



Monday, October 28, 2019

Karen Waters-Husted
CH2M HILL Plateau Remediation Company
825 Jadwin Avenue
Richland, WA 99352

Re: ALS Workorder: 1909538
Project Name: AQUIFER TUBES, OCTOBER 2019
Project Number: X20-001

Dear Ms. Waters-Husted:

Seven water samples were received from CH2M HILL Plateau Remediation Company, on 9/26/2019. The samples were scheduled for the following analyses:

Metals

Strontium-90

Tritium

The results for these analyses are contained in the enclosed reports.

The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

Thank you for your confidence in ALS Environmental. Should you have any questions, please call.

Sincerely,

ALS Environmental
Katie M. O'Brien
Project Manager

We certify that this data 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.

ALS -- Fort Collins

Sample Number(s) Cross-Reference Table

OrderNum: 1909538

Client Name: CH2M HILL Plateau Remediation Company

Client Project Name: AQUIFER TUBES, OCTOBER 2019

Client Project Number: X20-001

Client PO Number: BOA 54854

Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
B3RPP6	1909538-1		WATER	25-Sep-19	10:36
B3RNL9	1909538-2		WATER	25-Sep-19	10:15
B3RNL4	1909538-3		WATER	25-Sep-19	10:15
B3RNM0	1909538-4		WATER	25-Sep-19	10:15
B3RNL5	1909538-5		WATER	25-Sep-19	10:15
B3RPV1	1909538-6		WATER	25-Sep-19	8:49
B3RP61	1909538-7		WATER	25-Sep-19	8:16

CH2M Hill Plateau Remediation Company		CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST 1909538		C.O.C.# X20-001-037 Page 1 of 1
Collector: Juan Aguilar CHPRC	Contact/Requester: Karen Waters-Husted	Telephone No.: 509-376-4650		
SAF No.: X20-001	Sampling Origin: Hanford Site	Purchase Order/Charge Code: 303064		
Project Title: AQUIFER TUBES, OCTOBER 2019	Logbook No.: HNF-N-506-103/47	Ice Chest No.: GWS-030		
Shipped To (Lab): ALS Environmental Ft. Collins	Method of Shipment: Commercial Carrier	Bill of Lading/Air Bill No.: 77338350458		
Protocol: SURV	Priority: 30 Days	Offsite Property No.: 11659		
POSSIBLE SAMPLE HAZARDS/REMARK ** ** 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		SPECIAL INSTRUCTIONS N/A		
Sample No. B3RPV1	Filter N	Date 9-26-19	Time 0849	No/Type Container 2x1-L G/P
Sample Analysis		Holding Time	Preservative	
SRISO_SEP_PRECIP_GPC: COMMON		6 Months	HNO3 to pH <2	

Relinquished By		Received By		Matrix *	
Print First and Last Name	Signature	Print First and Last Name	Signature	S = Soil	DS = Drum Solids
Juan Aguilar CHPRC		Troy L. Bacon ACHPRC		SE = Sediment	DL = Drum Liquids
Troy L. Bacon ACHPRC		FEDEX	FEDEX	SO = Solid	T = Tissue
		EMILY LYONS		SL = Sludge	WI = Wipe
				W = Water	L = Liquid
				O = Oil	V = Vegetation
				A = Air	X = Other
FINAL SAMPLE DISPOSITION		Disposal Method (e.g., Return to customer, per lab procedure, used in process):		Date/Time:	

ORIGIN DPSCA (509) 531-0450
TROY BACON
CH2M
6287 LATAM ST.
RICHLAND, WA 99352
UNITED STATES US

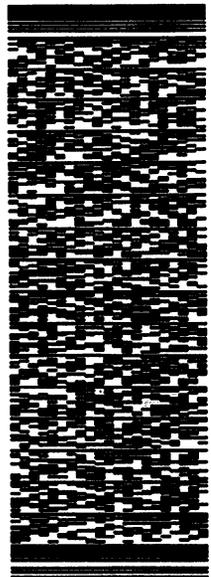
SHIP DATE: 25SEP19
ACTWGT: 77.00 LB
CAD: 107068051INET4160
BILL THIRD PARTY

TO JULIE ELLINGSON
ALS GLOBAL-FORT COLLINS
225 COMMERCE DR

FORT COLLINS CO 80524
(970) 400-1511
REF: PTR#11654
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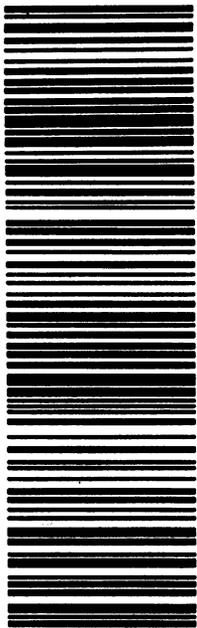


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0201

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DSR

XH FTCA

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80524



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Metals

Case Narrative

CH2M HILL Plateau Remediation Company

AQUIFER TUBES, OCTOBER 2019 -- X20-001

Work Order Number: 1909538

1. The samples were prepared and analyzed based on SW-846, 3rd Edition procedures.

For analysis by ICP-MS, the samples were digested following method 3005A and the current revision of SOP 806.

2. Analysis by ICP-MS followed method 6020B and the current revision of SOP 827.
3. All standards and solutions are NIST traceable and were used within their recommended shelf life.
4. The samples were prepared and analyzed within the established hold time.

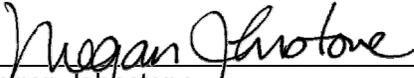
All in house quality control procedures were followed, as described below.

5. General quality control procedures.
 - A preparation (method) blank and laboratory control sample were digested and analyzed with the samples in this digestion batch.
 - The preparation (method) blank associated with this digestion batch was below the reporting limit for the requested analyte. Sample results have been compared to the blank results and are flagged as appropriate.
 - All laboratory control sample criteria were met.
 - All initial and continuing calibration blanks were below the reporting limit for the requested analyte.
 - All initial and continuing calibration verifications were within the acceptance criteria for the requested analyte.



- The interference check samples associated with Method 6020B were analyzed.
6. Matrix specific quality control procedures.
- Sample 1910007-4 was designated as the quality control sample for this analysis. Results for the shared quality control samples are included at the client's request.
- Similarity of matrix and therefore relevance of the QC results should not be automatically inferred for any sample other than the native sample selected for QC.
- A matrix spike and matrix spike duplicate were digested and analyzed with this batch. All acceptance criteria for accuracy and precision were met.
 - A serial dilution was analyzed with this ICP batch. All acceptance criteria were met with.
7. It is a standard practice that samples for ICP-MS are analyzed at a dilution. The 10X factor can be considered an artifact of the prep and does not indicate a secondary dilution and is therefore not flagged as a dilution.

The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.



Megan Johnstone
Inorganics Primary Data Reviewer

10/21/19
Date



Inorganics Final Data Reviewer

10/28/19
Date



Inorganic Data Reporting Qualifiers

The following qualifiers are used as needed by the laboratory when reporting results of inorganic analyses.

- Result qualifier -- A "B" is entered if the reported value was obtained from a reading that was less than the Reporting Limit but greater than or equal to the Method Detection Limit (MDL). If the analyte was analyzed for but not detected a "U" is entered. For samples, negative values are reported as non-detects ("U" flagged). For blanks, if the absolute value of the negative value is above the MDL and below the reporting limit, then the result is "B" flagged.
- QC qualifier -- Specified entries and their meanings are as follows:
 - E - The reported value is estimated because of the presence of interference. An explanatory note may be included in the narrative.
 - M - Duplicate injection precision was not met.
 - N - Spiked sample recovery not within control limits. A post spike is analyzed for all ICP analyses when the matrix spike and or spike duplicate fail and the native sample concentration is less than four times the spike added concentration.
 - Z - Spiked recovery not within control limits. An explanatory note may be included in the narrative.
 - * - Duplicate analysis (relative percent difference) not within control limits.
 - S - SAR value is estimated as one or more analytes used in the calculation were not detected above the detection limit.
 - C - The analyte was detected in both the sample and the associated QC blank, and the sample concentration was $\leq 20X$ the blank concentration.
 - D - Analyte was reported at a secondary dilution factor, typically $DF > 1$ (i.e., the primary preparation required dilution to either bring the analyte within the calibration range or to minimize interference). Required for organics/wetchem if the sample was diluted.

Dissolved CHROMIUM**Method SW6020B****Sample Results**

Lab Name: ALS -- Fort Collins
Client Name: CH2M HILL Plateau Remediation Company
Client Project ID: AQUIFER TUBES, OCTOBER 2019 X20-001
Work Order Number: 1909538 **Final Volume:** 50 ml
Reporting Basis: As Received **Matrix:** WATER
Analyst: Nicole C. Chirban **Result Units:** UG/L

Client Sample ID	Lab ID	Date Collected	Date Prepared	Date Analyzed	Percent Moisture	Dilution Factor	Result	RptLimit/ LOQ/LOD	MDL/DL	Flag	Sample Aliquot
B3RNL9	1909538-2	9/25/2019	10/14/2019	10/18/2019	N/A	10	0.96	10	0.46	B	50 ml
B3RNM0	1909538-4	9/25/2019	10/14/2019	10/19/2019	N/A	10	1.2	10	0.46	B	50 ml

Comments:

1. ND or U = Not Detected at or above the client requested detection limit.

Data Package ID: *IM1909538-1*

Total Recoverable CHROMIUM

Method SW6020B

Sample Results

Lab Name: ALS -- Fort Collins
Client Name: CH2M HILL Plateau Remediation Company
Client Project ID: AQUIFER TUBES, OCTOBER 2019 X20-001
Work Order Number: 1909538 **Final Volume:** 50 ml
Reporting Basis: As Received **Matrix:** WATER
Analyst: Nicole C. Chirban **Result Units:** UG/L

Client Sample ID	Lab ID	Date Collected	Date Prepared	Date Analyzed	Percent Moisture	Dilution Factor	Result	RptLimit/ LOQ/LOD	MDL/DL	Flag	Sample Aliquot
B3RNL4	1909538-3	9/25/2019	10/14/2019	10/18/2019	N/A	10	2	10	0.46	B	50 ml
B3RNL5	1909538-5	9/25/2019	10/14/2019	10/19/2019	N/A	10	1.5	10	0.46	B	50 ml

Comments:

1. ND or U = Not Detected at or above the client requested detection limit.

Data Package ID: *IM1909538-1*

ICPMS Metals

Method SW6020B

Method Blank

Lab Name: ALS -- Fort Collins

Work Order Number: 1909538

Client Name: CH2M HILL Plateau Remediation Company

ClientProject ID: AQUIFER TUBES, OCTOBER 2019 X20-001

Lab ID: IP191014-1MB

Sample Matrix: WATER

% Moisture: N/A

Date Collected: N/A

Date Extracted: 14-Oct-19

Date Analyzed: 18-Oct-19

Prep Batch: IP191014-1

QCBatchID: IP191014-1-5

Run ID: IM191018-10A5

Cleanup: NONE

Basis: N/A

File Name: 127SMPL_

Sample Aliquot: 50 ml

Final Volume: 50 ml

Result Units: UG/L

Clean DF: 1

CASNO	Target Analyte	DF	Result	Result Qualifier	Reporting Limit	MDL
7440-47-3	CHROMIUM	10	0.46	U	10	0.46

Data Package ID: IM1909538-1

ICPMS Metals

Method SW6020B

Laboratory Control Sample

Lab Name: ALS -- Fort Collins

Work Order Number: 1909538

Client Name: CH2M HILL Plateau Remediation Company

ClientProject ID: AQUIFER TUBES, OCTOBER 2019 X20-001

Lab ID: IM191014-1LCS	Sample Matrix: WATER % Moisture: N/A Date Collected: N/A Date Extracted: 10/14/2019 Date Analyzed: 10/18/2019 Prep Method: SW3005A	Prep Batch: IP191014-1 QCBatchID: IP191014-1-5 Run ID: IM191018-10A5 Cleanup: NONE Basis: N/A File Name: 128SMPL_	Sample Aliquot: 50 ml Final Volume: 50 ml Result Units: UG/L Clean DF: 1
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CASNO	Target Analyte	Spike Added	LCS Result	Reporting Limit	Result Qualifier	LCS % Rec.	Control Limits
7440-47-3	CHROMIUM	500	472	10		94	80 - 120%

Data Package ID: *IM1909538-1*

ICPMS Metals

Method SW6020B

Matrix Spike And Matrix Spike Duplicate

Lab Name: ALS -- Fort Collins

Work Order Number: 1909538

Client Name: CH2M HILL Plateau Remediation Company

ClientProject ID: AQUIFER TUBES, OCTOBER 2019 X20-001

Field ID: SHARED QC
LabID: 1910007-4MS

Sample Matrix: WATER
 % Moisture: N/A
 Date Collected: 30-Sep-19
 Date Extracted: 14-Oct-19
 Date Analyzed: 19-Oct-19
 Prep Method: SW3005 Rev A

Prep Batch: IP191014-1
 QCBatchID: IP191014-1-5
 Run ID: IM191018-10A5
 Cleanup: NONE
 Basis: As Received

Sample Aliquot: 50 ml
 Final Volume: 50 ml
 Result Units: UG/L
 File Name: 150SMPL_

CASNO	Target Analyte	Sample Result	Samp Qual	MS Result	MS Qual	Reporting Limit	Spike Added	MS % Rec.	Control Limits
7440-47-3	CHROMIUM	23		485		10	500	92	75 - 125%

Field ID: SHARED QC
LabID: 1910007-4MSD

Sample Matrix: WATER
 % Moisture: N/A
 Date Collected: 30-Sep-19
 Date Extracted: 14-Oct-19
 Date Analyzed: 19-Oct-19
 Prep Method: SW3005 Rev A

Prep Batch: IP191014-1
 QCBatchID: IP191014-1-5
 Run ID: IM191018-10A5
 Cleanup: NONE
 Basis: As Received

Sample Aliquot: 50 ml
 Final Volume: 50 ml
 Result Units: UG/L
 File Name: 153SMPL_

CASNO	Target Analyte	MSD Result	MSD Qual	Spike Added	MSD % Rec.	Reporting Limit	RPD Limit	RPD
7440-47-3	CHROMIUM	489		500	93	10	20	1

Data Package ID: *IM1909538-1*

Prep Batch ID: IP191014-1

Start Date: 10/14/19	End Date: 10/14/19	Concentration Method: NONE	Batch Created By: jml
Start Time: 7:52	End Time: 18:00	Extract Method: SW3005A	Date Created: 10/14/19
Prep Analyst: Jill M. Latelle		Initial Volume Units: ml	Time Created: 7:52
<u>Comments:</u>		Final Volume Units: ml	Validated By: jml
			Date Validated: 10/14/19
			Time Validated: 8:58

QC Batch ID: IP191014-1-5

Lab ID	QC Type	Field ID	Matrix	Date Collected	Initial Wt/Vol	Final Wt/Vol	Cleanup Method	Cleanup DF	Order Number
IP191014-1	MB	XXXXXX	WATER	XXXXXX	50	50	NONE	1	1910007
IM191014-1	LCS	XXXXXX	WATER	XXXXXX	50	50	NONE	1	1910007
1910007-4	MS	XXXXXX	WATER	XXXXXX	50	50	NONE	1	1910007
1910007-4	MSD	XXXXXX	WATER	XXXXXX	50	50	NONE	1	1910007
1909538-2	SMP	B3RNL9	WATER	9/25/2019	50	50	NONE	1	1909538
1909538-3	SMP	B3RNL4	WATER	9/25/2019	50	50	NONE	1	1909538
1909538-4	SMP	B3RNM0	WATER	9/25/2019	50	50	NONE	1	1909538
1909538-5	SMP	B3RNL5	WATER	9/25/2019	50	50	NONE	1	1909538
1910007-4	SMP	XXXXXX	WATER	XXXXXX	50	50	NONE	1	1910007
1910009-1	SMP	XXXXXX	WATER	XXXXXX	50	50	NONE	1	1910009
1910009-2	SMP	XXXXXX	WATER	XXXXXX	50	50	NONE	1	1910009
1910009-3	SMP	XXXXXX	WATER	XXXXXX	50	50	NONE	1	1910009
1910009-4	SMP	XXXXXX	WATER	XXXXXX	50	50	NONE	1	1910009

QC Types

CAR	Carrier reference sample	DLS	Detection Limit Standard
DUP	Laboratory Duplicate	LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicat	LODV	Limit of Detection Verification
LOQV	Limit of Quantitation Verification	MB	Method Blank
MS	Laboratory Matrix Spike	MSD	Laboratory Matrix Spike Duplicate
REP	Sample replicate	RVS	Reporting Level Verification Standar
SMP	Field Sample	SYS	Sample Yield Spike



Strontium-90

Case Narrative

CH2M HILL Plateau Remediation Company

AQUIFER TUBES, OCTOBER 2019 – X20-001

Work Order Number: 1909538

1. The samples were prepared according to the current revision of SOP 707.
2. The samples were analyzed for the presence of ⁹⁰Sr according to the current revision of SOP 724. The analyses were completed on 10/13/2019.
3. Total radio-strontium is reported as ⁹⁰Sr. The presence of other radioisotopes of strontium may cause positive bias in the measured strontium concentration.
4. The analysis results for the samples are reported in units of pCi/L. The samples were not filtered prior to analysis.
5. Sample volume was insufficient to allow preparation of a duplicate. A laboratory control sample duplicate (LCSD) was prepared in lieu of a client sample duplicate.
6. In accordance with project specific instructions, the evaluation threshold for Relative Percent Difference (RPD) has been set at 20%. RPD is defined as:

$$RPD = \frac{|S - D|}{(S + D)/2} * 100$$

Where: S = sample activity result and D = duplicate activity result.

7. No anomalous situations were encountered during the preparation and analysis of these samples. All quality control criteria were met.



The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

Pik Yee Yuen
Pik Yee Yuen
Radiochemistry Primary Data Reviewer

10/22/19
Date

Kath M. W.
Radiochemistry Final Data Reviewer

10/26/19
Date

Strontium-90 by GFPC

PAI 724 Rev 13

Method Blank Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1909538

Client Name: CH2M HILL Plateau Remediation Company

ClientProject ID: AQUIFER TUBES, OCTOBER 2019 X20-001

Lab ID: SR191009-1MB

Sample Matrix: WATER

Prep Batch: SR191009-1

Final Aliquot: 994 ml

Prep SOP: PAI 707 Rev 15

QCBatchID: SR191009-1-1

Result Units: pCi/l

Date Collected: 09-Oct-19

Run ID: SR191009-1A

File Name: SRC1013A

Date Prepared: 09-Oct-19

Count Time: 90 minutes

Date Analyzed: 13-Oct-19

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
10098-97-2	Sr-90	1.06E-01 +/- 2.85E-01	6.43E-01	1.00E+00	NA	U

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
STRONTIUM	1.040E+03	9.62E+02	ug	92.6	40 - 110 %	

Comments:**Qualifiers/Flags:**

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

DL - Decision Level

Data Package ID: SR1909538-1

Strontium-90 by GFPC

PAI 724 Rev 13

Laboratory Control Sample(s)

Lab Name: ALS -- Fort Collins
Work Order Number: 1909538
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: AQUIFER TUBES, OCTOBER 2019 X20-001

Lab ID: SR191009-1LCS

Sample Matrix: WATER
Prep SOP: PAI 707 Rev 15
Date Collected: 09-Oct-19
Date Prepared: 09-Oct-19
Date Analyzed: 13-Oct-19

Prep Batch: SR191009-1
QCBatchID: SR191009-1-1
Run ID: SR191009-1A
Count Time: 30 minutes

Final Aliquot: 994 ml
Result Units: pCi/l
File Name: SRC1013

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
10098-97-2	Sr-90	1.26E+01 +/- 3.24E+00	1.08E+00	1.150E+01	109	75 - 125	

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
STRONTIUM	1.040E+03	9.21E+02	ug	88.7	40 - 110 %	

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS Recovery within control limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration

Data Package ID: SR1909538-1

Strontium-90 by GFPC

PAI 724 Rev 13

Laboratory Control Sample(s)

Lab Name: ALS -- Fort Collins
Work Order Number: 1909538
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: AQUIFER TUBES, OCTOBER 2019 X20-001

Lab ID: SR191009-1LCSD	Sample Matrix: WATER	Prep Batch: SR191009-1	Final Aliquot: 994 ml
	Prep SOP: PAI 707 Rev 15	QCBatchID: SR191009-1-1	Result Units: pCi/l
	Date Collected: 09-Oct-19	Run ID: SR191009-1A	File Name: SRC1013
	Date Prepared: 09-Oct-19	Count Time: 30 minutes	
	Date Analyzed: 13-Oct-19		

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
10098-97-2	Sr-90	1.13E+01 +/- 2.94E+00	1.14E+00	1.150E+01	97.5	75 - 125	

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
STRONTIUM	1.040E+03	8.98E+02	ug	86.4	40 - 110 %	

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS Recovery within control limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration

Data Package ID: SR1909538-1

Strontium-90 by GFPC

PAI 724 Rev 13

Duplicate Sample Results (DER)

Lab Name: ALS -- Fort Collins
 Work Order Number: 1909538
 Client Name: CH2M HILL Plateau Remediation Company
 ClientProject ID: AQUIFER TUBES, OCTOBER 2019 X20-001

Field ID:	
Lab ID:	SR191009-1LCSD

Sample Matrix: WATER
 Prep SOP: PAI 707 Rev 15
 Date Collected: 09-Oct-19
 Date Prepared: 09-Oct-19
 Date Analyzed: 13-Oct-19

Prep Batch: SR191009-1
 QCBatchID: SR191009-1-1
 Run ID: SR191009-1A
 Count Time: 30 minutes

Final Aliquot: 994 ml
 Prep Basis: Unfiltered
 Moisture(%): NA
 Result Units: pCi/l
 File Name: SRC1013

CASNO	Analyte	Sample				Duplicate				DER	DER Lim
		Result +/-	2 s TPU	MDC	Flags	Result +/-	2 s TPU	MDC	Flags		
10098-97-2	Sr-90	1.26E+01 +/-	3.24E+00	1.08E+00		1.13E+01 +/-	2.94E+00	1.14E+00		0.612	3

Comments:

Duplicate Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- D - DER is greater than Control Limit of 3
- LT - Result is less than Request MDC, greater than sample specific MDC
- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits

Abbreviations:

- TPU - Total Propagated Uncertainty
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit
- NR - Not Reported

Data Package ID: SR1909538-1

Strontium-90 by GFPC

PAI 724 Rev 13

Duplicate Sample Results (RPD)

Lab Name: ALS -- Fort Collins
Work Order Number: 1909538
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: AQUIFER TUBES, OCTOBER 2019 X20-001

Field ID:	
Lab ID:	SR191009-1LCSD

Sample Matrix: WATER
Prep SOP: PAI 707 Rev 15
Date Collected: 09-Oct-19
Date Prepared: 09-Oct-19
Date Analyzed: 13-Oct-19

Prep Batch: SR191009-1
QCBatchID: SR191009-1-1
Run ID: SR191009-1A
Count Time: 30 minutes

Final Aliquot: 994 ml
Prep Basis: Unfiltered
Moisture(%): NA
Result Units: pCi/l
File Name: SRC1013

CASNO	Analyte	Sample				Duplicate				RPD	RPD Lim
		Result +/-	2 s TPU	MDC	Flags	Result +/-	2 s TPU	MDC	Flags		
10098-97-2	Sr-90	1.26E+01 +/-	3.24E+00	1.08E+00		1.13E+01 +/-	2.94E+00	1.14E+00		11.00	20

Comments:

Qualifiers/Flags:

- + - Duplicate RPD not within limits.
- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC

Abbreviations:

- TPU - Total Propagated Uncertainty
- BDL - Below Detection Limit
- NR - Not Reported

Data Package ID: SR1909538-1

Strontium-90 by GFPC

PAI 724 Rev 13

Sample Results**Lab Name:** ALS -- Fort Collins**Work Order Number:** 1909538**Client Name:** CH2M HILL Plateau Remediation Company**ClientProject ID:** AQUIFER TUBES, OCTOBER 2019 X20-001

Field ID:	B3RPP6
Lab ID:	1909538-1

Sample Matrix: WATER**Prep SOP:** PAI 707 Rev 15**Date Collected:** 25-Sep-19**Date Prepared:** 09-Oct-19**Date Analyzed:** 13-Oct-19**Prep Batch:** SR191009-1**QC Batch ID:** SR191009-1-1**Run ID:** SR191009-1A**Count Time:** 90 minutes**Report Basis:** Unfiltered**Final Aliquot:** 994 ml**Prep Basis:** Unfiltered**Moisture(%):** NA**Result Units:** pCi/l**File Name:** SRC1013A**Analysis ReqCode:** SRISO_SEP_PR

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
10098-97-2	Sr-90	-6.66E-02 +/- 2.51E-01	5.96E-01	1E+00	NA	U

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
STRONTIUM	1.210E+03	1.12E+03	ug	92.8	40 - 110 %	

Comments:**Qualifiers/Flags:**

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: SR1909538-1

Strontium-90 by GFPC

PAI 724 Rev 13

Sample Results

Lab Name: ALS -- Fort Collins
Work Order Number: 1909538
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: AQUIFER TUBES, OCTOBER 2019 X20-001

Field ID:	B3RPV1
Lab ID:	1909538-6

Sample Matrix: WATER
Prep SOP: PAI 707 Rev 15
Date Collected: 25-Sep-19
Date Prepared: 09-Oct-19
Date Analyzed: 13-Oct-19

Prep Batch: SR191009-1
QCBatchID: SR191009-1-1
Run ID: SR191009-1A
Count Time: 90 minutes
Report Basis: Unfiltered

Final Aliquot: 994 ml
Prep Basis: Unfiltered
Moisture(%): NA
Result Units: pCi/l
File Name: SRC1013A

Analysis ReqCode: SRISO_SEP_PR

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
10098-97-2	Sr-90	-1.08E-02 +/- 2.51E-01	5.87E-01	1E+00	NA	U

Chemical Yield Summary

Carrier/Tracer	Amount Added	Result	Units	Yield	Control Limits	Flag
STRONTIUM	1.250E+03	1.17E+03	ug	94.0	40 - 110 %	

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Sample specific Minimum Detectable Concentration
- BDL - Below Detection Limit
- DL - Decision Level

Data Package ID: SR1909538-1

Prep Batch ID: SR191009-1

Start Date: 10/09/19	End Date: 10/09/19	Concentration Method: NONE	Batch Created By: jxh
Start Time: 8:19	End Time: 8:19	Extract Method: PAI 70715	Date Created: 10/09/19
Prep Analyst: Jirushaya Hantula		Initial Volume Units: ml	Time Created: 8:39
Comments:		Final Volume Units: ml	Validated By: jxh
<div style="border: 1px solid black; height: 30px; width: 100%;"></div>			Date Validated: 10/11/19
			Time Validated: 13:03

QC Batch ID: SR191009-1-1

Lab ID	QC Type	Field ID	Matrix	Date Collected	Initial Wt/Vol	Final Wt/Vol	Cleanup Method	Cleanup DF	Order Number
SR191009-1	CAR	XXXXXX	WATER	XXXXXX	1000	1000	NONE	1	1909373
SR191009-1	MB	XXXXXX	WATER	XXXXXX	1000	994.01	NONE	1	1909373
SR191009-1	LCS	XXXXXX	WATER	XXXXXX	1000	994.01	NONE	1	1909373
SR191009-1	LCSD	XXXXXX	WATER	XXXXXX	1000	994.01	NONE	1	1909493
1909373-1	SMP	XXXXXX	WATER	XXXXXX	1000	994.01	NONE	1	1909373
1909375-1	SMP	XXXXXX	WATER	XXXXXX	1000	994.01	NONE	1	1909375
1909375-3	SMP	XXXXXX	WATER	XXXXXX	1000	994.01	NONE	1	1909375
1909375-5	SMP	XXXXXX	WATER	XXXXXX	1000	994.01	NONE	1	1909375
1909383-6	SMP	XXXXXX	WATER	XXXXXX	1000	994.01	NONE	1	1909383
1909383-9	SMP	XXXXXX	WATER	XXXXXX	1000	994.01	NONE	1	1909383
1909419-6	SMP	XXXXXX	WATER	XXXXXX	1000	994.01	NONE	1	1909419
1909419-8	SMP	XXXXXX	WATER	XXXXXX	1000	994.01	NONE	1	1909419
1909419-9	SMP	XXXXXX	WATER	XXXXXX	1000	994.01	NONE	1	1909419
1909441-1	SMP	XXXXXX	WATER	XXXXXX	1000	994.01	NONE	1	1909441
1909493-2	SMP	XXXXXX	WATER	XXXXXX	1000	994.01	NONE	1	1909493
1909493-5	SMP	XXXXXX	WATER	XXXXXX	1000	994.01	NONE	1	1909493
1909493-7	SMP	XXXXXX	WATER	XXXXXX	1000	994.01	NONE	1	1909493
1909538-1	SMP	B3RPP6	WATER	9/25/2019	1000	994.01	NONE	1	1909538
1909538-6	SMP	B3RPV1	WATER	9/25/2019	1000	994.01	NONE	1	1909538

QC Types

CAR	Carrier reference sample	DLS	Detection Limit Standard
DUP	Laboratory Duplicate	LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicat	LODV	Limit of Detection Verification
LOQV	Limit of Quantitation Verification	MB	Method Blank
MS	Laboratory Matrix Spike	MSD	Laboratory Matrix Spike Duplicate
REP	Sample replicate	RVS	Reporting Level Verification Standar
SMP	Field Sample	SYS	Sample Yield Spike



Tritium

Case Narrative

CH2M HILL Plateau Remediation Company

AQUIFER TUBES, OCTOBER 2019 – X20-001

Work Order Number: 1909538

1. The samples were prepared according to the current revision of SOP 700.
2. The samples were analyzed for the presence of tritium according to the current revision of SOP 704. The analyses were completed on 10/22/2019.
3. The duplicate of sample 1910097-4 and the matrix spikes of sample 1910047-4 are shared for this work order. The duplicate and matrix spikes were performed on CH2M HILL Plateau Remediation Company samples and the results are acceptable. The results can be found in the following report.
4. The analysis results for these samples are reported in units of pCi/L. The samples were not filtered prior to analysis.
5. In accordance with project specific instructions, the evaluation threshold for Relative Percent Difference (RPD) has been set at 20%. RPD is defined as:

$$RPD = \frac{|S - D|}{(S + D)/2} * 100$$

Where: S = sample activity result and D = duplicate activity result.

6. The magnitude of the negative activity for shared QC sample 1910047-4 is greater than the 3 sigma TPU. The analyst's review of the data does not indicate a problem with the instrument data or the subsequent reporting systems. It is believed that the data quality is unaffected and the results are submitted without qualification.
7. No anomalous situations were encountered during the preparation or analysis of these samples. All quality control criteria were met.



The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

Pik Yee Yuen
Pik Yee Yuen
Radiochemistry Primary Data Reviewer

10/23/19
Date

Kath M. W.
Radiochemistry Final Data Reviewer

10/26/19
Date

Tritium by Liquid Scintillation

PAI 704 Rev 12

Method Blank Results

Lab Name: ALS -- Fort Collins
Work Order Number: 1909538
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: AQUIFER TUBES, OCTOBER 2019 X20-001

Lab ID: 3H191014-2MB	Sample Matrix: WATER	Prep Batch: 3H191014-2	Final Aliquot: 10.0 ml
	Prep SOP: PAI 700 Rev 15	QCBatchID: 3H191014-2-1	Result Units: pCi/l
	Date Collected: 14-Oct-19	Run ID: 3H191014-2A	File Name: Z20191021_1946
	Date Prepared: 14-Oct-19	Count Time: 30 minutes	
	Date Analyzed: 22-Oct-19		

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
10028-17-8	H-3	8.92E+00 +/- 1.01E+02	1.85E+02	4.00E+02	NA	U

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC.
 Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
 Y2 - Chemical Yield outside default limits.

Abbreviations:

TPU - Total Propagated Uncertainty
 MDC - Sample specific Minimum Detectable Concentration
 BDL - Below Detection Limit

M - Requested MDC not met.
 B - Analyte concentration greater than MDC.
 B3 - Analyte concentration greater than MDC but less than Requested MDC.
 DL - Decision Level

Data Package ID: H31909538-1

Tritium by Liquid Scintillation

PAI 704 Rev 12

Laboratory Control Sample(s)

Lab Name: ALS -- Fort Collins
Work Order Number: 1909538
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: AQUIFER TUBES, OCTOBER 2019 X20-001

Lab ID: 3H191014-2LCS

Sample Matrix: WATER
Prep SOP: PAI 700 Rev 15
Date Collected: 14-Oct-19
Date Prepared: 14-Oct-19
Date Analyzed: 22-Oct-19

Prep Batch: 3H191014-2
QCBatchID: 3H191014-2-1
Run ID: 3H191014-2A
Count Time: 30 minutes

Final Aliquot: 9.84 ml
Result Units: pCi/l
File Name: Z20191021_1946

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
10028-17-8	H-3	1.58E+04 +/- 2.51E+03	1.88E+02	1.650E+04	96.2	80 - 120	

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS Recovery within control limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration

Data Package ID: H31909538-1

Tritium by Liquid Scintillation

PAI 704 Rev 12

Matrix Spike Results

Lab Name: ALS -- Fort Collins
Work Order Number: 1909538
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: AQUIFER TUBES, OCTOBER 2019 X20-001

Field ID:	Shared QC
Lab ID:	1910047-4MS

Sample Matrix: WATER
Prep SOP: PAI 700 Rev 15
Date Collected: 01-Oct-19
Date Prepared: 14-Oct-19
Date Analyzed: 22-Oct-19

Prep Batch: 3H191014-2
QCBatchID: 3H191014-2-1
Run ID: 3H191014-2A
Count Time: 30 minutes
Report Basis: Unfiltered

Final Aliquot: 9.84 ml
Prep Basis: Unfiltered
Moisture(%): 100.000
Result Units: pCi/l
File Name: Z20191021_1946

Analysis ReqCode: TRITIUM_DIST_L

CASNO	Target Nuclide	Matrix Spike	Sample Results	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
10028-17-8	H-3	1.76E+04	-1.37E+02	1.87E+02	1.650E+04	106	80 - 120	

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- N - Matrix Spike Recovery outside control limits
- P - Matrix Spike Recovery within control limits
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

Abbreviations:

MDC - Sample specific Minimum Detectable Concentration

Data Package ID: H31909538-1

Tritium by Liquid Scintillation

PAI 704 Rev 12

Matrix Spike Results

Lab Name: ALS -- Fort Collins
Work Order Number: 1909538
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: AQUIFER TUBES, OCTOBER 2019 X20-001

Field ID:	Shared QC
Lab ID:	1910047-4MSD

Sample Matrix: WATER
Prep SOP: PAI 700 Rev 15
Date Collected: 01-Oct-19
Date Prepared: 14-Oct-19
Date Analyzed: 22-Oct-19

Prep Batch: 3H191014-2
QC Batch ID: 3H191014-2-1
Run ID: 3H191014-2A
Count Time: 30 minutes
Report Basis: Unfiltered

Final Aliquot: 9.84 ml
Prep Basis: Unfiltered
Moisture(%): 100.000
Result Units: pCi/l
File Name: Z20191021_1946

Analysis ReqCode: TRITIUM_DIST_L

CASNO	Target Nuclide	Matrix Spike	Sample Results	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
10028-17-8	H-3	1.59E+04	-1.37E+02	1.87E+02	1.650E+04	96.4	80 - 120	

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- N - Matrix Spike Recovery outside control limits
- P - Matrix Spike Recovery within control limits
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

Abbreviations:

MDC - Sample specific Minimum Detectable Concentration

Data Package ID: H31909538-1

Tritium by Liquid Scintillation

PAI 704 Rev 12

Sample Results

Lab Name: ALS -- Fort Collins
Work Order Number: 1909538
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: AQUIFER TUBES, OCTOBER 2019 X20-001

Field ID:	Shared QC
Lab ID:	1910047-4

Sample Matrix: WATER
Prep SOP: PAI 700 Rev 15
Date Collected: 01-Oct-19
Date Prepared: 14-Oct-19
Date Analyzed: 22-Oct-19

Prep Batch: 3H191014-2
QCBatchID: 3H191014-2-1
Run ID: 3H191014-2A
Count Time: 30 minutes
Report Basis: Unfiltered

Final Aliquot: 10.0 ml
Prep Basis: Unfiltered
Moisture(%): 100.000
Result Units: pCi/l
File Name: Z20191021_1946

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
10028-17-8	H-3	-1.37E+02 +/- 7.67E+01	1.85E+02	4E+02	NA	U

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Sample specific Minimum Detectable Concentration
- BDL - Below Detection Limit
- DL - Decision Level

Data Package ID: H31909538-1

Tritium by Liquid Scintillation

PAI 704 Rev 12

Duplicate Sample Results (DER)

Lab Name: ALS -- Fort Collins
Work Order Number: 1909538
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: AQUIFER TUBES, OCTOBER 2019 X20-001

Field ID:	Shared QC
Lab ID:	1910047-4MSD

Sample Matrix: WATER
Prep SOP: PAI 700 Rev 15
Date Collected: 01-Oct-19
Date Prepared: 14-Oct-19
Date Analyzed: 22-Oct-19

Prep Batch: 3H191014-2
QCBatchID: 3H191014-2-1
Run ID: 3H191014-2A
Count Time: 30 minutes
Report Basis: Unfiltered

Final Aliquot: 9.84 ml
Prep Basis: Unfiltered
Moisture(%): 100.000
Result Units: pCi/l
File Name: Z20191021_1946

CASNO	Analyte	Sample				Duplicate				DER	DER Lim
		Result +/-	2 s TPU	MDC	Flags	Result +/-	2 s TPU	MDC	Flags		
10028-17-8	H-3	1.76E+04 +/-	2.77E+03	1.87E+02		1.59E+04 +/-	2.52E+03	1.87E+02		0.435	2.13

Comments:

Duplicate Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- LT - Result is less than Request MDC, greater than sample specific MDC
- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits

Abbreviations:

- TPU - Total Propagated Uncertainty
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit
- NR - Not Reported

Data Package ID: H31909538-1

Tritium by Liquid Scintillation

PAI 704 Rev 12

Duplicate Sample Results (RPD)

Lab Name: ALS -- Fort Collins
Work Order Number: 1909538
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: AQUIFER TUBES, OCTOBER 2019 X20-001

Field ID:	Shared QC
Lab ID:	1910047-4MSD

Sample Matrix: WATER
Prep SOP: PAI 700 Rev 15
Date Collected: 01-Oct-19
Date Prepared: 14-Oct-19
Date Analyzed: 22-Oct-19

Prep Batch: 3H191014-2
QC Batch ID: 3H191014-2-1
Run ID: 3H191014-2A
Count Time: 30 minutes
Report Basis: Unfiltered

Final Aliquot: 9.84 ml
Prep Basis: Unfiltered
Moisture(%): 100.000
Result Units: pCi/l
File Name: Z20191021_1946

CASNO	Analyte	Sample				Duplicate				RPD	RPD Lim
		Result +/-	2 s TPU	MDC	Flags	Result +/-	2 s TPU	MDC	Flags		
10028-17-8	H-3	1.76E+04 +/-	2.77E+03	1.87E+02		1.59E+04 +/-	2.52E+03	1.87E+02		10.00	20

Comments:

Qualifiers/Flags:

- + - Duplicate RPD not within limits.
- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC

Abbreviations:

- TPU - Total Propagated Uncertainty
- BDL - Below Detection Limit
- NR - Not Reported

Data Package ID: H31909538-1

Tritium by Liquid Scintillation

PAI 704 Rev 12

Duplicate Sample Results (DER)

Lab Name: ALS -- Fort Collins
Work Order Number: 1909538
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: AQUIFER TUBES, OCTOBER 2019 X20-001

Field ID:	Shared QC
Lab ID:	1910097-4DUP

Sample Matrix: WATER
Prep SOP: PAI 700 Rev 15
Date Collected: 02-Oct-19
Date Prepared: 14-Oct-19
Date Analyzed: 22-Oct-19

Prep Batch: 3H191014-2
QCBatchID: 3H191014-2-1
Run ID: 3H191014-2A
Count Time: 30 minutes
Report Basis: Unfiltered

Final Aliquot: 10.0 ml
Prep Basis: Unfiltered
Moisture(%): 100.000
Result Units: pCi/l
File Name: Z20191021_1946

CASNO	Analyte	Sample				Duplicate				DER	DER Lim
		Result +/-	2 s TPU	MDC	Flags	Result +/-	2 s TPU	MDC	Flags		
10028-17-8	H-3	8.67E+03 +/-	1.42E+03	1.85E+02		9.20E+03 +/-	1.50E+03	1.85E+02		0.253	2.13

Comments:

Duplicate Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- LT - Result is less than Request MDC, greater than sample specific MDC
- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits

Abbreviations:

- TPU - Total Propagated Uncertainty
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit
- NR - Not Reported

Data Package ID: H31909538-1

Tritium by Liquid Scintillation

PAI 704 Rev 12

Duplicate Sample Results (RPD)

Lab Name: ALS -- Fort Collins
Work Order Number: 1909538
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: AQUIFER TUBES, OCTOBER 2019 X20-001

Field ID:	Shared QC
Lab ID:	1910097-4DUP

Sample Matrix: WATER
Prep SOP: PAI 700 Rev 15
Date Collected: 02-Oct-19
Date Prepared: 14-Oct-19
Date Analyzed: 22-Oct-19

Prep Batch: 3H191014-2
QC Batch ID: 3H191014-2-1
Run ID: 3H191014-2A
Count Time: 30 minutes
Report Basis: Unfiltered

Final Aliquot: 10.0 ml
Prep Basis: Unfiltered
Moisture(%): 100.000
Result Units: pCi/l
File Name: Z20191021_1946

CASNO	Analyte	Sample				Duplicate				RPD	RPD Lim
		Result +/-	2 s TPU	MDC	Flags	Result +/-	2 s TPU	MDC	Flags		
10028-17-8	H-3	8.67E+03 +/-	1.42E+03	1.85E+02		9.20E+03 +/-	1.50E+03	1.85E+02		6.00	20

Comments:

Qualifiers/Flags:

- + - Duplicate RPD not within limits.
- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC

Abbreviations:

- TPU - Total Propagated Uncertainty
- BDL - Below Detection Limit
- NR - Not Reported

Data Package ID: H31909538-1

Tritium by Liquid Scintillation

PAI 704 Rev 12

Sample Results

Lab Name: ALS -- Fort Collins
Work Order Number: 1909538
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: AQUIFER TUBES, OCTOBER 2019 X20-001

Field ID:	Shared QC
Lab ID:	1910097-4

Sample Matrix: WATER
Prep SOP: PAI 700 Rev 15
Date Collected: 02-Oct-19
Date Prepared: 14-Oct-19
Date Analyzed: 22-Oct-19

Prep Batch: 3H191014-2
QCBatchID: 3H191014-2-1
Run ID: 3H191014-2A
Count Time: 30 minutes
Report Basis: Unfiltered

Final Aliquot: 10.0 ml
Prep Basis: Unfiltered
Moisture(%): 100.000
Result Units: pCi/l
File Name: Z20191021_1946

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
10028-17-8	H-3	8.67E+03 +/- 1.42E+03	1.85E+02	4E+02	NA	

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Sample specific Minimum Detectable Concentration
- BDL - Below Detection Limit
- DL - Decision Level

Data Package ID: H31909538-1

Tritium by Liquid Scintillation

PAI 704 Rev 12

Sample Duplicate Results

Lab Name: ALS -- Fort Collins
Work Order Number: 1909538
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: AQUIFER TUBES, OCTOBER 2019 X20-001

Field ID:	Shared QC
Lab ID:	1910097-4DUP

Sample Matrix: WATER	Prep Batch: 3H191014-2	Final Aliquot: 10.0 ml
Prep SOP: PAI 700 Rev 15	QCBatchID: 3H191014-2-1	Prep Basis: Unfiltered
Date Collected: 02-Oct-19	Run ID: 3H191014-2A	Moisture(%): 100.000
Date Prepared: 14-Oct-19	Count Time: 30 minutes	Result Units: pCi/l
Date Analyzed: 22-Oct-19	Report Basis: Unfiltered	File Name: Z20191021_1946

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
10028-17-8	H-3	9.20E+03 +/- 1.50E+03	1.85E+02	4E+02	NA	

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.
- W - DER is greater than Warning Limit of 1.42

- D - DER is greater than Control Limit of 2.13

Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Sample specific Minimum Detectable Concentration
- BDL - Below Detection Limit
- DL - Decision Level

Data Package ID: H31909538-1

Date Printed:

Wednesday, October 23, 2019

ALS -- Fort Collins

Page 1 of 1

LIMS Version: 6.915

Tritium by Liquid Scintillation

PAI 704 Rev 12

Sample Results

Lab Name: ALS -- Fort Collins
Work Order Number: 1909538
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: AQUIFER TUBES, OCTOBER 2019 X20-001

Field ID:	B3RPP6
Lab ID:	1909538-1

Sample Matrix: WATER
Prep SOP: PAI 700 Rev 15
Date Collected: 25-Sep-19
Date Prepared: 14-Oct-19
Date Analyzed: 21-Oct-19

Prep Batch: 3H191014-2
QCBatchID: 3H191014-2-1
Run ID: 3H191014-2A
Count Time: 30 minutes
Report Basis: Unfiltered

Final Aliquot: 10.0 ml
Prep Basis: Unfiltered
Moisture(%): 100.000
Result Units: pCi/l
File Name: Z20191021_1946

Analysis ReqCode: TRITIUM_DIST_L

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
10028-17-8	H-3	4.76E+03 +/- 8.30E+02	1.87E+02	4E+02	NA	

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Sample specific Minimum Detectable Concentration
- BDL - Below Detection Limit
- DL - Decision Level

Data Package ID: H31909538-1

Tritium by Liquid Scintillation

PAI 704 Rev 12

Sample Results

Lab Name: ALS -- Fort Collins
Work Order Number: 1909538
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: AQUIFER TUBES, OCTOBER 2019 X20-001

Field ID:	B3RP61
Lab ID:	1909538-7

Sample Matrix: WATER
Prep SOP: PAI 700 Rev 15
Date Collected: 25-Sep-19
Date Prepared: 14-Oct-19
Date Analyzed: 21-Oct-19

Prep Batch: 3H191014-2
QCBatchID: 3H191014-2-1
Run ID: 3H191014-2A
Count Time: 30 minutes
Report Basis: Unfiltered

Final Aliquot: 10.0 ml
Prep Basis: Unfiltered
Moisture(%): 100.000
Result Units: pCi/l
File Name: Z20191021_1946

Analysis ReqCode: TRITIUM_DIST_L

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
10028-17-8	H-3	2.25E+03 +/- 4.47E+02	1.86E+02	4E+02	NA	

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Sample specific Minimum Detectable Concentration
- BDL - Below Detection Limit
- DL - Decision Level

Data Package ID: H31909538-1

Prep Batch ID: 3H191014-2

Start Date: 10/14/19	End Date: 10/14/19	Concentration Method: NONE	Batch Created By: rgs
Start Time: 7:43	End Time: 7:43	Extract Method: PAI 70015	Date Created: 10/14/19
Prep Analyst: Reilly G. Stockton		Initial Volume Units: ml	Time Created: 7:43
<u>Comments:</u>		Final Volume Units: ml	Validated By: rgs
<div style="border: 1px solid black; height: 30px; width: 100%;"></div>			Date Validated: 10/21/19
			Time Validated: 7:51

QC Batch ID: 3H191014-2-1

Lab ID	QC Type	Field ID	Matrix	Date Collected	Initial Wt/Vol	Final Wt/Vol	Cleanup Method	Cleanup DF	Order Number
3H191014-2	MB	XXXXXX	WATER	XXXXXX	30	10	NONE	1	1909538
3H191014-2CB1	MB	XXXXXX	WATER	XXXXXX	30	10	NONE	1	1909538
3H191014-2CB2	MB	XXXXXX	WATER	XXXXXX	30	10	NONE	1	1909538
3H191014-2CB3	MB	XXXXXX	WATER	XXXXXX	30	10	NONE	1	1909538
3H191014-2	LCS	XXXXXX	WATER	XXXXXX	30	9.8361	NONE	1	1909538
1910047-4	MS	XXXXXX	WATER	XXXXXX	30	9.8361	NONE	1	1910047
1910047-4	MSD	XXXXXX	WATER	XXXXXX	30	9.8361	NONE	1	1910047
1910097-4	DUP	XXXXXX	WATER	XXXXXX	30	10	NONE	1	1910097
1909538-1	SMP	B3RPP6	WATER	9/25/2019	30	10	NONE	1	1909538
1909538-7	SMP	B3RP61	WATER	9/25/2019	30	10	NONE	1	1909538
1910007-10	SMP	XXXXXX	WATER	XXXXXX	30	10	NONE	1	1910007
1910007-11	SMP	XXXXXX	WATER	XXXXXX	30	10	NONE	1	1910007
1910007-12	SMP	XXXXXX	WATER	XXXXXX	30	10	NONE	1	1910007
1910047-1	SMP	XXXXXX	WATER	XXXXXX	30	10	NONE	1	1910047
1910047-4	SMP	XXXXXX	WATER	XXXXXX	30	10	NONE	1	1910047
1910047-5	SMP	XXXXXX	WATER	XXXXXX	30	10	NONE	1	1910047
1910097-4	SMP	XXXXXX	WATER	XXXXXX	30	10	NONE	1	1910097
1910097-5	SMP	XXXXXX	WATER	XXXXXX	30	10	NONE	1	1910097
1910138-10	SMP	XXXXXX	WATER	XXXXXX	30	10	NONE	1	1910138
1910138-9	SMP	XXXXXX	WATER	XXXXXX	30	10	NONE	1	1910138
1910171-1	SMP	XXXXXX	WATER	XXXXXX	30	10	NONE	1	1910171
1910172-1	SMP	XXXXXX	WATER	XXXXXX	30	10	NONE	1	1910172
1910173-3	SMP	XXXXXX	WATER	XXXXXX	30	10	NONE	1	1910173

Prep Batch ID: 3H191014-2

Start Date: 10/14/19	End Date: 10/14/19	Concentration Method: NONE	Batch Created By: rgs
Start Time: 7:43	End Time: 7:43	Extract Method: PAI 70015	Date Created: 10/14/19
Prep Analyst: Reilly G. Stockton		Initial Volume Units: ml	Time Created: 7:43
Comments:		Final Volume Units: ml	Validated By: rgs
<div style="border: 1px solid black; height: 30px; width: 100%;"></div>			Date Validated: 10/21/19
			Time Validated: 7:51

QC Types

CAR	Carrier reference sample		DLS	Detection Limit Standard	
DUP	Laboratory Duplicate		LCS	Laboratory Control Sample	
LCSD	Laboratory Control Sample Duplicat		LODV	Limit of Detection Verification	
LOQV	Limit of Quantitation Verification		MB	Method Blank	
MS	Laboratory Matrix Spike		MSD	Laboratory Matrix Spike Duplicate	
REP	Sample replicate		RVS	Reporting Level Verification Standar	
SMP	Field Sample		SYS	Sample Yield Spike	