 0 N/A			
				TPU: +/-8.98		RER: 0.82 (0-2)			
**Plutonium-242 Tracer	4.93			4.11	pCi/L	REC: 97 (30%-105%)			
				Uncert: +/-0.567					
				TPU: +/-0.847					
QC1203579662 LCS									
Plutonium-241	193			204	pCi/L	REC: 106 (80%-120%)			07/12/1622:55
				Uncert: +/-19.8					
				TPU: +/-47.5					
**Plutonium-242 Tracer	4.93			3.70	pCi/L	REC: 75 (30%-105%)			
				Uncert: +/-0.591					
				TPU: +/-0.878					
<b>Rad Gamma Spec</b>									
Batch	1577515								
QC1203575112 MB									
Antimony-125			U	-2.88	pCi/L			MJH1	07/15/1610:12
				Uncert: +/-7.15					
				TPU: +/-7.27					
Cesium-134			U	-0.226	pCi/L				
				Uncert: +/-2.67					
				TPU: +/-2.68					
Cesium-137			U	0.735	pCi/L				
				Uncert: +/-2.73					
				TPU: +/-2.75					
Cobalt-60			U	-1.15	pCi/L				
				Uncert: +/-2.38					
				TPU: +/-2.44					
Europium-152			U	4.22	pCi/L				
				Uncert: +/-7.97					
				TPU: +/-8.21					
Europium-154			U	2.32	pCi/L				
				Uncert: +/-6.67					
				TPU: +/-6.76					
Europium-155			U	0.290	pCi/L				
				Uncert: +/-7.72					
				TPU: +/-7.72					
Potassium-40			U	26.7	pCi/L				
				Uncert: +/-37.6					
				TPU: +/-37.6					
QC1203575113 400138001 DUP									
Antimony-125		U -2.89	U	-4.56	pCi/L				07/15/1612:31
				Uncert: +/-6.93		RPD: 0 N/A			
				TPU: +/-7.09					

## GEL LABORATORIES LLC

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

QC Summary

Workorder: 400884

Page 4 of 7

Parmname	NOM	Sample	Qual	QC	Units	QC Criteria	Range	Analyst	Date Time
Rad Gamma Spec									
Batch	1577515								
		TPU:		+/-7.06					
				+/-7.40					
Cesium-134		U	-1.59	U	0.369	pCi/L			
		Uncert:	+/-3.20		+/-2.69		RER: 0.32	(0-2)	
		TPU:	+/-3.28		+/-2.70		RPD: 0	N/A	
Cesium-137		U	-1.57	U	0.557	pCi/L			
		Uncert:	+/-3.24		+/-3.03		RER: 0.907	(0-2)	
		TPU:	+/-3.32		+/-3.04		RPD: 0	N/A	
Cobalt-60		U	-2.11	U	-1.39	pCi/L			
		Uncert:	+/-3.29		+/-2.35		RER: 0.924	(0-2)	
		TPU:	+/-3.43		+/-2.44		RPD: 0	N/A	
Europium-152		U	-5.15	U	1.78	pCi/L			
		Uncert:	+/-8.96		+/-6.46		RER: 0.337	(0-2)	
		TPU:	+/-9.27		+/-6.51		RPD: 0	N/A	
Europium-154		U	-6.42	U	2.21	pCi/L			
		Uncert:	+/-6.79		+/-7.07		RER: 1.2	(0-2)	
		TPU:	+/-7.40		+/-7.15		RPD: 0	N/A	
Europium-155		U	-0.765	U	3.78	pCi/L			
		Uncert:	+/-11.5		+/-8.70		RER: 0.612	(0-2)	
		TPU:	+/-11.5		+/-8.87		RPD: 0	N/A	
Potassium-40		U	-0.362	U	-21	pCi/L			
		Uncert:	+/-34.5		+/-34.2		RER: 0.817	(0-2)	
		TPU:	+/-34.5		+/-35.5		RPD: 0	N/A	
QC1203575114 LCS									
Americium-241	34400				38900	pCi/L	REC: 113	(80%-120%)	07/15/1610:39
		Uncert:			+/-1570				
		TPU:			+/-4870				
Antimony-125				U	140	pCi/L			
		Uncert:			+/-224				
		TPU:			+/-233				
Cesium-134				U	45.0	pCi/L			
		Uncert:			+/-90.2				
		TPU:			+/-92.6				
Cesium-137	13400				13600	pCi/L	REC: 101	(80%-120%)	
		Uncert:			+/-342				
		TPU:			+/-1130				
Cobalt-60	13400				13900	pCi/L	REC: 104	(80%-120%)	
		Uncert:			+/-374				
		TPU:			+/-1140				
Europium-152				U	-121	pCi/L			
		Uncert:			+/-221				
		TPU:			+/-228				
Europium-154				U	-18.1	pCi/L			
		Uncert:			+/-134				
		TPU:			+/-134				
Europium-155				U	-152	pCi/L			
		Uncert:			+/-252				
		TPU:			+/-261				
Potassium-40				U	-78.4	pCi/L			

## GEL LABORATORIES LLC

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

QC Summary

Workorder: 400884

Page 5 of 7

Parname	NOM	Sample	Qual	QC	Units	QC Criteria	Range	Analyst	Date Time
<b>Rad Gamma Spec</b>									
Batch	1577515								
				Uncert:					
				TPU:					
<b>Rad Gas Flow</b>									
Batch	1579902								
QC1203580405	MB								
Strontium-90			U	-1.82	pCi/L			KSD1	07/12/1613:05
				Uncert:					
				TPU:					
**Strontium Carrier				7.37	6.50	mg	REC: 88 (40%-110%)		
QC1203580406	400517005	DUP							
Strontium-90				6.92	6.32	pCi/L			07/18/1611:13
				Uncert:					
				TPU:					
**Strontium Carrier				7.37	6.50	mg	REC: 90 (40%-110%)		
QC1203580407	LCS								
Strontium-90				72.9	77.9	pCi/L	REC: 107 (80%-120%)		07/12/1613:05
				Uncert:					
				TPU:					
**Strontium Carrier				7.37	6.60	mg	REC: 90 (40%-110%)		
<b>Rad Liquid Scintillation</b>									
Batch	1580362								
QC1203581480	MB								
Carbon-14			U	-18.5	pCi/L			TXJ1	07/19/1621:19
				Uncert:					
				TPU:					
QC1203581481	400415001	DUP							
Carbon-14				365	366	pCi/L			07/19/1621:51
				Uncert:					
				TPU:					
**Selenium Carrier				20.0	17.7	mg	REC: 89 (40%-110%)		
QC1203581482	400415001	MS							
Carbon-14				1260	365	1590	pCi/L	REC: 97 (75%-125%)	07/19/1622:23
				Uncert:					
				TPU:					
QC1203581483	LCS								
Carbon-14				1260	1230	pCi/L	REC: 98 (80%-120%)		07/19/1622:54
				Uncert:					
				TPU:					
Batch	1582184								
QC1203585985	MB								
Selenium-79			U	-11.2	pCi/L			CXS7	07/26/1614:45
				Uncert:					
				TPU:					
**Selenium Carrier				20.0	17.7	mg	REC: 89 (40%-110%)		
QC1203585986	400884001	DUP							
Selenium-79			U	-5.91	U	-9.72	pCi/L		07/26/1616:18
				Uncert:					
				TPU:					
**Selenium Carrier				20.0	16.4	17.9	mg	REC: 90 (40%-110%)	
QC1203585987	LCS								

## GEL LABORATORIES LLC

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

QC Summary

Workorder: 400884

Page 6 of 7

Parname	NOM	Sample	Qual	QC	Units	QC Criteria	Range	Analyst	Date Time
<b>Rad Liquid Scintillation</b>									
Batch	1582184								
Selenium-79	1450			1630	pCi/L	REC: 112	(80%-120%)		
	Uncert:			+/-35.8					
	TPU:			+/-58.7					
*Selenium Carrier	20.0			16.0	mg	REC: 80	(40%-110%)		
Batch	1582186								
QC1203585992	MB								
Technetium-99			U	1.14	pCi/L			GXR1	07/26/1613:22
	Uncert:			+/-21.7					
	TPU:			+/-21.7					
*Technetium-99m Tracer	28900			24100	CPM	REC: 83	(30%-105%)		
QC1203585993	400884001	DUP							
Technetium-99			41.3	55.8	pCi/L				07/27/1612:35
	Uncert:		+/-22.8	+/-22.8		RPD: 30	(0% - 100%)		
	TPU:		+/-23.2	+/-23.6		RER: 0.858	(0-2)		
*Technetium-99m Tracer	28900		24500	24400	CPM	REC: 84	(30%-105%)		
QC1203585994	LCS								
Technetium-99	861			837	pCi/L	REC: 97	(80%-120%)		07/26/1614:25
	Uncert:			+/-38.2					
	TPU:			+/-100					
*Technetium-99m Tracer	28900			25400	CPM	REC: 88	(30%-105%)		
Batch	1582195								
QC1203586023	MB								
Tritium			U	-22.9	pCi/L			TXJ1	07/25/1617:19
	Uncert:			+/-180					
	TPU:			+/-180					
QC1203586024	400884001	DUP							
Tritium		U	39.3	165	pCi/L				07/25/1618:01
	Uncert:		+/-195	+/-198		RPD: 0	N/A		
	TPU:		+/-195	+/-200		RER: 0.882	(0-2)		
QC1203586025	400884001	MS							
Tritium	2320	U	39.3	1900	pCi/L	REC: 82	(75%-125%)		07/25/1618:43
	Uncert:		+/-195	+/-275					
	TPU:		+/-195	+/-459					
QC1203586026	LCS								
Tritium	2320			1940	pCi/L	REC: 84	(80%-120%)		07/25/1619:25
	Uncert:			+/-274					
	TPU:			+/-464					

**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
- 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.

**GEL LABORATORIES LLC**

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

**QC Summary**

Workorder: 400884

Page 7 of 7

Parname	NOM	Sample	Qual	QC	Units	QC Criteria	Range	Analyst	Date	Time
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.