

The order of this data package is as follows:

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

Comments:

[illegible]

[illegible]



[illegible]

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

EVENT ID: 11669

EVENT NAME: Water/CdV (TA-16 260, Feb Cr Monthly)  
MY18 Q2

SAMPLE ID: CAWA-18-43

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>		<u>AS PLANNED</u>	<u>AS COLLECTED</u>
Date Collected (MM/DD/YYYY):	<u>2/16/18</u>	<u>ok</u>	FIELD MATRIX:	<u>WG</u>	<u>ok</u>
TIME COLLECTED (HH:MM):	<u>939</u>		MEDIA:	<u>ok</u>	
PRS ID:	<u>N/A</u>		SAMPLE TECH CODE:	<u>GSP</u>	
LOCATION ID:	<u>CDV-16-4ip S1</u>		FIELD PREP:	<u>UF</u>	
LOCATION TYPE:	<u>mon</u>		FIELD QC TYPE:	<u>REG</u>	
TOP DEPTH:	<u>N/A</u>		SAMPLE USAGE:	<u>INV</u>	
BOTTOM DEPTH:	<u>N/A</u>	<u>✓</u>	EXCAVATED:		YES / NO / <u>(NA)</u>

PRIORITY	ORDER	CONTAINER	#	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
<u>N/A</u>	MSGP-Hg	500 ML POLY	1	HNO3	<u>y</u>	<u>N/A</u>
	WSP-8260B-VOA	40 ML SEPTUM AMBER GLASS	2	HCL		
	WSP-8270C-SVOA	1 LITER AMBER GLASS	2	ICE		
	WSP-8330B-NMED HEXMOD	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		
<u>✓</u>	WSP-TKN+TOC	500 ML AMBER GLASS	1	H2SO4	<u>✓</u>	<u>✓</u>

## SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 11669

EVENT NAME: Water/CdV (TA-16 260, Feb Cr Monthly)  
MY18 Q2

SAMPLE ID: CAWA-18-43

WORK ORDER:

SAMPLE COMMENTS: ~~generator Running at 50~~ <sup>ms 2/16/18</sup>  
noneLOCATION COMMENTS:  
none

## FIELD PARAMETERS:

Sample Time	<u>939</u> HH:MM	Discharge Rate	<u>8.82</u> gpm	Dissolved Oxygen	<u>7.18</u> mg/L
Groundwater Elevation	<u>6646.98'</u> ms1	Oxidation-Reduction Potential	<u>206.1</u> mV	Period Purge Volume	<u>3</u> w's
pH	<u>7.08</u> sV	Purge Volume	<u>264.6</u> gallons	Specific Conductance	<u>121.9</u> $\mu$ S/cm
Temperature	<u>10.8</u> °C	Total Volume Pumped	<u>423.36</u> gallons	Turbidity	<u>1.1</u> NTU

COLLECTED BY (PRINT): K. Tao &amp; W. Sanchez

RELINQUISHED BY (Printed Name) <u>Maurice Shendo</u> (Signature) <u>[Signature]</u>	Date/Time <u>2/16/18</u> <u>1300</u>	RECEIVED BY <u>MAT ENGELERT</u> (Printed Name) <u>[Signature]</u> (Signature)	Date/Time <u>2-16-18</u> <u>1300</u>
RELINQUISHED BY (Printed Name) (Signature)	Date/Time	RECEIVED BY (Printed Name) (Signature)	Date/Time

Sampling Plan ID/Name: 11669 (CDV-16-111)COC: 2018-1812

TEST – Explosives		YES	NO
Samples collected from a WFO area? (TAs -08, 09, 11, 14, 15, 16, 22, 36, 37, 39, 40, and 49)		<input checked="" type="checkbox"/>	
Field Test for Explosives Results		YES	NO
HE SPOT test result positive. If YES - Do not transport.			<input checked="" type="checkbox"/>

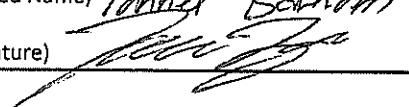
TEST – Chemical Preservation		YES	NO
Samples are chemically preserved?		<input checked="" type="checkbox"/>	
Field Team Member Statement		YES	NO
Chemical preservation exceeds limits given 40 CFR 136, Table II – Required Containers, Preservation Techniques and Holding Times (footnote 3). If YES - Do not ship.			<input checked="" type="checkbox"/>

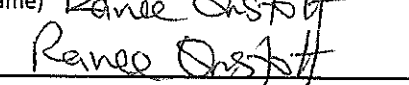
TEST – Field Screen			YES	NO
The sample has field screening measurements of alpha activity and beta activity?				<input checked="" type="checkbox"/>
Sample Activity (dpm/100cm <sup>2</sup> )	Shipment Activity (dpm*g/100cm <sup>2</sup> )	Sampled Location	YES	NO
Alpha detectable	AND Alpha ≥ 160,000	AT TA-1 and adjacent hillsides, TA-21, Acid Canyon, MDA C at TA-50, Area G at TA-54, TA-48, or TA-49		<input checked="" type="checkbox"/>
Alpha ≥ 125	AND Alpha ≥ 1,250,000	AT other locations		
Beta ≥ 1,500	AND Beta ≥ 15,000,000	AT 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
Prior analytical measurements of radioactive isotopes are available?			<input checked="" type="checkbox"/>	
Sample Activity (pCi/g)	Shipment Activity (pCi)		YES	NO
• Am-241 ≥ 27 pCi/g	AND	Am-241 ≥ 270,000 pCi Total		<input checked="" type="checkbox"/>
• Cs-137 ≥ 270 pCi/g	AND	Cs-137 ≥ 270,000 pCi Total		
• Pu-238 ≥ 27 pCi/g	AND	Pu-238 ≥ 270,000 pCi Total		
• Pu-239/240 ≥ 27 pCi/g	AND	Pu-239/240 ≥ 270,000 pCi Total		
• Th-228 ≥ 27 pCi/g	AND	Th-228 ≥ 270,000 pCi Total		
• U-234 ≥ 270 pCi/g	AND	U-234 ≥ 1,600,000,000 pCi Total		
• U-238 ≥ 270 pCi/g	AND	U-238 ≥ unlimited		
• H-3 ≥ 27,000,000 pCi/g	AND	H-3 ≥ 27,000,000,000 pCi Total		
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
The shippers documented knowledge of the sample positively identifies appropriate labeling.			<input checked="" type="checkbox"/>
Documented Field Team Member Statement		YES	NO
The sample is tentatively identified as DOT Hazard Class 7 (Radioactive). The shipment is labeled <i>Radioactive Material, Excepted Package – Limited Quantity of Material – UN2910</i> , and the sample is submitted to ARS or RP for hazard classification analysis.			<input checked="" type="checkbox"/>

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) <u>Tanner Boham</u>	<u>2-16-2018</u>
(Signature) 	<u>1350</u>

Hazard Assessment Reviewed By:	Date/Time
(Printed Name) <u>Renee Ostolt</u>	<u>2/16/18</u>
(Signature) 	<u>1350</u>

ER-SOP-10094, R1, Attachment



Sampling Plan ID/Name: cdv-16-4ip51  
cdv-16-2ir

11667

COC: 2018-1812

TEST - Explosives		YES	NO
Samples collected from a WFO area? (TAs -08, 09, 11, 14, 15, 16, 22, 36, 37, 39, 40, and 49)		<input checked="" type="checkbox"/>	
Field Test for Explosives Results		YES	NO
HE SPOT test result positive. If YES - Do not transport.		<input checked="" type="checkbox"/>	NA


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

TEST - Field Screen			YES	NO
The sample has field screening measurements of alpha activity and beta activity?				<input checked="" type="checkbox"/>
Sample Activity (dpm/100cm <sup>2</sup> )	Shipment Activity (dpm*g/100cm <sup>2</sup> )	Sampled Location	YES	NO
Alpha detectable	AND Alpha $\geq 160,000$	AT TA-1 and adjacent hillsides, TA-21, Acid Canyon, MDA C at TA-50, Area G at TA-54, TA-48, or TA-49		<input checked="" type="checkbox"/>
Alpha $\geq 125$	AND Alpha $\geq 1,250,000$	AT other locations		<input checked="" type="checkbox"/>
Beta $\geq 1,500$	AND Beta $\geq 15,000,000$	AT any location		<input checked="" type="checkbox"/>
The sample Alpha $\geq 16,000,000$ dpm*g/100cm <sup>2</sup> or Beta $\geq 160,000,000$ dpm*g/100cm <sup>2</sup> . If YES - Do not ship.				<input checked="" type="checkbox"/>
On the external surface of the sample container, alpha activity $\geq 24$ dpm/cm <sup>2</sup> , beta activity $\geq 240$ dpm/cm <sup>2</sup> , or surface activity $\geq 0.5$ mR/hr. If YES - Do not ship.				<input checked="" type="checkbox"/>
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.				<input checked="" type="checkbox"/>


TEST - Location		YES	NO
Prior analytical measurements of radioactive isotopes are available?		<input checked="" type="checkbox"/>	
Sample Activity (pCi/g)	Shipment Activity (pCi)	YES	NO
• Am-241 $\geq 27$ pCi/g	AND Am-241 $\geq 270,000$ pCi Total		<input checked="" type="checkbox"/>
• Cs-137 $\geq 270$ pCi/g	AND Cs-137 $\geq 270,000$ pCi Total		<input checked="" type="checkbox"/>
• Pu-238 $\geq 27$ pCi/g	AND Pu-238 $\geq 270,000$ pCi Total		<input checked="" type="checkbox"/>
• Pu-239/240 $\geq 27$ pCi/g	AND Pu-239/240 $\geq 270,000$ pCi Total		<input checked="" type="checkbox"/>
• Th-228 $\geq 27$ pCi/g	AND Th-228 $\geq 270,000$ pCi Total		<input checked="" type="checkbox"/>
• U-234 $\geq 270$ pCi/g	AND U-234 $\geq 1,600,000,000$ pCi Total		<input checked="" type="checkbox"/>
• U-238 $\geq 270$ pCi/g	AND U-238 $\geq$ unlimited		<input checked="" type="checkbox"/>
• H-3 $\geq 27,000,000$ pCi/g	AND H-3 $\geq 27,000,000,000$ pCi Total		<input checked="" type="checkbox"/>
Am-241, Pu-238, Pu-239/240, or Th-228 $\geq 27,000,000$ pCi; or Cs-137 $\geq 270,000,000$ pCi or U-234 $\geq 160,000,000$ pCi; or H-3 $\geq 1$ Ci. If YES - Do not ship.			<input checked="" type="checkbox"/>
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.			<input checked="" type="checkbox"/>

TEST - AK		YES	NO
The shippers documented knowledge of the sample positively identifies appropriate labeling.			<input checked="" type="checkbox"/>
Documented Field Team Member Statement		YES	NO
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.			<input checked="" type="checkbox"/>

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) Katrina Tow	2/16/18
(Signature) 	1300

cdv-16-4ip 51  
cdv-16-2ir

Hazard Assessment Reviewed By:	Date/Time
(Printed Name) Renee Onstott	2/16/18
(Signature) 	1300

ER-SOP-10094, R1, Attachment

sampling Plan ID/Name: Bulldog Spring, R-26 S1

COC: 2018-1812

TEST - Explosives		YES	NO
Samples collected from a WFO area? (TAs -08, 09, 11, 14, 15, 16, 22, 36, 37, 39, 40, and 49)		<input checked="" type="checkbox"/>	<input type="checkbox"/>
Field Test for Explosives Results		YES	NO
HE SPOT test result positive. If YES - Do not transport.		<input type="checkbox"/>	<input checked="" type="checkbox"/>

TEST - Chemical Preservation		YES	NO
Samples are chemically preserved?		<input checked="" type="checkbox"/>	<input type="checkbox"/>
Field Team Member Statement		YES	NO
Chemical preservation exceeds limits given 40 CFR 136, Table II - Required Containers, Preservation Techniques and Holding Times (footnote 3). If YES - Do not ship.		<input type="checkbox"/>	<input checked="" type="checkbox"/>

TEST - Field Screen			YES	NO
The sample has field screening measurements of alpha activity and beta activity?			<input checked="" type="checkbox"/>	<input type="checkbox"/>
Sample Activity (dpm/100cm <sup>2</sup> )	Shipment Activity (dpm*g/100cm <sup>2</sup> )	Sampled Location	YES	NO
Alpha detectable	AND Alpha ≥ 160,000	AT TA-1 and adjacent hillsides, TA-21, Acid Canyon, MDA C at TA-50, Area G at TA-54, TA-48, or TA-49	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Alpha ≥ 125	AND Alpha ≥ 1,250,000	AT other locations	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Beta ≥ 1,500	AND Beta ≥ 15,000,000	AT any location	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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.			<input type="checkbox"/>	<input checked="" type="checkbox"/>
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.			<input type="checkbox"/>	<input checked="" type="checkbox"/>
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.			<input type="checkbox"/>	<input checked="" type="checkbox"/>

TEST - Location		YES	NO
Prior analytical measurements of radioactive isotopes are available?		<input checked="" type="checkbox"/>	<input type="checkbox"/>
Sample Activity (pCi/g)	Shipment Activity (pCi)	YES	NO
• Am-241 ≥ 27 pCi/g	AND Am-241 ≥ 270,000 pCi Total	<input type="checkbox"/>	<input checked="" type="checkbox"/>
• Cs-137 ≥ 270 pCi/g	AND Cs-137 ≥ 270,000 pCi Total	<input type="checkbox"/>	<input checked="" type="checkbox"/>
• Pu-238 ≥ 27 pCi/g	AND Pu-238 ≥ 270,000 pCi Total	<input type="checkbox"/>	<input checked="" type="checkbox"/>
• Pu-239/240 ≥ 27 pCi/g	AND Pu-239/240 ≥ 270,000 pCi Total	<input type="checkbox"/>	<input checked="" type="checkbox"/>
• Th-228 ≥ 27 pCi/g	AND Th-228 ≥ 270,000 pCi Total	<input type="checkbox"/>	<input checked="" type="checkbox"/>
• U-234 ≥ 270 pCi/g	AND U-234 ≥ 1,600,000,000 pCi Total	<input type="checkbox"/>	<input checked="" type="checkbox"/>
• U-238 ≥ 270 pCi/g	AND U-238 ≥ unlimited	<input type="checkbox"/>	<input checked="" type="checkbox"/>
• H-3 ≥ 27,000,000 pCi/g	AND H-3 ≥ 27,000,000,000 pCi Total	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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.		<input type="checkbox"/>	<input checked="" type="checkbox"/>
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.		<input type="checkbox"/>	<input checked="" type="checkbox"/>

TEST - AK		YES	NO
The shippers documented knowledge of the sample positively identifies appropriate labeling.		<input checked="" type="checkbox"/>	<input type="checkbox"/>
Documented Field Team Member Statement		YES	NO
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.		<input type="checkbox"/>	<input checked="" type="checkbox"/>

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) <u>Tanya VanderVliet</u>	<u>2-21-18</u>
(Signature) <u>Tanya VanderVliet</u>	<u>1340</u>

Hazard Assessment Reviewed By:	Date/Time
(Printed Name) <u>Ranee Onstott</u>	<u>2/21/18</u>
(Signature) <u>Ranee Onstott</u>	<u>1340</u>

## DATA VALIDATION REPORT

Chain Of Custody No. 2018-1812

### 1. Distribution Of Samples In EDD.

SDG	Analytical Method	Regular Samples	Field Duplicates	Trip Blanks	Field Blanks	Equipment Blanks
ARS1-18-00556	Generic:Low_Level_Tritium	3	1			
ARS1-18-00556	Generic:Low_Level_Tritium	1				

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
ARS1-18-00556	Generic:Low_Level_Tritium	ARS1-B18-	ARS1-B18-	4	1				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	CAWA-18-127	ARS1-B18-00506-12	FD	1	0	0	0
Generic:Low_Level_Tritium	RAD	CAWA-18-36	ARS1-B18-00506-11	REG	1	0	0	0
Generic:Low_Level_Tritium	RAD	CAWA-18-40	ARS1-B18-00506-13	REG	1	0	0	0
Generic:Low_Level_Tritium	RAD	CAWA-18-43	ARS1-B18-00506-14	REG	1	0	0	0
Generic:Low_Level_Tritium	RAD	CAWA-18-56	ARS1-B18-00506-15	REG	1	0	0	0
Generic:Low_Level_Tritium	RAD	LCS	ARS1-B18-00506-01	LCS	0	0	1	0
Generic:Low_Level_Tritium	RAD	LCSD	ARS1-B18-00506-02	LCSD	0	0	1	0
Generic:Low_Level_Tritium	RAD	MB	ARS1-B18-00506-03	MB	1	0	0	0

### 3. Are any analytes missing?

No.

### 4. Were any holding times exceeded?

No.

Only results shown in Section 13 'Display Flagged Data' are current as of this report generation. All other sections are valid for the date the COC data was inserted into EIM, and may have changed due to data updates in the intervening time.

## DATA VALIDATION REPORT

5. Any contaminants in blanks?

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-26 S1	2018-1812	CAWA-18-56	REG	INIT	RAD	Generic:Low_Level_Tritium	Tritium	U	U	R5	N	-1.328	pCi/L	-1.328	pCi/L	2.763	0.814	W	02/21/2018		ARS1-B18-00506	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
CAWA-18-127	CdV-16-1(i)	FD	Generic:Low_Level_Tritium	0	1
CAWA-18-36	CdV-16-1(i)	REG	Generic:Low_Level_Tritium	0	1
CAWA-18-40	CdV-16-2(i)r	REG	Generic:Low_Level_Tritium	0	1
CAWA-18-43	CDV-16-4ip S1	REG	Generic:Low_Level_Tritium	0	1
CAWA-18-56	R-26 S1	REG	Generic:Low_Level_Tritium	0	1



2609 North River Road • Port Allen, Louisiana 70767

1 (800) 401-4277 • Fax (225) 381-2996

# **American Radiation Services Analytical Reports**

**for**

## **Los Alamos National Laboratory**

# **Request Number: 2018-1812**

## **SDG: ARS1-18-00556**



2609 North River Road • Port Allen, Louisiana 70767

1 (800) 401-4277 • Fax (225) 381-2996

# **American Radiation Services Analytical Reports**

**for**

**Los Alamos National Laboratory  
Request: 2018-1812**

# **Original COC**

American Radiation Baton Rouge LA	<h1>Chain of Custody/Analysis Request</h1> <p><b>COC/Lab Request #:</b> 2018-1812 Page 1 of 1</p>
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Special Instructions:						Date/Time:
Relinquished by:	Parvee Onself	Print Name:	Parvee Onself	Date/Time:	26/10/2020	2-23-18
Relinquished by:		Print Name:		Date/Time:		2/230
Relinquished by:		Print Name:		Date/Time:		





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# **American Radiation Services Analytical Reports**

**for**

**Los Alamos National Laboratory  
Request: 2018-1812**

# **Case Narrative**



## **ARS International, LLC**

### **Laboratory Analysis Report**

**ARS1-18-00556**

*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**

**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**



April 25, 2018

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

ARS SDG: **ARS1-18-00556**  
Project Description: **2018-1812**  
Charge Code: **ADEP**

Dear Nita,

On February 23, 2018, ARS Aleut Analytical, LLC received five (5) 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 Aleut Analytical, LLC



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

Client Sample ID	ARS Aleut Analytical Sample ID
CAWA-18-36	ARS1-18-00556-001
CAWA-18-127	ARS1-18-00556-002
CAWA-18-40	ARS1-18-00556-003
CAWA-18-43	ARS1-18-00556-004
CAWA-18-56	ARS1-18-00556-005

**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)".

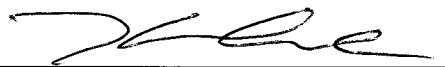
**ANALYTICAL RESULTS**

All QC criteria were met.

**ARS Aleut Analytical 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 Aleut Analytical  
Title

4-26-18  
Date



## 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).
- 3.0) All NIOSH method results are reported without blank corrections applied.

### 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<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:

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
MCL	Maximum Contaminant Level

### 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
E	Exceeds MCL
**	Reporting Limit is higher than MCL; Target cannot be detected



2609 North River Road • Port Allen, Louisiana 70767

1 (800) 401-4277 • Fax (225) 381-2996

**American Radiation Services  
Analytical Reports**

for

**Los Alamos National Laboratory**

**Low Level Tritium  
by  
Low Level Liquid  
Scintillation Counting**



2609 North River Road • Port Allen, Louisiana 70767

1 (800) 401-4277 • FAX (225) 381-2996

ARS Sample Delivery Group: ARS1-18-00556

Client Sample ID: CAWA-18-36

Sample Collection Date: 02/16/18

Sample Matrix: Aqueous

Percent Solids: N/A

Request or PO Number: 2018-1812

ARS Sample ID: ARS1-18-00556-001

Date Received: 02/23/18

Report Date: 04/24/18

## 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	26.645	4.196	2.961	1.436	3.221		pCi/L	ARS-040/	04/23/18 14:33	MMORGAN	N/A

Notes: ARS Aleut Analytical, LLC 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: ARS1-18-00556

Client Sample ID: CAWA-18-127

Sample Collection Date: 02/16/18

Sample Matrix: Aqueous

Percent Solids: N/A

Request or PO Number: 2018-1812

ARS Sample ID: ARS1-18-00556-002

Date Received: 02/23/18

Report Date: 04/24/18

## 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	29.418	4.591	2.812	1.364	3.221		pCi/L	ARS-040/	04/23/18 20:16	MMORGAN	N/A

Notes: ARS Aleut Analytical, LLC 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: ARS1-18-00556

Client Sample ID: CAWA-18-40

Sample Collection Date: 02/16/18

Sample Matrix: Aqueous

Percent Solids: N/A

Request or PO Number: 2018-1812

ARS Sample ID: ARS1-18-00556-003

Date Received: 02/23/18

Report Date: 04/24/18

## 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	4.993	1.132	2.581	1.252	3.221		pCi/L	ARS-040/	04/24/18 2:00	MMORGAN	N/A

Notes: ARS Aleut Analytical, LLC 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: ARS1-18-00556

Client Sample ID: CAWA-18-43

Sample Collection Date: 02/16/18

Sample Matrix: Aqueous

Percent Solids: N/A

Request or PO Number: 2018-1812

ARS Sample ID: ARS1-18-00556-004

Date Received: 02/23/18

Report Date: 04/24/18

## 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	9.398	1.733	2.873	1.393	3.221		pCi/L	ARS-040/	04/24/18 7:42	MMORGAN	N/A

Notes: ARS Aleut Analytical, LLC 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: ARS1-18-00556

Client Sample ID: CAWA-18-56

Sample Collection Date: 02/21/18

Sample Matrix: Aqueous

Percent Solids: N/A

Request or PO Number: 2018-1812

ARS Sample ID: ARS1-18-00556-005

Date Received: 02/23/18

Report Date: 04/24/18

## 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	-1.328	0.814	2.763	1.340	3.221	U	pCi/L	ARS-040/	04/24/18 13:25	MMORGAN	N/A

Notes: ARS Aleut Analytical, LLC 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-B18-00506
SDG	ARS1-18-00556
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	04/21/18 05:23	Analysis Technician	MMORGAN	
Analysis Batch Sample ID	QC Type	Analyte	Results	CSU (1s)	Expected Value	LCS Rec (%)	MDC
ARS1-B18-00506-01	LCS	ENRICHED H-3	32.327	5.026	31.600	102.3	2.876

<b>Duplicate RER/DER/RPD</b>			Analysis Date	04/21/18 11:07	Analysis Technician	MMORGAN	
Analyte	Results LCS	CSU LCS (1s)	Results LCSD	CSU LCSD (1s)	RER	DER	RPD
ENRICHED H-3	32.327	5.026	30.446	4.759	0.192	0.272	6.0

<b>Method Blank</b>			Analysis Date	04/21/18 16:49	Analysis Technician	MMORGAN	
Analysis Batch Sample ID	QC Type	Analyte	Results	CSU (1s)	MDC	Qual	
ARS1-B18-00506-03	MBL	ENRICHED H-3	-0.880	0.906	3.095	U	

Notes: ARS Aleut Analytical, LLC 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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# **American Radiation Services Analytical Reports**

**for**

**Los Alamos National Laboratory**

**Low Level Tritium  
by  
Low Level Liquid  
Scintillation Counting**

# **Laboratory Records**

# Analytical Batch Report

## Analysis Batch ID ARS1-B18-00506



ARS Alert Analytical

Method		ARS-040		Analysis		LSC-LLH3-AQ		Matrix		AQ		
Description		Blind Iso1	Blind Iso2	Blind Iso3	SDG	FR	Run	Prep Code	Filtered	Client ID	Group Name	Lab Deadline
Low Level Tritium by Electrolytic Enrichment												
ABatch Sample ID	Type											
ARS1-B18-00506-01	LCS	B-25087										
ARS1-B18-00506-02	LCSD	B-25088										
ARS1-B18-00506-03	MBL											
ARS1-B18-00506-04	TRG				ARS1-18-00506	001	1			CAWA-18-46		03/29/18
ARS1-B18-00506-05	TRG				ARS1-18-00506	002	1			CAPA-18-4		03/29/18
ARS1-B18-00506-06	TRG				ARS1-18-00506	003	1			CAWA-18-51		03/29/18
ARS1-B18-00506-07	TRG				ARS1-18-00506	004	1			CAMO-18-10		03/29/18
ARS1-B18-00506-08	TRG				ARS1-18-00506	005	1			CAWA-18-64		03/29/18
ARS1-B18-00506-09	TRG				ARS1-18-00506	006	1			CAWA-18-151310		03/29/18
ARS1-B18-00506-10	TRG				ARS1-18-00506	007	1			CAWA-18-58		03/29/18
ARS1-B18-00506-11	TRG				ARS1-18-00556	001	1			CAWA-18-36		04/01/18
ARS1-B18-00506-12	TRG				ARS1-18-00556	002	1			CAWA-18-127		04/01/18
ARS1-B18-00506-13	TRG				ARS1-18-00556	003	1			CAWA-18-40		04/01/18
ARS1-B18-00506-14	TRG				ARS1-18-00556	004	1			CAWA-18-43		04/01/18
ARS1-B18-00506-15	TRG				ARS1-18-00556	005	1			CAWA-18-56		04/01/18

# LCS Report

## Analytical Batch: ARS1-B18-00506

Blind ID	ABatch Sample ID	Blind Group	Std ID	Isotope	Exp Addition (g)	Expected Value (pCi/g)	Empty Wt (g)	Gross Wt (g)	Net Wt (g)	Expected Value CT (pCi/g)	Mid Point Count Date	Known Value (pCi)	User ID	Mod Date
B-25087	ARS1-B18-00506-01	B-H3	S-0324	H-3	5	2.46675	16.7549	21.7373	4.9824	2.45159	04/21/2018	12.21482	MMORGAN	03/12/2018
B-25088	ARS1-B18-00506-02	B-H3	S-0324	H-3	5	2.46675	17.0807	22.0536	4.9729	2.45159	04/21/2018	12.19153	MMORGAN	03/12/2018

\\Tricarb\ars\Low Level H3\_2\20180421

LSC Instrument Data Transfer Report												
Batch Sample ID				Non-BKG Samples Transferred				Samples Eligible To Save				
ARS1-B18-00506				15				15				
LIMS Batch Sample ID	LSC P#	LSC PID	LSC S#	LSC SNPL ID	LSC Count Date	LSC CPMA	LSC ISIE	LSC EFF	LSC Count Dur	Analysis Batch	LIMS SDG	LIMS Run
BKG	4		1	BACKGROUND	04/20/18 20:55	1.08	259.63	21.0600	330.00	ARS1-B18-00506		
ARS1-B18-00506-01	4		2	B18-00506-01	04/21/18 02:38	4.17	258.06	20.9900	330.00	ARS1-B18-00506		
ARS1-B18-00506-02	4		3	B18-00506-02	04/21/18 08:21	3.87	258.53	21.0100	330.00	ARS1-B18-00506		
ARS1-B18-00506-03	4		4	B18-00506-03	04/21/18 14:04	1.00	250.31	20.6400	330.00	ARS1-B18-00506		
ARS1-B18-00506-04	4		5	B18-00506-04	04/21/18 19:47	1.05	258.70	21.0200	330.00	ARS1-B18-00506	ARS1-18-00506	1
ARS1-B18-00506-05	4		6	B18-00506-05	04/22/18 01:30	1.04	233.48	19.8600	330.00	ARS1-B18-00506	ARS1-18-00506	1
ARS1-B18-00506-06	4		7	B18-00506-06	04/22/18 07:13	1.27	245.79	20.4400	330.00	ARS1-B18-00506	ARS1-18-00506	1
ARS1-B18-00506-07	4		8	B18-00506-07	04/22/18 12:56	3.61	248.46	20.5600	330.00	ARS1-B18-00506	ARS1-18-00506	1
ARS1-B18-00506-08	4		9	B18-00506-08	04/22/18 18:39	1.04	257.42	20.9600	330.00	ARS1-B18-00506	ARS1-18-00506	1
ARS1-B18-00506-09	4		10	B18-00506-09	04/23/18 00:21	0.94	241.86	20.2600	330.00	ARS1-B18-00506	ARS1-18-00506	1
ARS1-B18-00506-10	4		11	B18-00506-10	04/23/18 06:04	1.05	234.73	19.9200	330.00	ARS1-B18-00506	ARS1-18-00506	1
ARS1-B18-00506-11	4		12	B18-00506-11	04/23/18 11:48	3.55	246.50	20.4700	330.00	ARS1-B18-00506	ARS1-18-00556	1
ARS1-B18-00506-12	4		13	B18-00506-12	04/23/18 17:31	3.95	254.53	20.8300	330.00	ARS1-B18-00506	ARS1-18-00556	1
ARS1-B18-00506-13	4		14	B18-00506-13	04/23/18 23:14	1.61	229.58	19.6700	330.00	ARS1-B18-00506	ARS1-18-00556	1
ARS1-B18-00506-14	4		15	B18-00506-14	04/24/18 04:57	1.98	252.52	20.7400	330.00	ARS1-B18-00506	ARS1-18-00556	1
ARS1-B18-00506-15	4		16	B18-00506-15	04/24/18 10:40	0.95	244.37	20.3700	330.00	ARS1-B18-00506	ARS1-18-00556	1

\\Tricarb\ars\Low Level H3\_2\20180421



ARS-040 Calculation Results			
ARS1-B18-00506			
ACF	1		
UCF	2.22		
Sys Error	0.15		

AnalysisCode	ABatchSampleID	Initial_Mass_sample_g	Mass_Na2O2_added_g	Final_mass_electrolyzed_sample_NaOH_g	Mass_equivalent_NaOH_g	Final_Mass_Electrolyzed_sample_g	VolumeFactor_X	Enrichment_Factor_Y
LSC-LLH3-AQ	ARS1-B18-00506-01	386.550	1.500	15.660	1.539	14.121	0.037	21.608
LSC-LLH3-AQ	ARS1-B18-00506-02	377.520	1.500	15.950	1.539	14.411	0.038	20.714
LSC-LLH3-AQ	ARS1-B18-00506-03	375.360	1.500	16.870	1.539	15.331	0.041	19.410
LSC-LLH3-AQ	ARS1-B18-00506-04	378.150	1.500	14.760	1.539	13.221	0.035	22.539
LSC-LLH3-AQ	ARS1-B18-00506-05	375.840	1.500	14.740	1.539	13.201	0.035	22.439
LSC-LLH3-AQ	ARS1-B18-00506-06	376.250	1.500	15.660	1.539	14.121	0.038	21.054
LSC-LLH3-AQ	ARS1-B18-00506-07	378.330	1.500	14.430	1.539	12.891	0.034	23.103
LSC-LLH3-AQ	ARS1-B18-00506-08	375.320	1.500	16.290	1.539	14.751	0.039	20.141
LSC-LLH3-AQ	ARS1-B18-00506-09	376.040	1.500	16.760	1.539	15.221	0.040	19.579
LSC-LLH3-AQ	ARS1-B18-00506-10	380.110	1.500	11.980	1.539	10.441	0.027	28.420
LSC-LLH3-AQ	ARS1-B18-00506-11	380.040	1.500	16.200	1.539	14.661	0.039	20.505
LSC-LLH3-AQ	ARS1-B18-00506-12	383.800	1.500	15.840	1.539	14.301	0.037	21.200
LSC-LLH3-AQ	ARS1-B18-00506-13	380.000	1.500	13.500	1.539	11.961	0.031	24.933
LSC-LLH3-AQ	ARS1-B18-00506-14	378.700	1.500	16.080	1.539	14.541	0.038	20.597
LSC-LLH3-AQ	ARS1-B18-00506-15	375.800	1.500	15.050	1.539	13.511	0.036	21.942

ARS-040 Calculation Results

ARS1-B18-00506

ACF	1
UCF	2.22
Sys Error	0.15

AnalysisCode	ABatchSampleID	Average_Sample_CPM	Bkg_CPM	LSIE	Detector_Eff_decimal	Aliquot	AliqUnits	Activity_reference_date	Start_Date_of_Count	Sample_Count	Duration_min
LSC-LLH3-AQ	ARS1-B18-00506-01	4.167	1.081	258.060	0.210	0.01002	L	4/27/2017	4/21/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00506-02	3.867	1.081	258.530	0.210	0.01001	L	4/27/2017	4/21/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00506-03	1.003	1.081	250.310	0.206	0.01001	L	3/27/2018	4/21/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00506-04	1.049	1.081	258.700	0.210	0.01004	L	2/9/2018	4/21/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00506-05	1.036	1.081	233.480	0.199	0.01005	L	2/13/2018	4/22/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00506-06	1.268	1.081	245.790	0.204	0.01002	L	2/9/2018	4/22/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00506-07	3.609	1.081	248.460	0.206	0.01004	L	2/13/2018	4/22/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00506-08	1.039	1.081	257.420	0.210	0.01002	L	2/13/2018	4/22/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00506-09	0.938	1.081	241.860	0.203	0.01007	L	2/13/2018	4/23/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00506-10	1.052	1.081	234.730	0.199	0.01005	L	2/8/2018	4/23/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00506-11	3.551	1.081	246.500	0.205	0.01005	L	2/16/2018	4/23/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00506-12	3.953	1.081	254.530	0.208	0.01006	L	2/16/2018	4/23/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00506-13	1.612	1.081	229.580	0.197	0.00987	L	2/16/2018	4/23/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00506-14	1.979	1.081	252.520	0.207	0.01018	L	2/16/2018	4/24/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00506-15	0.949	1.081	244.370	0.204	0.01011	L	2/21/2018	4/24/2018		330.000

ARS-040 Calculation Results

ARS1-B18-00506

ACF	1
UCF	2.22
Sys Error	0.15

AnalysisCode	ABatchSampleID	Total_Bkg_Count	Duration_min	DF	Sample_Activity_Conc	Standard_Counting_Uncertainty	CU_1	CSU_1	CU_1_96	CSU_1_96	MDC	DLC	ActivityReportUnits
LSC-LLH3-AQ	ARS1-B18-00506-01	330.000	0.94620	0.94620	32.327	1.321	1.321	5.026	2.589	9.851	2.876	1.395	pCi
LSC-LLH3-AQ	ARS1-B18-00506-02	330.000	0.94620	0.94620	30.446	1.338	1.338	4.759	2.623	9.327	3.000	1.455	pCi
LSC-LLH3-AQ	ARS1-B18-00506-03	330.000	0.99616	0.99616	-0.880	0.896	0.896	0.906	1.756	1.775	3.095	1.501	pCi
LSC-LLH3-AQ	ARS1-B18-00506-04	330.000	0.98897	0.98897	-0.306	0.769	0.769	0.771	1.508	1.511	2.629	1.275	pCi
LSC-LLH3-AQ	ARS1-B18-00506-05	330.000	0.98958	0.98958	-0.457	0.814	0.814	0.817	1.596	1.601	2.790	1.353	pCi
LSC-LLH3-AQ	ARS1-B18-00506-06	330.000	0.98897	0.98897	1.975	0.891	0.891	0.939	1.747	1.841	2.900	1.406	pCi
LSC-LLH3-AQ	ARS1-B18-00506-07	330.000	0.98973	0.98973	24.125	1.138	1.138	3.793	2.230	7.435	2.620	1.271	pCi
LSC-LLH3-AQ	ARS1-B18-00506-08	330.000	0.98943	0.98943	-0.452	0.863	0.863	0.865	1.691	1.696	2.954	1.433	pCi
LSC-LLH3-AQ	ARS1-B18-00506-09	330.000	0.98943	0.98943	-1.630	0.891	0.891	0.924	1.747	1.812	3.129	1.518	pCi
LSC-LLH3-AQ	ARS1-B18-00506-10	330.000	0.98867	0.98867	-0.232	0.644	0.644	0.645	1.262	1.264	2.198	1.056	pCi
LSC-LLH3-AQ	ARS1-B18-00506-11	330.000	0.98989	0.98989	26.645	1.278	1.278	4.196	2.505	8.225	2.961	1.436	pCi
LSC-LLH3-AQ	ARS1-B18-00506-12	330.000	0.98989	0.98989	29.418	1.265	1.265	4.591	2.480	8.997	2.812	1.364	pCi
LSC-LLH3-AQ	ARS1-B18-00506-13	330.000	0.98973	0.98973	4.993	0.849	0.849	1.132	1.665	2.219	2.581	1.252	pCi
LSC-LLH3-AQ	ARS1-B18-00506-14	330.000	0.98973	0.98973	9.398	1.008	1.008	1.733	1.975	3.396	2.873	1.393	pCi
LSC-LLH3-AQ	ARS1-B18-00506-15	330.000	0.99050	0.99050	-1.328	0.789	0.789	0.814	1.547	1.596	2.763	1.340	pCi

ARS-040 Calculation Results			
ARS1-B18-00506			
ACF	1		
UCF	2.22		
Sys Error	0.15		

AnalysisCode	ABatchSampleID	AliquotReportUnits	UserID	ModDate
LSC-LLH3-AQ	ARS1-B18-00506-01	L	AMRAD\ECAMP	4/24/2018
LSC-LLH3-AQ	ARS1-B18-00506-02	L	AMRAD\ECAMP	4/24/2018
LSC-LLH3-AQ	ARS1-B18-00506-03	L	AMRAD\ECAMP	4/24/2018
LSC-LLH3-AQ	ARS1-B18-00506-04	L	AMRAD\ECAMP	4/24/2018
LSC-LLH3-AQ	ARS1-B18-00506-05	L	AMRAD\ECAMP	4/24/2018
LSC-LLH3-AQ	ARS1-B18-00506-06	L	AMRAD\ECAMP	4/24/2018
LSC-LLH3-AQ	ARS1-B18-00506-07	L	AMRAD\ECAMP	4/24/2018
LSC-LLH3-AQ	ARS1-B18-00506-08	L	AMRAD\ECAMP	4/24/2018
LSC-LLH3-AQ	ARS1-B18-00506-09	L	AMRAD\ECAMP	4/24/2018
LSC-LLH3-AQ	ARS1-B18-00506-10	L	AMRAD\ECAMP	4/24/2018
LSC-LLH3-AQ	ARS1-B18-00506-11	L	AMRAD\ECAMP	4/24/2018
LSC-LLH3-AQ	ARS1-B18-00506-12	L	AMRAD\ECAMP	4/24/2018
LSC-LLH3-AQ	ARS1-B18-00506-13	L	AMRAD\ECAMP	4/24/2018
LSC-LLH3-AQ	ARS1-B18-00506-14	L	AMRAD\ECAMP	4/24/2018
LSC-LLH3-AQ	ARS1-B18-00506-15	L	AMRAD\ECAMP	4/24/2018

Tritium Assay in Water Samples Using Electrolytic Enrichment

Preparation Date: 03/27/2018 09:55

Prepared By: MMORGAN

Procedure Data												
ABatch Sample ID	Type	SDG/Fraction	Tare Wt of Electrolysis Cell & Electrodes	Tare Wt Reservoir	Gross Weight of Sample Reservoir	Wt Sodium Peroxide	Gross Sample Added	Electrolysis Start Date & Time	Start AMP	Start Bath (C)	Electrolysis End Date/Time	End Bath (C)
ARS1-B18-00506-01	LCS		332.0200	278.3400	664.8900	1.5000	386.5500	3/27/2018 12:30:00 PM	5.0000	2.0000	4/12/2018 11:00:00 AM	2.0000
ARS1-B18-00506-02	LCSD		321.3100	222.0300	599.5500	1.5000	377.5200	3/27/2018 12:30:00 PM	5.0000	2.0000	4/12/2018 11:00:00 AM	2.0000
ARS1-B18-00506-03	MBL		327.7300	218.9000	594.2600	1.5000	375.3600	3/27/2018 12:30:00 PM	5.0000	2.0000	4/12/2018 11:00:00 AM	2.0000
ARS1-B18-00506-04	TRG	ARS1-18-00506-001	326.4800	223.7500	601.9000	1.5000	378.1500	3/27/2018 12:30:00 PM	5.0000	2.0000	4/12/2018 11:00:00 AM	2.0000
ARS1-B18-00506-05	TRG	ARS1-18-00506-002	332.4900	264.3100	640.1500	1.5000	375.8400	3/27/2018 12:30:00 PM	5.0000	2.0000	4/12/2018 11:00:00 AM	2.0000
ARS1-B18-00506-06	TRG	ARS1-18-00506-003	330.8900	227.0600	603.3100	1.5000	376.2500	3/27/2018 12:30:00 PM	5.0000	2.0000	4/12/2018 11:00:00 AM	2.0000
ARS1-B18-00506-07	TRG	ARS1-18-00506-004	320.8200	201.7000	580.0300	1.5000	378.3300	3/27/2018 12:30:00 PM	5.0000	2.0000	4/12/2018 11:00:00 AM	2.0000
ARS1-B18-00506-08	TRG	ARS1-18-00506-005	320.6100	209.5000	584.8200	1.5000	375.3200	3/27/2018 12:30:00 PM	5.0000	2.0000	4/12/2018 11:00:00 AM	2.0000
ARS1-B18-00506-09	TRG	ARS1-18-00506-006	321.0100	221.5900	597.6300	1.5000	376.0400	3/27/2018 12:30:00 PM	5.0000	2.0000	4/12/2018 11:00:00 AM	2.0000
ARS1-B18-00506-10	TRG	ARS1-18-00506-007	331.8100	212.1300	592.2400	1.5000	380.1100	3/27/2018 12:30:00 PM	5.0000	2.0000	4/12/2018 11:00:00 AM	2.0000
ARS1-B18-00506-11	TRG	ARS1-18-00556-001	317.0900	220.8000	600.8400	1.5000	380.0400	3/27/2018 12:30:00 PM	5.0000	2.0000	4/12/2018 11:00:00 AM	2.0000
ARS1-B18-00506-12	TRG	ARS1-18-00556-002	325.1500	228.7100	612.5100	1.5000	383.8000	3/27/2018 12:30:00 PM	5.0000	2.0000	4/12/2018 11:00:00 AM	2.0000
ARS1-B18-00506-13	TRG	ARS1-18-00556-003	316.7500	240.1500	620.1500	1.5000	380.0000	3/27/2018 12:30:00 PM	5.0000	2.0000	4/12/2018 11:00:00 AM	2.0000
ARS1-B18-00506-14	TRG	ARS1-18-00556-004	322.7300	220.2700	598.9700	1.5000	378.7000	3/27/2018 12:30:00 PM	5.0000	2.0000	4/12/2018 11:00:00 AM	2.0000
ARS1-B18-00506-15	TRG	ARS1-18-00556-005	321.1500	220.9200	596.7200	1.5000	375.8000	3/27/2018 12:30:00 PM	5.0000	2.0000	4/12/2018 11:00:00 AM	2.0000

Tritium Assay in Water Samples Using Electrolytic Enrichment

Procedure Data												
ABatch Sample ID	Type	End Wt of Cell + Resv + Sample	Gross Sample Recovered	Enrichment Factor	Tare Wt Cryo-distill flask	Gross Wt flask + Sample	Recovered Water	Tare Weight of LSC Vial	Vial + Sample	Net Sample	Gross Wt Vial + Dead Water If used	Net Dead Water Added
ARS1-B18-00506-01	LCS	626.0200	15.6600	24.6839	126.3400	138.9500	12.6100	6.7200	16.7400	10.0200	16.7400	0.0000
ARS1-B18-00506-02	LCSD	559.2900	15.9500	23.6690	122.8700	135.7400	12.8700	6.6000	16.6100	10.0100	16.6100	0.0000
ARS1-B18-00506-03	MBL	563.5000	16.8700	22.2501	128.3400	141.4900	13.1500	6.6500	16.6600	10.0100	16.6600	0.0000
ARS1-B18-00506-04	TRG	564.9900	14.7600	25.6199	129.7700	141.2700	11.5000	6.6000	16.6400	10.0400	16.6400	0.0000
ARS1-B18-00506-05	TRG	611.5400	14.7400	25.4980	126.3300	138.3100	11.9800	6.5700	16.6200	10.0500	16.6200	0.0000
ARS1-B18-00506-06	TRG	573.6100	15.6600	24.0262	122.8500	135.2800	12.4300	6.5600	16.5800	10.0200	16.5800	0.0000
ARS1-B18-00506-07	TRG	536.9500	14.4300	26.2183	128.3500	139.5000	11.1500	6.5600	16.6000	10.0400	16.6000	0.0000
ARS1-B18-00506-08	TRG	546.4000	16.2900	23.0399	129.7700	143.2800	13.5100	6.6600	16.6800	10.0200	16.6800	0.0000
ARS1-B18-00506-09	TRG	559.3600	16.7600	22.4368	126.2800	140.3300	14.0500	6.5500	16.6200	10.0700	16.6200	0.0000
ARS1-B18-00506-10	TRG	555.9200	11.9800	31.7287	128.3000	139.1800	10.8800	6.5800	16.6300	10.0500	16.6300	0.0000
ARS1-B18-00506-11	TRG	554.0900	16.2000	23.4593	129.7100	142.7600	13.0500	6.5400	16.5900	10.0500	16.5900	0.0000
ARS1-B18-00506-12	TRG	569.7000	15.8400	24.2298	121.3100	132.5200	11.2100	6.5700	16.6300	10.0600	16.6300	0.0000
ARS1-B18-00506-13	TRG	570.4000	13.5000	28.1481	126.3100	136.2600	9.9500	6.5800	16.4500	9.8700	16.6700	0.2200
ARS1-B18-00506-14	TRG	559.0800	16.0800	23.5510	122.8400	136.0600	13.2200	6.5200	16.7000	10.1800	16.7000	0.0000
ARS1-B18-00506-15	TRG	557.1200	15.0500	24.9701	127.3400	139.0200	11.6800	6.6000	16.7100	10.1100	16.7100	0.0000

Tritium Assay in Water Samples Using Electrolytic Enrichment

Procedure Data				
ABatch Sample ID	Type	Tare Wt b/f Cocktail	Gross Wt Vial + Cocktail	Net Wt of Cocktail Added
ARS1-B18-00506-01	LCS	16.7400	27.2600	10.5200
ARS1-B18-00506-02	LCS	16.6100	26.6400	10.0300
ARS1-B18-00506-03	MBL	16.6600	26.7200	10.0600
ARS1-B18-00506-04	TRG	16.6400	26.6800	10.0400
ARS1-B18-00506-05	TRG	16.6200	26.6600	10.0400
ARS1-B18-00506-06	TRG	16.5800	26.6500	10.0700
ARS1-B18-00506-07	TRG	16.6000	26.6600	10.0600
ARS1-B18-00506-08	TRG	16.6800	26.7300	10.0500
ARS1-B18-00506-09	TRG	16.6200	26.6400	10.0200
ARS1-B18-00506-10	TRG	16.6300	26.6900	10.0600
ARS1-B18-00506-11	TRG	16.5900	26.6300	10.0400
ARS1-B18-00506-12	TRG	16.6300	26.6900	10.0600
ARS1-B18-00506-13	TRG	16.6700	26.7200	10.0500
ARS1-B18-00506-14	TRG	16.7000	26.7500	10.0500
ARS1-B18-00506-15	TRG	16.7100	26.7800	10.0700

Reagent Amounts			
ABatch Sample ID	Type	SDG/Fraction	14.3.22 DISTILLATION - Add scint cocktail - Ultima Gold LLT Reagent Grade (mL)
ARS1-B18-00506-01	LCS		10.00
ARS1-B18-00506-02	LCSD		10.00
ARS1-B18-00506-03	MBL		10.00
ARS1-B18-00506-04	TRG	ARS1-18-00506-001	10.00
ARS1-B18-00506-05	TRG	ARS1-18-00506-002	10.00
ARS1-B18-00506-06	TRG	ARS1-18-00506-003	10.00
ARS1-B18-00506-07	TRG	ARS1-18-00506-004	10.00
ARS1-B18-00506-08	TRG	ARS1-18-00506-005	10.00
ARS1-B18-00506-09	TRG	ARS1-18-00506-006	10.00
ARS1-B18-00506-10	TRG	ARS1-18-00506-007	10.00
ARS1-B18-00506-11	TRG	ARS1-18-00556-001	10.00
ARS1-B18-00506-12	TRG	ARS1-18-00556-002	10.00
ARS1-B18-00506-13	TRG	ARS1-18-00556-003	10.00
ARS1-B18-00506-14	TRG	ARS1-18-00556-004	10.00
ARS1-B18-00506-15	TRG	ARS1-18-00556-005	10.00



ARS-040  
Tritium Assay in Water Samples Using Electrolytic Enrichment

Reagent Tracking	
Procedure Section	Reagent ID
14.2.12 DISTILLAT - Ionize & add O to electrolysis	R17-00926
14.3.22 DISTILLATION - Add scint cocktail	R17-00665

### Assay Definition

Assay Description:  
 LLH3 Assay in DPM Mode  
 Assay Type: DPM (Single)  
 Report Name: Report1  
 Output Data Path: C:\Packard\Tricarb\Results\ARS\Low Level H3\_2\20180420\_1511  
 Raw Results Path: C:\Packard\Tricarb\Results\ARS\Low Level H3\_2\20180420\_1511\20180420\_1511.results  
 RTF File Name: C:\Packard\Tricarb\Results\ARS\Low Level H3\_2\20180420\_1511\LLH3.rtf  
 Comma-Delimited File Name: C:\Packard\Tricarb\Results\ARS\Low Level H3\_2\20180420\_1511\LLH3 Results.csv  
 Assay File Name: C:\Packard\Tricarb\Assays\Low Level H3\_2.1sa

### Count Conditions

Nuclide: Low Level H3  
 Quench Indicator: tSIE/AEC  
 External Std Terminator (sec): 0.5 2s%  
 Pre-Count Delay (min): 0.00  
 Quench Set:  
   Low Energy: LLH3 10ml  
 Count Time (min): 330.00  
 Count Mode: Low Level  
 Assay Count Cycles: 1  
 Number of Vials/Sample: 1  
 Repeat Sample Count: 1  
 Calculate % Reference: Off

### Background Subtract

Background Subtract: Off  
 Low CPM Threshold: Off  
 2 Sigma % Terminator: Off

Regions	LL	UL
A	2.0	18.6
B	0.0	2000.0
C	0.0	2000.0

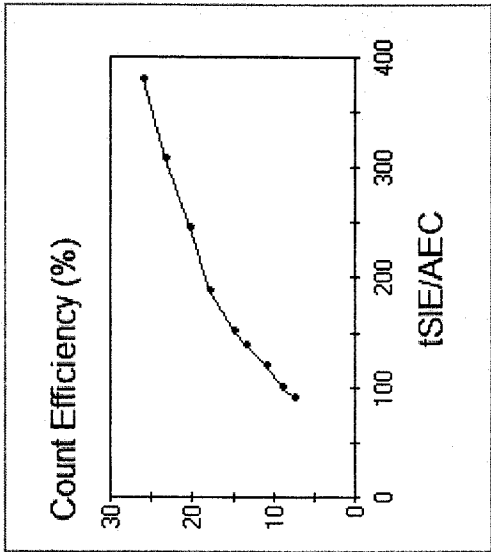
### Count Corrections

Static Controller: On  
 Colored Samples: n/a  
 Coincidence Time (nsec): 18  
 Luminescence Correction: Off  
 Heterogeneity Monitor: Off  
 Delay Before Burst (nsec): 75  
 GCT: Off  
 PAC: Disabled  
 PAC Strength: n/a  
 Auxiliary Spectrum: n/a

Cycle 1 Results

Quench Curve Block Data

LLH3 10ml in A



Date Acquired: 08/18/2017  
Date Modified:  
LLH3 10ml in A

tSIE/AEC	Count Efficiency (%)
380.12	26.09
307.45	23.20
245.66	20.44
188.72	17.73
151.46	14.93
138.74	13.42
120.63	11.00
99.95	9.01
90.27	7.44
70.00	6.00

P#	S#	SMPL ID	CPMA	DPMI	tSIE	Eff Nucl	In A	Count Time	DATE	TIME	MESSAGES
4	1	BACKGROUND	1.081	5.14	259.63		21.06	330.00	4/20/2018	8:55:06 PM	

4	2	B18-00506-01	4.167	19.85	258.06	20.99	330.00	4/21/2018	2:38:23 AM
4	3	B18-00506-02	3.867	18.41	258.53	21.01	330.00	4/21/2018	8:21:31 AM
4	4	B18-00506-03	1.003	4.86	250.31	20.64	330.00	4/21/2018	2:04:08 PM
4	5	B18-00506-04	1.049	4.99	258.70	21.02	330.00	4/21/2018	7:47:21 PM
4	6	B18-00506-05	1.036	5.21	233.48	19.86	330.00	4/22/2018	1:30:32 AM
4	7	B18-00506-06	1.268	6.20	245.79	20.44	330.00	4/22/2018	7:13:32 AM
4	8	B18-00506-07	3.609	17.55	248.46	20.56	330.00	4/22/2018	12:56:25 PM
4	9	B18-00506-08	1.039	4.96	257.42	20.96	330.00	4/22/2018	6:39:10 PM
4	10	B18-00506-09	0.938	4.63	241.86	20.26	330.00	4/23/2018	12:21:57 AM
4	11	B18-00506-10	1.052	5.28	234.73	19.92	330.00	4/23/2018	6:04:58 AM
4	12	B18-00506-11	3.551	17.34	246.50	20.47	330.00	4/23/2018	11:48:10 AM
4	13	B18-00506-12	3.953	18.98	254.53	20.83	330.00	4/23/2018	5:31:13 PM
4	14	B18-00506-13	1.612	8.20	229.58	19.67	330.00	4/23/2018	11:14:34 PM
4	15	B18-00506-14	1.979	9.54	252.52	20.74	330.00	4/24/2018	4:57:25 AM
4	16	B18-00506-15	0.949	4.66	244.37	20.37	330.00	4/24/2018	10:40:23 AM

# Liquid Scintillation Count Log

Date	Time	ARS Sample I.D. Number	Batch Fraction Number	Liquid Scintillation File Number	Technician Initials	Notes Identifier
4/20/2018	14:00	Background	N/A	1511	SC	
4/20/2018	14:00	B18-00506	1	1511	SC	
4/20/2018	14:00	B18-00506	2	1511	SC	
4/20/2018	14:00	B18-00506	3	1511	SC	
4/20/2018	14:00	B18-00506	4	1511	SC	
4/20/2018	14:00	B18-00506	5	1511	SC	
4/20/2018	14:00	B18-00506	6	1511	SC	
4/20/2018	14:00	B18-00506	7	1511	SC	
4/20/2018	14:00	B18-00506	8	1511	SC	
4/20/2018	14:00	B18-00506	9	1511	SC	
4/20/2018	14:00	B18-00506	10	1511	SC	
4/20/2018	14:00	B18-00506	11	1511	SC	
4/20/2018	14:00	B18-00506	12	1511	SC	
4/20/2018	14:00	B18-00506	13	1511	SC	
4/20/2018	14:00	B18-00506	14	1511	SC	
4/20/2018	14:00	B18-00506	15	1511	SC	
4/20/2018	14:00	SNC163	QA	QA	SC	3

## Notes

3	Late entry. SNC Counted before samples of B18-00506. 4/23/2018 11:11	SC
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# **American Radiation Services Analytical Reports**

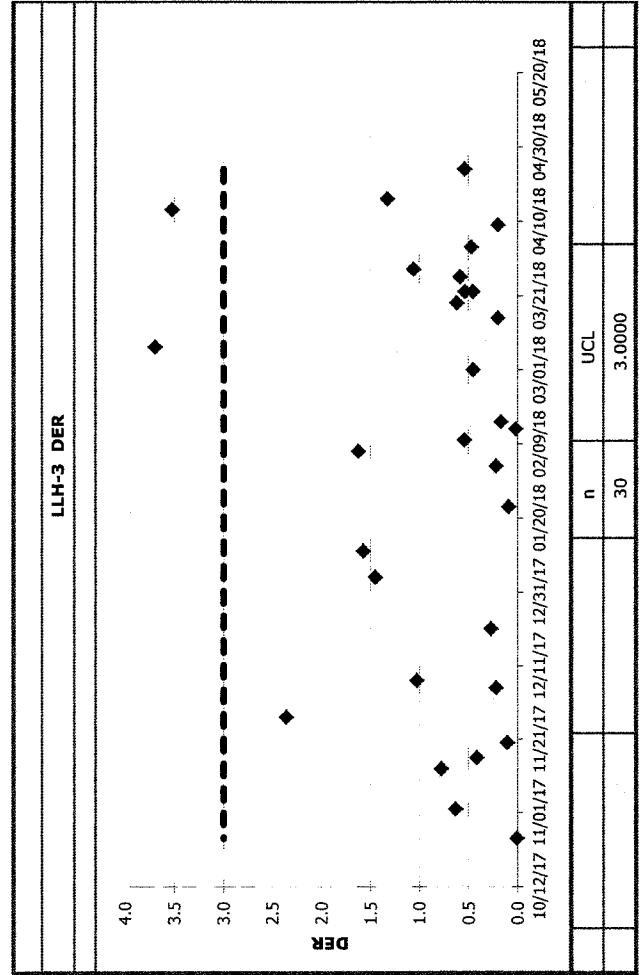
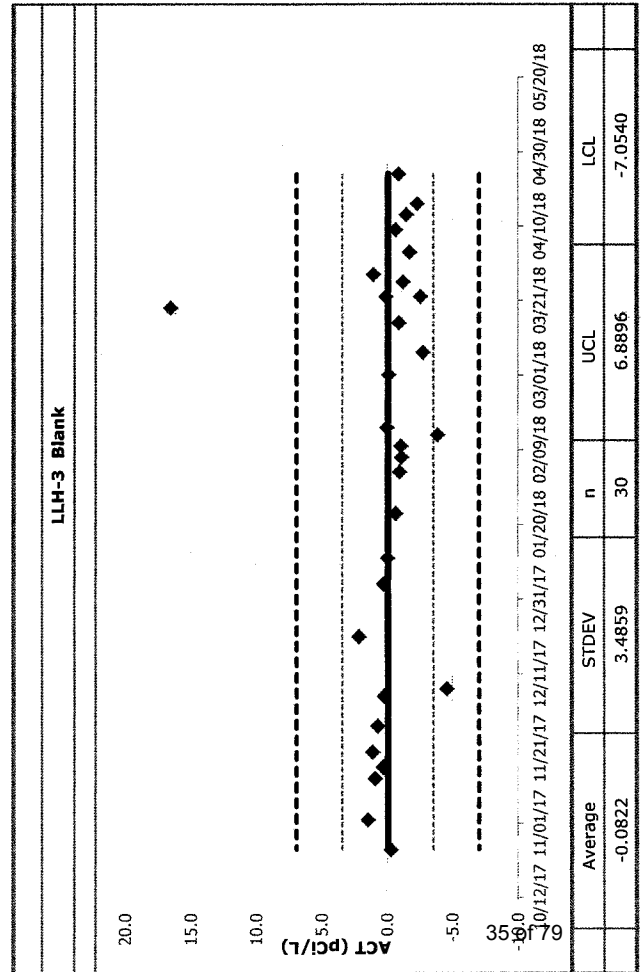
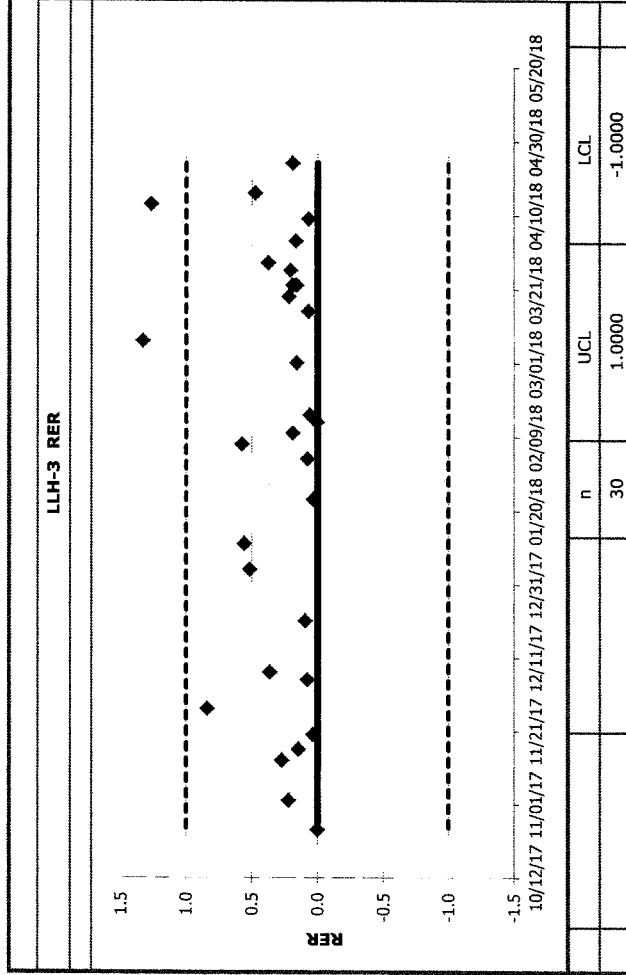
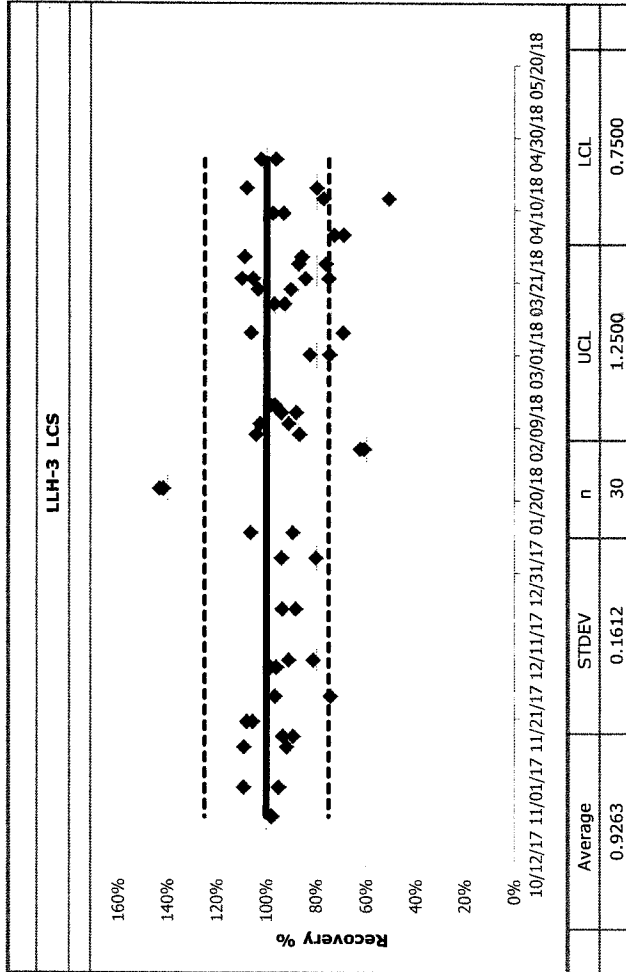
**for**

**Los Alamos National Laboratory**

**Low Level Tritium  
by  
Low Level Liquid  
Scintillation Counting**

# **Control Charts**

# QC Chart





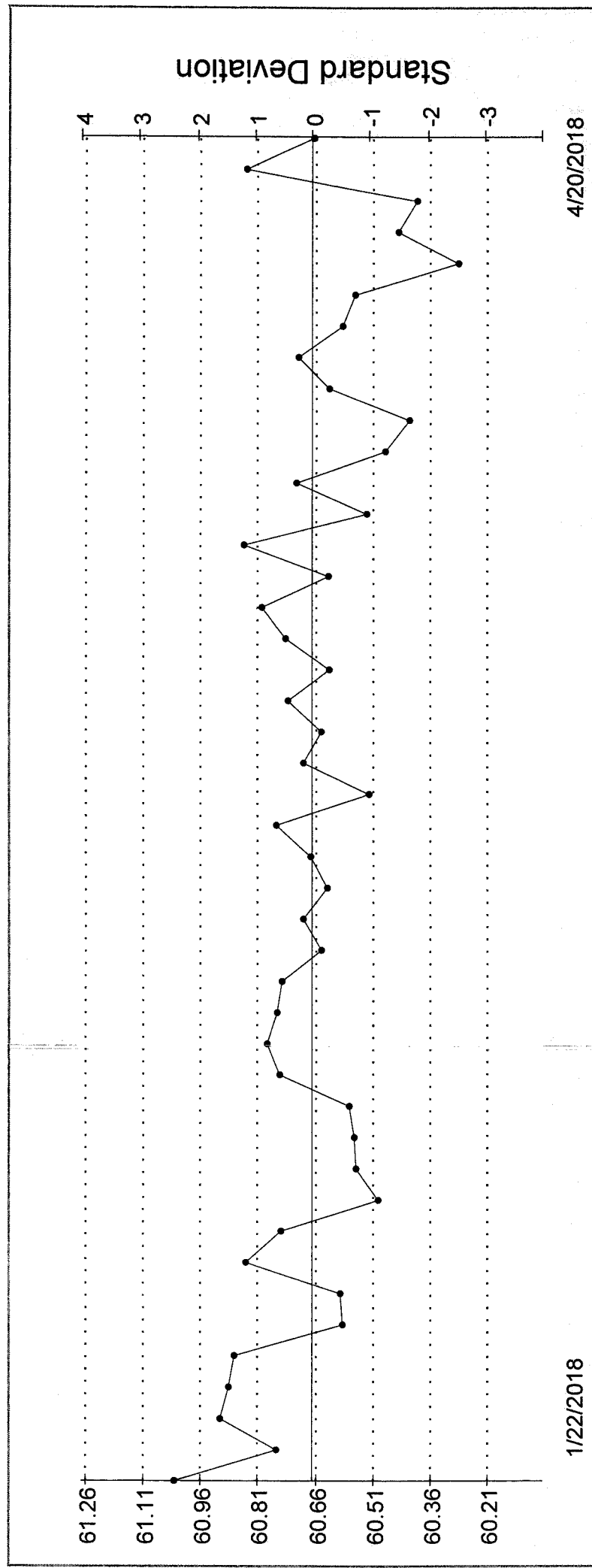
## 3H Efficiency

Total # pts : 117  
Valid # pts : 44  
Mean : 60.67  
SD : 0.15

Date	Value	Include
Jan 22, 2018	61.03	X
Jan 26, 2018	60.76	X
Jan 26, 2018	60.91	X
Feb 01, 2018	60.89	X
Feb 02, 2018	60.87	X
Feb 02, 2018	60.59	X
Feb 05, 2018	60.60	X
Feb 06, 2018	60.84	X
Feb 09, 2018	60.75	X
Feb 11, 2018	60.50	X
Feb 12, 2018	60.56	X
Feb 13, 2018	60.56	X
Feb 14, 2018	60.57	X
Feb 14, 2018	60.75	X
Feb 16, 2018	60.79	X
Feb 22, 2018	60.76	X
Feb 25, 2018	60.75	X
Feb 26, 2018	60.65	X
Feb 28, 2018	60.69	X
Mar 03, 2018	60.63	X
Mar 06, 2018	60.67	X
Mar 11, 2018	60.76	X
Mar 12, 2018	60.52	X
Mar 14, 2018	60.69	X
Mar 14, 2018	60.65	X
Mar 17, 2018	60.73	X
Mar 19, 2018	60.63	X
Mar 21, 2018	60.74	X
Mar 22, 2018	60.80	X
Mar 23, 2018	60.63	X
Mar 26, 2018	60.85	X
Mar 28, 2018	60.53	X
Mar 28, 2018	60.71	X
Mar 30, 2018	60.48	X
Apr 01, 2018	60.42	X
Apr 04, 2018	60.63	X
Apr 04, 2018	60.71	X
Apr 07, 2018	60.59	X
Apr 09, 2018	60.56	X
Apr 10, 2018	60.29	X
Apr 13, 2018	60.45	X
Apr 17, 2018	60.40	X

Apr 19, 2018	60.84	X
Apr 20, 2018	60.67	X

3H Efficiency : 117  
Total # pts : 44  
Valid # pts : 60.67  
Mean : 60.67  
SD : 0.15



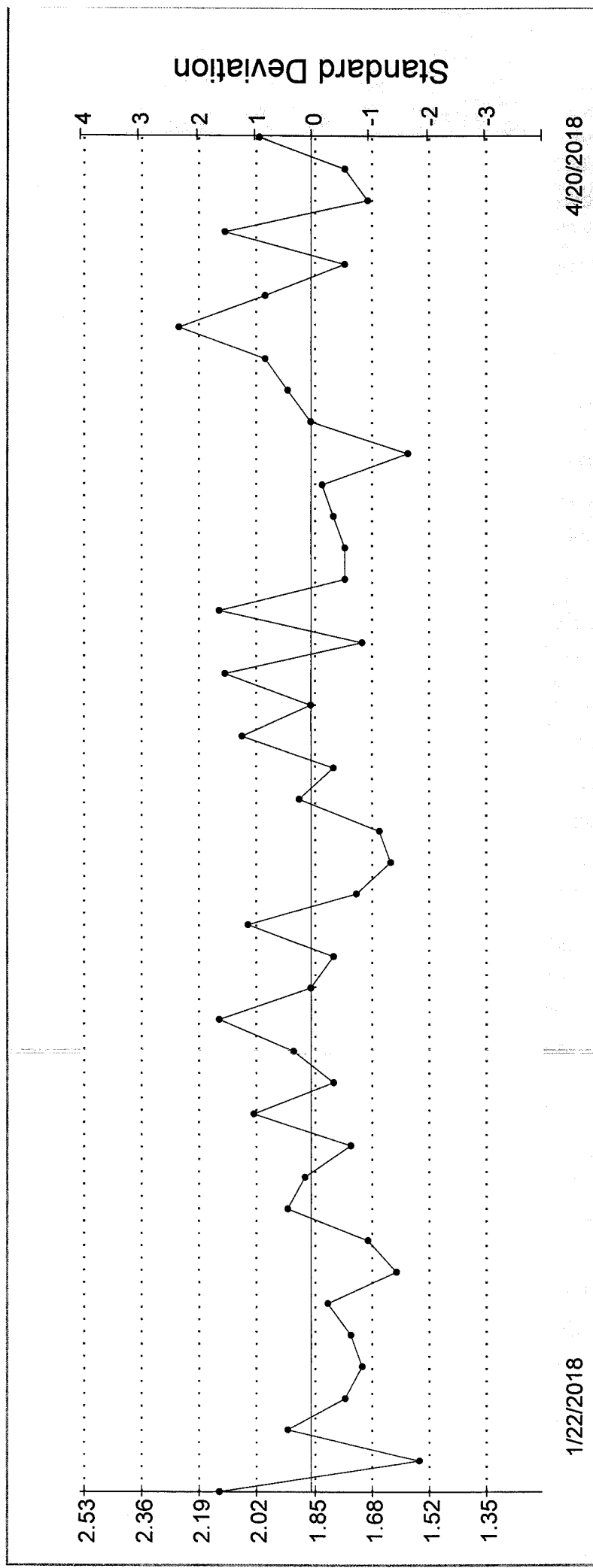
3H Background

Total # pts : 115  
Valid # pts : 44  
Mean : 1.86  
SD : 0.17

Date	Value	Include
Jan 22, 2018	2.13	X
Jan 26, 2018	1.55	X
Jan 26, 2018	1.93	X
Feb 01, 2018	1.77	X
Feb 02, 2018	1.72	X
Feb 02, 2018	1.75	X
Feb 05, 2018	1.82	X
Feb 06, 2018	1.62	X
Feb 09, 2018	1.70	X
Feb 11, 2018	1.93	X
Feb 12, 2018	1.88	X
Feb 13, 2018	1.75	X
Feb 14, 2018	2.03	X
Feb 14, 2018	1.80	X
Feb 16, 2018	1.92	X
Feb 22, 2018	2.13	X
Feb 25, 2018	1.87	X
Feb 26, 2018	1.80	X
Feb 28, 2018	2.05	X
Mar 03, 2018	1.73	X
Mar 06, 2018	1.63	X
Mar 11, 2018	1.67	X
Mar 12, 2018	1.90	X
Mar 14, 2018	1.80	X
Mar 14, 2018	2.07	X
Mar 17, 2018	1.87	X
Mar 19, 2018	2.12	X
Mar 21, 2018	1.72	X
Mar 22, 2018	2.13	X
Mar 23, 2018	1.77	X
Mar 26, 2018	1.77	X
Mar 28, 2018	1.80	X
Mar 28, 2018	1.83	X
Mar 30, 2018	1.58	X
Apr 01, 2018	1.87	X
Apr 04, 2018	1.93	X
Apr 04, 2018	2.00	X
Apr 07, 2018	2.25	X
Apr 09, 2018	2.00	X
Apr 10, 2018	1.77	X
Apr 13, 2018	2.12	X
Apr 17, 2018	1.70	X

Apr 19, 2018	1.77	X
Apr 20, 2018	2.02	X

3H Background  
 Total # pts : 115  
 Valid # pts : 44  
 Mean : 1.86  
 SD : 0.17





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# **American Radiation Services Analytical Reports**

for

**Los Alamos National Laboratory**

## **Tritium- Screening by Low Level Liquid Scintillation Counting**



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**American Radiation Services  
Analytical Reports**

**for**

**Los Alamos National Laboratory**

**Tritium-Screening  
by  
Low Level Liquid  
Scintillation Counting**

**Samples**





ARS Batch ID: ARS1-B18-00442  
ARS SDG ID(s): ARS1-18-00506; 556

**if activity is > 150 pCi/L, contact client before running by electrolytic enrichment**



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by  
Low Level Liquid  
Scintillation Counting**

**Laboratory  
Records**



Analysis Batch ID    **ARS1-B18-00442**

46 of 79

Preparation Date: 02/26/2018 12:57  
Prepared By: MMORGAN

Procedure Data						
ABatch Sample ID	Client ID	Parent	ICOC ID	Aliquot 1 Vol/Wt	Aliquot 1 Units	Aliquot 2 Vol/Wt
ARS1-B18-00442-01				1.0000		
ARS1-B18-00442-02				1.0000		
ARS1-B18-00442-03				1.0000		
ARS1-B18-00442-04	CAWA-18-46		287170	0.0010	L	
ARS1-B18-00442-05	CAPA-18-4		287171	0.0010	L	
ARS1-B18-00442-06	CAWA-18-51		287172	0.0010	L	
ARS1-B18-00442-07	CAMO-18-10		287173	0.0010	L	
ARS1-B18-00442-08	CAWA-18-64		287174	0.0010	L	
ARS1-B18-00442-09	CAWA-18-151310		287175	0.0010	L	
ARS1-B18-00442-10	CAWA-18-58		287176	0.0010	L	
ARS1-B18-00442-11	CAWA-18-36		287177	0.0010	L	
ARS1-B18-00442-12	CAWA-18-127		287178	0.0010	L	
ARS1-B18-00442-13	CAWA-18-40		287179	0.0010	L	
ARS1-B18-00442-14	CAWA-18-43		287180	0.0010	L	
ARS1-B18-00442-15	CAWA-18-56		287181	0.0010	L	

ARS-054  
Tritium in Water

ARS International  
Baton Rouge Laboratory

Reagent Amounts			Client ID	14.1.5 OPTIONAL AQ W/O DIST - Add scint cocktail - Ultima Gold LLT Reagent Grade (mL)	User ID
ABatch Sample ID					
ARS1-B18-00442-04			CAWA-18-46	10.00	
ARS1-B18-00442-05			CAPA-18-4	10.00	
ARS1-B18-00442-06			CAWA-18-51	10.00	
ARS1-B18-00442-07			CAMO-18-10	10.00	
ARS1-B18-00442-08			CAWA-18-64	10.00	
ARS1-B18-00442-09			CAWA-18-151310	10.00	
ARS1-B18-00442-10			CAWA-18-58	10.00	
ARS1-B18-00442-11			CAWA-18-36	10.00	
ARS1-B18-00442-12			CAWA-18-127	10.00	
ARS1-B18-00442-13			CAWA-18-40	10.00	
ARS1-B18-00442-14			CAWA-18-43	10.00	
ARS1-B18-00442-15			CAWA-18-56	10.00	

ARS-054  
Tritium in Water

ARS International  
Baton Rouge Laboratory

Reagent Tracking	
Procedure Section	Reagent ID
14.1.5 OPTIONAL AQ W/O DIST - Add scint cocktail	R17-00665

Protocol# 8 - Low Level H3.lsa

User: ARS

**Assay Definition**

Assay Description:  
LLH3 Assay in DPM Mode  
Assay Type: DPM (Single)  
Report Name: Report1  
Output Data Path: C:\Packard\Tricarb\Results\ARS\Low Level H3\20180228\_1606  
Raw Results Path: C:\Packard\Tricarb\Results\ARS\Low Level H3\20180228\_1606\20180228\_1606.results  
RTF File Name: C:\Packard\Tricarb\Results\ARS\Low Level H3\20180228\_1606\LLH3.rtf  
Comma-Delimited File Name: C:\Packard\Tricarb\Results\ARS\Low Level H3\20180228\_1606\LLH3 Results.csv  
Assay File Name: C:\Packard\Tricarb\Assays\Low Level H3.lsa

**Count Conditions**

Nuclide: Low Level H3  
Quench Indicator: tSIE/AEC  
External Std Terminator (sec): 0.5 2s%  
Pre-Count Delay (min): 0.00  
Quench Set:  
Low Energy: LLH3 10ml  
Count Time (min): 120.00  
Count Mode: Low Level  
Assay Count Cycles: 1 Repeat Sample Count: 1  
Number of Vials/Sample: 1 Calculate % Reference: Off

**Background Subtract**

Background Subtract: Off  
Low CPM Threshold: Off  
2 Sigma % Terminator: Off

Regions	LL	UL
A	2.0	18.6
B	0.0	2000.0
C	0.0	2000.0

**Count Corrections**

Static Controller: On Luminescence Correction: Off GCT: Off  
Colored Samples: n/a Heterogeneity Monitor: Off PAC: Disabled  
Coincidence Time (nsec): 18 Delay Before Burst (nsec): 75 PAC Strength: n/a Auxiliary Spectrum: n/a

Protocol# 8 - Low Level H3.lsa

User: ARS

## Cycle 1 Results

P#	S#	SMPL ID	CPMA	DPM1	tsIE	Eff	Nucl	In A	Count	Time	DATE	TIME	MESSAGES
8	1	BACKGROUND	1.250	5.93	259.93			21.07	120.00	120.00	2/28/2018	6:17:36 PM	
8	2	B18-00442-04	1.425	6.97	245.93			20.45	120.00	120.00	2/28/2018	8:29:04 PM	
8	3	B18-00442-05	1.153	5.49	258.16			20.99	120.00	120.00	2/28/2018	10:40:25 PM	
8	4	B18-00442-06	1.063	5.49	222.85			19.35	120.00	120.00	3/1/2018	12:52:22 AM	
8	5	B18-00442-07	1.103	5.31	253.00			20.76	120.00	120.00	3/1/2018	3:03:28 AM	
8	6	B18-00442-08	1.246	5.91	260.70			21.11	120.00	120.00	3/1/2018	5:14:50 AM	
8	7	B18-00442-09	1.156	5.49	259.83			21.07	120.00	120.00	3/1/2018	7:25:49 AM	
8	8	B18-00442-10	0.943	4.55	252.65			20.75	120.00	120.00	3/1/2018	9:36:44 AM	
8	9	B18-00442-11	1.346	6.45	255.67			20.88	120.00	120.00	3/1/2018	11:48:04 AM	
8	10	B18-00442-12	1.353	6.46	257.33			20.96	120.00	120.00	3/1/2018	1:59:15 PM	
8	11	B18-00442-13	1.213	5.82	255.06			20.86	120.00	120.00	3/1/2018	4:10:52 PM	
8	12	B18-00442-14	1.126	5.41	254.42			20.83	120.00	120.00	3/1/2018	6:22:26 PM	
8	13	B18-00442-15	1.041	5.02	252.20			20.73	120.00	120.00	3/1/2018	8:33:48 PM	



## \\Tricarb\ars\Low Level H3\20180228.

**Samples Eligible To Save**

## Low Level Tritium pH Checks

[illegible]

# Liquid Scintillation Count Log

Date	Time	ARS Sample I.D. Number	Batch Fraction Number	Liquid Scintillation File Number	Technician Initials	Notes Identifier
2/22/2018	15:00	Background	N/A	N/A	MM	
2/22/2018	15:00	B18-00131	1	1600	MM	
2/22/2018	15:00	B18-00131	2	1600	MM	
2/22/2018	15:00	B18-00131	3	1600	MM	
2/22/2018	15:00	B18-00131	4	1600	MM	
2/22/2018	15:00	B18-00131	5	1600	MM	
2/22/2018	15:00	B18-00131	6	1600	MM	
2/22/2018	15:00	B18-00131	7	1600	MM	
2/22/2018	15:00	B18-00131	8	1600	MM	
2/22/2018	15:00	B18-00131	9	1600	MM	
2/22/2018	15:00	B18-00131	10	1600	MM	
2/22/2018	15:00	B18-00131	11	1600	MM	
2/22/2018	15:00	B18-00131	12	1600	MM	
2/26/2018	15:00	SNC163	QA	1638	MM	
2/26/2018	15:00	Background	N/A	1638	MM	
2/26/2018	15:00	B18-00131	1	1638	MM	
2/26/2018	15:00	B18-00131	3	1638	MM	
2/26/2018	15:00	B18-00131	4	1638	MM	
2/26/2018	15:00	B18-00131	5	1638	MM	
2/26/2018	15:00	B18-00131	6	1638	MM	
2/26/2018	15:00	B18-00131	7	1638	MM	
2/26/2018	15:00	B18-00131	11	1638	MM	
2/28/2018	15:00	SNC163	QA	QA	MM	
2/28/2018	15:00	Background	N/A	1606	MM	
2/28/2018	15:00	B18-00442	1	1606	MM	
2/28/2018	15:00	B18-00442	4	1606	MM	
2/28/2018	15:00	B18-00442	5	1606	MM	
2/28/2018	15:00	B18-00442	6	1606	MM	
2/28/2018	15:00	B18-00442	7	1606	MM	
2/28/2018	15:00	B18-00442	8	1606	MM	
2/28/2018	15:00	B18-00442	9	1606	MM	
2/28/2018	15:00	B18-00442	10	1606	MM	
2/28/2018	15:00	B18-00442	11	1606	MM	
2/28/2018	15:00	B18-00442	12	1606	MM	
2/28/2018	15:00	B18-00442	13	1606	MM	
2/28/2018	15:00	B18-00442	14	1606	MM	
2/28/2018	15:00	B18-00442	15	1606	MM	



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# **American Radiation Services Analytical Reports**

for

**Los Alamos National Laboratory**

**Tritium-Screening  
by  
Low Level Liquid  
Scintillation Counting**

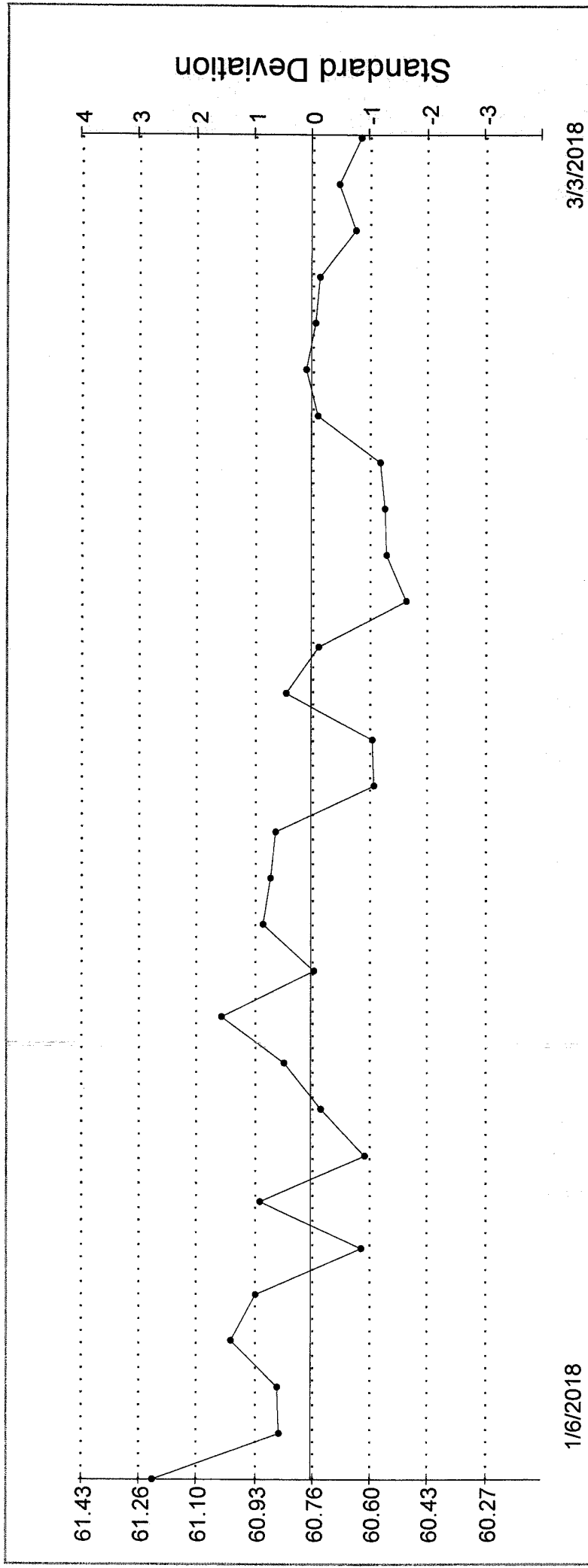
# **Control Charts**

## 3H Efficiency

Total # pts : 93  
Valid # pts : 30  
Mean : 60.77  
SD : 0.17

Date	Value	Include
Jan 06, 2018	61.23	X
Jan 08, 2018	60.86	X
Jan 10, 2018	60.87	X
Jan 11, 2018	61.00	X
Jan 14, 2018	60.93	X
Jan 15, 2018	60.63	X
Jan 15, 2018	60.92	X
Jan 16, 2018	60.62	X
Jan 18, 2018	60.74	X
Jan 20, 2018	60.85	X
Jan 22, 2018	61.03	X
Jan 26, 2018	60.76	X
Jan 26, 2018	60.91	X
Feb 01, 2018	60.89	X
Feb 02, 2018	60.87	X
Feb 02, 2018	60.59	X
Feb 05, 2018	60.60	X
Feb 06, 2018	60.84	X
Feb 09, 2018	60.75	X
Feb 11, 2018	60.50	X
Feb 12, 2018	60.56	X
Feb 13, 2018	60.56	X
Feb 14, 2018	60.57	X
Feb 14, 2018	60.75	X
Feb 16, 2018	60.79	X
Feb 22, 2018	60.76	X
Feb 25, 2018	60.75	X
Feb 26, 2018	60.65	X
Feb 28, 2018	60.69	X
Mar 03, 2018	60.63	X

3H Efficiency  
Total # pts : 93  
Valid # pts : 30  
Mean : 60.77  
SD : 0.17

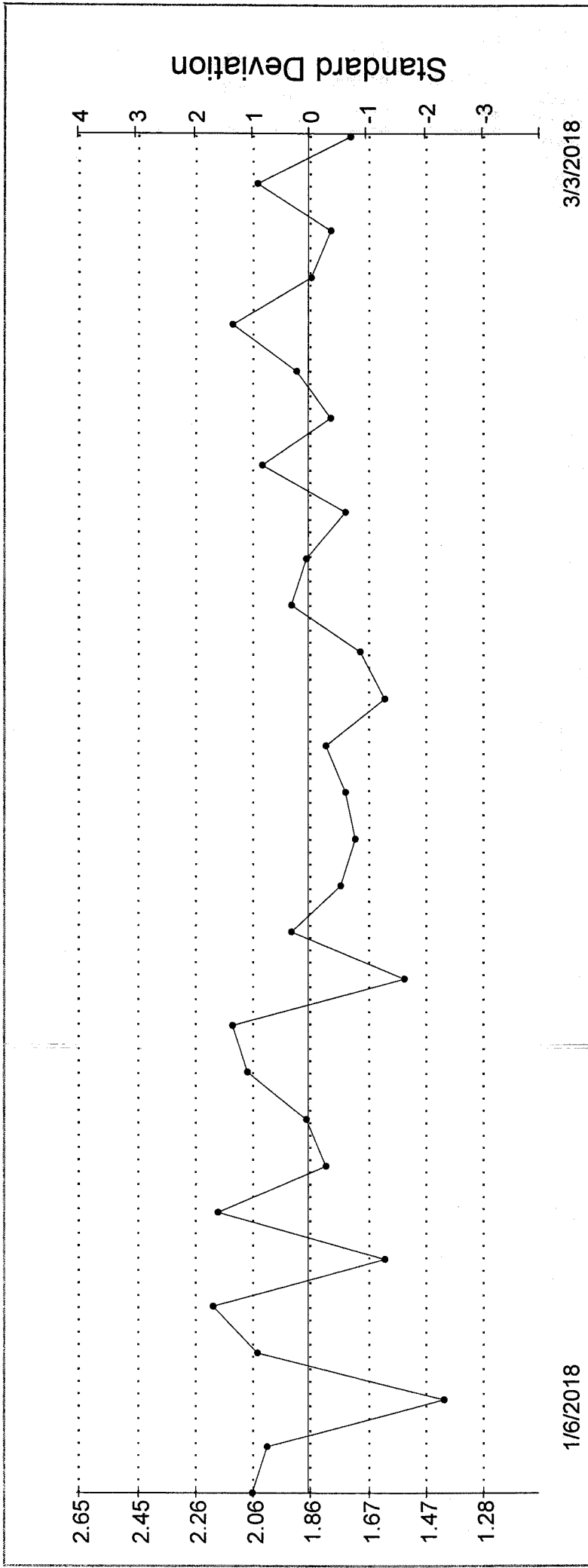


3H Background

Total # pts : 91  
 Valid # pts : 30  
 Mean : 1.87  
 SD : 0.20

Date	Value	Include
Jan 06, 2018	2.07	X
Jan 08, 2018	2.02	X
Jan 10, 2018	1.42	X
Jan 11, 2018	2.05	X
Jan 14, 2018	2.20	X
Jan 15, 2018	1.62	X
Jan 15, 2018	2.18	X
Jan 16, 2018	1.82	X
Jan 18, 2018	1.88	X
Jan 20, 2018	2.08	X
Jan 22, 2018	2.13	X
Jan 26, 2018	1.55	X
Jan 26, 2018	1.93	X
Feb 01, 2018	1.77	X
Feb 02, 2018	1.72	X
Feb 02, 2018	1.75	X
Feb 05, 2018	1.82	X
Feb 06, 2018	1.62	X
Feb 09, 2018	1.70	X
Feb 11, 2018	1.93	X
Feb 12, 2018	1.88	X
Feb 13, 2018	1.75	X
Feb 14, 2018	2.03	X
Feb 14, 2018	1.80	X
Feb 16, 2018	1.92	X
Feb 22, 2018	2.13	X
Feb 25, 2018	1.87	X
Feb 26, 2018	1.80	X
Feb 28, 2018	2.05	X
Mar 03, 2018	1.73	X

3H Background  
Total # pts : 91  
Valid # pts : 30  
Mean : 1.87  
SD : 0.20







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# **American Radiation Services Analytical Reports**

**for**

**Los Alamos National Laboratory**

**Low Level Liquid  
Scintillation Counting**

**Calibration  
Information**



**QUALITY CONTROL PROGRAM**  
**AMERICAN RADIATION SERVICES**  
**RADIOACTIVE REFERENCE SOLUTIONS**  
**ANNUAL ACTIVITY VERIFICATION**

VERIFICATION DATE 4/27/2017 0:00 date counted  
 STANDARD REFERENCE # S-0324

Principal Radionuclide

H-3

ENTER --&gt;

Half Life, Years

1.232E+01

OR --&gt;

Half Life, Days

4.4999E+03

Radionuclide

H-3

Dilution Reference Date

4/27/2017 0:00

Dilution Activity

2.59

pCi per gram ==&gt; dpm/g

5.75

Verif. Date Decay Corrected

2.59

pCi per gram ==&gt; dpm/g

5.75**Minimum of 3 Required**

Trial ID	Sample Counts	Count Time (min)	Detector	Efficiency	Bkg. (cpm)	Net Weight	Decay Corrected Activity Result (dpm/g)	Decay Corrected Activity Result (pCi/g)
S-0324-V2	17.76	1	LSC	0.3007	9.00	5.027	5.79	2.61
S-0324-V3	18.32	1	LSC	0.3033	9.00	5.071	6.06	2.73
S-0324-V4	17.74	1	LSC	0.3041	9.00	5.019	5.73	2.58
S-0324-V5	18.62	1	LSC	0.3036	9.00	5.008	6.33	2.85

**10% Max****PASS**

Standard Deviation percent of known concentration

**5% Max****PASS**

Target Activity

% Diff

Average

Two Sigma Uncertainty

Average	5.98	2.69
Two Sigma Uncertainty	0.54	0.24
Standard Deviation percent of known concentration	4.77%	4.77%
Target Activity	5.75	2.59
% Diff	3.93%	3.93%

Verification Expiration Date: April 27, 2018

Prepared &amp; Counted By

Date: 4/27/2017 0:00

Verified &amp; Approved By

Date: 4-28-17

QC Approval

Date: 04-28-17**S-0324****H-3**Verified 4/28/17**SL****Expires****4/28/18****Manufacturer****NIST SRM 4927F****Sol Matrix****H2O****Ref No****NIST SRM 4927F****Tech****Unknown****Parent ID****S-0316****RADIOACTIVE STANDARDS -- BATON ROUGE LABORATORY**

Q:\QAO\QA Assistant Folder\01 Documenting(sharedocs)\01 Documentation\01 Standards\Standard Verification Calculation(without plating recovery)

ARS-038



## Add / Edit Secondary Standards

Planning		Parent Standard Data			
Planning Comments	Create H-3 LCS standard	Parent Solution Reference #	NIST SRM 4927F		
Target dpm/g (on dil, date)	6	Parent Solution #	S-0316		
Target Final Volume mL	2000.00	Parent Principal Radionuclide	H-3	Half Life (Days)	4499.8
Appx mass g of Parent Sol'n	5.23779991812081	Parent Reference Data	08/10/2016 14:49		
Appx vol ml of Parent Sol'n	5.24724495904709	Parent Certified Act	2384.43044412127	Cert Act/Vol Units	dpm g
Expected Addition for Analysis g	5	Parent Cert Act Uncert 1 Sigma	0.0036		
		Parent Sp. Gravity G/ML	0.9982		
		Parent Supplier	NIST SRM 4927F		
		Parent Date Recvd	01/01/00		
		Parent Received By	Unknown		
		Parent Cert Exp Date			
		Parent Matrix	H2O		
		Certified dpm/g At Ref Date	607764.948573606		
		Certified dpm/g On 04/27/2017 0:00	583960.313234318		
		Parent Comments	Intermediate level H-3 standard for creating LCS solutions and matrix spikes. Dilution performed as stated above by Jacob Byrd- JPB 08/10/2016		
		Parent Tech	Unknown		
		Is Primary	FALSE		
		Is LCS	TRUE		
		Is Tracer	FALSE		
		Is Calib	FALSE		
<b>Standards Preparation / Dilution</b>					
Secondary Solution #	S-0324				
Dilution Date (New Ref Date)	04/27/2017 0:00				
Ampoule, Empty (g)					
Ampoule/Solution Gross (g)					
Net Wt Removed (g)					
Transfer Container, empty (g)	17.2688				
Container Plus Solution(g)	22.2799				
Net Wt Transferred (g)	5.0111				
DPM Xferred On04/27/2017 0:00	11480.6218145069				
Diluent/matrix	DI Water				
Diluent Density Cont, empty (g)	1E-05				
Test Mass of 5 ml of Diluent (g)					
Diluent Density Test - (g/mL)					
Dilution Empty Container Mass (g)	415.17				
Dilution Full Cont g (If measured)	2411.11				
Dilution Final Volume ml (If measured)	2000				
Final Dilution Density (g/mL)	0.99797				
Final Dilution Measured Mass g	1995.94				
Comments					
Final Dilution dpm/g	5.75198744176021				
Final Dil New Ref Date/Time	04/27/2017 0:00				

Protocol# 11 - H3 Normal Lvl 2.1sa

User: ARS

## Assay Definition

## Assay Description:

H3 Normal Lvl

Assay Type: DPM (Single)

Report Name: Report1

Output Data Path: C:\Packard\Tricarb\Results\ARS\H3 Normal Lvl 2\20170427\_1250

Raw Results Path: C:\Packard\Tricarb\Results\ARS\H3 Normal Lvl 2\20170427\_1250\20170427\_1250.results

RTF File Name: C:\Packard\Tricarb\Results\ARS\H3 Normal Lvl 2\20170427\_1250\H3 Results.rtf

Comma-Delimited File Name: C:\Packard\Tricarb\Results\ARS\H3 Normal Lvl 2\20170427\_1250\H3 Results.csv

Assay File Name: C:\Packard\Tricarb\Assays\H3 Normal Lvl 2.1sa

## Count Conditions

Nuclide: Standard H3

Quench Indicator: tSIE/AEC

External Std Terminator (sec): 0.5 2s%

Pre-Count Delay (min): 0.00

Quench Set:

Low Energy: PE UG STD H3

Count Time (min): 120.00

Count Mode: Normal

Assay Count Cycles: 1

#Vials/Sample: 1

Repeat Sample Count: 1

Calculate % Reference: Off

## Background Subtract

Background Subtract: Off

Low CPM Threshold: Off

2 Sigma % Terminator: On - Any Region

Regions	LL	UL	2Sigma % Terminator
A	2.0	18.6	0.50
B	0.0	2000.0	0.00
C	0.0	2000.0	0.00

## Count Corrections

Static Controller: On

Colored Samples: Off

Coincidence Time (nsec): 18

Luminescence Correction: n/a

Heterogeneity Monitor: n/a

Delay Before Burst (nsec): 75

Cycle 1 Results											
P#	S#	SMPL_ID	CPMA	DPM1	tsIE	Eff Nucl	In A	Count	Time	DATE	TIME
11	1	BACKGROUND	9.00	29.71	381.35		30.28	120.00		4/27/2017	12:51:17 PM
11	2	S-0234-V1	18.75	62.31	378.81		30.09	120.00		4/27/2017	3:03:56 PM
11	3	S-0234-V2	17.76	59.04	378.52		30.07	120.00		4/27/2017	5:16:35 PM
11	4	S-0234-V3	18.32	60.43	381.90		30.33	120.00		4/27/2017	7:29:15 PM
11	5	S-0234-V4	17.74	58.34	382.99		30.41	120.00		4/27/2017	9:41:55 PM
11	6	S-0234-V5	18.62	61.34	382.40		30.36	120.00		4/27/2017	11:54:37 PM

0324

JB

04-28-17

0324 JB 0428-17

S-0234 Verification Weights

Tech:	JPB
Pipette:	FJ15820
Scale ID:	12332539
Standard ID:	S-0234

Sample ID	Std. Weight(g)
S-0234-V1	5.0073
S-0234-V2	5.0271
S-0234-V3	5.0171
S-0234-V4	5.0189
S-0234-V5	5.0077

JB 0324  
04-28-17



2609 North River Road • Port Allen, Louisiana 70767

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1 (800) 401-4277 • Fax (225) 381-2996

# **American Radiation Services Analytical Reports**

**for**

**Los Alamos National Laboratory**

# **Folder Duplicate**



## Report Compilation Checklist

ARS SDG: 18-00556

Client Name: LANL

Sample Matrix: AQ

### LEVEL 1 COMPONENTS

	1st Reviewer			
1) Cover Page Complete and Accurate (see ARS-059)?	Yes	No	N/A	
2) Technical Review Checklist(s) Complete and Accurate?	Yes	No	N/A	
3) Case Narrative Complete and Accurate (see ARS-059)? <small>Include subcontractor name and information</small>	Yes	No	N/A	
4) Form 1s Present for all Samples and Tests? <small>Note: Ensure original Subcontract Forms 1s included if applicable.</small>	Yes	No	N/A	
5) Client Specific Components are Present and Complete?	Yes	No	N/A	

### LEVEL 2 COMPONENTS

	1st Reviewer			
6) Batch Quality Control Report is Present and Accurate? <small>Include subcontractor QC reports if applicable</small>	Yes	No	N/A	
7) DQO Report is Present and Accurate?	Yes	No	N/A	
8) Client Specific Batch QC Components are Present and Complete?	Yes	No	N/A	

### LEVEL 3 COMPONENTS

Ensure all original subcontractor information is included, if applicable

	1st Reviewer			
9) Efficiencies are Present?	Yes	No	N/A	
10) Calibrations are Present?	Yes	No	N/A	
11) Backgrounds are Present?	Yes	No	N/A	
12) Spectrum Analysis is Present?	Yes	No	N/A	
13) Spectral Plots are Present?	Yes	No	N/A	
14) Plateaus are Present?	Yes	No	N/A	
15) Control Charts are Present?	Yes	No	N/A	
16) Other:	Yes	No	N/A	

### LEVEL 4 COMPONENTS

Ensure all original subcontractor information is included, if applicable

	1st Reviewer			
17) Preparation Raw Data Present and Complete?	Yes	No	N/A	
18) Instrument Raw Data Present and Complete?	Yes	No	N/A	
19) Calibration Certificates Present?	Yes	No	N/A	
20) Copies of Log Book Pages Present?	Yes	No	N/A	
21) Sample Receiving Documentation Present?	Yes	No	N/A	
22) LIMS Reports Present?	Yes	No	N/A	
23) Applicable Correspondence Present?	Yes	No	N/A	
24) Other:	Yes	No	N/A	

*[Signature]*  
Report Generator Signature

4-25-18  
Date

*[Signature]*  
Management Review Signature

4-25-18  
Date





# LSC Technical Review Checklist

ARS SDG ARS1-18-00556

Sample Matrix: AQ Aliquot (Circle One): Dry As Received ☒ Filtered Other: \_\_\_\_\_

Required QC Samples (Mark all that apply): Blank LCS LCSD Sample Dup MS MSD

ARS A. Batch ID(s): Batch A: B18-00442 Batch B: N/A Batch C: N/A

Test Method(s): LSC-LLH3/SC-AQ N/A N/A

## A. RADIOCHEMICAL PREPARATION REVIEW

	Chemist Review			Verifier Review		
1) 100% of Manual Transcriptions Verified?	<input checked="" type="radio"/> Yes	No	N/A	<input checked="" type="radio"/> Yes	No	N/A
2) 100% of Manual Calculations Verified?	Yes	No	<input checked="" type="radio"/> N/A	Yes	No	<input checked="" type="radio"/> N/A
3) Blank Composition/Configuration Matches Calibration?	<input checked="" type="radio"/> Yes	No	N/A	<input checked="" type="radio"/> Yes	No	N/A
4) Deviations from procedure are documented and verified?	Yes	No	<input checked="" type="radio"/> N/A	Yes	No	<input checked="" type="radio"/> N/A
5) Appropriate Cocktail Selected?	<input checked="" type="radio"/> Yes	No	N/A	<input checked="" type="radio"/> Yes	No	N/A
6) Sample Prep Anomaly? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (See Tech Notes) NCR # (If initiated): _____						
Melisa Morgan 2-28-18 Chemist Signature Date			[Signature] 2-28-18 Verifier Review Signature Date			

## B. ANALYSIS REVIEW

	Analyst Review			QA Officer Review		
1) Calibrations Valid and Current?	<input checked="" type="radio"/> Yes	No	N/A	Yes	No	N/A
2) Backgrounds Valid and Current?	<input checked="" type="radio"/> Yes	No	N/A	Yes	No	N/A
3) Source Checks Completed and Acceptable?	<input checked="" type="radio"/> Yes	No	N/A	Yes	No	N/A
			QA Officer Signature _____ Date _____			
	Analyst Review			Technical Review		
4) Background Checks Complete and Acceptable?	<input checked="" type="radio"/> Yes	No	N/A	Yes	No	N/A
5) 100% of Manually Entered Parameters Verified Accurate?	<input checked="" type="radio"/> Yes	No	N/A	Yes	No	N/A
6) Appropriate QC samples initiated at required frequency?	<input checked="" type="radio"/> Yes	No	N/A	Yes	No	N/A
6) Test/Sample Specific Parameters (See ARS-059 for details)						
a) Analysis Parameters Checked and Correct and Peak Shapes are Acceptable?	<input checked="" type="radio"/> Yes	No	N/A	Yes	No	N/A
b) Spectra show no Evidence of Interferences?	<input checked="" type="radio"/> Yes	No	N/A	Yes	No	N/A
c) Sample Quench for All Samples within Range of Quench Curve?	<input checked="" type="radio"/> Yes	No	N/A	Yes	No	N/A
7) Analysis Anomaly? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (See Comments) NCR # (If initiated): _____						
Melisa Morgan 3-5-2018 Analyst Signature Date			NA Technical Reviewer Signature Date			



**LSC**  
**Technical Review Checklist**

Batch A: B18-00442

**C. BATCH QC VALIDATION**

	Proj. Mgr. Review	QA Officer Review
1) Activity + 3xCSU a Negative Number?	Yes   No <u>N/A</u>	Yes   No <u>N/A</u>
2) RDL Criteria are Met?	Yes   No <u>N/A</u>	Yes   No <u>N/A</u>
3) Method Blank Criterion Met?	Yes   No <u>N/A</u>	Yes   No <u>N/A</u>
4) LCS/LCD Criteria Met?	Yes   No <u>N/A</u>	Yes   No <u>N/A</u>
5) Duplicate (Sample Duplicate, LCSD, MSD) Criteria Met?	Yes   No <u>N/A</u>	Yes   No <u>N/A</u>
6) MS/MSD Criteria Met?	Yes   No <u>N/A</u>	Yes   No <u>N/A</u>
7) Batch QC Anomaly? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (See Tech Notes)   NCR # (If initiated): _____		
<u>NA</u> Project Manager Signature	_____ Date	<u>NA</u> QA Officer Signature
_____ Date		

**GENERAL COMMENTS**



# LSC Technical Review Checklist

ARS SDG ARS1-18-00556

Sample Matrix: AQ Aliquot (Circle One): Dry As Received ☒ Filtered Other: \_\_\_\_\_

Required QC Samples (Mark all that apply): Blank ☒ LOS ☒ LOSD ☒ Sample Dup MS MSD

ARS A. Batch ID(s): Batch A: B18-00506 Batch B: N/A Batch C: N/A

Test Method(s): LSC-LLH3-AQ N/A N/A

## A. RADIOCHEMICAL PREPARATION REVIEW

	Chemist Review			Verifier Review		
1) 100% of Manual Transcriptions Verified?	<input checked="" type="checkbox"/> Yes	No	N/A	<input checked="" type="checkbox"/> Yes	No	N/A
2) 100% of Manual Calculations Verified?	Yes	No	<input checked="" type="checkbox"/> N/A	Yes	No	N/A
3) Blank Composition/Configuration Matches Calibration?	<input checked="" type="checkbox"/> Yes	No	N/A	Yes	No	N/A
4) Deviations from procedure are documented and verified?	Yes	No	<input checked="" type="checkbox"/> N/A	Yes	No	N/A
5) Appropriate Cocktail Selected?	<input checked="" type="checkbox"/> Yes	No	N/A	Yes	No	N/A
6) Sample Prep Anomaly? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (See Tech Notes) NCR # (If initiated): _____						
Chemist Signature <u>Scott Casey</u>			Date <u>4-20-18</u>	Verifier Review Signature <u>No Verifier Present</u>		Date <u>4-24-18</u>

## B. ANALYSIS REVIEW

	Analyst Review			QA Officer Review		
1) Calibrations Valid and Current?	<input checked="" type="checkbox"/> Yes	No	N/A	<input checked="" type="checkbox"/> Yes	No	N/A
2) Backgrounds Valid and Current?	<input checked="" type="checkbox"/> Yes	No	N/A	<input checked="" type="checkbox"/> Yes	No	N/A
3) Source Checks Completed and Acceptable?	<input checked="" type="checkbox"/> Yes	No	N/A	<input checked="" type="checkbox"/> Yes	No	N/A
QA Officer Signature <u>[Signature]</u>			Date <u>4-24-18</u>			
	Analyst Review			Technical Review		
4) Background Checks Complete and Acceptable?	<input checked="" type="checkbox"/> Yes	No	N/A	<input checked="" type="checkbox"/> Yes	No	N/A
5) 100% of Manually Entered Parameters Verified Accurate?	<input checked="" type="checkbox"/> Yes	No	N/A	<input checked="" type="checkbox"/> Yes	No	N/A
6) Appropriate QC samples initiated at required frequency?	<input checked="" type="checkbox"/> Yes	No	N/A	<input checked="" type="checkbox"/> Yes	No	N/A
6) Test/Sample Specific Parameters (See ARS-059 for details)						
a) Analysis Parameters Checked and Correct and Peak Shapes are Acceptable?	<input checked="" type="checkbox"/> Yes	No	N/A	<input checked="" type="checkbox"/> Yes	No	N/A
b) Spectra show no Evidence of Interferences?	<input checked="" type="checkbox"/> Yes	No	N/A	<input checked="" type="checkbox"/> Yes	No	N/A
c) Sample Quench for All Samples within Range of Quench Curve?	<input checked="" type="checkbox"/> Yes	No	N/A	<input checked="" type="checkbox"/> Yes	No	N/A
7) Analysis Anomaly? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (See Comments) NCR # (If initiated): _____						
Analyst Signature <u>Scott Casey</u>			Date <u>4-24-18</u>	Technical Reviewer Signature <u>[Signature]</u>		Date <u>4-24-18</u>



**DQO Report for SDG**  
ARS1-18-00556

Client Name: Los Alamos National Laboratory      Profile Name: Nita Patel (Site Alias)      Report Level: 4

Analysis Code	Prep Type	Units	Aliquot	Prep Code	Procedure	Count Time					
LSC-LLH3/SC-AQ	WRAD	pCi	L		ARS-054						
		Analyte		RDL	LCS LL/UL	MS LL/UL	RadY LL/UL	GravY LL/UL	RER	RPD	Surt LL/UL
	H-3			150 pCi/L	75/125	60/140	30/120	40/110	1	25	N/A
LSC-LLH3-AQ	WRAD	pCi	L	N/A	ARS-040						
		Analyte		RDL	LCS LL/UL	MS LL/UL	RadY LL/UL	GravY LL/UL	RER	RPD	Surt LL/UL
	Enriched H-3			3.221 pCi/L	80/120	60/140	30/120	40/110	1	25	N/A

DQO Report for SDG  
ARS1-18-00556

Analysis Code	Fraction	Units	Aliquot	Conductivity	Analyte Count
LSC-LLH3/SC-AQ	001	pCi	L	N/A	1
		Group		H-3	
LSC-LLH3/SC-AQ	002	pCi	L	N/A	1
		Group		H-3	
LSC-LLH3/SC-AQ	003	pCi	L	N/A	1
		Group		H-3	
LSC-LLH3/SC-AQ	004	pCi	L	N/A	1
		Group		H-3	
LSC-LLH3/SC-AQ	005	pCi	L	N/A	1
		Group		H-3	
LSC-LLH3-AQ	001	pCi	L	N/A	1
		Group		Enriched H-3	
LSC-LLH3-AQ	002	pCi	L	N/A	1
		Group		Enriched H-3	
LSC-LLH3-AQ	003	pCi	L	N/A	1
		Group		Enriched H-3	
LSC-LLH3-AQ	004	pCi	L	N/A	1
		Group		Enriched H-3	
LSC-LLH3-AQ	005	pCi	L	N/A	1
		Group		Enriched H-3	

## SDG Report - Samples and Containers

SDG Specific Data									
SDG	ARS1-18-00556			TAT Days	40	Project Type	Environmental		
Sample Count	5	Rpt Level	4	Date Received	2/23/2018	COC Number	2018-1812		
Client	Los Alamos National Laboratory			Client Deadline	4/4/2018	PO Number			
Client Code	114			Internal Deadline	4/3/2018	Job Number			
Profile Number	PN-00094			Lab Deadline	4/1/2018	Job Location			
Comment									

Samples and Containers Checked In Thus Far												
FR	Name	Matrix	Start Date	End Date	Disp	Hold	Arch	Storage	Conductivity		Comments	
001	CAWA-18-36	AQ	2/16/2018 12:15 PM	2/16/2018 12:15 PM	H	90	5	K6				
	IC_ID	Cnt	Volume (mL)	Container Type	pH Orig	pH Final	CPM	uR Hr	VOA	Head	Temp (C)	
	287085	1	1000.00	HDP Container	7	7	90	20	N	N/A	0	
002	CAWA-18-127	AQ	2/16/2018 12:15 PM	2/16/2018 12:15 PM	H	90	5	K6				
	IC_ID	Cnt	Volume (mL)	Container Type	pH Orig	pH Final	CPM	uR Hr	VOA	Head	Temp (C)	
	287086	1	1000.00	HDP Container	7	7	90	20	N	N/A	0	
003	CAWA-18-40	AQ	2/16/2018 11:01 AM	2/16/2018 11:01 AM	H	90	5	K6				
	IC_ID	Cnt	Volume (mL)	Container Type	pH Orig	pH Final	CPM	uR Hr	VOA	Head	Temp (C)	
	287087	1	1000.00	HDP Container	7	7	90	20	N	N/A	0	
004	CAWA-18-43	AQ	2/16/2018 9:39 AM	2/16/2018 9:39 AM	H	90	5	K6				
	IC_ID	Cnt	Volume (mL)	Container Type	pH Orig	pH Final	CPM	uR Hr	VOA	Head	Temp (C)	
	287088	1	1000.00	HDP Container	7	7	90	20	N	N/A	0	
005	CAWA-18-56	AQ	2/21/2018 10:44 AM	2/21/2018 10:44 AM	H	90	5	K6				
	IC_ID	Cnt	Volume (mL)	Container Type	pH Orig	pH Final	CPM	uR Hr	VOA	Head	Temp (C)	
	287089	1	1000.00	HDP Container	7	7	90	20	N	N/A	0	

## SDG Report - Analysis Assignments

SDG	ARS1-18-00556	Sample Count	
Client	Los Alamos National Laboratory	Analysis Count	2-10

Sample Count Totals Per Analysis			
Analysis Code	Analysis Description	In/Out	Samples Count
LSC-LLH3/SC-AQ	Low Level Tritium Screen in (Aqueous)	I	5
LSC-LLH3-AQ	Low Level Tritium by Enrichment Process in (Aqueous [AQ])	I	5

Analyses Assigned Per Fraction		
Fraction	Analysis Code	X = Assigned
001	LSC-LLH3/SC-AQ	X
001	LSC-LLH3-AQ	X
002	LSC-LLH3/SC-AQ	X
002	LSC-LLH3-AQ	X
003	LSC-LLH3/SC-AQ	X
003	LSC-LLH3-AQ	X
004	LSC-LLH3/SC-AQ	X
004	LSC-LLH3-AQ	X
005	LSC-LLH3/SC-AQ	X
005	LSC-LLH3-AQ	X



# ARS FILE TRACKING SHEET

SDG: ARS1-18-00556

Task	Date / Time	Initials
Date & Time Samples Received	2/23/18 09:30	MC
ICOC Initiated/Storage Location: <u>K6</u>	2/23/18 12:18	MC
Technical Checks Performed	<i>See Batch</i>	
Report Written / EDD Generated <u>4-24-18 1448</u> <i>ADH</i>	<u>4-24-18 1457</u>	<i>ADH</i>
Report / EDD Reviewed for accuracy and completeness	<u>4-25-18 8:20</u>	<i>EDD LKADH</i> <i>JL</i>
Quality Assurance Checks Performed on Report	<u>4-26-18</u>	
Management Checks Performed on Report	<u>1115</u>	<i>JL</i>
<i>Preliminary Report Scan</i>		
Report E-mailed/Faxed		
Invoice Completed      Invoice #: _____		
Requires Report Mailed      Yes / No		
Requires Original COC mailed      Yes / No		
Report Reviewed and Imaged		

## SPECIAL REQUIREMENTS

Requirement	Yes	No
3 Hour Rush	<input type="checkbox"/>	<input checked="" type="checkbox"/>
24 Hour Rush	<input type="checkbox"/>	<input checked="" type="checkbox"/>
48 Hour Rush	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3 Day Rush	<input type="checkbox"/>	<input checked="" type="checkbox"/>
5 Day Rush	<input type="checkbox"/>	<input checked="" type="checkbox"/>
10 Day Rush	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Standard Oil/Gas Client (5 Day)	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Standard Turnaround	<input checked="" type="checkbox"/>	<input type="checkbox"/>

### NOTES

COMPANY NAME LANL

SDG: APSI-18-00596

## SHIPPING CONTAINER

Good Condition	<del>Yes</del>	<input type="checkbox"/> No
Radioactive	Yes	<del>No</del>
UN2810	Yes	<del>No</del>
Sec. Seal	<del>Yes</del>	<input type="checkbox"/> No
Seals intact	<del>Yes</del>	<input type="checkbox"/> No <input type="checkbox"/> N/A
Air Bill	Yes	<del>No</del>

**COC PRESENT WITH SAMPLES**

COC ☒ Yes ☐ No

**SAMPLE CONTAINER(S)**

Good Condition	Yes	<input checked="" type="checkbox"/>	No	<input type="checkbox"/>
Sec. Seal	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
Seal intact	Yes	<input type="checkbox"/>	No	<input type="checkbox"/> N/A
Rad or Oils	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>

Marked Radiograph: ☐ Yes ☒ No

# Sample Rev

Matr: AF, AO, BI, FE, LT, SI, SO, UF VG1

### External and Internal Surveys

Exposure Rate Meter: M3 269164 Serial No.: PR 256427 Calibration Due Date: 3/13/18

Count Rate Meter: **M2 154359** Serial No.: **PR 121649** Calibration Due Date: **3/9/18**

Background Exposure Rate ( $\mu\text{R/hr}$ )	20	Max. Exposure Rate on Shipping Containers Externals (Plus Bkgd.)	20	$\mu\text{R/hr}$
--	----	--	----	------------------

Background Count Rate (cpm) 90 Shipping Container & External (Plus Bkgd) 90 cpm

Max. Removable Count Rate on  
Shipping Containers Internals  
(Plus Bkgd) 70 cpm

### Acceptance Limits

$$<500 \mu R/hr \quad <100 \text{ cpm/cm}^2$$

pH - 2 is Acceptable

[illegible]

Surveyors'  
Name:

Date Time Surveyed:

2-23-18 0930

# Chain of Custody/Analysis Request

COC/Lab Request #:

2018-1812

Page 1 of 1

American Radiation

Baton Rouge LA

Site Name: Los Alamos National Laboratory

Lab Agreement #:

Project Number: ADEP

Analysis Turnaround Time:

24 Hour - ☐ Other - ☐

7 Days - ☐

14 Days - ☐

21 Days - ☐

28 Days - ☒

Rad Screening Info:

location; no

Lab Reporting Limit Type:

Method Detection Limit

Field Sample ID

CAWA-18-36

CAWA-18-127

CAWA-18-40

CAWA-18-43

CAWA-18-56

Sample Date

Feb 16 2018

Feb 16 2018

Feb 16 2018

Feb 16 2018

Feb 21 2018

Sample Time

12:15

12:15

11:01

9:39

10:44

Sample Matrix

W

W

W

W

W

WSP-LL-H-3

1

1

1

1

1

Special Instructions:

Relinquished by: Renee Onstiff

Relinquished by:

Relinquished by:

Print Name: Renee Onstiff

Print Name:

Print Name:

Date/Time: 2/21/18

Date/Time:

Date/Time:

Received by: Myra J. Hill

Received by:

Received by:

Print Name: Myra J. Hill

Print Name:

Print Name:

Date/Time: 2-23-18

Date/Time:

Date/Time:

ORIGIN ID:SAFA (505) 665-9966  
KEITH GREENE  
LOS ALAMOS NATL LAB.  
TA00 BLDG 1237 DPU 03

LOS ALAMOS, NM 87545  
UNITED STATES US

SHIP DATE: 22FEB18  
ACTWGT: 21.0 LB MAN  
CAD: 0014176/CAFE2916

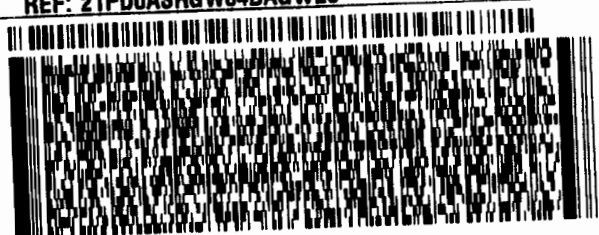
BILL SENDER

TO **DANNY COLEMAN**  
**AMERICAN RADIATION SERVICES**  
**2609 NORTH RIVER ROAD**

**PORT ALLEN LA 70767**

(800) 401-4277

REF: 21PD0ASRGW04BAGWEO



**FedEx**  
Express



J1513150813010Y

TRK# 5908 1783 5451  
0201

**FRI - 23 FEB 10:30A**  
**PRIORITY OVERNIGHT**

**XH OPLA**

**70767**  
**LA-US MSY**



Part # 156145V-434 RIT 2 EXP 02/18