

The order of this data package is as follows:

1. Chain-of-Custody/Lab Request
2. Copies of field COCs
3. Validation Report
4. Laboratory analysis

Comments:

[illegible]

## SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 11508

EVENT NAME: Pajarito (TA-54) & Chromium October  
Monthly MY2018 Q1

SAMPLE ID: CAPA-18-147592

WORK ORDER:

	AS PLANNED	AS COLLECTED		AS PLANNED	AS COLLECTED
Date Collected (MM/DD/YYYY):	10-27-17	OK	FIELD MATRIX:	WG	OK
TIME COLLECTED (HH:MM):	1130		MEDIA:		
PRS ID:	NA		SAMPLE TECH CODE:	GSP	
LOCATION ID:	R-53 S1		FIELD PREP:	UF	
LOCATION TYPE:	NA		FIELD QC TYPE:	REG	
TOP DEPTH:			SAMPLE USAGE:	INV	
BOTTOM DEPTH:			EXCAVATED:		YES / NO / <u>NA</u>

PRIORITY	ORDER	CONTAINER	#	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
NA	MSGP-Hg	500 ML POLY	1	HNO3	Y	NA
	WSP-8260B-VOA	40 ML SEPTUM AMBER GLASS	2	HCL		
	WSP-8270C-SVOA	1 LITER AMBER GLASS	2	ICE		
	WSP-CN(T)	250 ML POLY	1	NAOH		
	WSP-GrossA/B	1 LITER POLY	1	HNO3		
	WSP-LL-H-3	1 LITER POLY	1	NONE		
	WSP-RAD	1 GAL POLY	1	HNO3		
	WSP-TKN+TOC	500 ML AMBER GLASS	1	H2SO4		

SAMPLE COMMENTS: Sampled with running diesel generator ~40ft. away.

LOCATION COMMENTS: None

## FIELD PARAMETERS:

Sample Time	1130	HH:MM	Dissolved Oxygen	6.26 mg/L	Flow (in gpm)	4.00
Oxidation-Reduction Potential	225.9 mV		pH	8.02	Specific Conductance	124.8 $\mu$ S/cm
Temperature	20.2°C		Turbidity	0.41 NTU		

COLLECTED BY (PRINT): D. Hughes, D. Jaramillo



**SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY****EVENT ID:** 11508**EVENT NAME:** Pajarito (TA-54) & Chromium October  
Monthly MY2018 Q1**SAMPLE ID:** CAPA-18-147592**WORK ORDER:**

<b>RELINQUISHED BY</b> (Printed Name) Tanya VanderVis (Signature) <i>Tanya VanderVis</i>	<b>Date/Time</b> 10-27-2017 1405	<b>RECEIVED BY</b> MATT ENGLERT (Printed Name) (Signature) <i>[Signature]</i>	<b>Date/Time</b> 10-27-17 1405
<b>RELINQUISHED BY</b> (Printed Name) (Signature)	<b>Date/Time</b>	<b>RECEIVED BY</b> (Printed Name) (Signature)	<b>Date/Time</b>

Report Date: 10/05/2017

## SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 11508

EVENT NAME: Pajarito (TA-54) & Chromium October  
Monthly MY2018 Q1

SAMPLE ID: CAPA-18-147593

WORK ORDER:

	AS PLANNED	AS COLLECTED		AS PLANNED	AS COLLECTED
Date Collected (MM/DD/YYYY):	10-27-2017	OK	FIELD MATRIX:	WG	OK
TIME COLLECTED (HH:MM):	1315		MEDIA:		
PRS ID:	NA		SAMPLE TECH CODE:	GSP	
LOCATION ID:	R-53 S2		FIELD PREP:	UF	
LOCATION TYPE:	NA		FIELD QC TYPE:	REG	
TOP DEPTH:			SAMPLE USAGE:	INV	
BOTTOM DEPTH:			EXCAVATED:		YES / NO / <u>NA</u>

PRIORITY	ORDER	CONTAINER	#	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
NA	MSGP-Hg	500 ML POLY	1	HNO3	Y	NA
	WSP-8260B-VOA	40 ML SEPTUM AMBER GLASS	2	HCL		
	WSP-8270C-SVOA	1 LITER AMBER GLASS	2	ICE		
	WSP-CN(T)	250 ML POLY	1	NAOH		
	WSP-GrossA/B	1 LITER POLY	1	HNO3		
	WSP-LL-H-3	1 LITER POLY	1	NONE		
	WSP-RAD	1 GAL POLY	1	HNO3		
	WSP-TKN+TOC	500 ML AMBER GLASS	1	H2SO4		

SAMPLE COMMENTS: Sampled with running diesel generator ~40ft away

LOCATION COMMENTS: none

## FIELD PARAMETERS:

Sample Time	1315	HH:MM	Dissolved Oxygen	6.55 mg/L	Flow (in gpm)	3.90
Oxidation-Reduction Potential	265.7mV		pH	8.15	Specific Conductance	122.0 $\mu$ S/cm
Temperature	21.4°C		Turbidity	0.10 NTU		

COLLECTED BY (PRINT): D. Hughes, D. Jaramillo

**SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY****EVENT ID:** 11508**EVENT NAME:** Pajarito (TA-54) & Chromium October  
Monthly MY2018 Q1**SAMPLE ID:** CAPA-18-147593**WORK ORDER:**

RELINQUISHED BY (Printed Name) <i>Tanya VanderVis</i> (Signature) <i>Tanya VanderVis</i>	Date/Time <i>10-27-17</i> <i>1405</i>	RECEIVED BY (Printed Name) (Signature)	Date/Time <i>10-27-17</i> <i>1405</i>
RELINQUISHED BY (Printed Name) (Signature)	Date/Time	RECEIVED BY (Printed Name) (Signature)	Date/Time

Report Date: 10/05/2017



## SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 11508

EVENT NAME: Pajarito (TA-54) & Chromium October  
Monthly MY2018 Q1

SAMPLE ID: CAPA-18-147596

WORK ORDER:

	AS PLANNED	AS COLLECTED		AS PLANNED	AS COLLECTED
Date Collected (MM/DD/YYYY):	10-26-17	OK	FIELD MATRIX:	WG	OK
TIME COLLECTED (HH:MM):	1038		MEDIA:		
PRS ID:	NA		SAMPLE TECH CODE:	GSP	
LOCATION ID:	R-56 S1		FIELD PREP:	UF	
LOCATION TYPE:	NA		FIELD QC TYPE:	REG	
TOP DEPTH:			SAMPLE USAGE:	INV	
BOTTOM DEPTH:			EXCAVATED:		YES / NO / <del>NA</del>

PRIORITY	ORDER	CONTAINER	#	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
NA	MSGP-Hg	500 ML POLY	1	HNO3	Y	NA
	WSP-8260B-VOA	40 ML SEPTUM AMBER GLASS	2	HCL		
	WSP-8270C-SVOA	1 LITER AMBER GLASS	2	ICE		
	WSP-CN(T)	250 ML POLY	1	NAOH		
	WSP-GrossAB	1 LITER POLY	1	HNO3		
	WSP-LL-H-3	1 LITER POLY	1	NONE		
	WSP-RAD	1 GAL POLY	1	HNO3		
	WSP-TKN+TOC	500 ML AMBER GLASS	1	H2SO4		

SAMPLE COMMENTS: Sampled with running diesel generator ~30ft away.

LOCATION COMMENTS: none

## FIELD PARAMETERS:

Sample Time	1038	HH:MM	Dissolved Oxygen	6.68 mg/L	Flow (in gpm)	4.17
Oxidation-Reduction Potential	262.8 mV		pH	8.08	Specific Conductance	148.5 $\mu$ S/cm
Temperature	20.7 °C		Turbidity	0.11 NTU		

COLLECTED BY (PRINT): A. Vigil, D. Jaramillo

**SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY****EVENT ID:** 11508**EVENT NAME:** Pajarito (TA-54) & Chromium October  
Monthly MY2018 Q1**SAMPLE ID:** CAPA-18-147596**WORK ORDER:**

<b>RELINQUISHED BY</b> (Printed Name) Tanya VanderVis (Signature) <i>Tanya VanderVis</i>	<b>Date/Time</b> 10-26-17 1345	<b>RECEIVED BY</b> (Printed Name) <i>H. Montoya</i> (Signature) <i>[Signature]</i>	<b>Date/Time</b> 10/26/17 1345
<b>RELINQUISHED BY</b> (Printed Name) (Signature)	<b>Date/Time</b>	<b>RECEIVED BY</b> (Printed Name) (Signature)	<b>Date/Time</b>

Report Date: 10/05/2017



## SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 11508

EVENT NAME: Pajarito (TA-54) & Chromium October  
Monthly MY2018 Q1

SAMPLE ID: CAPA-18-147597

WORK ORDER:

	AS PLANNED	AS COLLECTED		AS PLANNED	AS COLLECTED
Date Collected (MM/DD/YYYY):	10-26-17	OK	FIELD MATRIX:	WG	OK
TIME COLLECTED (HH:MM):	1231		MEDIA:		
PRS ID:	NA		SAMPLE TECH CODE:	GSP	
LOCATION ID:	R-56 S2		FIELD PREP:	UF	
LOCATION TYPE:	NA		FIELD QC TYPE:	REG	
TOP DEPTH:			SAMPLE USAGE:	INV	
BOTTOM DEPTH:			EXCAVATED:		YES / NO / <u>NA</u>

PRIORITY	ORDER	CONTAINER	#	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
NA	MSGP-Hg	500 ML POLY	1	HNO3	Y	NA
	WSP-8260B-VOA	40 ML SEPTUM AMBER GLASS	2	HCL		
	WSP-8270C-SVOA	1 LITER AMBER GLASS	2	ICE		
	WSP-CN(T)	250 ML POLY	1	NAOH		
	WSP-GrossA/B	1 LITER POLY	1	HNO3		
	WSP-LL-H-3	1 LITER POLY	1	NONE		
	WSP-RAD	1 GAL POLY	1	HNO3		
	WSP-TKN+TOC	500 ML AMBER GLASS	1	H2SO4		

SAMPLE COMMENTS: Sampled with running generator ~30 ft away.

LOCATION COMMENTS: None

## FIELD PARAMETERS:

Sample Time	1231	HH:MM	Dissolved Oxygen	5.19 mg/L	Flow (in gpm)	4.29
Oxidation-Reduction Potential	265.3mV		pH	8.59	Specific Conductance	131.4 $\mu$ S/cm
Temperature	21.2°C		Turbidity	0.25 NTU		

COLLECTED BY (PRINT): A. Vigil, D. Jaramillo

**SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY**

EVENT ID: 11508

EVENT NAME: Pajarito (TA-54) & Chromium October  
Monthly MY2018 Q1

SAMPLE ID: CAPA-18-147597

WORK ORDER:

RELINQUISHED BY (Printed Name) Tanya VanderVis (Signature) <i>Tanya VanderVis</i>	Date/Time 10-26-17 1345	RECEIVED BY (Printed Name) <i>M. Martin</i> (Signature) <i>M. Martin</i>	Date/Time 10/26/17 1345
RELINQUISHED BY (Printed Name) (Signature)	Date/Time	RECEIVED BY (Printed Name) (Signature)	Date/Time

Report Date: 10/05/2017



Samples collected from a WFO area?		YES	NO	NA
Field Test for Explosives Results		YES	NO	NA
Spot test shows presence of explosives residues. If YES - Do not ship.			X	

TEST - Chemical Preservation		YES	NO	NA
Samples are chemically preserved?				X
Field Team Member Statement		YES	NO	NA
Chemical preservation exceeds limits given 40 CFR 136, Table II - Required Containers, Preservation Techniques and Holding Times (footnote 3). If YES - Do not ship.			X	

TEST - Field Screen			YES	NO	NA
The sample has field screening measurements of alpha activity and beta activity?					X
Sample Activity (dpm/100cm <sup>2</sup> )	Shipment Activity (dpm/g/100cm <sup>2</sup> )	Sampled Location	YES	NO	NA
Alpha detectable	Alpha >160,000	TA-1 and adjacent hillsides, TA-21, Acid Canyon, MDA C at TA-50, Area G at TA-54, TA-48, or TA-49			
Alpha > 125	Alpha >1,250,000	other locations			
Beta > 1,500	Beta >15,000,000	any location			
The sample Alpha >16,000,000 dpm/g/100cm <sup>2</sup> or Beta > 160,000,000 dpm/g/100cm <sup>2</sup> . If YES - Do not ship.					
On the external surface of the sample container, alpha activity ≥ 24 dpm/cm <sup>2</sup> , beta activity ≥ 240 dpm/cm <sup>2</sup> , or surface activity ≥ 0.5 mR/hr. If YES - Do not ship.					
The sample is tentatively identified as DOT Hazard Class 7 (Radioactive). The shipment is labeled Radioactive Material, Excepted Package - Limited Quantity of Material - UN2910, based on field screening measurements of alpha and beta activity.					

TEST - Location			YES	NO	NA
Prior analytical measurements of radioactive isotopes are available?			X		
Sample Activity (pCi/g)	Shipment Activity (pCi)		YES	NO	NA
<ul style="list-style-type: none"> <li>Am-241 &gt; 27</li> <li>Cs-137 &gt; 270</li> <li>Pu-238 &gt; 27</li> <li>Pu-239/240 &gt; 27</li> <li>Th-228 &gt; 27</li> <li>U-234 &gt; 270</li> <li>U-238 &gt; 270</li> <li>H-3 &gt; 27,000,000</li> </ul>	<ul style="list-style-type: none"> <li>Am-241 &gt; 270,000</li> <li>Cs-137 &gt; 270,000</li> <li>Pu-238 &gt; 270,000</li> <li>Pu-239/240 &gt; 270,000</li> <li>Th-228 &gt; 270,000</li> <li>U-234 &gt; 1,600,000,000</li> <li>U-238 &gt; unlimited</li> <li>H-3 &gt; 27,000,000,000</li> </ul>				
Am-241, Pu-238, Pu-239/240, or Th 228 > 27,000,000 pCi; or Cs-137 > 270,000,000 pCi or U-234 ≥ 160,000,000 pCi; or H-3 ≥ 1 Ci. If YES - Do not ship.					
The sample is tentatively identified as DOT Hazard Class 7 (Radioactive). The shipment is labeled Radioactive Material, Excepted Package - Limited Quantity of Material - UN2910, based on prior analytical measurements of radioactive isotopes.					

TEST - AK		YES	NO	NA
The shippers documented knowledge of the sample positively identifies appropriate labeling.				
The sample is tentatively identified as DOT Hazard Class 7 (Radioactive). The shipment is labeled Radioactive Material, Excepted Package - Limited Quantity of Material - UN2910, and the sample is submitted to ARS or RP for hazard classification analysis.				

HOLD SAMPLES FOR ANALYSIS	
The samples are held per ER-SOP-10094, Rev. 1, 5.2.2 [7]	

These samples do not meet the criteria for classification in any hazard class according to regulation OSHA 29 CFR 1910.1200. The sample(s) contained in this shipment have been assigned a tentative proper DOT shipping name, hazard class, identification number, and packing group, based on the shipper's knowledge of the sample:

Hazard Assessment Completed By:	Date/Time
(Printed Name) <i>Karee Onstott</i>	<i>11/2/17</i>
(Signature) <i>Karee Onstott</i>	<i>1500</i>

Hazard Assessment Reviewed By:	Date/Time
(Printed Name) <i>Malissa May</i>	<i>11/2/17</i>
(Signature) <i>Malissa May</i>	<i>300</i>



## DATA VALIDATION REPORT

Chain Of Custody No. 2018-684

### 1. Distribution Of Samples In EDD.

SDG	Analytical Method	Regular Samples	Field Duplicates	Trip Blanks	Field Blanks	Equipment Blanks
ARS1-17-03231	Generic:Low_Level_Tritium	2				
ARS1-17-03231	Generic:Low_Level_Tritium	2				

SDG	Analytical Method	Analysis Lot ID	Prep Lot ID	Regular Samples	Field Duplicates	Trip Blanks	Field Blanks	Equipment Blanks	Method Blanks	Matrix Spikes	Matrix Spike Dups	Analytical Spikes	Post-Digestion Spikes	Lab Control Samples	Lab Control Sample Dups	Blank Spike	Blank Spike Dups	Lab Duplicates	Storage Blanks	Preparation Blanks	Reagent Blanks
ARS1-17-03231	Generic:Low_Level_Tritium	ARS1-B17-	ARS1-B17-	4					1					1	1						

### 2. Distribution Of Analytes In EDD.

Analytical Method	Analytical Method Category	Field Sample ID	Lab Sample ID	Sample Purpose	Target Analytes	Surrogates	Spiked Compounds	TICS
Generic:Low_Level_Tritium	RAD	CAPA-18-147592	ARS1-B17-02496-05	REG	1	0	0	0
Generic:Low_Level_Tritium	RAD	CAPA-18-147593	ARS1-B17-02496-06	REG	1	0	0	0
Generic:Low_Level_Tritium	RAD	CAPA-18-147596	ARS1-B17-02496-07	REG	1	0	0	0
Generic:Low_Level_Tritium	RAD	CAPA-18-147597	ARS1-B17-02496-08	REG	1	0	0	0
Generic:Low_Level_Tritium	RAD	LCS	ARS1-B17-02496-01	LCS	0	0	1	0
Generic:Low_Level_Tritium	RAD	LCSD	ARS1-B17-02496-02	LCSD	0	0	1	0
Generic:Low_Level_Tritium	RAD	MB	ARS1-B17-02496-03	MB	1	0	0	0

### 3. Are any analytes missing?

No.

### 4. Were any holding times exceeded?

No.

### 5. Any contaminants in blanks?

## DATA VALIDATION REPORT

No.

6. Any surrogate recoveries outside the control limits?

No.

7. Any MS/MSD recoveries or RPDs outside the control limits?

No.

8. Any LCS/LCSD or BS/BSD recoveries or RPDs outside the control limits?

No.

9. Any Field Duplicate RPDs outside the desired limits?

No.

10. Any Lab Duplicate RPDs outside the desired limits?

No.

11. Any required reporting limits exceeded?

No.

12. Additional Validator's Comments.

13. Display Flagged Data.

DATA VALIDATION REPORT

Location ID	COC Number	Field Sample ID	Sample Purpose	Analysis Type Code	Analytical Suite	Analytical Method	Parameter Name	Lab Qualifier	Validation Qualifier	Validation Reason Codes	Detect Flag	Lab Result	Lab Units	Report Result	Report Units	Report MDA	Report Uncertainty	Lab Matrix	Sample Date	Percent	Analysis Lot ID	Validation Status Code	Use Flag
R-53 S1	2018-684	CAPA-18-147592	REG	INIT	RAD	Generic:Low_Level_Tritium	Tritium	U	U	R5	N	0.493	pCi/L	0.493	pCi/L	2.207	0.664	W	10/27/2017		ARS1-B17-02496	VAL	Y
R-56 S2	2018-684	CAPA-18-147597	REG	INIT	RAD	Generic:Low_Level_Tritium	Tritium	U	U	R5	N	0.746	pCi/L	0.746	pCi/L	2.874	0.869	W	10/26/2017		ARS1-B17-02496	VAL	Y

Reason Code

Description

- NQ

The analytical laboratory did not qualify the analyte as not detected and/or any other standard qualify. The analyte is detected in the sample.
- R5

Analyte is not detected because the amount reported is less than the MDC.

14. Usable Result Count.

Field Sample ID	Location ID	Sample Purpose	Analytical Method	No. Unuseable Records	Total Records
CAPA-18-147592	R-53 S1	REG	Generic:Low_Level_Tritium	0	1
CAPA-18-147593	R-53 S2	REG	Generic:Low_Level_Tritium	0	1
CAPA-18-147596	R-56 S1	REG	Generic:Low_Level_Tritium	0	1
CAPA-18-147597	R-56 S2	REG	Generic:Low_Level_Tritium	0	1





## **ARS International, LLC**

### **Laboratory Analysis Report**

**ARS1-17-03231**

*Prepared for:*

### **Los Alamos National Laboratory**

**Nita Patel  
P.O. Box 1663  
MS M992  
Los Alamos, NM 87545**

**[npatel@lanl.gov](mailto:npatel@lanl.gov)  
[sherwoods@lanl.gov](mailto:sherwoods@lanl.gov)**

**Phone: 505-665-9273  
Fax: 505-665-9972**

  
**Project Manager Review**

Notes: ARS International, LLC assumes no liability for the use or the interpretation of any analytical results provided other than the cost of the analysis itself. Reproduction of this report in less than full requires the written consent of the client.

**Contact Person: Questions regarding this analytical report should be addressed to:**

**Project Manager  
[ProjectManagers@amrad.com](mailto:ProjectManagers@amrad.com)**

**Phone: 225.381.2991  
Fax: 225.381.2996**



January 9, 2018

Nita Patel  
Sherri Sherwood  
Los Alamos National Laboratory  
505-665-9273  
npatel@lanl.gov

ARS SDG: **ARS1-17-03231**  
COC Number: 2018-684  
Charge Code: **ADEP**

Dear Nita,

On November 3, 2017, ARS International received four (4) samples to be analyzed for Enriched H-3.

The samples were processed and counted using the appropriate equipment and techniques for these types of analyses. Results of all the analyses are attached in the data package.

The client and QA/QC samples were counted with a count time sufficient to meet quality control parameters for counting equipment and were within acceptance criteria and statistical sound detection limits.

If you have any questions, please do not hesitate to call at 255.381.2991 or email [ProjectManagers@amrad.com](mailto:ProjectManagers@amrad.com).

Sincerely,

Susan Leese  
Project Management  
ARS International



**PROJECT SAMPLE IDENTIFICATION  
CROSS-REFERENCE  
TO ARS SAMPLE LABORATORY IDs**

Project ID	Client Sample ID NUMBER	American Radiation Services SAMPLE ID NUMBER(S)
2018-684	CAPA-18-147592	ARS1-17-03231-001
2018-684	CAPA-18-147593	ARS1-17-03231-002
2018-684	CAPA-18-147596	ARS1-17-03231-003
2018-684	CAPA-18-147597	ARS1-17-03231-004

**SAMPLE RECEIPT/PREP**

The samples arrived in good condition. The samples were screened for radioactive contamination as per procedure ARS-062 "Sample Receiving". Turnaround time was set at 40 calendar days.

**ANALYTICAL METHODS**

Enriched H-3 analysis was performed using ARS-040, "Tritium Assay in Water Samples Using Electrolytic Enrichment".

H-3 screening analysis was performed using ARS-054, "Tritium in Water (EPA 906.0)".

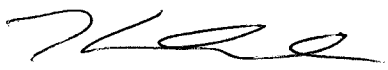
**ANALYTICAL RESULTS**

All QC criteria were met.

**American Radiation Services Laboratory Management's Comments:**

*"I certify that this sample data package is in compliance with SOW requirements, both technically and for completeness, other than the conditions detailed above. Release of the data contained in this sample data package and the computer-readable EDD, as applicable, submitted on diskette or by modem, has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature."*

*"I certify that this electronic image and all hardcopies produced from this image accurately represent the data and is in compliance with client specific requirements, both technically and for completeness, other than the conditions detailed above or in the sample data package narrative. Release, by submission through email, the data contained in this electronic image and the computer-readable EDD (as applicable), has been authorized by the laboratory Manager/Technical Director or the Manager's designee."*

  
Signature

Laboratory Management, ARS International  
Title

1-11-18  
Date





2609 North River Road • Port Allen, Louisiana 70767

1 (800) 401-4277 • FAX (225) 381-2996

ARS Sample Delivery Group: ARS1-17-03231

Client Sample ID: CAPA-18-147592

Sample Collection Date: 10/27/17

Sample Matrix: Aqueous

Percent Solids: N/A

Request or PO Number: 2018-684

ARS Sample ID: ARS1-17-03231-001

Date Received: 11/03/17

Report Date: 01/08/18

## Radiochemistry

Analysis Description	Analysis Results	CSU +/-1s	MDC	DLC	CRDL	Qual	Analysis Units	Method	Analysis Date/Time	Analysis Technician	Tracer/Chem Recovery
Enriched H-3	0.493	0.664	2.207	1.071	3.221	U	pCi/L	ARS-040/	01/05/18 22:50	MMORGAN	N/A

Notes: American Radiation Services, Inc. assumes no liability for the use or interpretation of any analytical results provided other than the cost of the analysis itself. Reproduction of this report in less than full requires the written consent of the client.

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ARS Sample Delivery Group: ARS1-17-03231

Client Sample ID: CAPA-18-147593

Sample Collection Date: 10/27/17

Sample Matrix: Aqueous

Percent Solids: N/A

Request or PO Number: 2018-684

ARS Sample ID: ARS1-17-03231-002

Date Received: 11/03/17

Report Date: 01/08/18

## Radiochemistry

Analysis Description	Analysis Results	CSU +/-1s	MDC	DLC	CRDL	Qual	Analysis Units	Method	Analysis Date/Time	Analysis Technician	Tracer/Chem Recovery
Enriched H-3	67.805	10.308	2.853	1.384	3.221		pCi/L	ARS-040/	01/06/18 4:33	MMORGAN	N/A

Notes: American Radiation Services, Inc. assumes no liability for the use or interpretation of any analytical results provided other than the cost of the analysis itself. Reproduction of this report in less than full requires the written consent of the client.

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ARS Sample Delivery Group: ARS1-17-03231

Client Sample ID: CAPA-18-147596

Sample Collection Date: 10/26/17

Sample Matrix: Aqueous

Percent Solids: N/A

Request or PO Number: 2018-684

ARS Sample ID: ARS1-17-03231-003

Date Received: 11/03/17

Report Date: 01/08/18

## Radiochemistry

Analysis Description	Analysis Results	CSU +/-1s	MDC	DLC	CRDL	Qual	Analysis Units	Method	Analysis Date/Time	Analysis Technician	Tracer/Chem Recovery
Enriched H-3	85.597	12.945	2.384	1.157	3.221		pCi/L	ARS-040/	01/06/18 10:16	MMORGAN	N/A

Notes: American Radiation Services, Inc. assumes no liability for the use or interpretation of any analytical results provided other than the cost of the analysis itself. Reproduction of this report in less than full requires the written consent of the client.

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1 (800) 401-4277 • FAX (225) 381-2996

ARS Sample Delivery Group: ARS1-17-03231

Client Sample ID: CAPA-18-147597

Sample Collection Date: 10/26/17

Sample Matrix: Aqueous

Percent Solids: N/A

Request or PO Number: 2018-684

ARS Sample ID: ARS1-17-03231-004

Date Received: 11/03/17

Report Date: 01/08/18

## Radiochemistry

Analysis Description	Analysis Results	CSU +/-1s	MDC	DLC	CRDL	Qual	Analysis Units	Method	Analysis Date/Time	Analysis Technician	Tracer/Chem Recovery
Enriched H-3	0.746	0.869	2.874	1.395	3.221	U	pCi/L	ARS-040/	01/06/18 15:59	MMORGAN	N/A

Notes: American Radiation Services, Inc. assumes no liability for the use or interpretation of any analytical results provided other than the cost of the analysis itself. Reproduction of this report in less than full requires the written consent of the client.

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## QC Results per Analytical Batch

Analytical Batch	ARS1-B17-02496
SDG	ARS1-17-03231
Analysis	Low Level Tritium by Electrolytic Enrichment
Analysis Test Method	ARS-040/
Analysis Code	LSC-LLH3-AQ
Report Units	pCi/L

### Acceptable QC Performance Ranges

QC Sample Type	Performance Items and Ranges		
Laboratory Control Sample	Recovery (%):	> 80	< 120
Matrix Spike	Recovery (%):	> 60	< 140
Duplicate	Replicate Error Ratio (RER):	< 1	
	Duplicate Error Ratio (DER):	< 3	
	Relative Percent Difference (RPD %):	≤ 25	

<b>Laboratory Control Sample</b>			Analysis Date	01/04/18 23:59	Analysis Technician	MMORGAN	
Analysis Batch Sample ID	QC Type	Analyte	Results	CSU (1s)	Expected Value	LCS Rec (%)	MDC
ARS1-B17-02496-01	LCS	ENRICHED H-3	31.082	4.824	32.989	94.2	2.677

<b>Duplicate RER/DER/RPD</b>			Analysis Date	01/05/18 05:42	Analysis Technician	MMORGAN	
Analyte	Results LCS	CSU LCS (1s)	Results LCSD	CSU LCSD (1s)	RER	DER	RPD
ENRICHED H-3	31.082	4.824	26.477	4.095	0.516	0.728	16.0

<b>Method Blank</b>			Analysis Date	01/05/18 11:24	Analysis Technician	MMORGAN	
Analysis Batch Sample ID	QC Type	Analyte	Results	CSU (1s)	MDC	Qual	
ARS1-B17-02496-03	MBL	ENRICHED H-3	0.269	0.717	2.410	U	

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## Notes (Case Narrative):

### General Comments:

- 1.0) Soil and Sludge analysis are reported on a wet basis or an as received basis unless otherwise indicated.
- 2.0) Modified analysis procedures are procedures that are modified to meet the certain specifications. An example may be the use of a water method to analyze a solid matrix due to the lack of an officially recognized procedure for the analysis of the solid matrix. Modified analyses are indicated by the subsequent addition of "m" to the procedure number (i.e. 900.0M).

### Radiochemistry Comments:

- 1.0) All MDAMDC values are calculated on a sample specific basis.
- 2.0) Data in this report are within the limits of uncertainty specified in the reference method unless otherwise specified.
- 3.0) Total activity is actually total gamma activity and is determined utilizing the prominent gamma emitters from the naturally occurring radioactive decay chains and other prominent radioactive nuclides. Total activity may be lower than the actual total activity due to the extent of secular equilibrium achieved in the various decay chains at the time of analysis. The total activity is not representative of nuclides that emit solely alpha or beta particles.
- 4.0) Ra-228 is determined via secular equilibrium with its daughter, Actinium 228 (Gamma Spectroscopy only).
- 5.0) U-238 is determined via secular equilibrium with its daughter, Thorium 234 (Gamma Spectroscopy only).
- 6.0) All gamma spectroscopy was performed utilizing high purity germanium detectors (HPGe).
- 7.0) ARS makes every attempt to match sample density to calibrated density; however, in some cases, it is not practical or possible to do so and data results may be affected (Gamma Spectroscopy only).
- 8.0) Gamma spectroscopy results are calculated values based on the ORTEC® GammaVision ENV32 Analysis Engine.
- 9.0) ACLASS DOD and ISO 17025 certification applies only to the following analytes and methods: Gross Alpha and Gross Beta (EPA 900, SM7110B&C, SW846 9310); Radium 226 (EPA 903, EPA 903.1, SM 7500 Ra-B, SW846 9315); Radium 228 (EPA 904, SM 7500 Ra-B SW846 9320); Iodine-131(EPA 901.1); Uranium by ICPMS (EPA 200.8); Strontium 89/90 (EPA 905, Eichrom SRW01, HASL 300 Sr-03-RC); Tritium (EPA 906, EPA 906M); Gamma Emitters (EPA 901.1, SM7120B, HASL 300 Ga-01-R); Americium-241, Curium 242/244, Plutonium 239/240 and 241, Thorium 228/230/232, Uranium 234/233 and 238 (Eichrom ACW03 VBS); Lead 210 (HASL 300 Pb-01-RC, Eichrom OTW01); Polonium 210 (HASL 300 Po-01-RC, HASL 300 Po-02-RC); Technetium-99 (Eichrom TCW02, Eichrom TCS01M).

### Definitions:

CRDL	Contract Required Detection Limit
CSU	Combined Standard Uncertainty
DLC	Decision Level Concentration (ANSI N42.23) or critical level
DO	Duplicate Original
DUP	Method Duplicate
LCS/LCSD	Laboratory Control Sample/Laboratory Control Sample Duplicate
MDA	Minimum Detectable Activity
MDC	(Minimum Detectable Concentration) minimum concentration of the analyte that ARS can detect utilizing the specific analysis
MBL	Method Blank
MS/MSD	Matrix Spike/Matrix Spike Duplicate
N/A	Not Applicable
NP	Not Provided
NR	Not Referenced
LOD	Limit of Detection
LOQ	Limit of Quantitation

### Data Qualifiers:

B	The analyte is found in both the associated method blank and the sample. This flag indicates probable blank contamination.
D	Sample analysis accomplished through dilution.
J	The reported result is an estimated value above the limit of detection but outside of quantitation range (e.g., matrix interference was observed).
Q	One or more quality control criteria failed (e.g., LCS recovery, surrogate spike recovery, or CCV recovery).
U	Activity is below the MDC, MDA, MDL, or LOD
N	The analyte is a tentatively identified compound using mass spectrometry or any non-customer requested compounds that are tentatively identified.
*	LCS/LCSD or MS/MSD fails RPD criteria.
S	Spike
SC	Subcontracted out to another qualified laboratory
H	Holding time exceeded

[illegible]