

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: 11415

EVENT NAME: LA/Pueblo (TA 21) and Ancho (MDA AB)  
MY2017 Q4

SAMPLE ID: CALA-17-144825

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>		<u>AS PLANNED</u>	<u>AS COLLECTED</u>
Date Collected (MM/DD/YYYY):	09/26/17	o/c	FIELD MATRIX:	WG	o/c
TIME COLLECTED (HH:MM):	0824		MEDIA:	w	
PRS ID:	o/c		SAMPLE TECH CODE:	DC	
LOCATION ID:	R-9		FIELD PREP:	UF	
LOCATION TYPE:	NA		FIELD QC TYPE:	PEB	
TOP DEPTH:	NA		SAMPLE USAGE:	QC	
BOTTOM DEPTH:	NA		EXCAVATED:		YES / NO / NA

PRIORITY	ORDER	CONTAINER	#	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
NA	WSP-8260B-VOA	40 ML SEPTUM AMBER GLASS	2	HCL	y	NA
	WSP-8270C-SVOA	1 LITER AMBER GLASS	2	ICE		
	WSP-8330B-NMED HEXP	1 LITER AMBER GLASS	3	ICE		
	WSP-All Metals	1 LITER POLY	1	HNO3 ICE		
	WSP-CN(T)	250 ML POLY	1	NAOH		
	WSP-GENINORG+PerChlorate	1 LITER POLY	1	ICE		
	WSP-GrossA/B	1 LITER POLY	1	HNO3		
	WSP-H-3	250 ML AMBER GLASS	1	ICE		
	WSP-LL-H-3	1 LITER POLY	1	NONE		
	WSP-NH3+NO3/NO2+PO4	500 ML AMBER GLASS	1	H2SO4		
	WSP-RAD	1 GAL POLY	1	HNO3		
	WSP-TKN+TOC	500 ML AMBER GLASS	1	H2SO4		

SAMPLE COMMENTS:



**SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY****EVENT ID:** 11415**EVENT NAME:** LA/Pueblo (TA 21) and Ancho (MDA AB)  
MY2017 Q4**SAMPLE ID:** CALA-17-144825**WORK ORDER:****LOCATION COMMENTS:** *KA***FIELD PARAMETERS:**

Sample Time

*KA*

HH:MM

**COLLECTED BY (PRINT):***A. Vigil M. Stenke*

<b>RELINQUISHED BY</b> (Printed Name) (Signature) <i>[Signature]</i>	<b>Date/Time</b> <i>9/26/17</i> <i>1300</i>	<b>RECEIVED BY</b> (Printed Name) (Signature) <i>S. Sherwood</i> <i>[Signature]</i>	<b>Date/Time</b> <i>9/26/17</i> <i>1300</i>
<b>RELINQUISHED BY</b> (Printed Name) (Signature)	<b>Date/Time</b>	<b>RECEIVED BY</b> (Printed Name) (Signature)	<b>Date/Time</b>

Report Date: 09/06/2017

## SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 11415

EVENT NAME: LA/Pueblo (TA 21) and Ancho (MDA AB)  
MY2017 Q4

SAMPLE ID: CAAN-17-144828

WORK ORDER:

	AS PLANNED	AS COLLECTED		AS PLANNED	AS COLLECTED
Date Collected (MM/DD/YYYY):	09/22/2017	ok	FIELD MATRIX:	WG	ok
TIME COLLECTED (HH:MM):	1213		MEDIA:	W	
PRS ID:	ok		SAMPLE TECH CODE:	GSP	
LOCATION ID:	R-29		FIELD PREP:	UF	
LOCATION TYPE:	Mon		FIELD QC TYPE:	REG	
TOP DEPTH:	NA		SAMPLE USAGE:	INV	
BOTTOM DEPTH:	NA		EXCAVATED:		YES / NO / NA

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-8330B-NMED HEXP	1 LITER AMBER GLASS	3	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: generator running at about 50' away. windy!!!

LOCATION COMMENTS: none

FIELD PARAMETERS:

Sample Time

1213

HH:MM

PH = 8.14 SU    SP. COND = 120.4  $\mu$ S/cm    Turb = 6.81 NTU    GPM = 7.69 gpm  
 Temp = 19.5 °C    DO = 5.28 mg/L    ORP = 240.9 mV

COLLECTED BY (PRINT):

A. Visil, T. Vander Vis

**SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY****EVENT ID:** 11415**EVENT NAME:** LA/Pueblo (TA 21) and Ancho (MDA AB)  
MY2017 Q4**SAMPLE ID:** CAAN-17-144828**WORK ORDER:**

<b>RELINQUISHED BY</b> (Printed Name) <i>Maurice Shendo</i> (Signature) <i>Maurice Shendo</i>	<b>Date/Time</b> <i>9/22/17</i> <i>1330</i>	<b>RECEIVED BY</b> (Printed Name) <i>M. Shendo</i> (Signature) <i>M. Shendo</i>	<b>Date/Time</b> <i>9/22/17</i> <i>1330</i>
<b>RELINQUISHED BY</b> (Printed Name) (Signature)	<b>Date/Time</b>	<b>RECEIVED BY</b> (Printed Name) (Signature)	<b>Date/Time</b>

Report Date: 09/06/2017



## SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 11415

EVENT NAME: LA/Pueblo (TA 21) and Ancho (MDA AB)  
MY2017 Q4

SAMPLE ID: CAAN-17-144829

WORK ORDER:

	AS PLANNED	AS COLLECTED		AS PLANNED	AS COLLECTED
Date Collected (MM/DD/YYYY):	09/22/2017	OK	FIELD MATRIX:	WG	OK
TIME COLLECTED (HH:MM):	1057		MEDIA:	W	
PRS ID:	OK		SAMPLE TECH CODE:	GSP	
LOCATION ID:	R-30		FIELD PREP:	UF	
LOCATION TYPE:	mon		FIELD QC TYPE:	REG	
TOP DEPTH:	NA		SAMPLE USAGE:	INV	
BOTTOM DEPTH:	NA		EXCAVATED:		YES / NO / (NA)

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-8330B-NMED HEXP	1 LITER AMBER GLASS	3	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: generator Running at about 50' away

LOCATION COMMENTS: none

## FIELD PARAMETERS:

Sample Time

1057

HH:MM

PH = 8.11 SV Spec. Cond = 118.8  $\mu$ S/cm Turb = 0.28 NTU

Temp = 20.2°C

DO = 7.00 mg/L

ORP = 292.3 mV

COLLECTED BY (PRINT):

GPM = 5.7 gpm

A. Visil, T. Vander Vis

**SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY****EVENT ID:** 11415**EVENT NAME:** LA/Pueblo (TA 21) and Ancho (MDA AB)  
MY2017 Q4**SAMPLE ID:** CAAN-17-144829**WORK ORDER:**

<b>RELINQUISHED BY</b> (Printed Name) <i>Mauricio Shundo</i> (Signature) <i>Mauricio Shundo</i>	<b>Date/Time</b> <i>9/22/17</i> <i>12:00</i>	<b>RECEIVED BY</b> (Printed Name) <i>M. Martin</i> (Signature) <i>M. Martin</i>	<b>Date/Time</b> <i>9/22/17</i> <i>12:00</i>
<b>RELINQUISHED BY</b> (Printed Name) (Signature)	<b>Date/Time</b>	<b>RECEIVED BY</b> (Printed Name) (Signature)	<b>Date/Time</b>

Report Date: 09/06/2017



COC: 2017-2937

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

TEST - Field Screen			YES	NO
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		X
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 - UN 2910, based on field screening measurements of alpha and beta activity.				

TEST - Location		YES	NO
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>		X
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.			X
The sample is tentatively identified as DOT Hazard Class 7 (Radioactive). The shipment is labeled Radioactive Material, Excepted Package - Limited Quantity of Material - UN 2910, based on prior analytical measurements of radioactive isotopes.			

TEST - AK		YES	NO	NA
The shippers documented knowledge of the sample positively identifies appropriate labeling.				X
The sample is tentatively identified as DOT Hazard Class 7 (Radioactive). The shipment is labeled Radioactive Material, Excepted Package - Limited Quantity of Material - UN 2910, and the sample is submitted to ARS or RP for hazard classification analysis.				X

HOLD SAMPLES FOR ANALYSIS	
The sampling location within TA-1 and adjacent hillsides, TA-21, Acid Canyon, MDA C at TA-50, Area G at TA-54, Sediment/Soil from Effluent Canyon, Mortandad Canyon from Effluent Canyon to the Soil Contamination Area near the sediment traps, Bayo Canyon at TA-10, TA-35, TA-15, TA-36, TA-39, TA-48 or TA-49 AND does not have usable field screening measurements of alpha and beta activity available AND the sampling location or related sampling location(s) do not have prior reliable analytical measurements of radioactive isotopes available AND knowledge of the sample is not acceptable to identify appropriate labeling.	

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) Melissa Under	9/28/17
(Signature)	3:00

Hazard Assessment Reviewed By:	Date/Time
(Printed Name) J. Sherwood	9/28/17
(Signature)	3:00

## DATA VALIDATION REPORT

Chain Of Custody No. 2017-2937

### 1. Distribution Of Samples In EDD.

SDG	Analytical Method	Regular Samples	Field Duplicates	Trip Blanks	Field Blanks	Equipment Blanks
ARS1-17-02840	Generic:Low_Level_Tritium	2				
ARS1-17-02840	Generic:Low_Level_Tritium					

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
ARS1-17-02840	Generic:Low_Level_Tritium	ARS1-B17-	ARS1-B17-	2					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	CAAN-17-144828	ARS1-B17-02252-06	REG	1	0	0	0
Generic:Low_Level_Tritium	RAD	CAAN-17-144829	ARS1-B17-02252-07	REG	1	0	0	0
Generic:Low_Level_Tritium	RAD	CALA-17-144825	ARS1-B17-02252-08	PEB	1	0	0	0
Generic:Low_Level_Tritium	RAD	LCS	ARS1-B17-02252-01	LCS	0	0	1	0
Generic:Low_Level_Tritium	RAD	LCSD	ARS1-B17-02252-02	LCSD	0	0	1	0
Generic:Low_Level_Tritium	RAD	MB	ARS1-B17-02252-03	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-29	2017-2937	CAAN-17-144828	REG	INIT	RAD	Generic:Low_Level_Tritium	Tritium	U	U	R5	N	0.213	pCi/L	0.213	pCi/L	2.739	0.812	W	09/22/2017		ARS1-B17-02252	VAL	Y
R-30	2017-2937	CAAN-17-144829	REG	INIT	RAD	Generic:Low_Level_Tritium	Tritium	U	U	R5	N	1.679	pCi/L	1.679	pCi/L	2.441	0.792	W	09/22/2017		ARS1-B17-02252	VAL	Y
R-9	2017-2937	CALA-17-144825	PEB	INIT	RAD	Generic:Low_Level_Tritium	Tritium	U	U	R5	N	1.102	pCi/L	1.102	pCi/L	2.920	0.897	W	09/26/2017		ARS1-B17-02252	VAL	Y

Reason Code

Description

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
CAAN-17-144828	R-29	REG	Generic:Low_Level_Tritium	0	1
CAAN-17-144829	R-30	REG	Generic:Low_Level_Tritium	0	1
CALA-17-144825	R-9	PEB	Generic:Low_Level_Tritium	0	1



## **ARS International, LLC**

### **Laboratory Analysis Report**

**ARS1-17-02840**

*Prepared for:*

### **Los Alamos National Laboratory**

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

**npatel@lanl.gov  
sherwoods@lanl.gov**

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

A handwritten signature in cursive script, reading 'Susan Leese', is positioned above a horizontal line.

**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**

**Phone: 225.381.2991  
Fax: 225.381.2996**



November 30, 2017

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

ARS SDG: **ARS1-17-02840**  
Project Description: **2017-2937**  
Charge Code: **ADEP**

Dear Nita,

On September 29, 2017, ARS International received three (3) 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**

Client Sample ID NUMBER	American Radiation Services SAMPLE ID NUMBER(S)
CAAN-17-144828	ARS1-17-02840-001
CAAN-17-144829	ARS1-17-02840-002
CALA-17-144825	ARS1-17-02840-003

**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

11-30-17  
Date



2609 North River Road • Port Allen, Louisiana 70767

1 (800) 401-4277 • FAX (225) 381-2996

ARS Sample Delivery Group: ARS1-17-02840

Client Sample ID: CAAN-17-144828

Sample Collection Date: 09/22/17

Sample Matrix: Aqueous

Percent Solids: N/A

Request or PO Number: 2017-2937

ARS Sample ID: ARS1-17-02840-001

Date Received: 09/29/17

Report Date: 11/13/17

## 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	0.213	0.812	2.739	1.328	3.221	U	pCi/L	ARS-040/	11/10/17 4:20	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.

LELAP Certificate# 01949



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1 (800) 401-4277 • FAX (225) 381-2996

ARS Sample Delivery Group: ARS1-17-02840

Client Sample ID: CAAN-17-144829

Sample Collection Date: 09/22/17

Sample Matrix: Aqueous

Percent Solids: N/A

Request or PO Number: 2017-2937

ARS Sample ID: ARS1-17-02840-002

Date Received: 09/29/17

Report Date: 11/13/17

## 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	1.679	0.792	2.441	1.183	3.221	U	pCi/L	ARS-040/	11/10/17 10:01	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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2609 North River Road • Port Allen, Louisiana 70767

1 (800) 401-4277 • FAX (225) 381-2996

ARS Sample Delivery Group: ARS1-17-02840

Client Sample ID: CALA-17-144825

Sample Collection Date: 09/26/17

Sample Matrix: Aqueous

Percent Solids: N/A

Request or PO Number: 2017-2937

ARS Sample ID: ARS1-17-02840-003

Date Received: 09/29/17

Report Date: 11/13/17

## 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	1.102	0.897	2.920	1.416	3.221	U	pCi/L	ARS-040/	11/10/17 15:43	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-B17-02252
SDG	ARS1-17-02840
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	11/08/17 23:52	Analysis Technician	MMORGAN	
Analysis Batch Sample ID	QC Type	Analyte	Results	CSU (1s)	Expected Value	LCS Rec (%)	MDC
ARS1-B17-02252-01	LCS	ENRICHED H-3	27.000	4.236	29.349	92.0	2.818

<b>Duplicate RER/DER/RPD</b>			Analysis Date	11/09/17 05:33	Analysis Technician	MMORGAN	
Analyte	Results LCS	CSU LCS (1s)	Results LCSD	CSU LCSD (1s)	RER	DER	RPD
ENRICHED H-3	27.000	4.236	32.020	5.024	0.542	0.764	17.0

<b>Duplicate RER/DER/RPD (Dup Sample)</b>			Analysis Date	11/12/17 07:34	Analysis Technician	MMORGAN	
Analyte	Results DO	CSU DO (1s)	Results DUP	CSU DUP (1s)	RER	DER	RPD
ENRICHED H-3	17.368	2.988	15.207	2.658	0.383	0.540	13.3

Method Blank		Analysis Date	11/09/17 11:15	Analysis Technician	MMORGAN	
Analysis Batch Sample ID	QC Type	Analyte	Results	CSU (1s)	MDC	Qual
ARS1-B17-02252-03	MBL	ENRICHED H-3	0.914	0.780	2.548	U

<b>Matrix Spike</b>			Analysis Date	11/12/17 13:16	Analysis Technician	MMORGAN	
Analysis Batch Sample ID	QC Type	Analyte	Results	Expected Value	MS Rec (%)	CSU (1s)	MDC
ARS1-B17-02252-16	MS	ENRICHED H-3	51.883	44.565	77.5	8.023	4.071
ARS1-B17-02252-05	TRG	ENRICHED H-3	17.368	N/A	N/A	2.988	3.967

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.

LELAP Certificate# 01949



## 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 MDA/MDC 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**<sup>®</sup> 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:

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

### Data Qualifiers:

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

[illegible]