



Tuesday, October 15, 2019

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

Re: ALS Workorder: 1909373
Project Name: AEA, September 2019
Project Number: I19-028

Dear Ms. Waters-Husted:

One water sample was received from CH2M HILL Plateau Remediation Company, on 9/18/2019. The sample was scheduled for the following analyses:

Metals

Strontium-90

Technetium-99

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. OBrien
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: 1909373

Client Name: CH2M HILL Plateau Remediation Company

Client Project Name: AEA, September 2019

Client Project Number: I19-028

Client PO Number: BOA 54854

| Client Sample Number | Lab Sample Number | COC Number | Matrix | Date Collected | Time Collected |
|----------------------|-------------------|------------|--------|----------------|----------------|
| B3R4F7 | 1909373-1 | | WATER | 16-Sep-19 | 11:01 |

| CH2M Hill Plateau Remediation Company | | CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST | | C.O.C.# I19-028-011 | | | |
|--|--------|---|------|---|--------------------------------|--------------|---------------|
| Collector: Jeff Tucksen CHPRC | | Contact/Requester: Karen Waters-Husted | | Page 1 of 1 | | | |
| SAF No.: I19-028 | | Sampling Origin: Hanford Site | | Telephone No.: 509-376-4650 | | | |
| Project Title: AEA, September 2019 | | Logbook No.: HNF-N-506 112 | | Purchase Order/Charge Code: 300071 | | | |
| Shipped To (Lab): ALS Environmental Ft. Collins | | Method of Shipment: Commercial Carrier | | Ice Chest No.: GWS-109 | | | |
| Protocol: SURV | | Priority: 30 Days | | Bill of Lading/Air Bill No.: 7762 5807 8848 | | | |
| POSSIBLE SAMPLE HAZARDS/REMARK | | SPECIAL INSTRUCTIONS | | Offsite Property No.: 11603 | | | |
| ** ** 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 | | N/A | | | | | |
| Sample No. | Filter | Date | Time | No/Type Container | Sample Analysis | Holding Time | Preservative |
| B3R4F7 | N | SEP 16 2019 | 1101 | 1x500-mL G/P | 6020_METALS_ICPMS: Uranium (1) | 6 Months | HNO3 to pH <2 |
| B3R4F7 | N | ↓ | ↓ | 2x1-L G/P | SRISO_SEP_PRECIP_GPC: COMMON | 6 Months | HNO3 to pH <2 |
| B3R4F7 | N | ↓ | ↓ | 1x500-mL G/P | TC99_SEP_LSC: COMMON | 6 Months | HNO3 to pH <2 |

| Relinquished By | | Received By | |
|---------------------------|-----------|---------------------------|-----------|
| Print First and Last Name | Signature | Print First and Last Name | Signature |
| Jeff Tucksen CHPRC | | Janelle Zunker CHPRC | |
| Janelle Zunker CHPRC | | SSU-1 | |
| SSU-1 | | Janelle Zunker CHPRC | |
| Janelle Zunker CHPRC | | FEDEX | |
| | | Erik Evans | |

| | | | | |
|-----------|---|---|------------------|------------------|
| Date/Time | SEP 16 2019 1110 | SEP 16 2019 1145 | SEP 17 2019 1100 | SEP 17 2019 1100 |
| Matrix * | 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 | | |

| | | | |
|---------------------------------|---|--------------|------------|
| FINAL SAMPLE DISPOSITION | Disposal Method (e.g., Return to customer, per lab procedure, used in process): | Disposed By: | Date/Time: |
| Printed On 7/25/2019 | | | |

FSR ID = FSR82921 A-6004-842 (REV 3)



ALS Environmental - Fort Collins
CONDITION OF SAMPLE UPON RECEIPT FORM

Client: CHPRC

Workorder No: 1909373

Project Manager: KMO

Initials: EE

Date: 9/19/19

| | | | | |
|--|---------------|----------|-------------------------------------|-------------------------------------|
| 1. Are airbills / shipping documents present and/or removable? | | DROP OFF | <input checked="" type="checkbox"/> | NO |
| 2. Are custody seals on shipping containers intact? | | NONE | <input checked="" type="checkbox"/> | NO * |
| 3. Are custody seals on sample containers intact? | | NONE | <input checked="" type="checkbox"/> | NO * |
| 4. Is there a COC (chain-of-custody) present? | | | <input checked="" type="checkbox"/> | NO * |
| 5. Is the COC in agreement with samples received? (IDs, dates, times, # of samples, # of containers, matrix, requested analyses, etc.) | | | <input checked="" type="checkbox"/> | NO * |
| 6. Are short-hold samples present? | | | YES | <input checked="" type="checkbox"/> |
| 7. Are all samples within holding times for the requested analyses? | | | <input checked="" type="checkbox"/> | NO * |
| 8. Were all sample containers received intact? (not broken or leaking) | | | <input checked="" type="checkbox"/> | NO * |
| 9. Is there sufficient sample for the requested analyses? | | | <input checked="" type="checkbox"/> | NO * |
| 10. Are all samples in the proper containers for the requested analyses? | | | <input checked="" type="checkbox"/> | NO * |
| 11. Are all aqueous samples preserved correctly, if required? (excluding volatiles) | | N/A | <input checked="" type="checkbox"/> | NO * |
| 12. Are all aqueous non-preserved samples pH 4-9? | | NA | YES | NO * |
| 13. Are all samples requiring no headspace (VOC, GRO, RSK/MEE, radon) free of bubbles > 6 mm (1/4 inch) diameter? (i.e. size of green pea) | | NA | YES | NO |
| 14. Were the samples shipped on ice? | | | <input checked="" type="checkbox"/> | NO |
| 15. Were cooler temperatures measured at 0.1-6.0°C? | IR gun used*: | | | RAD ONLY |
| | #1 | #3 | #4 | <input checked="" type="checkbox"/> |
| Cooler #: | <u>1</u> | | | |
| Temperature (°C): | <u>0.9</u> | | | |
| No. of custody seals on cooler: | <u>2</u> | | | |
| External µR/hr reading: | <u>13</u> | | | |
| Background µR/hr reading: | <u>13</u> | | | |
| Were external µR/hr readings ≤ two times background and within DOT acceptance criteria? <input checked="" type="checkbox"/> YES / NO / NA (If no, see Form 008.) | | | | |

* Please provide details here for NO responses to gray boxes above - for 2 thru 5 & 7 thru 12, notify PM & continue w/ login.

All client bottle ID's vs ALS lab ID's double-checked by: EE

If applicable, was the client contacted? YES / NO / NA Contact: _____ Date/Time: _____

Project Manager Signature / Date: [Signature] 9/20/19

1909373

ORIGIN ID: PSCA (509) 531-0450
 TROY BACON
 CH2M
 8287 LATAH ST.
 RICHLAND, WA 99352
 UNITED STATES US

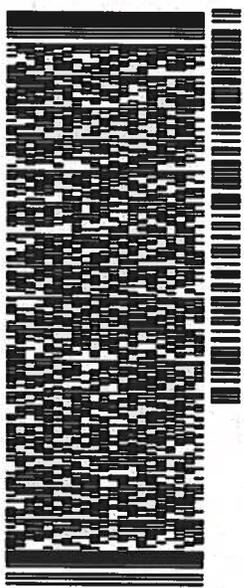
SHIP DATE: 17SEP19
 ACTWGT: 66.00 LB
 CAD: 10708805/INNET4160

BILL THIRD PARTY

TO JULIE ELLINGSON
 ALS GLOBAL-FORT COLLINS
 225 COMMERCE DR
 FORT COLLINS CO 80524
 (970) 490-1511
 NV
 PO
 REF: PRT#1603
 DEPT

13-2
D.9°

567J19D0405A2



TRK# 7762 5807 8848
 0201

WED - 18 SEP 10:30A
 PRIORITY OVERNIGHT
 DSR

XH FTCA

80524
 co-us DEN



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Metals

Case Narrative

CH2M HILL Plateau Remediation Company

AEA, September 2019 -- I19-028

Work Order Number: 1909373

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

For analysis by ICP-MS, the sample was 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 sample was 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.



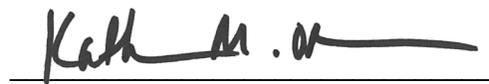
- The interference check samples associated with Method 6020B were analyzed.
6. Matrix specific quality control procedures.
- Sample 1909373-1 was designated as the quality control sample for this analysis.
- Similarity of matrix and therefore relevance of the QC results should not be automatically inferred 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

10/9/19
Date



Inorganics Final Data Reviewer

10/15/19
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.

Total Recoverable ICPMS Metals

Method SW6020B

Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1909373

Client Name: CH2M HILL Plateau Remediation Company

ClientProject ID: AEA, September 2019 I19-028

| | |
|-----------|-----------|
| Field ID: | B3R4F7 |
| Lab ID: | 1909373-1 |

Sample Matrix: WATER
 % Moisture: N/A
 Date Collected: 16-Sep-19
 Date Extracted: 24-Sep-19
 Date Analyzed: 26-Sep-19
 Prep Method: SW3005 Rev A

Prep Batch: IP190924-3
 QCBatchID: IP190924-3-4
 Run ID: IM190926-20A5
 Cleanup: NONE
 Basis: As Received
 File Name: 024SMPL_

Analyst: Nicole C. Chirban
 Sample Aliquot: 50 ml
 Final Volume: 50 ml
 Result Units: UG/L
 Clean DF: 1

Analysis ReqCode: 6020_METALS_I

| CASNO | Target Analyte | Dilution Factor | Result | Result Qualifier | Reporting Limit | MDL |
|-----------|----------------|-----------------|--------|------------------|-----------------|--------|
| 7440-61-1 | URANIUM | 10 | 2.9 | | 0.1 | 0.0049 |

Data Package ID: IM1909373-1

ICPMS Metals

Method SW6020B

Method Blank

Lab Name: ALS -- Fort Collins

Work Order Number: 1909373

Client Name: CH2M HILL Plateau Remediation Company

ClientProject ID: AEA, September 2019 I19-028

Lab ID: IP190924-3MB

Sample Matrix: WATER

% Moisture: N/A

Date Collected: N/A

Date Extracted: 24-Sep-19

Date Analyzed: 26-Sep-19

Prep Batch: IP190924-3

QCBatchID: IP190924-3-4

Run ID: IM190926-20A5

Cleanup: NONE

Basis: N/A

File Name: 017SMPL_

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 |
|-----------|----------------|----|--------|------------------|-----------------|--------|
| 7440-61-1 | URANIUM | 10 | 0.0049 | U | 0.1 | 0.0049 |

Data Package ID: IM1909373-1

ICPMS Metals

Method SW6020B

Laboratory Control Sample

Lab Name: ALS -- Fort Collins

Work Order Number: 1909373

Client Name: CH2M HILL Plateau Remediation Company

ClientProject ID: AEA, September 2019 I19-028

| | | | |
|------------------------------|---|--|---|
| Lab ID: IM190924-3LCS | Sample Matrix: WATER % Moisture: N/A Date Collected: N/A Date Extracted: 09/24/2019 Date Analyzed: 09/26/2019 Prep Method: SW3005A | Prep Batch: IP190924-3 QCBatchID: IP190924-3-4 Run ID: IM190926-20A5 Cleanup: NONE Basis: N/A File Name: 018SMPL_ | Sample Aliquot: 50 ml Final Volume: 50 ml Result Units: UG/L Clean DF: 1 |
|------------------------------|---|--|---|

| CASNO | Target Analyte | Spike Added | LCS Result | Reporting Limit | Result Qualifier | LCS % Rec. | Control Limits |
|-----------|----------------|-------------|------------|-----------------|------------------|------------|----------------|
| 7440-61-1 | URANIUM | 10 | 9.29 | 0.1 | | 93 | 80 - 120% |

Data Package ID: *IM1909373-1*

ICPMS Metals

Method SW6020B

Matrix Spike And Matrix Spike Duplicate

Lab Name: ALS -- Fort Collins

Work Order Number: 1909373

Client Name: CH2M HILL Plateau Remediation Company

ClientProject ID: AEA, September 2019 I19-028

| | | | |
|--------------------|---------------------------|-------------------------|-----------------------|
| Field ID: B3R4F7 | Sample Matrix: WATER | Prep Batch: IP190924-3 | Sample Aliquot: 50 ml |
| LabID: 1909373-1MS | % Moisture: N/A | QCBatchID: IP190924-3-4 | Final Volume: 50 ml |
| | Date Collected: 16-Sep-19 | Run ID: IM190926-20A5 | Result Units: UG/L |
| | Date Extracted: 24-Sep-19 | Cleanup: NONE | File Name: 026SMPL_ |
| | Date Analyzed: 26-Sep-19 | Basis: As Received | |
| | Prep Method: SW3005 Rev A | | |

| CASNO | Target Analyte | Sample Result | Samp Qual | MS Result | MS Qual | Reporting Limit | Spike Added | MS % Rec. | Control Limits |
|-----------|----------------|---------------|-----------|-----------|---------|-----------------|-------------|-----------|----------------|
| 7440-61-1 | URANIUM | 2.9 | | 12.4 | | 0.1 | 10 | 95 | 75 - 125% |

| | | | |
|---------------------|---------------------------|-------------------------|-----------------------|
| Field ID: B3R4F7 | Sample Matrix: WATER | Prep Batch: IP190924-3 | Sample Aliquot: 50 ml |
| LabID: 1909373-1MSD | % Moisture: N/A | QCBatchID: IP190924-3-4 | Final Volume: 50 ml |
| | Date Collected: 16-Sep-19 | Run ID: IM190926-20A5 | Result Units: UG/L |
| | Date Extracted: 24-Sep-19 | Cleanup: NONE | File Name: 029SMPL_ |
| | Date Analyzed: 26-Sep-19 | Basis: As Received | |
| | Prep Method: SW3005 Rev A | | |

| CASNO | Target Analyte | MSD Result | MSD Qual | Spike Added | MSD % Rec. | Reporting Limit | RPD Limit | RPD |
|-----------|----------------|------------|----------|-------------|------------|-----------------|-----------|-----|
| 7440-61-1 | URANIUM | 12.5 | | 10 | 96 | 0.1 | 20 | 0 |

Data Package ID: IM1909373-1

Prep Batch ID: IP190924-3

| | | | |
|-------------------------------|--------------------|----------------------------|--------------------------|
| Start Date: 09/24/19 | End Date: 09/24/19 | Concentration Method: NONE | Batch Created By: jml |
| Start Time: 9:30 | End Time: 18:00 | Extract Method: SW3005A | Date Created: 09/24/19 |
| Prep Analyst: Jill M. Latelle | | Initial Volume Units: ml | Time Created: 9:34 |
| Comments: | | Final Volume Units: ml | Validated By: jml |
| | | | Date Validated: 09/24/19 |
| | | | Time Validated: 10:25 |

QC Batch ID: IP190924-3-4

| Lab ID | QC Type | Field ID | Matrix | Date Collected | Initial Wt/Vol | Final Wt/Vol | Cleanup Method | Cleanup DF | Order Number |
|------------|---------|----------|--------|----------------|----------------|--------------|----------------|------------|--------------|
| IP190924-3 | MB | XXXXXX | WATER | XXXXXX | 50 | 50 | NONE | 1 | 1909373 |
| IM190924-3 | LCS | XXXXXX | WATER | XXXXXX | 50 | 50 | NONE | 1 | 1909373 |
| 1909373-1 | MS | B3R4F7 | WATER | 9/16/2019 | 50 | 50 | NONE | 1 | 1909373 |
| 1909373-1 | MSD | B3R4F7 | WATER | 9/16/2019 | 50 | 50 | NONE | 1 | 1909373 |
| 1909373-1 | SMP | B3R4F7 | WATER | 9/16/2019 | 50 | 50 | NONE | 1 | 1909373 |

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

AEA, September 2019 – I19-028

Work Order Number: 1909373

1. The sample was prepared according to the current revision of SOP 707.
2. The sample was analyzed for the presence of ⁹⁰Sr according to the current revision of SOP 724. The analysis was 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 sample are reported in units of pCi/L. The sample was 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. Sample 1909373-1 has an alpha count rate elevated above ten times the specific alpha background count rate. Based on the high beta count rate, the alpha cpm appears to be due to the beta to alpha crosstalk. Thus, no alpha contamination is suspected to be present in this sample. Results are submitted without further qualification.
8. No anomalous situations were encountered during the preparation and analysis of this sample. 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

10/14/19
Date

Kath M. W.
Radiochemistry Final Data Reviewer

10/15/19
Date

Strontium-90 by GFPC

PAI 724 Rev 13

Method Blank Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1909373

Client Name: CH2M HILL Plateau Remediation Company

ClientProject ID: AEA, September 2019 I19-028

| | | | |
|----------------------|---------------------------|-------------------------|-----------------------|
| 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.

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

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

Data Package ID: SR1909373-1

Strontium-90 by GFPC

PAI 724 Rev 13

Laboratory Control Sample(s)**Lab Name:** ALS -- Fort Collins**Work Order Number:** 1909373**Client Name:** CH2M HILL Plateau Remediation Company**ClientProject ID:** AEA, September 2019 I19-028**Lab ID:** SR191009-1LCS**Sample Matrix:** WATER**Prep Batch:** SR191009-1**Final Aliquot:** 994 ml**Prep SOP:** PAI 707 Rev 15**QC Batch ID:** 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 | 1.26E+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: SR1909373-1

Strontium-90 by GFPC

PAI 724 Rev 13

Laboratory Control Sample(s)**Lab Name:** ALS -- Fort Collins**Work Order Number:** 1909373**Client Name:** CH2M HILL Plateau Remediation Company**ClientProject ID:** AEA, September 2019 I19-028**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
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 | 1.13E+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: SR1909373-1

Strontium-90 by GFPC

PAI 724 Rev 13

Duplicate Sample Results (DER)

Lab Name: ALS -- Fort Collins
Work Order Number: 1909373
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: AEA, September 2019 I19-028

| | |
|------------------|----------------|
| 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: SR1909373-1

Strontium-90 by GFPC

PAI 724 Rev 13

Duplicate Sample Results (RPD)

Lab Name: ALS -- Fort Collins
Work Order Number: 1909373
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: AEA, September 2019 I19-028

| | |
|------------------|----------------|
| 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: SR1909373-1

Strontium-90 by GFPC

PAI 724 Rev 13

Sample Results**Lab Name:** ALS -- Fort Collins**Work Order Number:** 1909373**Client Name:** CH2M HILL Plateau Remediation Company**ClientProject ID:** AEA, September 2019 I19-028

| | |
|------------------|-----------|
| Field ID: | B3R4F7 |
| Lab ID: | 1909373-1 |

Sample Matrix: WATER
Prep SOP: PAI 707 Rev 15
Date Collected: 16-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 | 9.79E+03 +/- 2.30E+03 | 5.95E-01 | 1E+00 | NA | |

Chemical Yield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|----------------|--------------|----------|-------|-------|----------------|------|
| STRONTIUM | 1.430E+03 | 1.29E+03 | ug | 90.6 | 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.

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: SR1909373-1

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 | B3R4F7 | WATER | 9/16/2019 | 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 | XXXXXX | WATER | XXXXXX | 1000 | 994.01 | NONE | 1 | 1909538 |
| 1909538-6 | SMP | XXXXXX | WATER | XXXXXX | 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 |



Technetium-99

Case Narrative

CH2M HILL Plateau Remediation Company

AEA, September 2019 – I19-028

Work Order Number: 1909373

1. The sample was prepared according to the current revision of SOP 755, with procedure modifications outlined in QASS 378635 and 378636.
2. The sample was analyzed for the presence of ⁹⁹Tc according to the current revision of SOP 704. The analysis was completed on 10/08/2019.
3. The analysis results for the sample are reported in units of pCi/L. The sample was not filtered prior to analysis.
4. The duplicate of sample 1909245-11 is shared for this work order. The duplicate was performed on a CH2M HILL Plateau Remediation Company sample and the results are acceptable. The results can be found in the following report.
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. For this analysis, "Region B" is monitored for high energy beta contamination. Sample 1909373-1 had a "Region B" count rate of 0.98 cpm, above the upper control limit of 0.95 cpm, established from calibration on 10/07/2019 through 10/08/2019. Any bias is considered insignificant compared to sample activity. Data quality is not believed to be affected.
7. No anomalous situations were encountered during the preparation or analysis of this sample. 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

10/14/19
Date

Kath M. W.
Radiochemistry Final Data Reviewer

10/15/19
Date

Technetium-99 by Liquid Scintillation

PAI 704_Tc99 Rev 12

Method Blank Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1909373

Client Name: CH2M HILL Plateau Remediation Company

ClientProject ID: AEA, September 2019 I19-028

| | | | |
|----------------------|---------------------------|-------------------------|---------------------------|
| Lab ID: TC191002-2MB | Sample Matrix: WATER | Prep Batch: TC191002-2 | Final Aliquot: 250 ml |
| | Prep SOP: PAI 755 Rev 12 | QCBatchID: TC191002-2-1 | Result Units: pCi/l |
| | Date Collected: 02-Oct-19 | Run ID: TC191002-2A | File Name: Z20191007_1030 |
| | Date Prepared: 02-Oct-19 | Count Time: 30 minutes | |
| | Date Analyzed: 08-Oct-19 | | |

| CASNO | Target Nuclide | Result +/- 2 s TPU | MDC | Requested MDC | DL | Lab Qualifier |
|------------|----------------|------------------------|----------|---------------|----|---------------|
| 14133-76-7 | Tc-99 | -1.07E-01 +/- 1.15E+00 | 2.11E+00 | 2.00E+01 | NA | U |

Chemical Yield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|----------------|--------------|----------|-------|-------|----------------|------|
| Tc-99m | 3.540E+04 | 3.52E+04 | Pci | 99.4 | 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.

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

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

Data Package ID: TC1909373-1

Technetium-99 by Liquid Scintillation

PAI 704_Tc99 Rev 12

Laboratory Control Sample(s)

Lab Name: ALS -- Fort Collins

Work Order Number: 1909373

Client Name: CH2M HILL Plateau Remediation Company

ClientProject ID: AEA, September 2019 I19-028

| | | | |
|-----------------------|---------------------------|-------------------------|---------------------------|
| Lab ID: TC191002-2LCS | Sample Matrix: WATER | Prep Batch: TC191002-2 | Final Aliquot: 250 ml |
| | Prep SOP: PAI 755 Rev 12 | QCBatchID: TC191002-2-1 | Result Units: pCi/l |
| | Date Collected: 02-Oct-19 | Run ID: TC191002-2A | File Name: Z20191007_1030 |
| | Date Prepared: 02-Oct-19 | Count Time: 30 minutes | |
| | Date Analyzed: 08-Oct-19 | | |

| CASNO | Target Nuclide | Results +/- 2s TPU | MDC | Spike Added | % Rec | Control Limits | Lab Qualifier |
|------------|----------------|-----------------------|----------|-------------|-------|----------------|---------------|
| 14133-76-7 | Tc-99 | 9.15E+02 +/- 1.47E+02 | 2.30E+00 | 9.110E+02 | 100 | 75 - 125 | |

Chemical Yield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|----------------|--------------|----------|-------|-------|----------------|------|
| Tc-99m | 3.540E+04 | 3.28E+04 | Pci | 92.7 | 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: TC1909373-1

Technetium-99 by Liquid Scintillation

PAI 704_Tc99 Rev 12

Duplicate Sample Results (DER)

Lab Name: ALS -- Fort Collins
Work Order Number: 1909373
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: AEA, September 2019 119-028

| | |
|------------------|---------------|
| Field ID: | Shared QC |
| Lab ID: | 1909245-11DUP |

Sample Matrix: WATER
Prep SOP: PAI 755 Rev 12
Date Collected: 11-Sep-19
Date Prepared: 02-Oct-19
Date Analyzed: 07-Oct-19

Prep Batch: TC191002-2
QC Batch ID: TC191002-2-1
Run ID: TC191002-2A
Count Time: 30 minutes
Report Basis: Unfiltered

Final Aliquot: 100 ml
Prep Basis: Unfiltered
Moisture(%): NA
Result Units: pCi/l
File Name: Z20191007_1030

| CASNO | Analyte | Sample | | | | Duplicate | | | | DER | DER Lim |
|------------|---------|--------------|----------|----------|-------|--------------|----------|----------|-------|-------|---------|
| | | Result +/- | 2 s TPU | MDC | Flags | Result +/- | 2 s TPU | MDC | Flags | | |
| 14133-76-7 | Tc-99 | 2.85E+02 +/- | 4.80E+01 | 6.01E+00 | | 2.60E+02 +/- | 4.40E+01 | 5.80E+00 | | 0.745 | 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: TC1909373-1

Technetium-99 by Liquid Scintillation

PAI 704_Tc99 Rev 12

Duplicate Sample Results (RPD)

Lab Name: ALS -- Fort Collins
Work Order Number: 1909373
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: AEA, September 2019 119-028

| | |
|------------------|---------------|
| Field ID: | Shared QC |
| Lab ID: | 1909245-11DUP |

Sample Matrix: WATER
Prep SOP: PAI 755 Rev 12
Date Collected: 11-Sep-19
Date Prepared: 02-Oct-19
Date Analyzed: 07-Oct-19

Prep Batch: TC191002-2
QCBatchID: TC191002-2-1
Run ID: TC191002-2A
Count Time: 30 minutes
Report Basis: Unfiltered

Final Aliquot: 100 ml
Prep Basis: Unfiltered
Moisture(%): NA
Result Units: pCi/l
File Name: Z20191007_1030

| CASNO | Analyte | Sample | | | | Duplicate | | | | RPD | RPD Lim |
|------------|---------|--------------|----------|----------|-------|--------------|----------|----------|-------|------|---------|
| | | Result +/- | 2 s TPU | MDC | Flags | Result +/- | 2 s TPU | MDC | Flags | | |
| 14133-76-7 | Tc-99 | 2.85E+02 +/- | 4.80E+01 | 6.01E+00 | | 2.60E+02 +/- | 4.40E+01 | 5.80E+00 | | 9.00 | 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: TC1909373-1

Technetium-99 by Liquid Scintillation

PAI 704_Tc99 Rev 12

Sample Results

Lab Name: ALS -- Fort Collins
Work Order Number: 1909373
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: AEA, September 2019 I19-028

| | |
|------------------|------------|
| Field ID: | Shared QC |
| Lab ID: | 1909245-11 |

Sample Matrix: WATER
Prep SOP: PAI 755 Rev 12
Date Collected: 11-Sep-19
Date Prepared: 02-Oct-19
Date Analyzed: 07-Oct-19

Prep Batch: TC191002-2
QCBatchID: TC191002-2-1
Run ID: TC191002-2A
Count Time: 30 minutes
Report Basis: Unfiltered

Final Aliquot: 100 ml
Prep Basis: Unfiltered
Moisture(%): NA
Result Units: pCi/l
File Name: Z20191007_1030

| CASNO | Target Nuclide | Result +/- 2 s TPU | MDC | Requested MDC | DL | Lab Qualifier |
|------------|----------------|-----------------------|----------|---------------|----|---------------|
| 14133-76-7 | Tc-99 | 2.85E+02 +/- 4.80E+01 | 6.01E+00 | 2E+01 | NA | |

Chemical Yield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|----------------|--------------|----------|-------|-------|----------------|------|
| Tc-99m | 3.540E+04 | 3.15E+04 | Pci | 89.1 | 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: TC1909373-1

Technetium-99 by Liquid Scintillation

PAI 704_Tc99 Rev 12

Sample Duplicate Results

Lab Name: ALS -- Fort Collins
Work Order Number: 1909373
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: AEA, September 2019 I19-028

| | |
|------------------|---------------|
| Field ID: | Shared QC |
| Lab ID: | 1909245-11DUP |

Sample Matrix: WATER
Prep SOP: PAI 755 Rev 12
Date Collected: 11-Sep-19
Date Prepared: 02-Oct-19
Date Analyzed: 07-Oct-19

Prep Batch: TC191002-2
QCBatchID: TC191002-2-1
Run ID: TC191002-2A
Count Time: 30 minutes
Report Basis: Unfiltered

Final Aliquot: 100 ml
Prep Basis: Unfiltered
Moisture(%): NA
Result Units: pCi/l
File Name: Z20191007_1030

| CASNO | Target Nuclide | Result +/- 2 s TPU | MDC | Requested MDC | DL | Lab Qualifier |
|------------|----------------|-----------------------|----------|---------------|----|---------------|
| 14133-76-7 | Tc-99 | 2.60E+02 +/- 4.40E+01 | 5.80E+00 | 2E+01 | NA | |

Chemical Yield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|----------------|--------------|----------|-------|-------|----------------|------|
| Tc-99m | 3.540E+04 | 3.29E+04 | Pci | 93.1 | 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.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

- D - DER is greater than Control Limit of 3

Abbreviations:

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

Data Package ID: TC1909373-1

Date Printed:

Monday, October 14, 2019

ALS -- Fort Collins

LIMS Version: 6.912

Page 1 of 1

Technetium-99 by Liquid Scintillation

PAI 704_Tc99 Rev 12

Sample Results

Lab Name: ALS -- Fort Collins
Work Order Number: 1909373
Client Name: CH2M HILL Plateau Remediation Company
ClientProject ID: AEA, September 2019 I19-028

| | |
|------------------|-----------|
| Field ID: | B3R4F7 |
| Lab ID: | 1909373-1 |

Sample Matrix: WATER
Prep SOP: PAI 755 Rev 12
Date Collected: 16-Sep-19
Date Prepared: 02-Oct-19
Date Analyzed: 07-Oct-19

Prep Batch: TC191002-2
QCBatchID: TC191002-2-1
Run ID: TC191002-2A
Count Time: 30 minutes
Report Basis: Unfiltered

Final Aliquot: 100 ml
Prep Basis: Unfiltered
Moisture(%): NA
Result Units: pCi/l
File Name: Z20191007_1030

Analysis ReqCode: TC99_SEP_LSC

| CASNO | Target Nuclide | Result +/- 2 s TPU | MDC | Requested MDC | DL | Lab Qualifier |
|------------|----------------|-----------------------|----------|---------------|----|---------------|
| 14133-76-7 | Tc-99 | 1.88E+01 +/- 5.99E+00 | 6.04E+00 | 2E+01 | NA | |

Chemical Yield Summary

| Carrier/Tracer | Amount Added | Result | Units | Yield | Control Limits | Flag |
|----------------|--------------|----------|-------|-------|----------------|------|
| Tc-99m | 3.540E+04 | 3.15E+04 | Pci | 89.0 | 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: TC1909373-1

Prep Batch ID: TC191002-2

| | | | |
|--------------------------------|--------------------|----------------------------|--------------------------|
| Start Date: 10/02/19 | End Date: 10/02/19 | Concentration Method: NONE | Batch Created By: jcp |
| Start Time: 10:07 | End Time: 10:07 | Extract Method: PAI 75512 | Date Created: 10/02/19 |
| Prep Analyst: John C. Petrovic | | Initial Volume Units: ml | Time Created: 10:08 |
| Comments: | | Final Volume Units: ml | Validated By: jcp |
| | | | Date Validated: 10/03/19 |
| | | | Time Validated: 10:02 |

QC Batch ID: TC191002-2-1

| Lab ID | QC Type | Field ID | Matrix | Date Collected | Initial Wt/Vol | Final Wt/Vol | Cleanup Method | Cleanup DF | Order Number |
|---------------|---------|----------|--------|----------------|----------------|--------------|----------------|------------|--------------|
| TC191002-2 | MB | XXXXXX | WATER | XXXXXX | 250 | 250 | NONE | 1 | 1909245 |
| TC191002-2CB1 | MB | XXXXXX | WATER | XXXXXX | 250 | 250 | NONE | 1 | 1909245 |
| TC191002-2CB2 | MB | XXXXXX | WATER | XXXXXX | 250 | 250 | NONE | 1 | 1909245 |
| TC191002-2CB3 | MB | XXXXXX | WATER | XXXXXX | 250 | 250 | NONE | 1 | 1909245 |
| TC191002-2 | LCS | XXXXXX | WATER | XXXXXX | 250 | 250 | NONE | 1 | 1909245 |
| 1909245-11 | DUP | XXXXXX | WATER | XXXXXX | 100 | 100 | NONE | 1 | 1909245 |
| 1909241-15 | SMP | XXXXXX | WATER | XXXXXX | 100 | 100 | NONE | 1 | 1909241 |
| 1909242-7 | SMP | XXXXXX | WATER | XXXXXX | 100 | 100 | NONE | 1 | 1909242 |
| 1909245-10 | SMP | XXXXXX | WATER | XXXXXX | 100 | 100 | NONE | 1 | 1909245 |
| 1909245-11 | SMP | XXXXXX | WATER | XXXXXX | 100 | 100 | NONE | 1 | 1909245 |
| 1909245-3 | SMP | XXXXXX | WATER | XXXXXX | 100 | 100 | NONE | 1 | 1909245 |
| 1909245-8 | SMP | XXXXXX | WATER | XXXXXX | 100 | 100 | NONE | 1 | 1909245 |
| 1909305-2 | SMP | XXXXXX | WATER | XXXXXX | 100 | 100 | NONE | 1 | 1909305 |
| 1909373-1 | SMP | B3R4F7 | WATER | 9/16/2019 | 100 | 100 | NONE | 1 | 1909373 |
| 1909378-3 | SMP | XXXXXX | WATER | XXXXXX | 100 | 100 | NONE | 1 | 1909378 |
| 1909382-1 | SMP | XXXXXX | WATER | XXXXXX | 100 | 100 | NONE | 1 | 1909382 |
| 1909382-2 | SMP | XXXXXX | WATER | XXXXXX | 100 | 100 | NONE | 1 | 1909382 |

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 | |

ALS Laboratory Group - Fort Collins

QUALITY ASSURANCE SUMMARY SHEET

PAR W.O. # / BATCH General
 TEST Tc99
 METHOD Prep
 SOP/REV (PREP) 755
 SOP/REV (ANAL) _____

Briefly document any QA or other problems or deviations associated with the analysis of samples. Problems could result from: log-in, color, odor, dilution, consistency, scheduling, equipment, or instrumentation, or may include documentation of minor deviations necessary due to unique DQO's or sample characteristics.

0288112109

Tc99^m 711.2613.17 was used as a tracer for this batch. It has a half-life of 6 hours and therefore must be delivered the day of prep and diluted to a working level solution. The procedure noted below is standard for all Tc99^m dilutions.

1. Open the Pb shielded container and carefully remove the vial containing the Tc99^m primary standard.
2. Withdraw a 1 mL aliquot of the Tc99^m primary standard from the vial using a 10 mL syringe fitted with a hypodermic needle. Dispense the aliquot into a disposable beaker that contains ~100 mL of DI water. Cap and mix well. This intermediate solution is a 1/100x dilution of the primary standard.
3. Using a 10 mL syringe, transfer 10 mL of the intermediate solution prepared in step 2 into a disposable beaker that contains ~70 mL of DI water. Cap and mix well. This working standard solution is a 1/800x dilution of the primary standard.

0288112109

0288112109

Attach vendor label

Rx# 817907
 CardinalHealth
 CARDINAL HEALTH 414, LLC
 DENVER
 10400 48TH AVE, STE B
 DENVER CO 80239
 303.373.0579

Date Ordered : 02Oct2019
 Date/Time Prepared : 03Oct2019 00:58 MT
ALS LABORATORY GROUP
 225 COMMERCE DR
 FORT COLLINS CO 80524-2762
1 0430 Fort Collins

Safetrac
 CH102884

CAUTION

RADIOACTIVE MATERIALS

Patient : **SOURCE, Tc99m**
 Product : Tc-99m **Sodium Pertechnetate Unit Dose mCi (No)**
 Disp Amt : **0.55 mCi**
 Calibration : **03Oct2019 08:00 MT**
 Source - Not for Human Use For Calibration Use Only
 Indication : **Point Source mCi**
 Dispense Date : **03Oct2019** Lot# : **E19276-0027** Price(est) : **N/A**
 Use By : **04Oct2019 00:58 MT** Physician : **Charles Orchard, RSO** NPT :
 Notes NDC : RPh : **A.Worthem**

Caution: Federal law prohibits dispensing without a prescription - Rx only All Tc-99m drugs are below 0.15 uCi of Mo-99mCi or Tc-99m at BUD.

TECHNICIAN/ANALYST Crystal Shreffler

DATE 8/12/09

DEPARTMENT MANAGER Jelly Z

DATE 8/12/09

378636

FORM 302r6.doc (4/22/04)

ALS Laboratory Group - Fort Collins

QUALITY ASSURANCE SUMMARY SHEET

PAR W.O. # / BATCH Generic
 TEST Tc99
 METHOD Prep
 SOP/REV (PREP) 755
 SOP/REV (ANAL) _____

Briefly document any QA or other problems or deviations associated with the analysis of samples. Problems could result from: log-in, color, odor, dilution, consistency, scheduling, equipment, or instrumentation, or may include documentation of minor deviations necessary due to unique DQO's or sample characteristics.

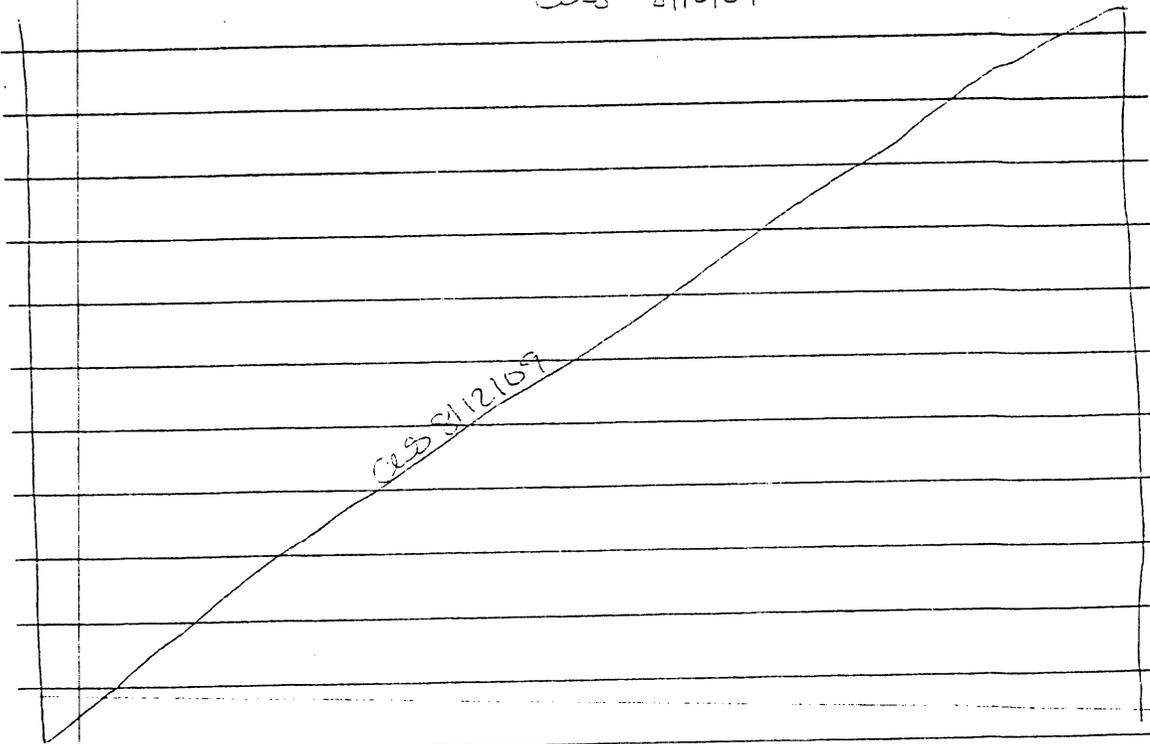
ces 8/12/09

ces 8/12/09

Due to possible matrix interference, a ferric hydroxide precipitation was performed on all samples per SOP 755, section 8.2.10

ces 8/12/09

ces 8/12/09



TECHNICIAN/ANALYST Crystal Sheaffer

DATE 8/12/09

DEPARTMENT MANAGER [Signature]

DATE 8/12/09

378635

FORM 302r6.doc (4/22/04)