

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]

Sampling Plan ID/Name: 11694

R-27i (R-27)

COC: 2018-2173

Page 2 of 2

TEST - Explosives	YES	NO	
Samples collected from a WFO area? (TAs -8, 9, 11, 16, 37, 14, 15, 36, 22, 39, 40, and 49)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Field Test for Explosives Results	YES	NO	NA
HE SPOT test result positive. If YES - Do not transport.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

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

TEST - Field Screen	YES	NO			
The sample has field screening measurements of alpha and beta activity?	<input type="checkbox"/>	<input checked="" type="checkbox"/>			
Sample Activity (dpm/100cm ²)	Shipment Activity (dpm/g/100cm ²)	Sampled Location	YES	NO	NA
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 type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Alpha \geq 125	AND Alpha \geq 1,250,000	AT other locations	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Beta \geq 1,500	AND Beta \geq 15,000,000	AT any location	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
The sample Alpha \geq 16,000,000 dpm/g/100cm ² or Beta \geq 160,000,000 dpm/g/100cm ² . If YES - Do not ship.					
On the external surface of the sample container, alpha activity \geq 24 dpm/cm ² , beta activity \geq 240 dpm/cm ² , or surface activity \geq 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 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"/>	<input type="checkbox"/>			
Sample Activity (pCi/g)	Shipment Activity (pCi)	YES	NO	NA	
Am-241 \geq 27 pCi/g	AND Am-241 \geq 270,000 pCi Total	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Cs-137 \geq 270 pCi/g	AND Cs-137 \geq 270,000 pCi Total	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Pu-238 \geq 27 pCi/g	AND Pu-238 \geq 270,000 pCi Total	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Pu-239/240 \geq 27 pCi/g	AND Pu-239/240 \geq 270,000 pCi Total	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Th-228 \geq 27 pCi/g	AND Th-228 \geq 270,000 pCi Total	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
U-234 \geq 270 pCi/g	AND U-234 \geq 1,600,000,000 pCi Total	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
U-238 \geq 270 pCi/g	AND U-238 \geq unlimited	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
H-3 \geq 27,000,000 pCi/g	AND H-3 \geq 27,000,000,000 pCi Total	<input type="checkbox"/>	<input type="checkbox"/>	<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.					
The sample is tentatively identified as DOT hazard Class 7 (Radioactive). The shipment is labeled Radioactive Material, Excepted Package - Limited Quantity of Material - UN2910, based on prior analytical measurements of radioactive isotopes.					

TEST - AK	YES	NO	NA
The shippers documented knowledge of the sample positively identifies appropriate labeling.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Documented Field Team Member Statement	YES	NO	NA
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 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	Date/Time
(Printed Name) Tanya Vander Vis (Signature) Tanya Vander Vis	3-9-18 1340

Hazard Assessment Reviewed	Date/Time
(Printed Name) D. Sherwood (Signature) D. Sherwood	3-9-18 1340

ER-SOP-10094, R1, Attachment 1

Shipping Classification Determination Checklist

Page 2 of 2

Sampling Plan ID/Name: 11694

R-27, R-27

coc: 2018-2173

TEST - Explosives				YES	NO	
Samples collected from a WFO area? (TAs -8, 9, 11, 16, 37, 14, 15, 36, 22, 39, 40, and 49)				<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Field Test for Explosives Results				YES	NO	NA
HE SPOT test result positive. If YES - Do not transport.				<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
TEST - Chemical Preservation				YES	NO	
Samples are chemically preserved?				<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Field Team Member Statement				YES	NO	NA
Chemical preservation exceeds limits given 40 CFR 136, Table II - Required Containers, Preservation Techniques and Holding Times (footnote 3). If YES - Do not ship.				<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
TEST - Field Screen				YES	NO	
The sample has field screening measurements of alpha and beta activity?				<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Sample Activity (dpm/100cm ²)	Shipment Activity (dpm*g/100cm ²)	Sampled Location		YES	NO	NA
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 type="checkbox"/>	<input checked="" type="checkbox"/>
Alpha ≥ 125	AND Alpha ≥ 1,250,000	AT	other locations	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Beta ≥ 1,500	AND Beta ≥ 15,000,000	AT	any location	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
The sample Alpha ≥ 16,000,000 dpm*g/100cm ² or Beta ≥ 160,000,000 dpm*g/100cm ² . If YES - Do not ship.				<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
On the external surface of the sample container, alpha activity ≥ 24 dpm/cm ² , beta activity ≥ 240 dpm/cm ² , or surface activity ≥ 0.5 mR/hr. If YES - Do not ship.				<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
The sample is tentatively identified as DOT hazard Class 7 (Radioactive). The shipment is labeled <i>Radioactive Material, Excepted Package - Limited Quantity Material - UN2910</i> , based on field screening measurements of alpha and beta activity.				<input type="checkbox"/>	<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	NA
Am-241 ≥ 27 pCi/g	AND	Am-241 ≥ 270,000 pCi Total		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Cs-137 ≥ 270 pCi/g	AND	Cs-137 ≥ 270,000 pCi Total		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Pu-238 ≥ 27 pCi/g	AND	Pu-238 ≥ 270,000 pCi Total		<input type="checkbox"/>	<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 type="checkbox"/>	<input checked="" type="checkbox"/>
Th-228 ≥ 27 pCi/g	AND	Th-228 ≥ 270,000 pCi Total		<input type="checkbox"/>	<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 type="checkbox"/>	<input checked="" type="checkbox"/>
U-238 ≥ 270 pCi/g	AND	U-238 ≥ unlimited		<input type="checkbox"/>	<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 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 type="checkbox"/>	<input checked="" type="checkbox"/>
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> , based on prior analytical measurements of radioactive isotopes.				<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
TEST - AK				YES	NO	NA
The shippers documented knowledge of the sample positively identifies appropriate labeling.				<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Documented Field Team Member Statement				YES	NO	NA
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 type="checkbox"/>	<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	Date/Time
(Printed Name) Tanya VanderVis (Signature) Tanya VanderVis	3-9-18 1340

Hazard Assessment Reviewed	Date/Time
(Printed Name) S. Sherwood (Signature) S. Sherwood	3-9-18 1340

ER-SOP-10094, R1, Attachment 1

DATA VALIDATION REPORT

Chain Of Custody No. 2018-2173

1. Distribution Of Samples In EDD.

SDG	Analytical Method	Regular Samples	Field Duplicates	Trip Blanks	Field Blanks	Equipment Blanks
ARS1-18-00856	Generic:Low_Level_Tritium	2				

SDG	Analytical Method	Analysis Lot ID	Prep Lot ID	Regular Samples	Field Duplicates	Trip Blanks	Field Blanks	Equipment Blanks	Method Blanks	Matrix Spikes	Matrix Spike Dups	Analytical Spikes	Post-Digestion Spikes	Lab Control Samples	Lab Control Sample Dups	Blank Spike	Blank Spike Dups	Lab Duplicates	Storage Blanks	Preparation Blanks	Reagent Blanks
ARS1-18-00856	Generic:Low_Level_Tritium	ARS1-B18-	ARS1-B18-	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	CAWA-18-151437	ARS1-B18-00684-04	REG	1	0	0	0
Generic:Low_Level_Tritium	RAD	CAWA-18-151439	ARS1-B18-00684-05	REG	1	0	0	0
Generic:Low_Level_Tritium	RAD	LCS	ARS1-B18-00684-01	LCS	0	0	1	0
Generic:Low_Level_Tritium	RAD	LCSD	ARS1-B18-00684-02	LCSD	0	0	1	0
Generic:Low_Level_Tritium	RAD	MB	ARS1-B18-00684-03	MB	1	0	0	0

3. Are any analytes missing?

No.

4. Were any holding times exceeded?

No.

5. Any contaminants in blanks?

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

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?

LCS Lab Sample	LCSD Lab	Analytical Method	Parameter Name	Lab Lot ID	Analysis	Sample Matrix	LCS Spike Recovery	LCSD Spike Recovery	Upper Limit	Lower Limit	Upper Rejection Limit	Lower Rejection Limit	RPD	RPD Limit
ARS1-B18-00684-01	ARS1-B18-00684-02	Generic:Low_Level_Tritium	Tritium	ARS1-B18-00684	05-22-2018	W	77.000	87.000	120.00	80.000		10	10.136	

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.

DATA VALIDATION REPORT

13. Display Flagged Data.

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-27	2018-2173	CAWA-18-151437	REG	INIT	RAD	Generic:Low_Level_Tritium	Tritium	U	U	R5	N	-0.263	pCi/L	-0.263	pCi/L	2.490	0.729	W	03/09/2018		ARS1-B18-00684	VAL	Y
R-27i	2018-2173	CAWA-18-151439	REG	INIT	RAD	Generic:Low_Level_Tritium	Tritium	U	U	R5	N	-0.587	pCi/L	-0.587	pCi/L	2.435	0.711	W	03/09/2018		ARS1-B18-00684	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
CAWA-18-151437	R-27	REG	Generic:Low_Level_Tritium	0	1
CAWA-18-151439	R-27i	REG	Generic:Low_Level_Tritium	0	1



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ARS Aleut Analytical Reports

for

Los Alamos National Laboratory

Request Number: 2018-2173

SDG: ARS1-18-00856



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ARS Aleut Analytical Reports

for

**Los Alamos National Laboratory
Request: 2018-2173**

Original COC

[illegible]



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ARS Aleut Analytical Reports

for

**Los Alamos National Laboratory
Request: 2018-2173**

Case Narrative



ARS Aleut Analytical, LLC

Laboratory Analysis Report

ARS1-18-00856

Prepared for:

Los Alamos National Laboratory

**Sean Sandborgh
TA-03, SM271
Los Alamos, NM 87545**

sean.sandborgh@em-la.doe.gov

Phone: 505-309-1178

Project Manager Review

Notes: ARS Aleut Analytical, 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**



May 24, 2018

Sean Sandborgh
TA-03, SM271
Los Alamos, NM 87545
505-665-9273
Sean.sandborgh@em-la.doe.gov

ARS SDG: **ARS1-18-00856**
Project Description: **2018-2173**
Project ID: **ADEP**

Dear Sean,

On March 16, 2018, ARS Aleut Analytical, LLC received two (2) 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.

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-18-151437	ARS1-18-00856-001
CAWA-18-151439	ARS1-18-00856-002

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 (ARS-040)".

The 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

Date

6-7-18



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.
- 3.0) Modified analyses are indicated by the subsequent addition of "m" to the procedure number (i.e. 900.0M).
All NIOSH method results are reported without blank corrections applied.

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[®] 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



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**ARS Aleut
Analytical Reports**

for

Los Alamos National Laboratory

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



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ARS Sample Delivery Group: ARS1-18-00856
Client Sample ID: CAWA-18-151437
Sample Collection Date: 03/09/18
Sample Matrix: Aqueous
Percent Solids: N/A

Request or PO Number: 2018-2173
ARS Sample ID: ARS1-18-00856-001
Date Received: 03/16/18
Report Date: 06/06/18

Radiochemistry

Analysis Description	Analysis Results	CSU +/-1s	MDC	DLC	CRDL	Qual	Analysis Units	Method	Analysis Date/Time	Analysis Technician	Tracer/Chem Recovery
Enriched H-3	-0.263	0.729	2.490	1.206	3.221	U	pCi/L	ARS-040/ARS-040	05/23/18 15:34	SCAUSEY	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: ARS1-18-00856

Client Sample ID: CAWA-18-151439

Sample Collection Date: 03/09/18

Sample Matrix: Aqueous

Percent Solids: N/A

Request or PO Number: 2018-2173

ARS Sample ID: ARS1-18-00856-002

Date Received: 03/16/18

Report Date: 06/06/18

Radiochemistry

Analysis Description	Analysis Results	CSU +/-1s	MDC	DLC	CRDL	Qual	Analysis Units	Method	Analysis Date/Time	Analysis Technician	Tracer/Chem Recovery
Enriched H-3	-0.587	0.711	2.435	1.180	3.221	U	pCi/L	ARS-040/ARS-040	05/23/18 21:16	SCAUSEY	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-B18-00684
SDG	ARS1-18-00856
Analysis	Low Level Tritium by Enrichment Process in
Analysis Test Method	ARS-040/LLH3
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	

Laboratory Control Sample			Analysis Date	05/23/18 04:10	Analysis Technician	SCAUSEY	
Analysis Batch Sample ID	QC Type	Analyte	Results	CSU (1s)	Expected Value	LCS Rec (%)	MDC
ARS1-B18-00684-02	LCSD	ENRICHED H-3	30.993	4.803	35.309	87.8	2.541

Duplicate RER/DER/RPD			Analysis Date	05/23/18 04:10	Analysis Technician	SCAUSEY	
Analyte	Results LCS	CSU LCS (1s)	Results LCSD	CSU LCSD (1s)	RER	DER	RPD
ENRICHED H-3	28.003	4.374	30.993	4.803	0.326	0.460	10.1

Method Blank			Analysis Date	05/23/18 09:52	Analysis Technician	SCAUSEY	
Analysis Batch Sample ID	QC Type	Analyte	Results	CSU (1s)	MDC	Qual	
ARS1-B18-00684-03	MBL	ENRICHED H-3	-0.904	0.730	2.497	U	

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**ARS Aleut
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for

Los Alamos National Laboratory

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

**Laboratory
Records**

Analytical Batch Report

Analysis Batch ID ARS1-B18-00684													
Method		ARS-040		Analysis		LSC-LLH3-AQ		Matrix		Aqueous			
Description		Low Level Tritium by Enrichment Process in (Aqueous [AQ])											
ABatch Sample ID	Type	Blind Iso1	Blind Iso2	Blind Iso3	SDG	FR	Run	Prep Code	Filtered	Client ID	Group Name	Lab Deadline	
ARS1-B18-00684-01	LCS	B-25245											
ARS1-B18-00684-02	LCSD	B-25246											
ARS1-B18-00684-03	MBL												
ARS1-B18-00684-04	TRG				ARS1-18-00856	001	1			CAWA-18-151437		05/09/18	
ARS1-B18-00684-05	TRG				ARS1-18-00856	002	1			CAWA-18-151439		05/09/18	

Analytical Batch Report

Analysis Batch ID ARS1-B18-00684												
Method		ARS-040		Analysis		LSC-LLH3-AQ		Matrix		AQ		
Description		Low Level Tritium by Electrolytic Enrichment										
Type	Blind Iso1	Blind Iso2	Blind Iso3	SDG	FR	Run	Prep Code	Filtered	Client ID	Group Name	Lab Deadline	
ABatch Sample ID												
ARS1-B18-00684-01	LCS											
ARS1-B18-00684-02	LCSD											
ARS1-B18-00684-03	MBL											
ARS1-B18-00684-04	TRG				ARS1-18-00856	001	1			CAWA-18-151437	05/09/18	
ARS1-B18-00684-05	TRG				ARS1-18-00856	002	1			CAWA-18-151439	05/09/18	

LCS Report

Analytical Batch: ARS1-B18-00684

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-25245	ARS1-B18-00684-01	B-H3	S-0332	H-3	5	2.71290	17.0044	22.0874	5.0830	2.70205	05/22/2018	13.73453	SCAUSEY	04/26/2018
B-25246	ARS1-B18-00684-02	B-H3	S-0332	H-3	5	2.71290	17.0999	22.1242	5.0243	2.70164	05/23/2018	13.57383	SCAUSEY	04/26/2018

Tritium Assay in Water Samples Using Electrolytic Enrichment

Preparation Date: 04/26/2018 14:43
Prepared By: SCAUSEY

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-B18-00684-01	LCS		314.6600	204.4900	586.0400	1.5000	381.5500	4/26/2018 2:54:00 PM	5.0000	2.0000	5/15/2018 11:00:00 AM	2.0000
ARS1-B18-00684-02	LCSD		323.0000	210.1100	594.5400	1.5000	384.4300	4/26/2018 2:54:00 PM	5.0000	2.0000	5/15/2018 11:00:00 AM	2.0000
ARS1-B18-00684-03	MBL		325.1000	223.4400	609.1400	1.5000	385.7000	4/26/2018 2:54:00 PM	5.0000	2.0000	5/15/2018 11:00:00 AM	2.0000
ARS1-B18-00684-04	TRG	ARS1-18-00856-001	320.7300	278.8500	659.6900	1.5000	380.8400	4/26/2018 2:54:00 PM	5.0000	2.0000	5/15/2018 11:00:00 AM	2.0000
ARS1-B18-00684-05	TRG	ARS1-18-00856-002	323.4900	196.5200	577.2200	1.5000	380.7000	4/26/2018 2:54:00 PM	5.0000	2.0000	5/15/2018 11:00:00 AM	2.0000

Tritium Assay in Water Samples Using Electrolytic Enrichment

Procedure Data		End Wt of Cell + Resv + Sample	Gross Sample Recovered	Enrichment Factor	Tare Wt Cryo- distil 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
ABatch Sample ID	Type											
ARS1-B18-00684-01	LCS	534.9900	15.8400	24.0878	128.3400	141.6700	13.3300	6.5900	16.6300	10.0400	16.6300	0.0000
ARS1-B18-00684-02	LCSD	548.9400	15.8300	24.2849	126.3100	139.2300	12.9200	6.6100	16.6400	10.0300	16.6400	0.0000
ARS1-B18-00684-03	MBL	563.9900	15.4500	24.9644	96.6800	109.4100	12.7300	6.7100	16.8000	10.0900	16.8000	0.0000
ARS1-B18-00684-04	TRG	613.3400	13.7600	27.6773	129.8900	139.2100	9.3200	6.5500	15.7500	9.2000	16.6200	0.8700
ARS1-B18-00684-05	TRG	534.8200	14.8100	25.7056	122.8500	135.0100	12.1600	6.6300	16.6700	10.0400	16.6700	0.0000

ARS-040

Tritium Assay in Water Samples Using Electrolytic Enrichment

ARS Aleut Analytical, LLC
Baton Rouge Laboratory

Procedure Data				
ABatch Sample ID	Type	Tare Wt b/f Cocktail	Gross Wt Vial + Cocktail	Net Wt of Cocktail Added
ARS1-B18-00684-01	CS	16.6300	26.7000	10.0700
ARS1-B18-00684-02	LCSD	16.6400	26.7100	10.0700
ARS1-B18-00684-03	MBL	16.8000	26.8800	10.0800
ARS1-B18-00684-04	TRG	16.6200	26.6800	10.0600
ARS1-B18-00684-05	TRG	16.6700	26.7200	10.0500

ARS-040

Tritium Assay in Water Samples Using Electrolytic Enrichment

ARS Aleut Analytical, LLC
Baton Rouge Laboratory

Reagent Amounts				
ABatch Sample ID	Type	SDG/Fraction	14.2.12 DISTILLAT - Ionize & add O to electrolysis - Sodium Peroxide (granular) Reagent Grade (g)	14.3.22 DISTILLATION - Add scint cocktail - Ultima Gold LIT Reagent Grade (mL)
ARS1-B18-00684-01	LCS		1.50	10.00
ARS1-B18-00684-02	LCSD		1.50	10.00
ARS1-B18-00684-03	MBL		1.50	10.00
ARS1-B18-00684-04	TRG	ARS1-18-00856-001	1.50	10.00
ARS1-B18-00684-05	TRG	ARS1-18-00856-002	1.50	10.00

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	R17-00962

Assay Definition-

Assay Description:
 Low Level H3

Assay Type: DPM (Single)

Report Name: Report1

Output Data Path: C:\Packard\Tricarb\Results\ARS\Low Low Level Tritium 3\20180522_1350

Raw Results Path: C:\Packard\Tricarb\Results\ARS\Low Low Level Tritium 3\20180522_1350\20180522_1350.results

RTF File Name: C:\Packard\Tricarb\Results\ARS\Low Low Level Tritium 3\20180522_1350\Report1.rtf

Comma-Delimited File Name: C:\Packard\Tricarb\Results\ARS\Low Low Level Tritium 3\20180522_1350\LLH3 Results.csv

Assay File Name: C:\Packard\Tricarb\Assays\Low Low Level Tritium 3.lsa

Count Conditions-

Nuclide: H-3 LL

Quench Indicator: tSIE/AEC

External Std Terminator (sec): 0.5 2s%

Pre-Count Delay (min): 0.00

Quench Set:

Low Energy: ARS LL H3 10

Count Time (min): 330.00

Count Mode: Low Level

Assay Count Cycles: 1

#Vials/Sample: 1

Repeat Sample Count: 1

Calculate % Reference: Off

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

2 Coincidence Time (nsec): 18

3 Delay Before Burst (nsec): 200

4 Half Life-

Half Life Correction: Off

Regions Half Life

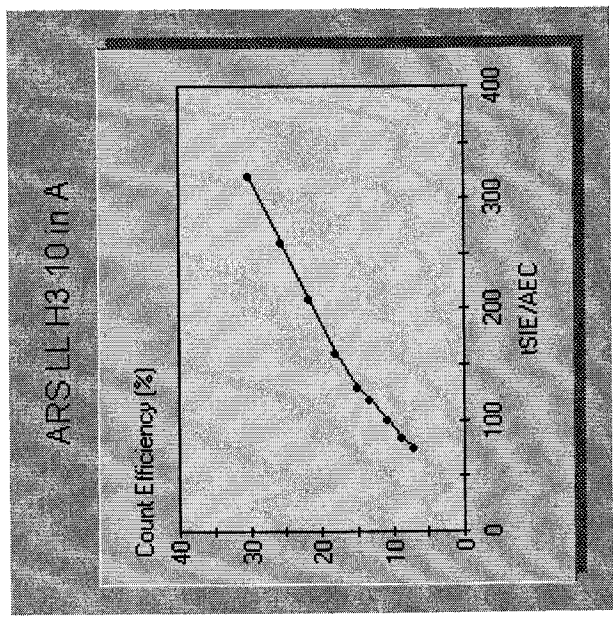
Units

Reference Date

Reference Time

A
B
C

Cycle 1 Results
Quench Curve Block Data



Date Acquired: 08/30/2017
Date Modified:
ARS LL H3 10 in A

tSIE/AEC	Count Efficiency (%)
320.32	30.21
259.88	25.50
209.67	21.83
160.20	18.05
131.12	14.84
9119.84	13.13
101.33	10.74
84.91	8.63
75.26	7.12

P#	S#	SMPL_ID	CPMA	DPM1	tSIE	Eff Nucl	In A	Count	Time	DATE	TIME	MESSAGES
49	1	BACKGROUND	1.007	4.595	210.84		21.91	330.00		5/22/2018	1:59:43 PM	
49	2	B18-00684-01	3.769	17.790	201.27		21.19	330.00		5/22/2018	7:41:33 PM	
49	3	B18-00684-02	4.242	19.045	215.77		22.27	330.00		5/23/2018	1:24:50 AM	
49	4	B18-00684-03	0.911	4.183	208.91		21.77	330.00		5/23/2018	7:07:02 AM	
49	5	B18-00684-04	0.979	4.540	206.17		21.56	330.00		5/23/2018	12:49:14 PM	
49	6	B18-00684-05	0.943	4.310	210.35		21.88	330.00		5/23/2018	6:31:26 PM	

LSC Instrument Data Transfer Report													\\PACKARD3170_NEW\Results\ARS\Low Low Level Tritium								
Batch Sample ID													Non-BKG Samples Transferred			Samples Eligible To Save			LSC 2		
ARS1-B18-00684													5			5					
Lab Sample ID	PID	LSC #	LSC	SMPL ID	LSC Count Date	LSC CPMA	LSC TSTIE	LSC EFF	LSC Count Dur	Analysis Batch	LIMS SDG	LIMS Run									
BKG	49	1		BACKGROUND	05/22/18 13:59	1.01	210.84	21.9100	330.00	ARS1-B18-00684											
ARS1-B18-00684-01	49	2		B18-00684-01	05/22/18 19:41	3.77	201.27	21.1900	330.00	ARS1-B18-00684											
ARS1-B18-00684-02	49	3		B18-00684-02	05/23/18 01:24	4.24	215.77	22.2700	330.00	ARS1-B18-00684											
ARS1-B18-00684-03	49	4		B18-00684-03	05/23/18 07:07	0.91	208.91	21.7700	330.00	ARS1-B18-00684											
ARS1-B18-00684-04	49	5		B18-00684-04	05/23/18 12:49	0.98	206.17	21.5600	330.00	ARS1-B18-00684	ARS1-18-00856	1									
ARS1-B18-00684-05	49	6		B18-00684-05	05/23/18 18:31	0.94	210.35	21.8800	330.00	ARS1-B18-00684	ARS1-18-00856	1									

ARS-040 Calculation Results			
ARS1-B18-00684			
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-B18-00684-01	381.550	1.500	15.840	1.539	14.301	0.037	21.081
LSC-LLH3-AQ	ARS1-B18-00684-02	384.430	1.500	15.830	1.539	14.291	0.037	21.248
LSC-LLH3-AQ	ARS1-B18-00684-03	385.700	1.500	15.450	1.539	13.911	0.036	21.875
LSC-LLH3-AQ	ARS1-B18-00684-04	380.840	1.500	13.760	1.539	12.221	0.032	24.474
LSC-LLH3-AQ	ARS1-B18-00684-05	380.700	1.500	14.810	1.539	13.271	0.035	22.602

ARS-040 Calculation Results	
ARS1-B18-00684	
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-B18-00684-01	3.769	1.007	201.270	0.212	0.01004	L	3/23/2018	5/22/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00684-02	4.242	1.007	215.270	0.223	0.01003	L	3/23/2018	5/23/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00684-03	0.911	1.007	208.910	0.218	0.01009	L	4/26/2018	5/23/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00684-04	0.979	1.007	206.170	0.216	0.00920	L	3/9/2018	5/23/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00684-05	0.943	1.007	210.350	0.219	0.01004	L	3/9/2018	5/23/2018		330.000

ARS-040 Calculation Results

ARS1-B18-00684

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-B18-00684-01	330.000	330.000	0.99065	28.003	1.220	1.220	4.374	2.391	8.573	2.689	1.303	pCi
LSC-LLH3-AQ	ARS1-B18-00684-02	330.000	330.000	0.99065	30.983	1.208	1.208	4.803	2.368	9.415	2.541	1.231	pCi
LSC-LLH3-AQ	ARS1-B18-00684-03	330.000	330.000	0.99585	-0.904	0.718	0.718	0.730	1.407	1.432	2.497	1.210	pCi
LSC-LLH3-AQ	ARS1-B18-00684-04	330.000	330.000	0.98851	-0.263	0.728	0.728	0.729	1.427	1.429	2.490	1.206	pCi
LSC-LLH3-AQ	ARS1-B18-00684-05	330.000	330.000	0.98836	-0.587	0.706	0.706	0.711	1.383	1.394	2.435	1.180	pCi

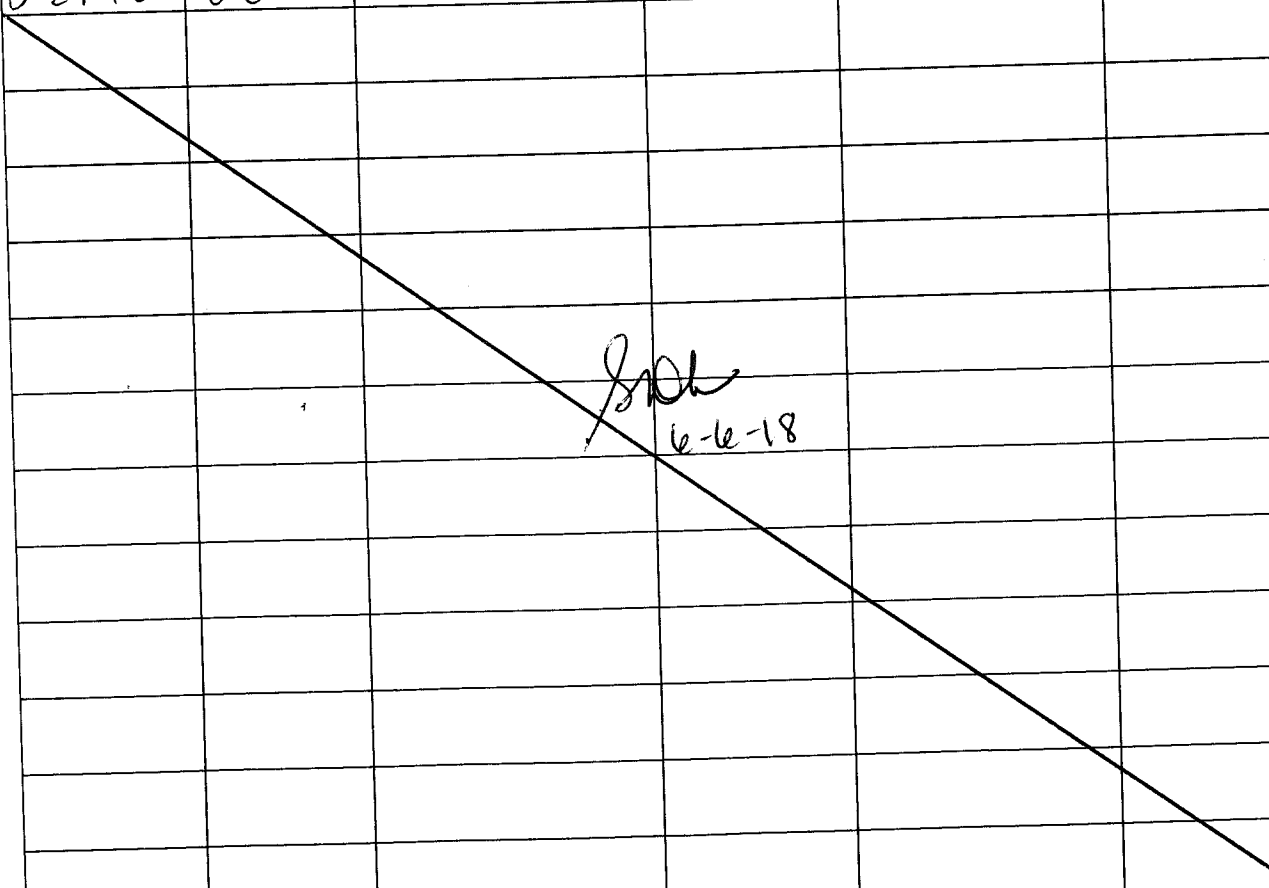
ARS-040 Calculation Results		
ARS1-B18-00684		
ACF	1	
UCF	2.22	
Sys Error	0.15	

AnalysisCode	ABatchSampleID	AliquotReportUnits	UserID	ModDate
LSC-LLH3-AQ	ARS1-B18-00684-01	L	AMRAD\mmorgan	5/24/2018
LSC-LLH3-AQ	ARS1-B18-00684-02	L	AMRAD\mmorgan	5/24/2018
LSC-LLH3-AQ	ARS1-B18-00684-03	L	AMRAD\mmorgan	5/24/2018
LSC-LLH3-AQ	ARS1-B18-00684-04	L	AMRAD\mmorgan	5/24/2018
LSC-LLH3-AQ	ARS1-B18-00684-05	L	AMRAD\mmorgan	5/24/2018

Beta Liquid Scintillation Counter Log Book

Date	Time	ARS Sample I.D. Number	Batch Number	Liquid Scintillation File Number	Technician Initials
5-10-18	1645	SNC5	QA	QA	J
5-16-18	1645	SNC5	QA	QA	MM
		Background	B18-01144	1236 1710 ^{mm} 5-16-18	MM
		B18-01144-04			MM
		-05			MM
		-06			MM
		-07			MM
5-17-18	0820	SNC5	QA	QA	MM
5-21-18	0900	SNC5	QA	QA	MM
		Background	B18-00693	1041	MM
		B18-00693-01			MM
		-02			MM
		-03			MM
		-04			MM
		-05			MM
		-06			MM
		-07			MM
5-22-18	1330	SNC5	QA	QA	MM
		Background	B18-00693	1350	MM
		B18-00693-01 00693 Min 5-22-18			MM

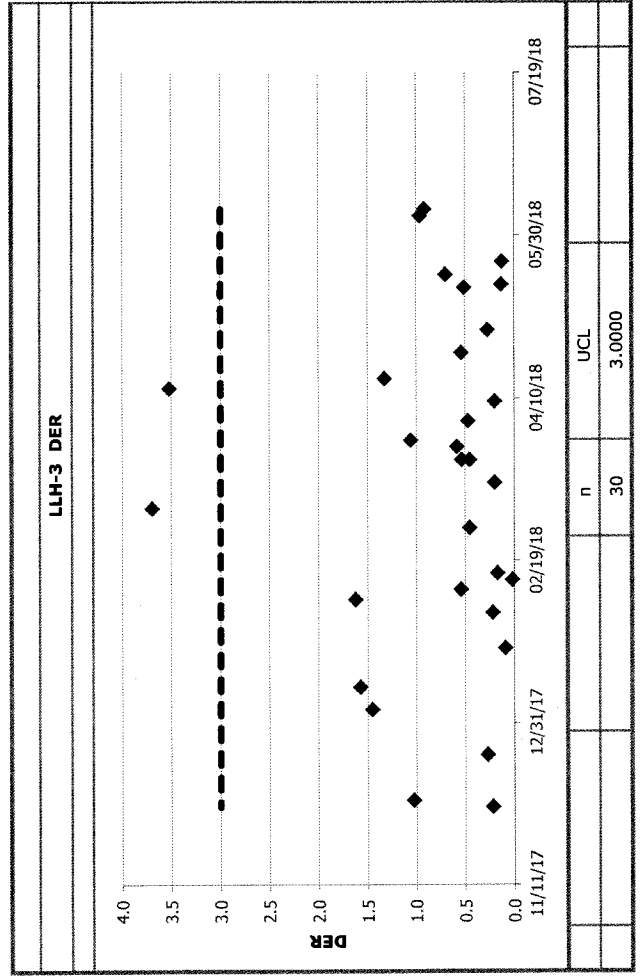
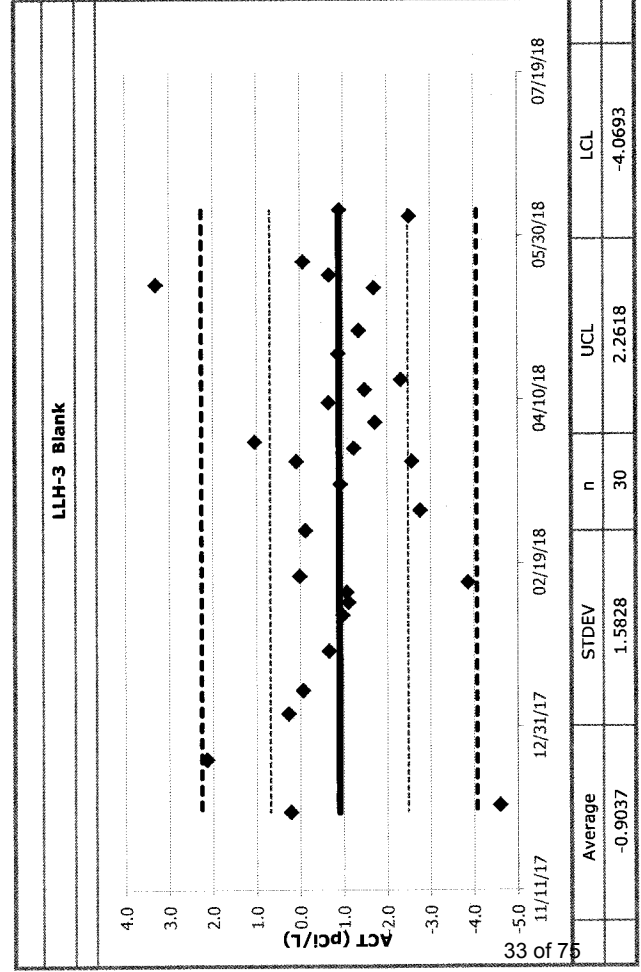
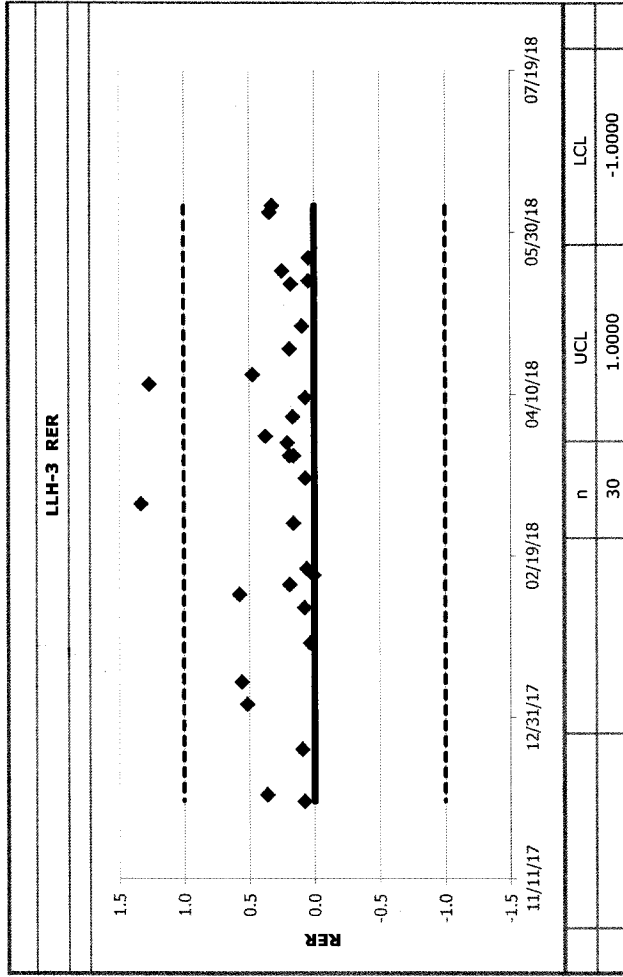
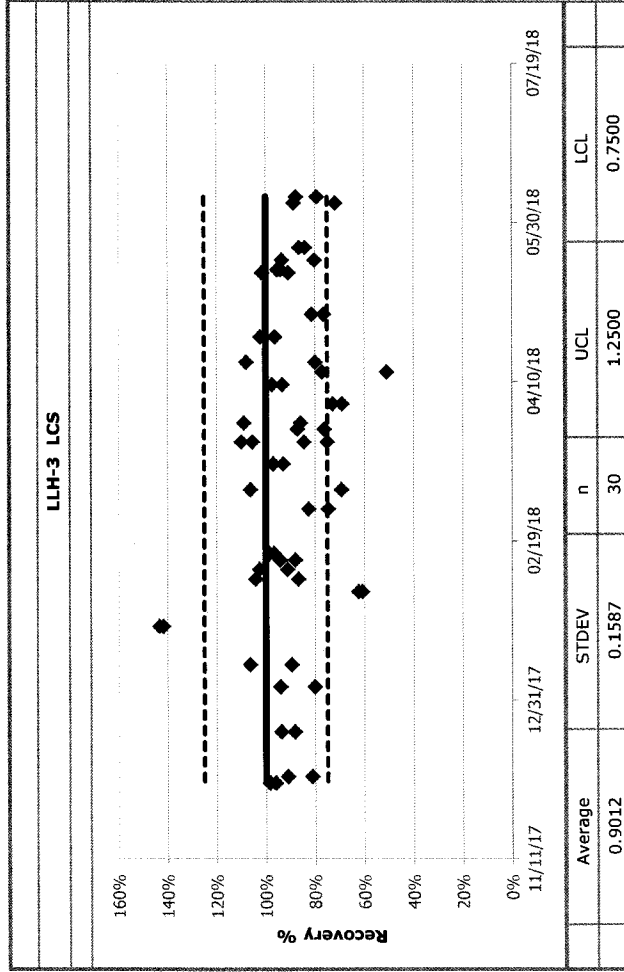
Beta Liquid Scintillation Counter Log Book

Date	Time	ARS Sample I.D. Number	Batch Number	Liquid Scintillation File Number	Technician Initials
5-22-18	1330	B18-00693-02	B18-00693	1350	MM
		-03			MM
		-04			MM
		-05			MM
		-06			MM
		-07			MM
5-23-18	1250	SNC5	QA	QA	MM
5-24-18	0800	SNC5	QA	QA	MM
					



**ARS Aleut
Analytical Reports
for
Los Alamos National Laboratory
Low Level Tritium
by
Low Level Liquid
Scintillation Counting
Control Charts**

QC Chart

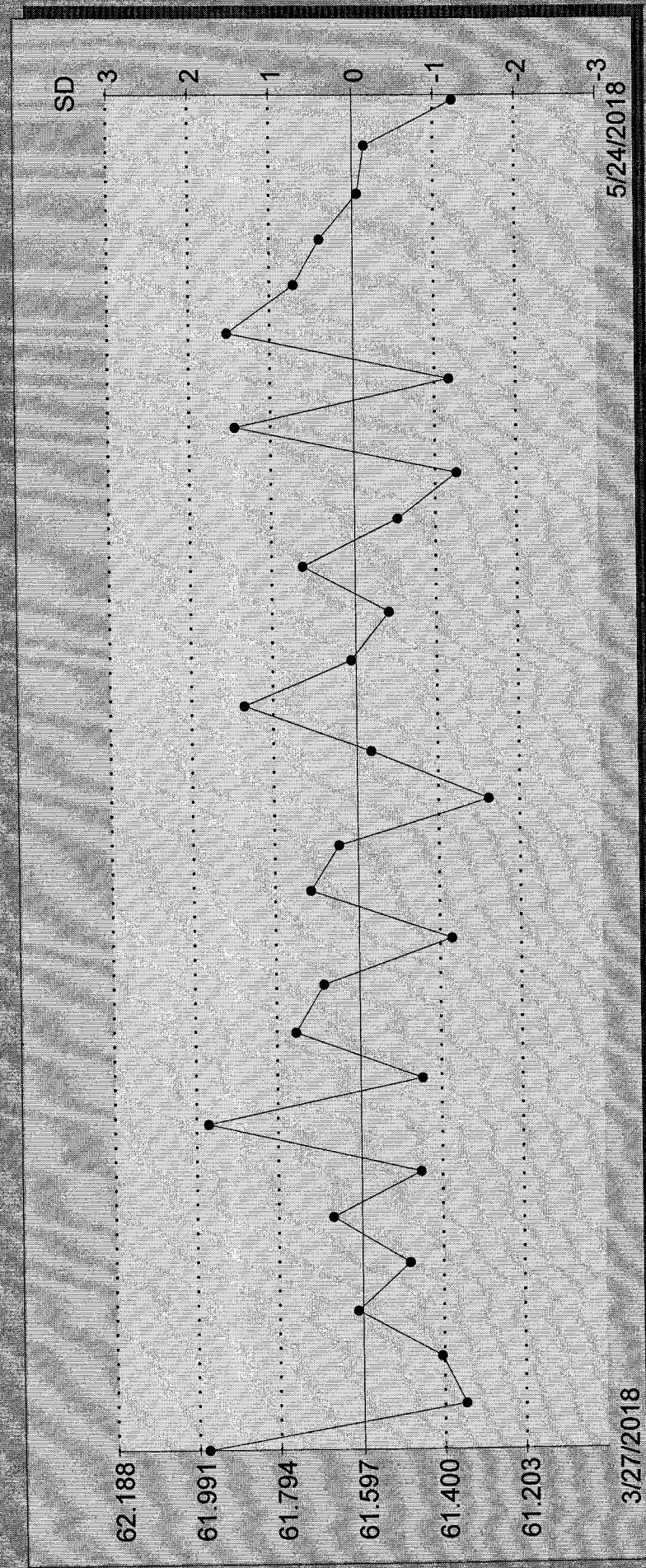


3H Efficiency

Total # pts : 2505
Valid # pts : 30
Mean : 61.60
SD : 0.20

Date	Value	Valid Pt
Mar 27, 2018	61.97	X
Mar 28, 2018	61.35	X
Mar 29, 2018	61.40	X
Apr 06, 2018	61.61	X
Apr 07, 2018	61.48	X
Apr 09, 2018	61.66	X
Apr 10, 2018	61.45	X
Apr 11, 2018	61.97	X
Apr 11, 2018	61.45	X
Apr 11, 2018	61.75	X
Apr 12, 2018	61.69	X
Apr 12, 2018	61.37	X
Apr 12, 2018	61.71	X
Apr 13, 2018	61.64	X
Apr 14, 2018	61.28	X
Apr 19, 2018	61.56	X
Apr 20, 2018	61.87	X
Apr 24, 2018	61.61	X
Apr 26, 2018	61.52	X
Apr 30, 2018	61.72	X
May 01, 2018	61.49	X
May 03, 2018	61.35	X
May 07, 2018	61.89	X
May 09, 2018	61.36	X
May 12, 2018	61.90	X
May 16, 2018	61.74	X
May 17, 2018	61.68	X
May 21, 2018	61.58	X
May 22, 2018	61.56	X
May 24, 2018	61.36	X

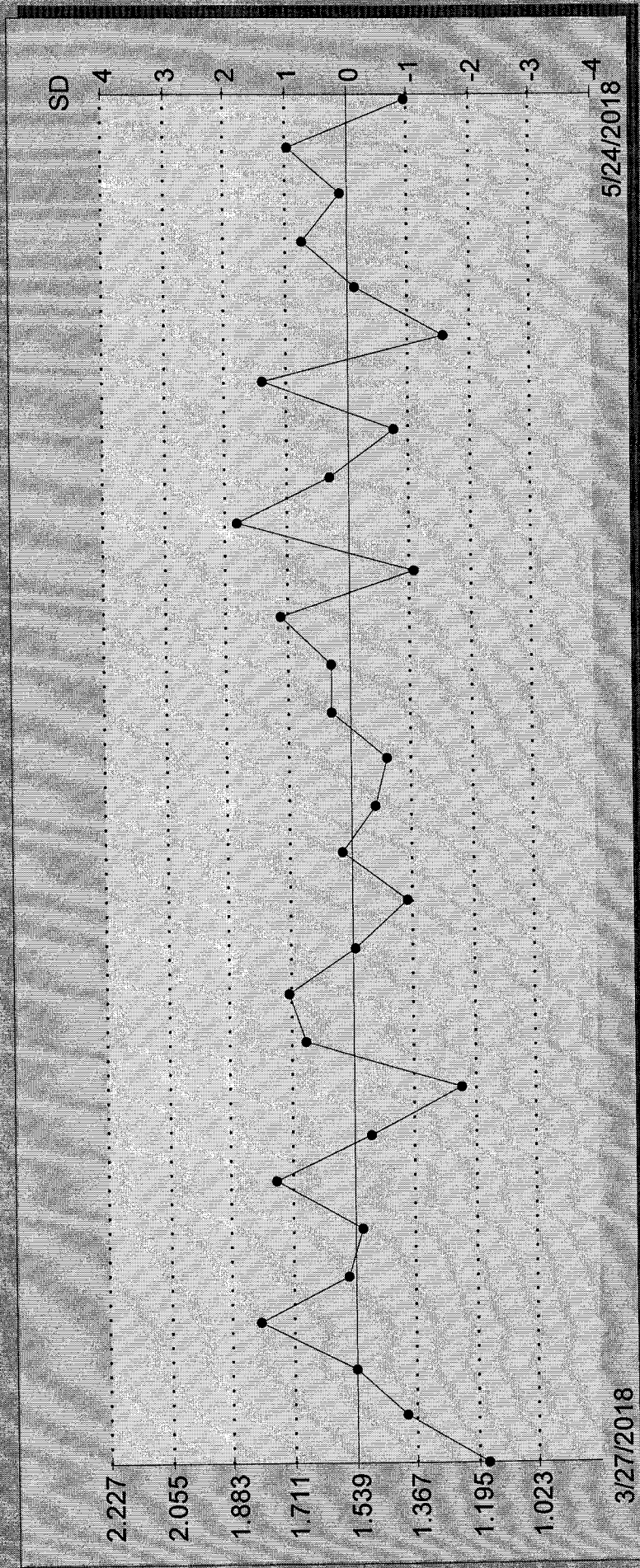
3H Efficiency : 2505
Total # pts : 30
Valid # pts : 61.60
Mean : 0.20
SD



3H Background
Total # pts : 2458
Valid # pts : 30
Mean : 1.54
SD : 0.17

Date	Value	Valid Pt
Mar 27, 2018	1.17	X
Mar 28, 2018	1.40	X
Mar 29, 2018	1.54	X
Apr 06, 2018	1.81	X
Apr 07, 2018	1.56	X
Apr 09, 2018	1.52	X
Apr 10, 2018	1.76	X
Apr 11, 2018	1.49	X
Apr 11, 2018	1.24	X
Apr 11, 2018	1.67	X
Apr 12, 2018	1.72	X
Apr 12, 2018	1.53	X
Apr 12, 2018	1.38	X
Apr 13, 2018	1.57	X
Apr 14, 2018	1.47	X
Apr 19, 2018	1.43	X
Apr 20, 2018	1.59	X
Apr 24, 2018	1.59	X
Apr 26, 2018	1.73	X
Apr 30, 2018	1.35	X
May 01, 2018	1.85	X
May 03, 2018	1.59	X
May 07, 2018	1.41	X
May 09, 2018	1.78	X
May 12, 2018	1.27	X
May 16, 2018	1.52	X
May 17, 2018	1.67	X
May 21, 2018	1.56	X
May 22, 2018	1.70	X
May 24, 2018	1.38	X

3H Background
Total # pts : 2458
Valid # pts : 30
Mean : 1.54
SD : 0.17





2609 North River Road • Port Allen, Louisiana 70767

1 (800) 401-4277 • Fax (225) 381-2996

**ARS Aleut
Analytical Reports**

for

Los Alamos National Laboratory

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



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**ARS Aleut
Analytical Reports**

for

Los Alamos National Laboratory

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

Samples



ARS Batch ID: ARS1-B18-00654
ARS SDG ID(s): ARS-18-00854; 856

ARS-040-002 r0.0



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**ARS Aleut
Analytical Reports**

for


Los Alamos National Laboratory

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

**Laboratory
Records**



Analysis Batch ID **ARS1-B18-00654**



Method		ARS-054		Analysis		LSC-LLH3/SC-AQ		Matrix		AQ		
Description		Low Level Tritium Screening		SDG		FR		Run		Prep Code		
Type	ABatch Sample ID	Blind Iso1	Blind Iso2	Blind Iso3	SDG	FR	Run	Prep Code	Filtered	Client ID	Group Name	Lab Deadline
LCS	ARS1-B18-00654-01											
LCSD	ARS1-B18-00654-02											
MBL	ARS1-B18-00654-03											
TRG	ARS1-B18-00654-04				ARS1-18-00854	001	1			405-031418-3		04/25/18
TRG	ARS1-B18-00654-05				ARS1-18-00854	002	1			405-031418-4		04/25/18
TRG	ARS1-B18-00654-06				ARS1-18-00856	001	1			CAWA-18-151437		05/09/18
TRG	ARS1-B18-00654-07				ARS1-18-00856	002	1			CAWA-18-151439		05/09/18

Preparation Date: 03/21/2018 15:17
Prepared By: MMORGAN

Procedure Data

ABatch Sample ID	Type	SDG/Fraction	ICOC ID	Aliquot 1 Vol/Wt	Aliquot 1 Units	Aliquot 2 Vol/Wt	Aliquot 2 Units
ARS1-B18-00654-01	LCS			1.0000			
ARS1-B18-00654-02	LCSD			1.0000			
ARS1-B18-00654-03	MBL			1.0000			
ARS1-B18-00654-04	TRG	ARS1-18-00854-001	288744	0.0100	L		
ARS1-B18-00654-05	TRG	ARS1-18-00854-002	288745	0.0100	L		
ARS1-B18-00654-06	TRG	ARS1-18-00856-001	288746	0.0100	L		
ARS1-B18-00654-07	TRG	ARS1-18-00856-002	288747	0.0100	L		

ARS-054
Tritium in Water

ARS Aleut Analytical, LLC
Baton Rouge Laboratory

Reagent Amounts			
ABatch Sample ID	Type	SDG/Fraction	14.1.5 OPTIONAL AQ W/O DIST - Add scint cocktail - Ultima Gold LLT Reagent Grade (mL)
ARS1-B18-00654-01	LCS		1.00
ARS1-B18-00654-02	LCSD		1.00
ARS1-B18-00654-03	MBL		1.00
ARS1-B18-00654-04	TRG	ARS1-18-00854-001	10.00
ARS1-B18-00654-05	TRG	ARS1-18-00854-002	10.00
ARS1-B18-00654-06	TRG	ARS1-18-00856-001	10.00
ARS1-B18-00654-07	TRG	ARS1-18-00856-002	10.00

ARS-054
Tritium in Water

ARS Aleut Analytical, LLC
Baton Rouge Laboratory

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

Assay Definition-

Assay Description:
Low Level H3

Assay Type: DPM (Single)
Report Name: Report1
Output Data Path: C:\Packard\Tricarb\Results\ARS\Low Low Level Tritium 4\20180321_1639
Raw Results Path: C:\Packard\Tricarb\Results\ARS\Low Low Level Tritium 4\20180321_1639\20180321_1639.results
RTF File Name: C:\Packard\Tricarb\Results\ARS\Low Low Level Tritium 4\20180321_1639\Report1.rtf
Comma-Delimited File Name: C:\Packard\Tricarb\Results\ARS\Low Low Level Tritium 4\20180321_1639\LLH3 Results.csv
Assay File Name: C:\Packard\Tricarb\Assays\Low Low Level Tritium 4.lsa

Count Conditions-

Nuclide: H-3 LL
Quench Indicator: tSIE/AEC
External Std Terminator (sec): 0.5 2s%
Pre-Count Delay (min): 0.00
Quench Set:
Low Energy: ARS LL H3 10
Count Time (min): 120.00
Count Mode: Low Level
Assay Count Cycles: 1
#Vials/Sample: 1
Repeat Sample Count: 1
Calculate % Reference: Off

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
Delay Before Burst (nsec): 200
Luminescence Correction: Off
Heterogeneity Monitor: Off

Half Life-

Regions	Half Life	Correction: Off	Units	Reference Date	Reference Time
---------	-----------	-----------------	-------	----------------	----------------

A
B
C

Cycle 1 Results

P#	S#	SMPL_ID	CPMA	DPM1	tSIE	Eff Nucl	In A	Count Time	DATE	TIME	MESSAGES
53	1	BACKGROUND	1.395	6.378	210.38		21.88	120.00	3/21/2018	4:48:43 PM	
53	2	B18-00654-04	0.853	4.339	181.25		19.66	120.00	3/21/2018	6:58:56 PM	
53	3	B18-00654-05	1.238	6.374	178.11		19.42	120.00	3/21/2018	9:09:00 PM	
53	4	B18-00654-06	0.989	4.569	207.21		21.64	120.00	3/21/2018	11:19:05 PM	
53	5	B18-00654-07	1.252	5.686	212.41		22.03	120.00	3/22/2018	1:29:44 AM	



LSC Instrument Data Transfer Report

\\PACKARD03170_NEW\Results\ARS\Low Level Tritium

				Batch Sample ID		Non-BKG Samples Transferred		Samples Eligible To Save					
				ARS1-B18-00654		4		4		LSC 2			
LIMS Batch Sample ID	LSC P#	LSC PID	LSC S#	LSC SMPL ID	LSC Count Date	LSC CPMA	LSC TSIE	LSC EFF	LSC Count Dur	Analysis Batch	LIMS SDG	LIMS Run	
BKG	53		1	BACKGROUHD	03/21/18 16:48	1.40	210.38	21.8800	120.00	ARS1-B18-00654			
ARS1-B18-00654-04	53		2	B18-00654-14	03/21/18 18:58	0.85	181.25	19.6600	120.00	ARS1-B18-00654	ARS1-18-00854	1	
ARS1-B18-00654-05	53		3	B18-00654-15	03/21/18 21:09	1.24	178.11	19.4200	120.00	ARS1-B18-00654	ARS1-18-00854	1	
ARS1-B18-00654-06	53		4	B18-00654-16	03/21/18 23:19	0.99	207.21	21.6400	120.00	ARS1-B18-00654	ARS1-18-00856	1	
ARS1-B18-00654-07	53		5	B18-00654-17	03/22/18 01:29	1.25	212.41	22.0300	120.00	ARS1-B18-00654	ARS1-18-00856	1	

Low Level Tritium pH Checks

[illegible]

Beta Liquid Scintillation Counter Log Book

Date	Time	ARS Sample I.D. Number	Batch Number	Liquid Scintillation File Number	Technician Initials
3-13-18	16:15	B17-62876 C7	B18-02876	1514	mm
		-08			mm
		-09			mm
		-10			mm
		-11			mm
		-12			mm
		-13			mm
		-14			mm
		-15			mm
		-16			mm
		-17			mm
		-18			mm
		-19			mm
3-21-18	15:00	mm 3-21-18 SNCS	QA	QA	mm
		Background	B18-00654	1039	mm
		B18-00654-04			mm
		-05			mm
		-06			mm
		-07			mm
		N/a	3-22-2018		
			mm		



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**ARS Aleut
Analytical Reports**

for

Los Alamos National Laboratory

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

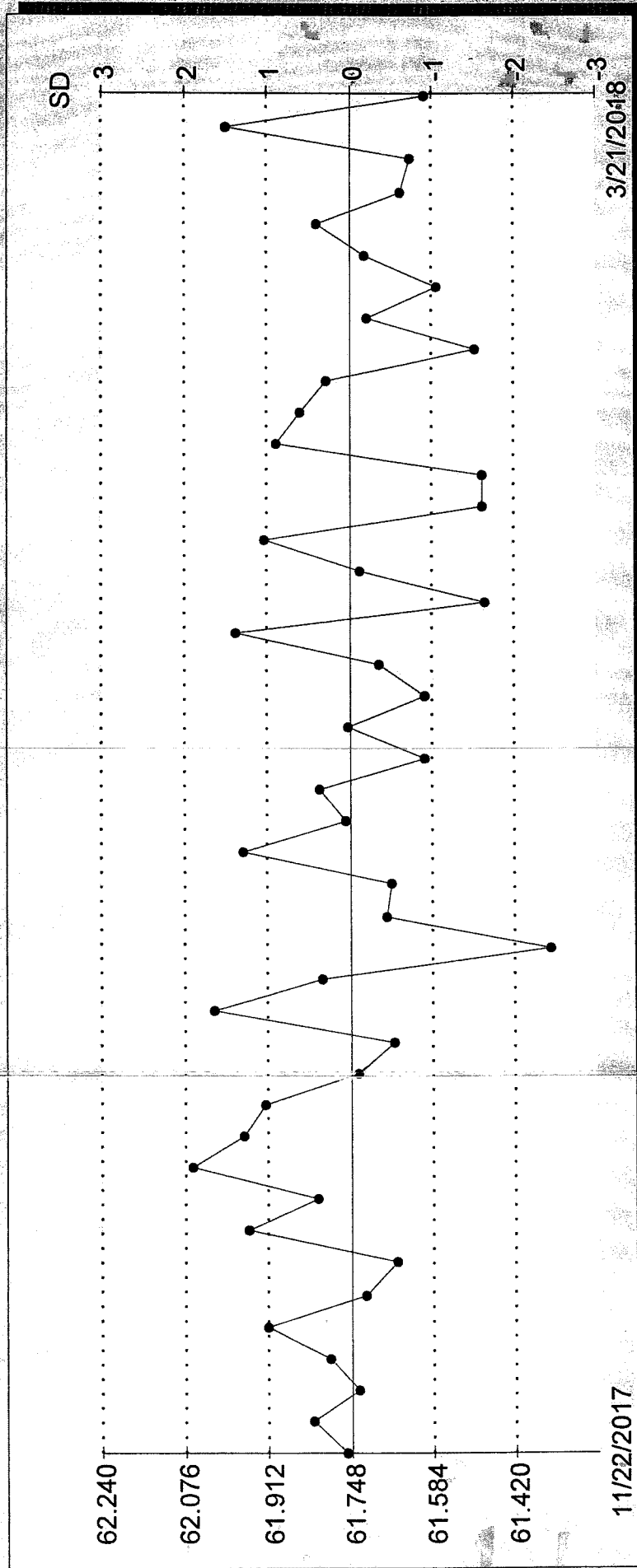
Control Charts

3H Efficiency

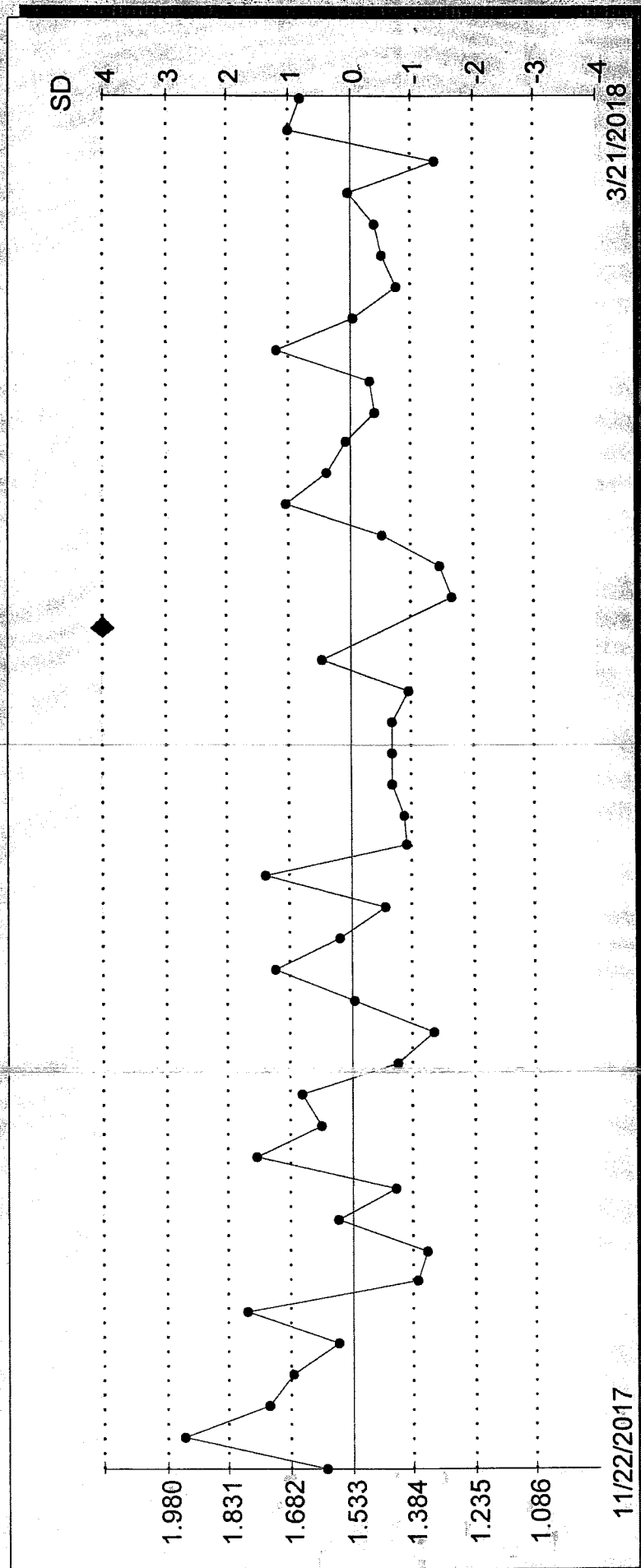
Total # pts : 2472
Valid # pts : 44
Mean : 61.75
SD : 0.16

Date	Value	Valid Pt
Nov 22, 2017	61.76	X
Nov 25, 2017	61.82	X
Nov 29, 2017	61.73	X
Dec 03, 2017	61.79	X
Dec 03, 2017	61.92	X
Dec 03, 2017	61.72	X
Dec 03, 2017	61.65	X
Dec 04, 2017	61.95	X
Dec 04, 2017	61.81	X
Dec 04, 2017	62.06	X
Dec 04, 2017	61.96	X
Dec 04, 2017	61.92	X
Dec 04, 2017	61.73	X
Dec 11, 2017	61.66	X
Dec 14, 2017	62.02	X
Dec 15, 2017	61.80	X
Dec 17, 2017	61.35	X
Dec 18, 2017	61.67	X
Dec 19, 2017	61.66	X
Jan 08, 2018	61.96	X
Jan 08, 2018	61.75	X
Jan 10, 2018	61.81	X
Jan 14, 2018	61.60	X
Jan 15, 2018	61.75	X
Jan 17, 2018	61.60	X
Jan 29, 2018	61.69	X
Feb 01, 2018	61.98	X
Feb 05, 2018	61.48	X
Feb 06, 2018	61.73	X
Feb 06, 2018	61.92	X
Feb 13, 2018	61.48	X
Feb 14, 2018	61.48	X
Feb 15, 2018	61.89	X
Feb 28, 2018	61.85	X
Mar 03, 2018	61.79	X
Mar 06, 2018	61.50	X
Mar 07, 2018	61.71	X
Mar 09, 2018	61.57	X
Mar 10, 2018	61.72	X
Mar 12, 2018	61.82	X
Mar 13, 2018	61.65	X
Mar 17, 2018	61.62	X
Mar 19, 2018	61.99	X
Mar 21, 2018	61.60	X

3H Efficiency
 Total # pts : 2472
 Valid # pts : 44
 Mean : 61.75
 SD : 0.16



3H Background
 Total # pts : 2425
 Valid # pts : 44
 Mean : 1.53
 SD : 0.15





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ARS Aleut 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 3/24/2018 2:20 date counted
 STANDARD REFERENCE # S-0332

Principal Radionuclide
H-3

ENTER --> Half Life, Years
1.232E+01

OR --> Half Life, Days
4.4998E+03
4.4998E+03

Radionuclide H-3

Dilution Reference Date 3/23/2018 10:39

Dilution Activity 2.73 pCi per gram ==> dpm/g 6.05
 Verif. Date Decay Corrected 2.73 pCi per gram ==> dpm/g 6.05

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-0332-V1	18.21	1	LSC	0.3032	8.32	5.047	6.46	2.91
S-0332-V2	17.34	1	LSC	0.3016	8.32	5.021	5.96	2.68
S-0332-V3	18.38	1	LSC	0.3027	8.32	5.020	6.62	2.98
S-0332-V4	17.35	1	LSC	0.3007	8.32	5.011	5.99	2.70
S-0332-V5	17.71	1	LSC	0.3040	8.32	5.009	6.17	2.78

		Average	<u>6.24</u>	<u>2.81</u>
		Two Sigma Uncertainty	<u>0.57</u>	<u>0.26</u>
10% Max	PASS	Standard Deviation percent of known concentration	<u>4.82%</u>	<u>4.82%</u>
		Target Activity	<u>6.05</u>	<u>2.73</u>
5% Max	PASS	% Diff	<u>3.07%</u>	<u>3.07%</u>

Verification Expiration Date: March 24, 2019

Prepared & Counted By Melisa Morgan Date: 3/24/2018 2:20
 Verified & Approved By [Signature] Date: 3-27-18
 QC Approval [Signature] Date: 3-28-18

S-0332



H-3

Verified 3/24/18

SL

Expires 3/24/19

Manufacturer NIST SRM 4927F

Sol Matrix H2O

Ref No NIST SRM 4927F

Tech Unknown

Parent ID S-0316



RADIOACTIVE STANDARDS -- BATON ROUGE LABORATORY

Verification Weights		
Header	Melisa Morgan	
Preparer		
Sample ID	P214062006	
Standard ID	S-0332	
Trader ID		
Sample ID	Std. Weight(g)	Trader Weight(g)
S-0332-V1	5.047	
S-0332-V2	5.021	
S-0332-V3	5.0203	
S-0332-V4	5.0107	
S-0332-V5	5.0092	

Verification Weights

Tech: Melisa Morgan
 Pipette: _____
 Scale ID: _____
 Standard ID: S-0332
 Tracer ID: ~~S-0332~~ 3-26-18

Sample ID	Std Weight (g)	Tracer Weight (g)
V1	^{5.0412} 5.0469	
V2	5.0210	
V3	5.0203	
V4	5.0107	
V5	5.0092	

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\20180326_1050
 Raw Results Path: C:\Packard\Tricarb\Results\ARS\H3 Normal Lvl 2\20180326_1050\20180326_1050.results
 RTF File Name: C:\Packard\Tricarb\Results\ARS\H3 Normal Lvl 2\20180326_1050\H3 Results.rtf
 Comma-Delimited File Name: C:\Packard\Tricarb\Results\ARS\H3 Normal Lvl 2\20180326_1050\H3 Results.csv
 Assay File Name: C:\Packard\Tricarb\Assays\H3 Normal Lvl 2.lsa

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): 60.00
 Count Mode: Normal
 Assay Count Cycles: 1 Repeat Sample Count: 1
 #Vials/Sample: 1 Calculate % Reference: Off

Background Subtract

Background Subtract: Off
 Low CPM Threshold: Off
 2 Sigma % Terminator: On - Any Region

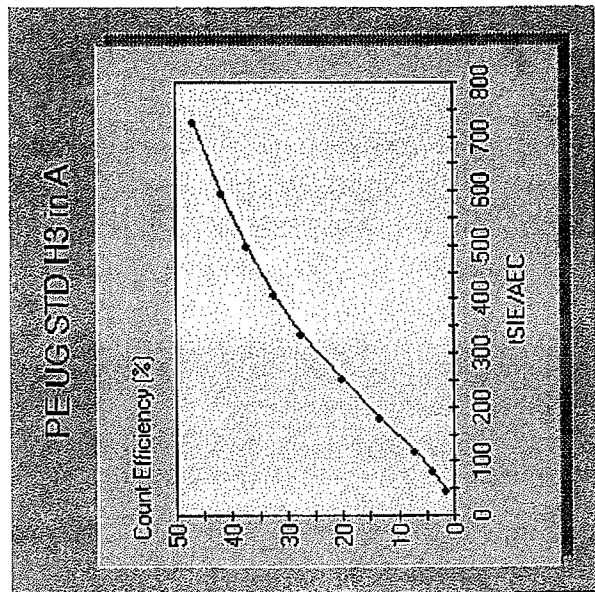
Regions	LL	UL	2Sigma % Terminator
A	2.0	18.6	0.50
B	0.0	2000.0	0.00
C	0.0	2000.0	0.00

Count Corrections

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

Cycle 1 Results

Quench Curve Block Data



Date Acquired: 08/23/2017

Date Modified:

PE UG STD H3 in A

tSIE/AEC	Count Efficiency (%)
726.74	46.87
596.52	41.80
498.08	37.41
409.46	32.44
337.01	27.37
251.64	20.19
181.53	13.47
117.85	6.98
83.68	3.80
48.86	1.28

P#	S#	SMPL ID	CPMA	DEMI	tSIE	Eff Nucl In A	Count Time	DATE	TIME	MESSAGES
----	----	---------	------	------	------	---------------	------------	------	------	----------

QuantaSmart (TM) - 4.00 - Serial# 117992

3/26/2018 5:30:58 PM

Protocol# 7 - H3 Normal Lvl 2.lsa

7	1	BACKGROUND	8.32	27.50	378.41	30.26	60.00	3/26/2018	10:50:41 AM
7	2	S-0332-V1	18.21	60.07	379.18	30.32	60.00	3/26/2018	11:57:26 AM
7	3	S-0332-V2	17.34	57.51	376.90	30.16	60.00	3/26/2018	1:04:13 PM
7	4	S-0332-V3	18.38	60.71	378.56	30.27	60.00	3/26/2018	2:10:57 PM
7	5	S-0332-V4	17.35	57.69	375.69	30.07	60.00	3/26/2018	3:17:40 PM
7	6	S-0332-V5	17.71	58.26	380.36	30.40	60.00	3/26/2018	4:24:23 PM

ARS INTERNATIONAL		Add/Edit Secondary Stds	Parent Standard Data			
Planning		Parent Solution Reference #	NIST SRM 4927F			
Planning Comments	Create an H3 LCS standard solution.	Parent Solution #	S-0316			
Target dpm/g (on dil. date)	6	Parent Principal Radionuclide	H-3	Half Life (Days)	4499.8000000	
Target Final volume mL	2000	Parent Reference Date	08/10/2016 14:49			
Appx mass g of Parent Sol'n	5.511313364	Parent Certified Act	2384.430444	Cert Act/Vol Units	dpm	g
Appx vol ml of Parent Sol'n	5.521251616	Parent Cert Act Uncert 1 Sigma	0.036			
Expected Addition for Analysis g	5	Parent Sp. Gravity G/ML	0.9982			
Standards Preparation / Dilution		Parent Supplier	NIST SRM 4927F			
Secondary Solution #	S-0332	Parent Date Recvd	01/02/00			
Dilution Date (New Ref Date)	03/23/2018 10:39	Parent Received By	Unknown			
Ampoule, Empty (g)		Parent Cert Exp Date				
Ampoule /Solution Gross (g)		Parent Matrix	H2O			
Net Wt Removed (g)		Certified dpm/g At Ref Date	2384.430444			
Transfer Container, empty (g)	16.9844	Certified dpm/g on 03/23/2018 10:39	2177.339449			
Container Plus Solution (g)	22.5094	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			
Net Wt Transferred (g)	5.525					
DPM Xferred on 03/23/2018 10:39	12029.80045					
Diluent/matrix	DI H2O	Parent Tech	Unknown			
Diluent Density Cont, empty (g)	13.0778	Is_Primary	FALSE			
Test Mass of 5 ml of Diluent (g)	18.0453	Is_LCS	TRUE			
Diluent Density Test - (g/mL)	0.9935	Is_Tracer	FALSE			
Dilution Empty Container Mass (g)		Is_Calib	FALSE			
Dilution Full Cont g (if measured)						
Dilution Final Volume ml (if measured)	2000					
Final Dilution Density (g/mL)	0.9935					
Final Dilution Measured Mass g	1987					
Comments	H3 LCS standard, dilution performed as stated above by M Morgan. -BJS 3/23/18					
Final Dilution dpm/g	6.05425287					
Final Dil New Ref Date/Time	03/23/2018 10:39					

STD ID: S-0332

ARS INTERNATIONAL		Add/Edit Secondary Stds	Parent Standard Data			
Planning		Parent Solution Reference #	NIST SRM 4927F			
Planning Comments		Parent Solution #	S-0316			
Target dpm/g (on dil. date)	6	Parent Principal Radionuclide	H-3	Half Life (Days)	4499.8000000	
Target Final volume mL	2000	Parent Reference Date	08/10/2016 14:49			
Appx mass g of Parent Sol'n	5.510556028	Parent Certified Act	2384.430444	Certi Act/Vol Units	dpm	g
Appx vol ml of Parent Sol'n	5.520492916	Parent Cert Act Uncert 1 Sigma	0.036			
Expected Addition for Analysis g	5	Parent Sp. Gravity G/ML	0.9982			
Standards Preparation / Dilution		Parent Supplier	NIST SRM 4927F			
Secondary Solution #	S-0332	Parent Date Recvd	01/02/00			
Dilution Date (New Ref Date)		Parent Received By	Unknown			
Ampoule, Empty (g)		Parent Cert Exp Date				
Ampoule /Solution Gross (g)		Parent Matrix	H2O			
Net Wt Removed (g)		Certified dpm/g At Ref Date	2384.430444			
Transfer Container, empty (g)	16.9844	Certified dpm/g on 03/22/2018 13:14	2177.638688			
Container Plus Solution (g)	22.5094	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			
Net Wt Transferred (g)						
DPM Xferred on 03/22/2018 13:14						
Diluent/matrix						
Diluent Density Cont, empty (g)	13.0778	Parent Tech	Unknown			
Test Mass of 5 ml of Diluent (g)	18.0453	Is_Primary	FALSE			
Diluent Density Test - (g/mL)		Is_LCS	TRUE			
Dilution Empty Container Mass (g)	393.22	Is_Tracer	FALSE			
Dilution Full Cont g (if measured)		Is_Calib	FALSE			
Dilution Final Volume ml (if measured)						
Final Dilution Density (g/mL)						
Final Dilution Measured Mass g						
Comments						
Final Dilution dpm/g						
Final Dil New Ref Date/Time	03/22/2018 13:14					



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Report Compilation Checklist

ARS SDG: 18-00856 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	

Report Generator Signature

Date

Management Review Signature

Date



LSC
Technical Review Checklist

ARS SDG ARS1-18-00856

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: B18-00684 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="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): _____						
<div style="display: flex; justify-content: space-between;"><div>Chemist Signature <u>Melisa Morgan</u> Date <u>05-22-18</u></div><div>Verifier Review Signature <u>[Signature]</u> Date <u>5-22-18</u></div></div>						

B. ANALYSIS REVIEW

	Analyst Review			QA Officer Review		
1) Calibrations Valid and Current?	<input checked="" type="radio"/> Yes	No	N/A	<input checked="" type="radio"/> Yes	No	N/A
2) Backgrounds Valid and Current?	<input checked="" type="radio"/> Yes	No	N/A	<input checked="" type="radio"/> Yes	No	N/A
3) Source Checks Completed and Acceptable?	<input checked="" type="radio"/> Yes	No	N/A	<input checked="" type="radio"/> Yes	No	N/A
<div style="display: flex; justify-content: space-between;"><div>QA Officer Signature <u>[Signature]</u></div><div>Date <u>5-24-18</u></div></div>						
	Analyst Review			Technical Review		
4) Background Checks Complete and Acceptable?	<input checked="" type="radio"/> Yes	No	N/A	<input checked="" type="radio"/> Yes	No	N/A
5) 100% of Manually Entered Parameters Verified Accurate?	<input checked="" type="radio"/> Yes	No	N/A	<input checked="" type="radio"/> Yes	No	N/A
6) Appropriate QC samples initiated at required frequency?	<input checked="" type="radio"/> Yes	No	N/A	<input checked="" type="radio"/> 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	<input checked="" type="radio"/> Yes	No	N/A
b) Spectra show no Evidence of Interferences?	<input checked="" type="radio"/> Yes	No	N/A	<input checked="" type="radio"/> Yes	No	N/A
c) Sample Quench for All Samples within Range of Quench Curve?	<input checked="" type="radio"/> Yes	No	N/A	<input checked="" type="radio"/> Yes	No	N/A
7) Analysis Anomaly? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (See Comments) NCR # (If initiated): _____						
<div style="display: flex; justify-content: space-between;"><div>Analyst Signature <u>Melisa Morgan</u> Date <u>5-24-18</u></div><div>Technical Reviewer Signature <u>[Signature]</u> Date <u>5-24-18</u></div></div>						



C. BATCH QC VALIDATION

GENERAL COMMENTS

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There is no handwriting or other markings on the paper.



LSC Technical Review Checklist

ARS SDG ARS1-18-00856

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: B18-00654 Batch B: N/A Batch C: N/A

Test Method(s): LSC-LLH3/5C-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?	Yes No <input checked="" type="radio"/> N/A	Yes No <input checked="" type="radio"/> 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): _____		
Chemist Signature <u>Melisa Morgan</u>		Verifier Review Signature <u>[Signature]</u>
Date <u>3-21-18</u>		Date <u>3-21-18</u>

B. ANALYSIS REVIEW

	Analyst Review	QA Officer Review
1) Calibrations Valid and Current?	<input checked="" type="radio"/> Yes No N/A	<input checked="" type="radio"/> Yes No N/A
2) Backgrounds Valid and Current?	<input checked="" type="radio"/> Yes No N/A	<input checked="" type="radio"/> Yes No N/A
3) Source Checks Completed and Acceptable?	<input checked="" type="radio"/> Yes No N/A	<input checked="" type="radio"/> Yes No N/A
QA Officer Signature <u>[Signature]</u>		Date <u>3-22-18</u>
	Analyst Review	Technical Review
4) Background Checks Complete and Acceptable?	<input checked="" type="radio"/> Yes No N/A	<input checked="" type="radio"/> Yes No N/A
5) 100% of Manually Entered Parameters Verified Accurate?	<input checked="" type="radio"/> Yes No N/A	<input checked="" type="radio"/> Yes No N/A
6) Appropriate QC samples initiated at required frequency?	<input checked="" type="radio"/> Yes No N/A	<input checked="" type="radio"/> 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	<input checked="" type="radio"/> Yes No N/A
b) Spectra show no Evidence of Interferences?	<input checked="" type="radio"/> Yes No N/A	<input checked="" type="radio"/> Yes No N/A
c) Sample Quench for All Samples within Range of Quench Curve?	<input checked="" type="radio"/> Yes No N/A	<input checked="" type="radio"/> Yes No N/A
7) Analysis Anomaly? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (See Comments) NCR # (If initiated): _____		
Analyst Signature <u>Melisa Morgan</u>		Technical Reviewer Signature <u>N/A</u>
Date <u>3-22-18</u>		Date _____

Report Level: 4

Profile Name: Nita Patel (Site Alias)

Client Name: Los Alamos National Laboratory

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

Analysis Code	Fraction	Units	Group	Aliquot	Conductivity	Analyte Count
LSC-LLH3/SC-AQ	001	pCi		L	N/A	1
LSC-LLH3/SC-AQ			Group			
LSC-LLH3/SC-AQ	002	pCi		L	N/A	1
			Group			
LSC-LLH3-AQ	001	pCi		L	N/A	1
			Group			
LSC-LLH3-AQ	002	pCi		L	N/A	1
			Group			

SDG Report - Samples and Containers

SDG Specific Data

SDG	ARS1-18-00856	TAT Days	40	Project Type	Environmental
Sample Count	2	Date Received	3/16/2018	COC Number	2018-2173
Client	Los Alamos National Laboratory	Client Deadline	4/25/2018	PO Number	
Client Code	114	Internal Deadline	4/24/2018	Job Number	
Profile Number	PN-00094	Lab Deadline	4/22/2018	Job Location	

Samples and Containers Checked In Thus Far

Samples and Containers checked at this site											
FR	Name	Matrix	Start Date	End Date	Disp	Hold	Arch	Storage	Conductivity	Comments	
001	CAWA-18-151437	AQ	3/9/2018 11:18 AM	3/9/2018 11:18 AM	H	90	5	L1			
	IC_ID	Cnt	Volume (mL)	Container Type	pH Orig	pH Final	CPM	uR Hr	VOA	Head	Temp (C)
	288573	1	1109.00	HDP Container	0	0	80	20	N	N/A	0
002	CAWA-18-151439	AQ	3/9/2018 12:00 PM	3/9/2018 12:00 PM	H	90	5	L1			
	IC_ID	Cnt	Volume (mL)	Container Type	pH Orig	pH Final	CPM	uR Hr	VOA	Head	Temp (C)
	288574	1	1123.00	HDP Container	0	0	80	20	N	N/A	0

SDG Report - Analysis Assignments

SDG	ARS1-18-00856	Sample Count	2
Client	Los Alamos National Laboratory	Analysis Count	2-4

Sample Count Totals Per Analysis				Analyses Assigned Per Fraction		
Analysis Code	Analysis Description	In/Out	Samples Count	Fraction	Analysis Code	X = Assigned
LSC-LLH3/SC-AQ	Low Level Tritium Screen in (Aqueous)	I	2	001	LSC-LLH3/SC-AQ	X
LSC-LLH3-AQ	Low Level Tritium by Enrichment Process in (Aqueous [AQ])	I	2	001	LSC-LLH3-AQ	X
				002	LSC-LLH3/SC-AQ	X
				002	LSC-LLH3-AQ	X

ARS FILE TRACKING SHEET

SDG: ARS1-18-00856

Task	Date / Time	Initials
Date & Time Samples Received	3/16/18 10:00	MC
ICOC Initiated/Storage Location: <u>L1</u>	3/16/18 15:01	MC
Technical Checks Performed	<i>See Match</i>	
Report Written / EDD Generated <u>5-24-18/1156</u> <i>SOA</i>	<u>5-24-18/1156</u>	<i>SOA</i>
Report / EDD Reviewed for accuracy and completeness	<i>200 LCC added 5-24-18 12:30/14</i>	
Quality Assurance Checks Performed on Report	<i>6-7-18</i>	
Management Checks Performed on Report	<i>10:50</i>	<i>NO</i>
Preliminary Report Scan	<i>na</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

[illegible]