

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: 11667 CdV-P-15-3 S4

coc: 2018-2000

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 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
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"/>	<input 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 ²)	Shipment Activity (dpm*g/100cm ²)	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"/>	<input type="checkbox"/>
Alpha ≥ 125	AND Alpha $\geq 1,250,000$	AT other locations	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Beta $\geq 1,500$	AND Beta $\geq 15,000,000$	AT any location	<input checked="" type="checkbox"/>	<input 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.			<input checked="" type="checkbox"/>	<input 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 checked="" type="checkbox"/>	<input 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"/>	<input 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 $\geq 270,000$ pCi Total	<input checked="" type="checkbox"/>	<input type="checkbox"/>
• Cs-137 ≥ 270 pCi/g	AND Cs-137 $\geq 270,000$ pCi Total	<input checked="" type="checkbox"/>	<input type="checkbox"/>
• Pu-238 ≥ 27 pCi/g	AND Pu-238 $\geq 270,000$ pCi Total	<input checked="" type="checkbox"/>	<input type="checkbox"/>
• Pu-239/240 ≥ 27 pCi/g	AND Pu-239/240 $\geq 270,000$ pCi Total	<input checked="" type="checkbox"/>	<input type="checkbox"/>
• Th-228 ≥ 27 pCi/g	AND Th-228 $\geq 270,000$ pCi Total	<input checked="" type="checkbox"/>	<input type="checkbox"/>
• U-234 ≥ 270 pCi/g	AND U-234 $\geq 1,600,000,000$ pCi Total	<input checked="" type="checkbox"/>	<input type="checkbox"/>
• U-238 ≥ 270 pCi/g	AND U-238 \geq unlimited	<input checked="" type="checkbox"/>	<input type="checkbox"/>
• H-3 $\geq 27,000,000$ pCi/g	AND H-3 $\geq 27,000,000,000$ pCi Total	<input checked="" type="checkbox"/>	<input 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 ≥ 1 Ci. If YES - Do not ship.		<input checked="" type="checkbox"/>	<input 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"/>	<input 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 checked="" type="checkbox"/>	<input 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) Tanya Vander Vliet	2-22-18
(Signature) Tanya Vander Vliet	1450

Hazard Assessment Reviewed By:	Date/Time
(Printed Name) Ekaterina Popova	2/22/18
(Signature) [Signature]	1450

ER-SOP-10094, R1, Attachment

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 ²)	Shipment Activity (dpm*g/100cm ²)	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 ² or Beta ≥ 160,000,000 dpm*g/100cm ² . If YES – Do not ship.				
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.				
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 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) Allisyn Starnick	2/22/18
(Signature)	1345

Hazard Assessment Reviewed By:	Date/Time
(Printed Name) MAT ENGERT	2-22-18
(Signature)	1345

DATA VALIDATION REPORT

Chain Of Custody No. 2018-2000

1. Distribution Of Samples In EDD.

SDG	Analytical Method	Regular Samples	Field Duplicates	Trip Blanks	Field Blanks	Equipment Blanks
ARS1-18-00635	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
ARS1-18-00635	Generic:Low_Level_Tritium	ARS1-B18-	ARS1-B18-	2					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-18-32	ARS1-B18-00542-04	REG	1	0	0	0
Generic:Low_Level_Tritium	RAD	CAWA-18-67	ARS1-B18-00542-05	REG	1	0	0	0
Generic:Low_Level_Tritium	RAD	CAWA-18-69	ARS1-B18-00542-06	TEST	1	0	0	0
Generic:Low_Level_Tritium	RAD	LCS	ARS1-B18-00542-01	LCS	0	0	1	0
Generic:Low_Level_Tritium	RAD	MB	ARS1-B18-00542-03	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-B18-00542-01		Generic:Low_Level_Tritium	Tritium	ARS1-B18-00542	05-01-2018	W	75.000		120.00	80.000		10		

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
16-26644	2018-2000	CAWA-18-32	REG	INIT	RAD	Generic:Low_Level_Tritium	Tritium		U	R12a	Y	6.290	pCi/L	6.290	pCi/L	3.810	1.580	W	02/22/2018		ARS1-B18-00542	VAL	Y
CdV-R-15-3 S4	2018-2000	CAWA-18-67	REG	INIT	RAD	Generic:Low_Level_Tritium	Tritium	U	U	R5	N	-0.660	pCi/L	-0.660	pCi/L	3.410	0.980	W	02/22/2018		ARS1-B18-00542	VAL	Y
CdV-R-37-2 S2	2018-2000	CAWA-18-69	TEST	INIT	RAD	Generic:Low_Level_Tritium	Tritium	U	U	R5	N	-0.810	pCi/L	-0.810	pCi/L	3.960	1.140	W	02/22/2018		ARS1-B18-00542	VAL	Y

Reason Code

Description

- R12a

The LCS percent recovery was <the LAL but >10%. Follow the external laboratory limits located within the associated data package.
- 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-18-32	16-26644	REG	Generic:Low_Level_Tritium	0	1
CAWA-18-67	CdV-R-15-3 S4	REG	Generic:Low_Level_Tritium	0	1
CAWA-18-69	CdV-R-37-2 S2	TEST	Generic:Low_Level_Tritium	0	1



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ARS Aleut Analytical Reports

for

Los Alamos National Laboratory

Request Number: 2018-2000

SDG: ARS1-18-00635



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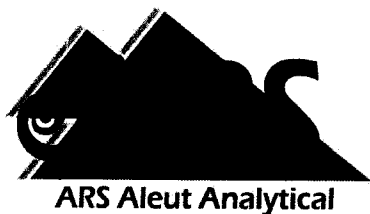
ARS Aleut Analytical Reports

for

**Los Alamos National Laboratory
Request: 2018-2000**

Original COC

[illegible]



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ARS Aleut Analytical Reports

for

**Los Alamos National Laboratory
Request: 2018-2000**

Case Narrative



ARS Aleut Analytical, LLC

Laboratory Analysis Report

ARS1-18-00635

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 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**



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May 10, 2018

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

ARS SDG: **ARS1-18-00635**
Project Description: **2018-2000**
Cost Code: **ADEP**

Dear Nita,

On March 1, 2018, ARS Aleut Analytical, LLC received three (3) samples to be analyzed for Enriched H-3.

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

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

If you have any questions, please do not hesitate to call at 255.381.2991 or email ProjectManagers@amrad.com.

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-18-32	ARS1-18-00635-001
CAWA-18-67	ARS1-18-00635-002
CAWA-18-69	ARS1-18-00635-003

SAMPLE RECEIPT/PREP

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

ANALYTICAL METHODS

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

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

ANALYTICAL RESULTS**ARS1-B18-00542:**

LCS recovery is 75%, which is lower than the client's acceptance range (80-120%). Data is being released as qualified.


The Batch LCSD (Sample B18-00542-02) was lost during enrichment, therefore there are no duplicate criteria for this batch.

MDCs for Fractions #2 and #3 are slightly elevated above the CRDL of 3.221 pCi/L.

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

5-11-18
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 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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1 (800) 401-4277 • FAX (225) 381-2996

ARS Sample Delivery Group: ARS1-18-00635

Client Sample ID: CAWA-18-32

Sample Collection Date: 02/22/18

Sample Matrix: Aqueous

Percent Solids: N/A

Request or PO Number: 2018-2000

ARS Sample ID: ARS1-18-00635-001

Date Received: 03/01/18

Report Date: 05/11/18

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	6.290	1.580	3.810	1.830	3.221	Q	pCi/L	ARS-040	05/02/18 10:24	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: ARS1-18-00635

Client Sample ID: CAWA-18-67

Sample Collection Date: 02/22/18

Sample Matrix: Aqueous

Percent Solids: N/A

Request or PO Number: 2018-2000

ARS Sample ID: ARS1-18-00635-002

Date Received: 03/01/18

Report Date: 05/11/18

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	-0.660	0.980	3.410	1.630	3.221	QU	pCi/L	ARS-040	05/02/18 16:06	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: ARS1-18-00635

Client Sample ID: CAWA-18-69

Sample Collection Date: 02/22/18

Sample Matrix: Aqueous

Percent Solids: N/A

Request or PO Number: 2018-2000

ARS Sample ID: ARS1-18-00635-003

Date Received: 03/01/18

Report Date: 05/11/18

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	-0.810	1.140	3.960	1.900	3.221	QU	pCi/L	ARS-040	05/02/18 21:48	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 Aleut Analytical

QC Results Report

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Sample Delivery Group: ARS1-18-00635; 637

Laboratory Control Sample Evaluation

Analysis Batch	QC Type	Analyte	Analysis Results	CSU 1 (2s)	MDC	Expected Value	Qual	Report Units	Analysis Test Method	Analysis Date/Time	Analysis Technician	Percent Recovery (%)	LCS Acceptance Range
B18-00542	LCS	LLH3	27.020	4.360	3.600	35.900		pCi/L	ARS-040	5/1/18 22:59	MM	75	80-120%

Blank Evaluation

Analysis Batch	QC Type	Analyte	Analysis Results	CSU 1 (2s)	MDC	Expected Value	Qual	Report Units	Analysis Test Method	Analysis Date/Time	Analysis Technician
B18-00542	MBL	LLH3	-1.120	0.830	2.890	N/A	U	pCi/L	ARS-040	5/2/18 4:42	MM

Project Manager Review

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

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NELAP Certificate # E87558



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

ARS-040 Tritium Assay in Water Samples Using Electrolytic Enrichment

ARS SDG Number:	ARS1-18-00635; 637
ARS Batch Number:	ARS1-818-00542

Enrichment Factor Curve coeff. - Power $y = a \cdot x^b$	
a	8.978E-01
b	-9.611E-01

lambda	1.5403E-04	ACF (def. = 1)	1
Syserror (%)	15%	Reporting Units	pCi
Reporting Unc.	1	UCF	2.22

[illegible]

ARS-040 Tritium Assay in Water Samples Using Electrolytic Enrichment

[illegible]

Analytical Batch Report

Analysis Batch ID ARS1-B18-00542													
Method		ARS-040		Analysis		LSC-LLH3-AQ		Matrix		AQ			
Description Low Level Tritium by Electrolytic Enrichment													
ABatch Sample ID	Type	Blind Iso1	Blind Iso2	Blind Iso3	SDG	FR	Run	Prep Code	Filtered	Client ID	Group Name	Lab Deadline	
ARS1-B18-00542-01	LCS	B-25159											
ARS1-B18-00542-02	LCSD	B-25160											
ARS1-B18-00542-03	MBL												
ARS1-B18-00542-04	TRG				ARS1-18-00635	001	1			CAWA-18-32		04/07/18	
ARS1-B18-00542-05	TRG				ARS1-18-00635	002	1			CAWA-18-67		04/07/18	
ARS1-B18-00542-06	TRG				ARS1-18-00635	003	1			CAWA-18-69		04/07/18	
ARS1-B18-00542-07	TRG				ARS1-18-00637	001	1			CAWA-18-12		04/07/18	

LCS Report

Analytical Batch: ARS1-B18-00542

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-25159	ARS1-B18-00542-01	B-H3	S-0332	H-3	5	2.72210	16.8379	21.8727	5.0348	2.71081	05/01/2018	13.64837	MMORGAN	04/04/2018
B-25160	ARS1-B18-00542-02	B-H3	S-0332	H-3	5	2.72210	17.0094	22.0323	5.0229				MMORGAN	04/04/2018



Expected Value Calculations

ARS Batch Number: <input type="text" value="ARS1-B18-00542"/>	
LCS	Range
Enter these Values	26.938 - 44.896
CALCULATED EXPECTED VALUE(pCi/L)	35.917
Current ACT(DPM)	Standards Report generated for Analysis Date
NetWt(grams)	LCS Report
Aliquot	Procedural Data Report
LCSD	Range
Enter these Values	##### - #####
CALCULATED EXPECTED VALUE	NA
Current ACT(DPM)	Standards Report generated for Analysis Date
NetWt(grams)	LCS Report
Aliquot	Procedural Data Report



Standards Activity as of: 05/01/18 22:59

Active	Std ID	Isotope	PSCLT	Verification Date	Exp Date	Status	Ref Date	Ref ACT (dpm)	ACT at Date Above (dpm/g)	Half-life (days)	Parent ID	Expend Date
A	S-0332	H-3	SL	03/24/18	03/24/19	OK	03/23/18	6.0543E+00	6.0180	4.500E+03	S-0316	

ARS-040
Tritium Assay in Water Samples Using Electrolytic Enrichment

ARS Aleut Analytical, LLC
Baton Rouge Laboratory

Preparation Date: 04/10/2018 13:05
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-B18-00542-01	LCS		323.2400	206.5500	582.7200	1.5000	376.1700	4/10/2018 1:45:00 PM	5.0000	2.0000	4/24/2018 9:22:00 AM	2.0000
ARS1-B18-00542-02	LCS		318.4500	204.5300	577.4600	1.5000	375.9300	4/10/2018 1:45:00 PM	5.0000	2.0000	4/24/2018 9:22:00 AM	2.0000
ARS1-B18-00542-03	MBL		320.8300	199.4700	578.3900	1.5000	378.9200	4/10/2018 1:45:00 PM	5.0000	2.0000	4/24/2018 9:22:00 AM	2.0000
ARS1-B18-00542-04	TRG	ARS1-18-00635-001	329.9500	213.3700	589.9900	1.5000	376.6200	4/10/2018 1:45:00 PM	5.0000	2.0000	4/24/2018 9:22:00 AM	2.0000
ARS1-B18-00542-05	TRG	ARS1-18-00635-002	319.5000	212.0400	588.7400	1.5000	376.7000	4/10/2018 1:45:00 PM	5.0000	2.0000	4/24/2018 9:22:00 AM	2.0000
ARS1-B18-00542-06	TRG	ARS1-18-00635-003	319.2700	201.3800	578.6300	1.5000	377.2500	4/10/2018 1:45:00 PM	5.0000	2.0000	4/24/2018 9:22:00 AM	2.0000
ARS1-B18-00542-07	TRG	ARS1-18-00637-001	325.8400	200.6800	577.5500	1.5000	376.8700	4/10/2018 1:45:00 PM	5.0000	2.0000	4/24/2018 9:22:00 AM	2.0000

ARS-040
Tritium Assay in Water Samples Using Electrolytic Enrichment

ARS Aleut Analytical, LLC
Baton Rouge Laboratory

Procedure Data		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
ABatch Sample ID	Type											
ARS1-B18-00542-01	LCS	545.5800	15.7900	23.8233	121.4000	134.0000	12.6000	6.4600	16.4700	10.0100	16.4700	0.0000
ARS1-B18-00542-02	LCS	519.9800	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ARS1-B18-00542-03	MBL	533.4400	13.1400	28.8371	115.7800	126.6200	10.8400	6.6000	16.6100	10.0100	16.6100	0.0000
ARS1-B18-00542-04	TRG	559.5200	16.2000	23.2481	122.8300	136.5900	13.7600	6.6000	16.6200	10.0200	16.6200	0.0000
ARS1-B18-00542-05	TRG	546.1000	14.5600	25.8723	129.7600	141.8100	12.0500	6.6100	16.6500	10.0400	16.6500	0.0000
ARS1-B18-00542-06	TRG	537.4000	16.7500	22.5224	125.6400	139.6200	13.9800	6.5400	16.5600	10.0200	16.5600	0.0000
ARS1-B18-00542-07	TRG	543.7400	17.2200	21.8856	121.3400	133.8900	12.5500	6.4800	16.5300	10.0500	16.5300	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-B18-00542-01	LCS	16.4700	26.6500	10.1800
ARS1-B18-00542-02	LCSD	0.0000	0.0000	0.0000
ARS1-B18-00542-03	MBL	16.6100	26.7900	10.1800
ARS1-B18-00542-04	TRG	16.6200	26.6800	10.0600
ARS1-B18-00542-05	TRG	16.6500	26.7200	10.0700
ARS1-B18-00542-06	TRG	16.5600	26.6300	10.0700
ARS1-B18-00542-07	TRG	16.5300	26.5900	10.0600

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 LLT Reagent Grade (mL)
ARS1-B18-00542-01	LCS		1.50	10.00
ARS1-B18-00542-02	LCS		1.50	10.00
ARS1-B18-00542-03	MBL		1.50	10.00
ARS1-B18-00542-04	TRG	ARS1-18-00635-001	1.50	10.00
ARS1-B18-00542-05	TRG	ARS1-18-00635-002	1.50	10.00
ARS1-B18-00542-06	TRG	ARS1-18-00635-003	1.50	10.00
ARS1-B18-00542-07	TRG	ARS1-18-00637-001	1.50	10.00

ARS-040
Tritium Assay in Water Samples Using Electrolytic Enrichment

ARS Aleut Analytical, LLC
Baton Rouge Laboratory

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

LSC Instrument Data Transfer Report

\\PACKARD03176_NEW\Results\ARS\Low Level Tritium

Batch Sample ID		Non-BKG Samples Transferred		Samples Eligible To Save								
ARS1-B18-00542		6		6								
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	49		1	BACKGROUND	05/01/18 17:17	1.05	209.89	21.8400	330.00	ARS1-B18-00542		
ARS1-B18-00542-01	49		2	B18-00542-01	05/01/18 22:59	3.83	211.07	21.9300	330.00	ARS1-B18-00542		
ARS1-B18-00542-03	49		3	B18-00542-03	05/02/18 04:42	0.91	213.66	22.1200	330.00	ARS1-B18-00542		
ARS1-B18-00542-04	49		4	B18-00542-04	05/02/18 10:24	1.66	206.78	21.6100	330.00	ARS1-B18-00542	ARS1-18-00635	1
ARS1-B18-00542-05	49		5	B18-00542-05	05/02/18 16:06	0.98	206.17	21.5600	330.00	ARS1-B18-00542	ARS1-18-00635	1
ARS1-B18-00542-06	49		6	B18-00542-06	05/02/18 21:48	0.97	205.73	21.5300	330.00	ARS1-B18-00542	ARS1-18-00635	1
ARS1-B18-00542-07	49		7	B18-00542-07	05/03/18 03:31	3.00	210.76	21.9100	330.00	ARS1-B18-00542	ARS1-18-00637	1

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\20180501_1708

Raw Results Path: C:\Packard\Tricarb\Results\ARS\Low Low Level Tritium 3\20180501_1708\20180501_1708.results

RTF File Name: C:\Packard\Tricarb\Results\ARS\Low Low Level Tritium 3\20180501_1708\Report1.rtf

Comma-Delimited File Name: C:\Packard\Tricarb\Results\ARS\Low Low Level Tritium 3\20180501_1708\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

Coincidence Time (nsec): 18

Delay Before Burst (nsec): 200

Luminescence Correction: Off

Heterogeneity Monitor: Off

Half Life-

Half Life

Half Life Correction: Off

Regions Half Life

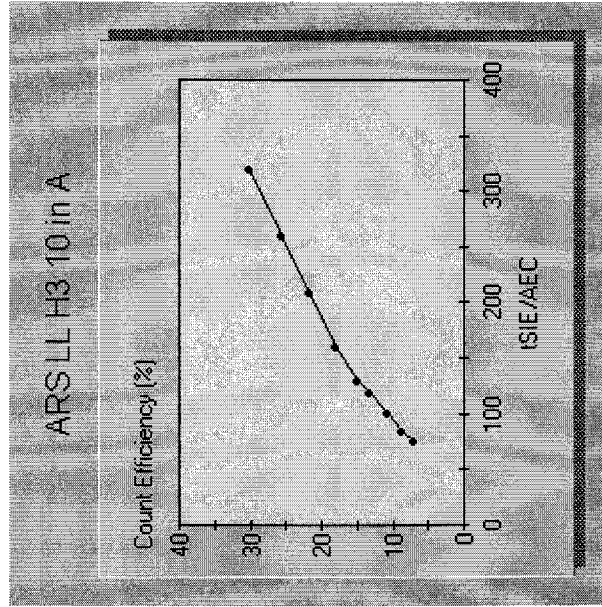
Units

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 (%)
30.21	320.32
25.50	259.88
21.83	209.67
18.05	160.20
14.84	131.12
13.13	119.84
10.74	101.33
8.63	84.91
7.12	75.26

P#	S#	SMPL_ID	CPMA	DPM1	tsIE	Eff	Nucl	In A	Count	Time	DATE	TIME	MESSAGES
49	1	BACKGROUN	1.049	4.803	209.89			21.84	330.00		5/1/2018	5:17:20 PM	
49	2	B18-00542-01	3.826	17.446	211.07			21.93	330.00		5/1/2018	10:59:47 PM	
49	3	B18-00542-03	0.905	4.092	213.66			22.12	330.00		5/2/2018	4:42:17 AM	
49	4	B18-00542-04	1.660	7.681	206.78			21.61	330.00		5/2/2018	10:24:26 AM	
49	5	B18-00542-05	0.977	4.534	206.17			21.56	330.00		5/2/2018	4:06:34 PM	
49	6	B18-00542-06	0.973	4.520	205.73			21.53	330.00		5/2/2018	9:48:46 PM	
49	7	B18-00542-07	3.004	13.714	210.76			21.91	330.00		5/3/2018	3:31:44 AM	

Beta Liquid Scintillation Counter Log Book

Date	Time	ARS Sample I.D. Number	Batch Number	Liquid Scintillation File Number	Technician Initials
4-30-18	1530	B18-00541-04	B18-00541	1710	MM
↓	↓	↓ -05	↓	↓	MM
↓	↓	↓ -06	↓	↓	MM
↓	↓	↓ -07	↓	↓	MM
4-30-18 43mm 4-30-18	1530	SNC5	QA	QA	MM
↓	↓	Background	B18-00542	1708	MM
↓	↓	B18-00542-01	↓	↓	MM
↓	↓	↓ -03	↓	↓	MM
↓	↓	↓ -04	↓	↓	MM
↓	↓	↓ -05	↓	↓	MM
↓	↓	↓ -06	↓	↓	MM
↓	↓	↓ -07	↓	↓	MM
5-2-18	1704	SNC5	QA	QA	J

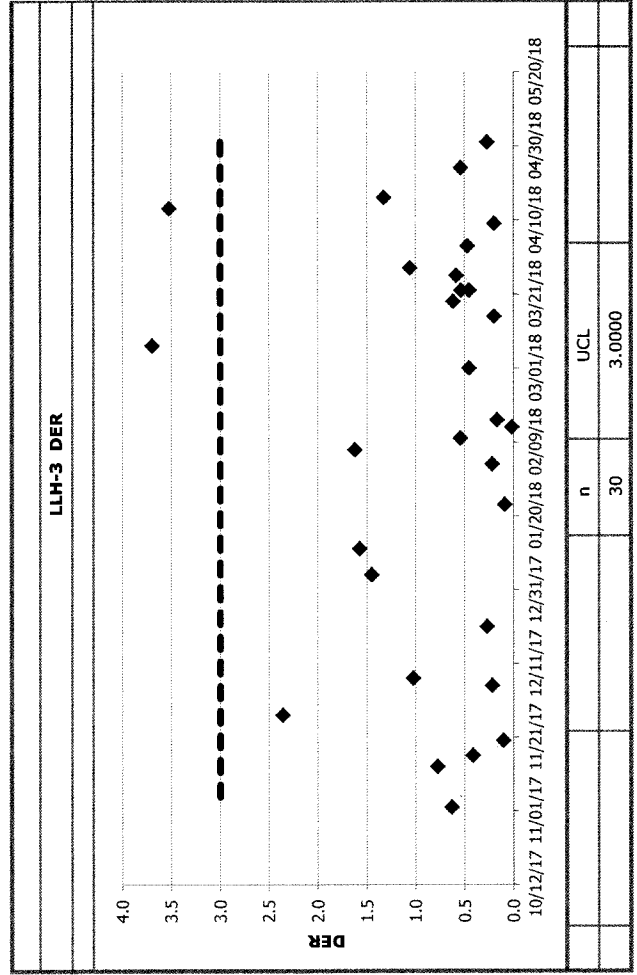
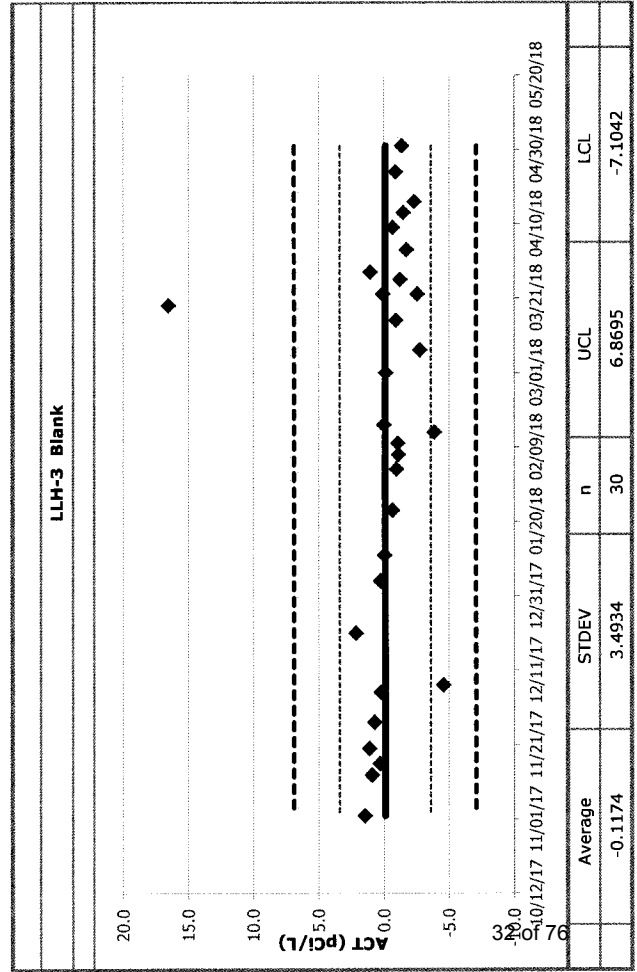
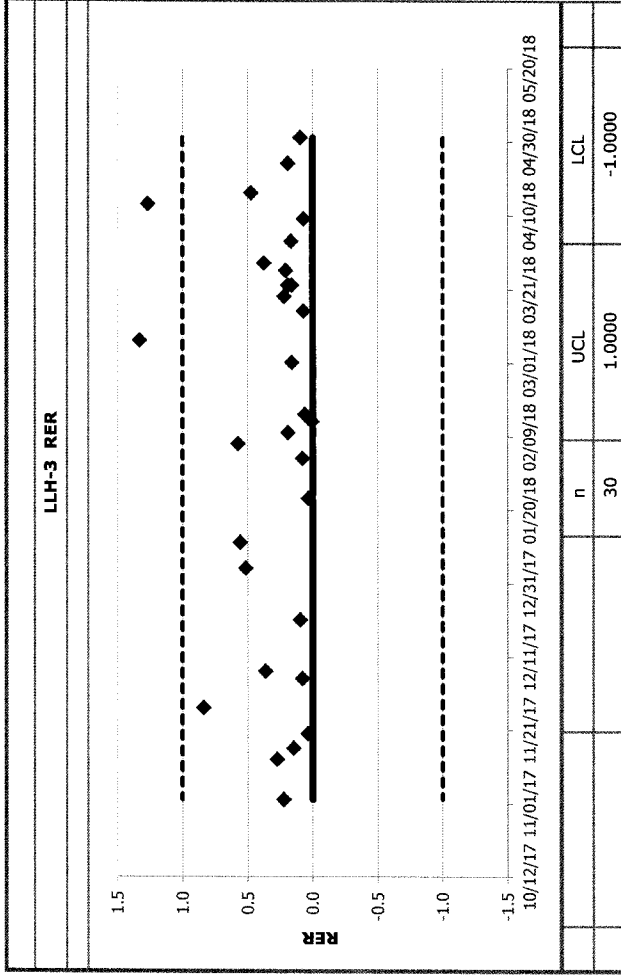
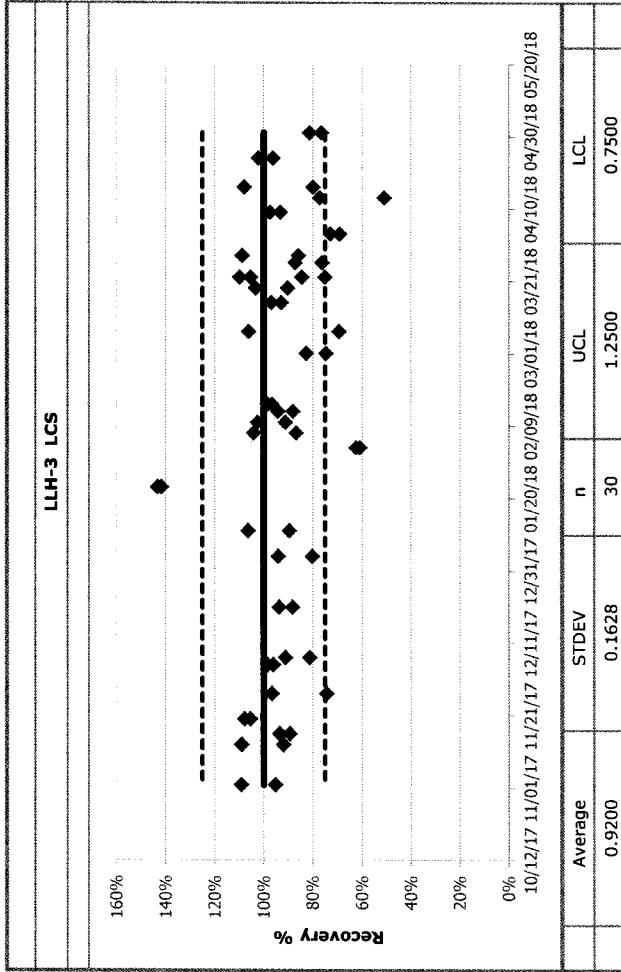


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**ARS Aleut
Analytical Reports
for
Los Alamos National Laboratory
Low Level Tritium
by
Low Level Liquid
Scintillation Counting
Control Charts**

QC Chart

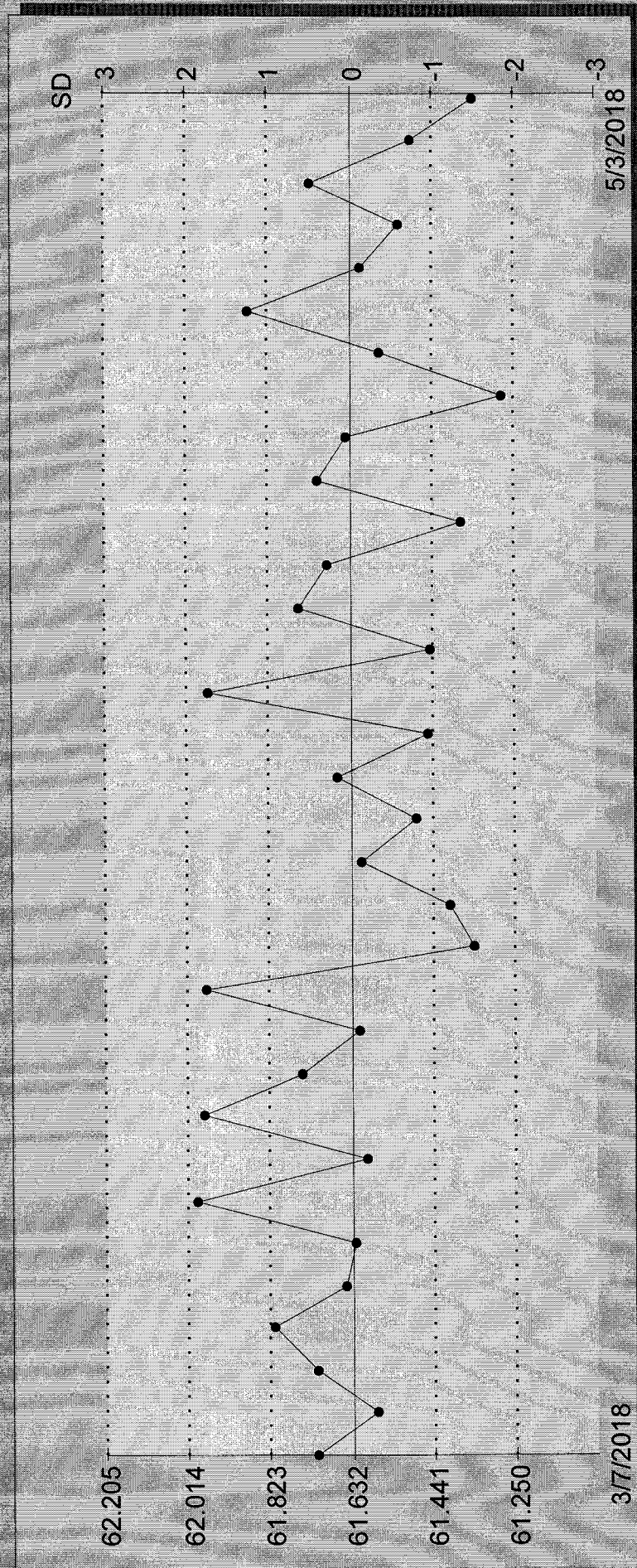


3H Efficiency

Total # pts : 2497
Valid # pts : 33
Mean : 61.63
SD : 0.19

Date	Value	Valid Pt
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 18, 2018	61.62	X
Mar 19, 2018	61.99	X
Mar 21, 2018	61.60	X
Mar 22, 2018	61.98	X
Mar 22, 2018	61.75	X
Mar 23, 2018	61.61	X
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

3H Efficiency : 2497
Total # pts : 33
Valid # pts : 61.63
Mean : 0.19
SD :

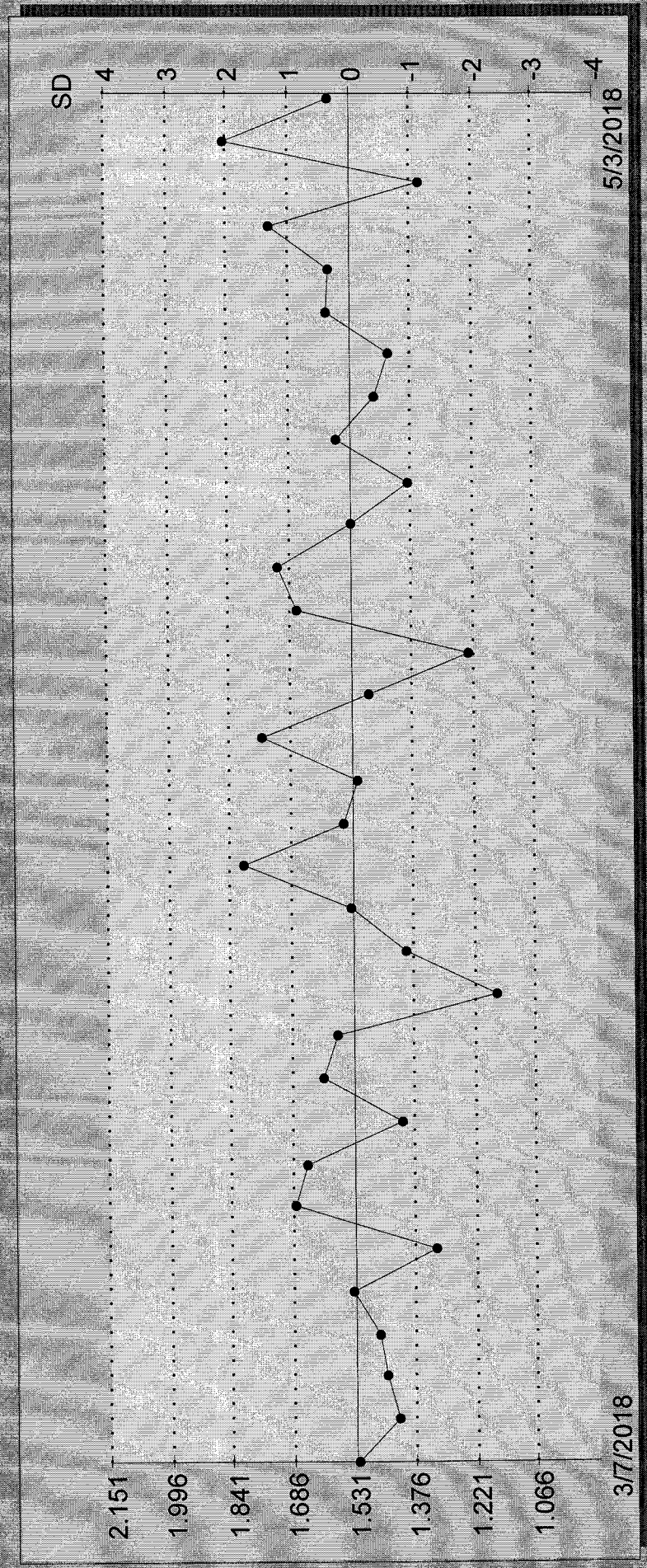


3H Background

Total # pts : 2450
Valid # pts : 33
Mean : 1.53
SD : 0.16

Date	Value	Valid Pt
Mar 07, 2018	1.52	X
Mar 09, 2018	1.42	X
Mar 10, 2018	1.45	X
Mar 12, 2018	1.47	X
Mar 13, 2018	1.54	X
Mar 18, 2018	1.33	X
Mar 19, 2018	1.68	X
Mar 21, 2018	1.65	X
Mar 22, 2018	1.41	X
Mar 22, 2018	1.61	X
Mar 23, 2018	1.58	X
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

3H Background
Total # pts : 2450
Valid # pts : 33
Mean : 1.53
SD : 0.16





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**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-B18-00508
ARS SDG ID(s): ARS1-18-00635; 637

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**

Analytical Batch Report

Analysis Batch ID ARS1-B18-00508												
Method		ARS-054		Analysis		LSC-LLH3/SC-AQ		Matrix		AQ		
Description Low Level Tritium Screening												
ABatch Sample ID	Type	Blind Iso1	Blind Iso2	Blind Iso3	SDG	FR	Run	Prep Code	Filtered	Client ID	Group Name	Lab Deadline
ARS1-B18-00508-01	LCS											
ARS1-B18-00508-02	LCSD											
ARS1-B18-00508-03	MBL											
ARS1-B18-00508-04	TRG				ARS1-18-00635	001	1			CAWA-18-32		04/07/18
ARS1-B18-00508-05	TRG				ARS1-18-00635	002	1			CAWA-18-67		04/07/18
ARS1-B18-00508-06	TRG				ARS1-18-00635	003	1			CAWA-18-69		04/07/18
ARS1-B18-00508-07	TRG				ARS1-18-00637	001	1			CAWA-18-12		04/07/18

ARS-054
Tritium in Water

ARS International
Baton Rouge Laboratory

Preparation Date: 03/06/2018 13:04
Prepared By: MMORGAN

Procedure Data						
ABatch Sample ID	Type	SDG/Fraction	ICOC ID	Aliquot 1 Vol/Wt	Aliquot 1 Units	Aliquot 2 Units
ARS1-B18-00508-01	LCS			1.0000		
ARS1-B18-00508-02	LCSD			1.0000		
ARS1-B18-00508-03	MBL			1.0000		
ARS1-B18-00508-04	TRG	ARS1-18-00635-001	287696	0.0010	L	
ARS1-B18-00508-05	TRG	ARS1-18-00635-002	287697	0.0010	L	
ARS1-B18-00508-06	TRG	ARS1-18-00635-003	287698	0.0010	L	
ARS1-B18-00508-07	TRG	ARS1-18-00637-001	287699	0.0010	L	

ARS-054
Tritium in Water

ARS International
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-B18-00508-01	LCS		1.00
ARS1-B18-00508-02	LCSD		1.00
ARS1-B18-00508-03	MBL		1.00
ARS1-B18-00508-04	TRG	ARS1-18-00635-001	10.00
ARS1-B18-00508-05	TRG	ARS1-18-00635-002	10.00
ARS1-B18-00508-06	TRG	ARS1-18-00635-003	10.00
ARS1-B18-00508-07	TRG	ARS1-18-00637-001	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

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\20180306_2220
Raw Results Path: C:\Packard\Tricarb\Results\ARS\Low Low Level Tritium 3\20180306_2220\20180306_2220.results
RTF File Name: C:\Packard\Tricarb\Results\ARS\Low Low Level Tritium 3\20180306_2220\Report1.rtf
Comma-Delimited File Name: C:\Packard\Tricarb\Results\ARS\Low Low Level Tritium 3\20180306_2220\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): 120.00
Count Mode: Low Level
Assay Count Cycles: 1 Repeat Sample Count: 1
#Vials/Sample: 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 Luminescence Correction: Off
Flashed Samples: Off Heterogeneity Monitor: Off
Coincidence Time (nsec): 18 Delay Before Burst (nsec): 200
Half Life-

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


A
 B
 C

Cycle 1 Results									
P#	S#	SMPL ID	CPMA	DPM1	tsIE	Eff Nucl	In A	Count	Time
49	1	BACKGROUND	0.836	3.823	210.37		21.88	120.00	3/6/2018 10:29:09 PM
49	2	B18-00508-04	1.112	5.127	207.98		21.70	120.00	3/7/2018 12:39:21 AM
49	3	B18-00508-05	1.133	5.140	212.67		22.05	120.00	3/7/2018 2:49:51 AM
49	4	B18-00508-06	1.177	5.446	206.95		21.62	120.00	3/7/2018 5:00:05 AM
49	5	B18-00508-07	1.193	5.500	207.82		21.69	120.00	3/7/2018 7:10:26 AM

*

\\PACKARD03170_NEW\Results\ARS\Low Level Tritium

LSC Instrument Data Transfer Report



LSC Instrument Data Transfer Report

Batch Sample ID

ARS1-B18-00508

Non-BKG Samples Transferred

4

Samples Eligible To Save

4

LSC 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

49

1

BACKGROUND

03/06/18 22:29

0.84

210.37

21.8800

120.00

ARS1-B18-00508

ARS1-B18-00508-04

49

2

B18-00508-04

03/07/18 00:39

1.11

207.98

21.7000

120.00

ARS1-B18-00508

ARS1-18-00635

1

ARS1-B18-00508-05

49

3

B18-00508-05

03/07/18 02:49

1.13

212.67

22.0500

120.00

ARS1-B18-00508

ARS1-18-00635

1

ARS1-B18-00508-06

49

4

B18-00508-06

03/07/18 05:00

1.18

206.95

21.6200

120.00

ARS1-B18-00508

ARS1-18-00635

1

ARS1-B18-00508-07

49

5

B18-00508-07

03/07/18 07:10

1.19

207.82

21.6900

120.00

ARS1-B18-00508

ARS1-18-00637

1

\\PACKARD3170_NEW\Results\ARS1\Low Level Tritium

Beta Liquid Scintillation Counter Log Book

Date	Time	ARS Sample I.D. Number	Batch Number	Liquid Scintillation File Number	Technician Initials
2-28-18	15:30	B18-00131-10	B18-00131	1719	mm
↓	↓	↓ -11	↓	↓	mm
↓	↓	↓ -12	↓	↓	mm
3-2-18	0816	SNC 5	QA	QA	mm
3-6-18	15:00	SNC 5	QA	QA	mm
↓	↓	Background	B18-00509	1547	mm
↓	↓	B18-00509-04	↓	↓	mm
↓	↓	↓ -05	↓	↓	mm
↓	↓	Background	B18-00508	2220	mm
↓	↓	B18-00508-04	↓	↓	mm
↓	↓	↓ -05	↓	↓	mm
↓	↓	↓ -06	↓	↓	mm
↓	↓	↓ -07	↓	↓	mm
↓	↓	Background	B18-00468		mm
↓	↓	B18-00468-04	↓	↓	mm
↓	↓	↓ -05	↓	↓	mm
↓	↓	↓ -06	↓	↓	mm
↓	↓	↓ -07	↓	↓	mm
3-6-18	16:30	SNC 5	QA	QA	mm

Low Level Tritium pH Checks

[illegible]



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for

Los Alamos National Laboratory

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

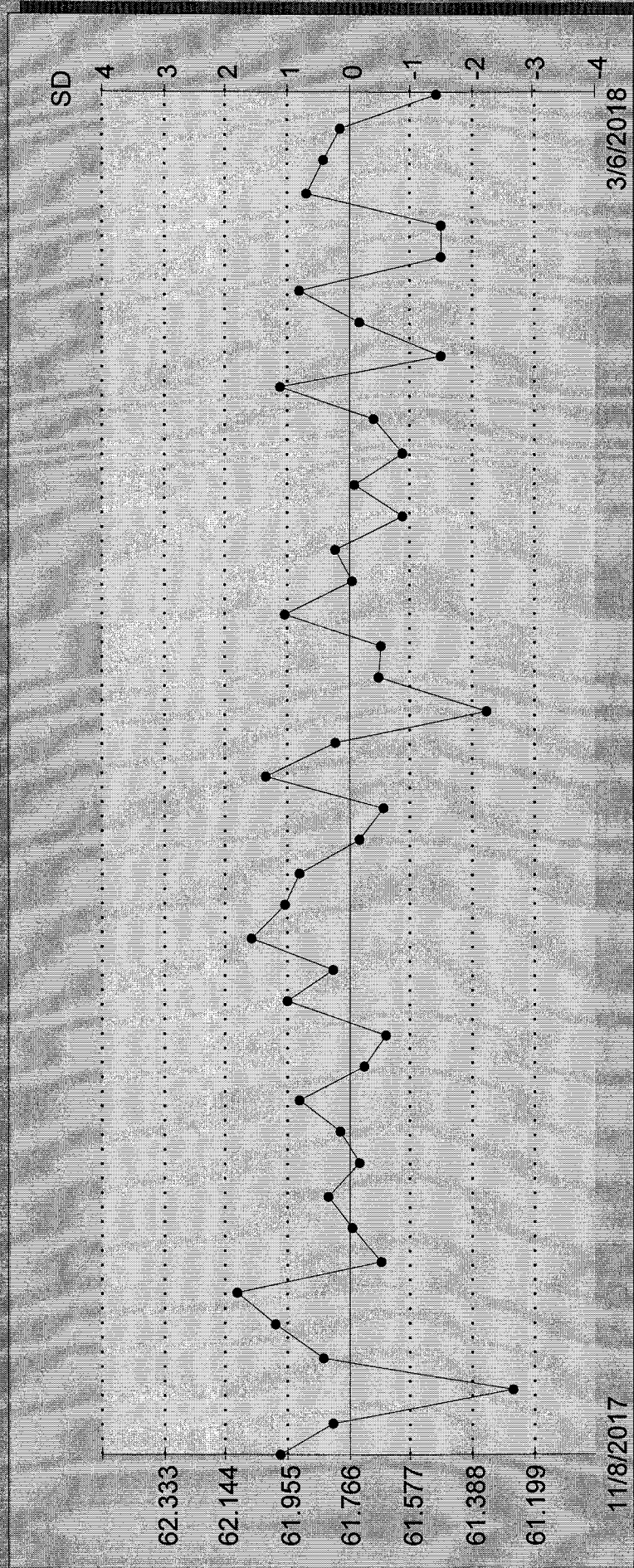
Control Charts

3H Efficiency

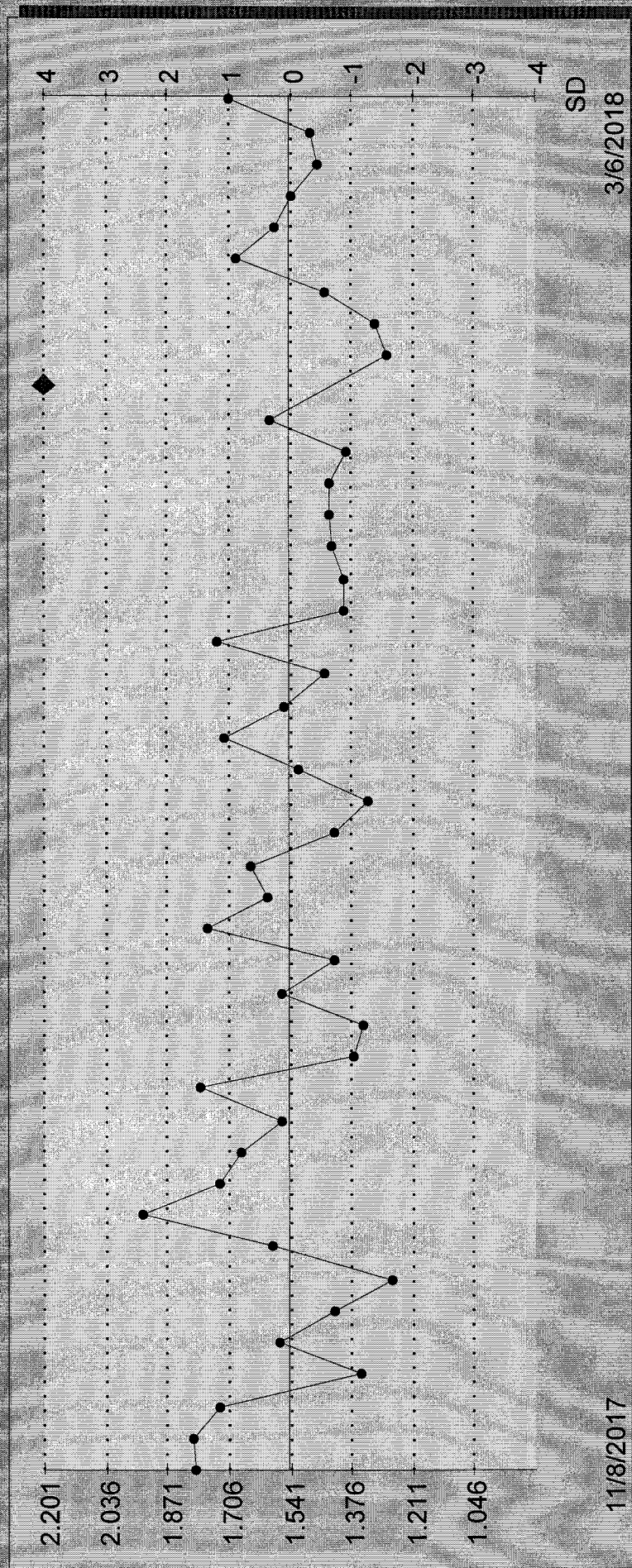
Total # pts : 2464
Valid # pts : 43
Mean : 61.77
SD : 0.19

Date	Value	Valid Pt
Nov 08, 2017	61.98	X
Nov 09, 2017	61.81	X
Nov 09, 2017	61.26	X
Nov 13, 2017	61.84	X
Nov 14, 2017	61.99	X
Nov 17, 2017	62.11	X
Nov 21, 2017	61.67	X
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

3H Efficiency : 2464
 Total # pts : 43
 Valid # pts : 61.77
 Mean : 61.77
 SD : 0.19



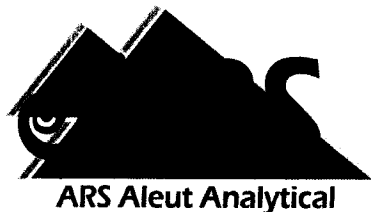
3H Background
Total # pts : 2417
Valid # pts : 43
Mean : 1.54
SD : 0.17



3H Background

Total # pts : 2417
Valid # pts : 43
Mean : 1.54
SD : 0.17

Date	Value	Valid Pt
Nov 08, 2017	1.80	X
Nov 09, 2017	1.81	X
Nov 09, 2017	1.73	X
Nov 13, 2017	1.35	X
Nov 14, 2017	1.57	X
Nov 17, 2017	1.42	X
Nov 21, 2017	1.27	X
Nov 22, 2017	1.59	X
Nov 25, 2017	1.94	X
Nov 29, 2017	1.74	X
Dec 03, 2017	1.67	X
Dec 03, 2017	1.57	X
Dec 03, 2017	1.78	X
Dec 03, 2017	1.37	X
Dec 04, 2017	1.35	X
Dec 04, 2017	1.57	X
Dec 04, 2017	1.42	X
Dec 04, 2017	1.76	X
Dec 04, 2017	1.60	X
Dec 04, 2017	1.65	X
Dec 11, 2017	1.42	X
Dec 14, 2017	1.34	X
Dec 15, 2017	1.52	X
Dec 17, 2017	1.72	X
Dec 18, 2017	1.56	X
Dec 19, 2017	1.45	X
Jan 08, 2018	1.74	X
Jan 08, 2018	1.40	X
Jan 10, 2018	1.40	X
Jan 14, 2018	1.43	X
Jan 15, 2018	1.43	X
Jan 17, 2018	1.43	X
Jan 29, 2018	1.39	X
Feb 01, 2018	1.60	X
Feb 05, 2018	152768.14	
Feb 05, 2018	1.28	X
Feb 06, 2018	1.31	X
Feb 06, 2018	1.45	X
Feb 13, 2018	1.69	X
Feb 14, 2018	1.59	X
Feb 15, 2018	1.54	X
Feb 28, 2018	1.47	X
Mar 03, 2018	1.49	X
Mar 06, 2018	1.71	X



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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

10% Max

PASS

Standard Deviation percent of known concentration

5% Max

PASS

Average
 Two Sigma Uncertainty

Target Activity

% Diff

6.24	2.81
0.57	0.26
4.82%	4.82%
6.05	2.73
3.07%	3.07%

Verification Expiration Date: **March 24, 2019**

Prepared & Counted By Melissa 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

Tech:	Melisa Morgan	
Pipette:		
Scale ID:	P214062006	
Standard ID:	S-0332	
Tracer ID:		
Sample ID	Std. Weight(g)	Tracer 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	5.0477 <u>5.0469</u>	
V2	<u>5.0240</u>	
V3	<u>5.0203</u>	
V4	<u>5.0107</u>	
V5	<u>5.0092</u>	

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\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

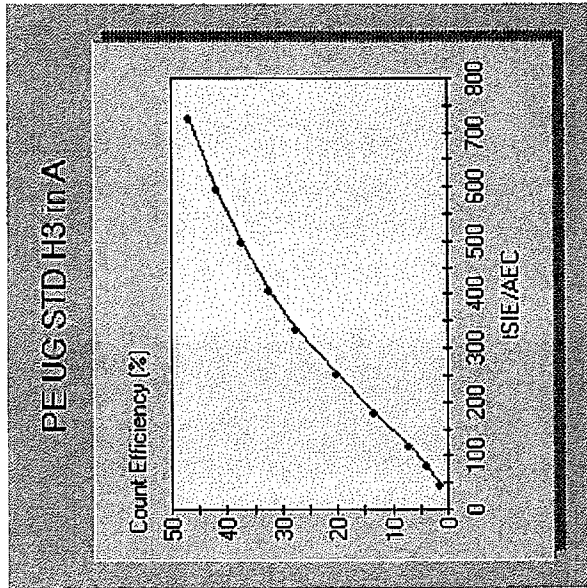
Background Subtract: Off
 Low CPM Threshold: Off
 2 Sigma % Terminator: On - Any Region

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#	SNPL ID	CPMA	DFM1	tSIE	Eff Nucl In A	Count Time	DATE	TIME	MESSAGES
----	----	---------	------	------	------	---------------	------------	------	------	----------

QuantaSmart (TM) - 4.00 - Serial# 117992

3/26/2018 5:30:58 PM

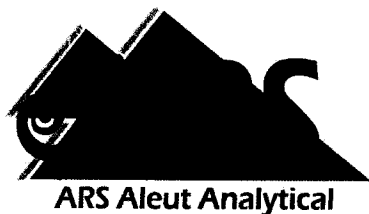
Protocol# 7 - H3 Normal Lvl 2.lsa

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_Calb	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)	4499.5000000	
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 03/22/2016 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 03/22/2016 13:14						
Diluent/matrix		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)		Is_Tracer	FALSE			
Dilution Empty Container Mass (g)	393.22	Is_Calib	FALSE			
Dilution Full Cont g (if measured)						
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	03/22/2016 13:14					



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Folder Duplicate**



Report Compilation Checklist

ARS SDG: 18-00635

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	

SOB
Report Generator Signature

5-10-18
Date

[Signature]
Management Review Signature

5-11-18
Date



LSC
Technical Review Checklist

ARS SDG ARS1-18-00635

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: B18-00508 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?	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): _____						
Melisa Morgan 3-6-2018 Chemist Signature Date			[Signature] 3-6-18 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	<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
			[Signature] 3-7-18 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 3-7-2018 Analyst Signature Date			N/A Technical Reviewer Signature Date			



Batch A: B18-00508

LSC
Technical Review Checklist

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



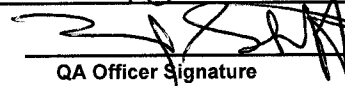
LSC Technical Review Checklist

ARS SDG ARS1-18-00635Sample Matrix: AQ Aliquot (Circle One): Dry As Received ☒ Filtered Other: _____Required QC Samples (Mark all that apply): ☒ Blank ☒ LCS ☐ LCSD ☐ Sample Dup ☐ MS ☐ MSDARS A. Batch ID(s): Batch A: B18-00542 Batch B: N/A Batch C: N/ATest 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): _____		
Melisa Morgan 4-30-2018 Chemist Signature Date		 4-30-18 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	<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
 5-7-18 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 5-7-18 Analyst Signature Date		_____ Technical Reviewer Signature Date

Batch A: B18-00542

LSC Technical Review Checklist

C. BATCH QC VALIDATION

	Proj. Mgr. Review	QA Officer Review
1) Activity + 3xCSU a Negative Number?	Yes No N/A	Yes No N/A
2) RDL Criteria are Met?	Yes No N/A	Yes No N/A
3) Method Blank Criterion Met?	Yes No N/A	Yes No N/A
4) LCS/LCD Criteria Met?	Yes No N/A	Yes No N/A
5) Duplicate (Sample Duplicate, LCSD, MSD) Criteria Met?	Yes No N/A	Yes No N/A
6) MS/MSD Criteria Met?	Yes No N/A	Yes No N/A
7) Batch QC Anomaly? <input type="checkbox"/> No <input checked="" type="checkbox"/> Yes (See Tech Notes) <i>narrative</i> NCR # (If initiated): _____		
 Project Manager Signature		 QA Officer Signature
5-10-18 Date	5-11-18 Date	

GENERAL COMMENTS

SDG Report - Samples and Containers

SDG Specific Data

SDG	ARS1-18-00635	TAT Days	40	Project Type	Environmental
Sample Count	3	Date Received	3/1/2018	COC Number	2018-2000
Client	Los Alamos National Laboratory	Client Deadline	4/10/2018	PO Number	
Client Code	114	Internal Deadline	4/9/2018	Job Number	
Profile Number	PN-00094	Lab Deadline	4/7/2018	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-18-32	AQ	2/22/2018 12:07 PM	2/22/2018 12:07 PM	H	90	5	AE-3		
	IC_ID	Cnt	Volume (mL)	Container Type	pH Orig	pH Final	CPM	uR Hr	VOA	Head
	287511	1	1143.00	HDP Container	7	7	80	20	N	N/A
002	CAWA-18-67	AQ	2/22/2018 1:43 PM	2/22/2018 1:43 PM	H	90	5	AE-3		
	IC_ID	Cnt	Volume (mL)	Container Type	pH Orig	pH Final	CPM	uR Hr	VOA	Head
	287512	1	1132.00	HDP Container	7	7	80	22	N	N/A
003	CAWA-18-69	AQ	2/22/2018 12:34 PM	2/22/2018 12:34 PM	H	90	5	AE-3		
	IC_ID	Cnt	Volume (mL)	Container Type	pH Orig	pH Final	CPM	uR Hr	VOA	Head
	287513	1	1151.00	HDP Container	7	7	70	20	N	N/A
										Temp (C)
										4.5

SDG Report - Analysis Assignments

SDG	ARS1-18-00635	Sample Count	3
Client	Los Alamos National Laboratory	Analysis Count	2-6

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	3	001	LSC-LLH3/SC-AQ	X
				001	LSC-LLH3-AQ	X
LSC-LLH3-AQ	Low Level Tritium by Enrichment Process in (Aqueous [AQ])	I	3	002	LSC-LLH3/SC-AQ	X
				002	LSC-LLH3-AQ	X
				003	LSC-LLH3/SC-AQ	X
				003	LSC-LLH3-AQ	X

Client Name: Los Alamos National Laboratory

Profile Name: Nita Patel (Site Alias)

Report Level: 4

72 of 76

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

Analysis Code	Fraction	Units	Aliquot	Conductivity	Analyte Count
LSC-LLH3/SC-AQ	001	PCI	L	N/A	1
		Group			
LSC-LLH3/SC-AQ	002	PCI	L	N/A	1
		Group			
LSC-LLH3/SC-AQ	003	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			
LSC-LLH3-AQ	003	PCI	L	N/A	1
		Group			

Report Level: 4

73 of 76

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

ARS FILE TRACKING SHEET

SDG: ARS1-18-00635

Task	Date / Time	Initials
Date & Time Samples Received	03/1/18 13:45	MC
ICOC Initiated/Storage Location: <u>AE-3</u>	03/1/18 14:39	MC
Technical Checks Performed	<i>See Batch</i>	
Report Written / EDD Generated <u>5-7-18/1146</u> <i>SDH</i>	<u>5-7-18/1154</u>	<i>SDH</i>
Report / EDD Reviewed for accuracy and completeness	<u>5-7-18-12:05</u>	<i>LD + SDH</i> <i>SDH</i>
Quality Assurance Checks Performed on Report	<u>5-11-18</u>	
Management Checks Performed on Report	<i>10:30</i>	<i>SDH</i>
<i>Preliminary Report Scan</i>	<i>na</i>	
Report E-mailed/Faxed		
Invoice Completed Invoice #: _____		
Requires Report Mailed Yes / No	<i>na</i>	
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

SDG: APSI-18-00635

SHIPPING CONTAINER

COC PRESENT WITH SAMPLES

SAMPLE CONTAINER(S)

Marked Radioactive ☒ Yes ☐ No

Samples Rcv

Matrix

[AF , AQ , BI , FE , LT , SI , SO , UR , VG]

pH ≤ 2 is Acceptable

Acceptance Limits

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

Surveyors' Name:

Date/Time Surveyed:

American Radiation

Baton Rouge LA

Chain of Custody/Analysis Request

COC/Lab Request #:

2018-2000

Page 1 of 1

Client Contact:

Lab Agreement #:

Site Name:

Los Alamos National Laboratory

Project Number: ADEP

Analysis Turnaround Time:

24 Hour - ☐ Other - ☐7 Days - ☐14 Days - ☐21 Days - ☐28 Days - ☒

Rad Screening Info:



Lab Reporting Limit Type:

Method Detection Limit

Field Sample ID

Sample
DateSample
TimeSample
Matrix

WSP-LL-H-3

CAWA-18-32

Feb 22 2018

12:07

W

1

CAWA-18-67

Feb 22 2018

13:43

W

1

CAWA-18-69

Feb 22 2018

12:34

W

1

Special Instructions:

Relinquished by:

Print Name:

Date/Time:

Received by:

Print Name:

Date/Time:

Relinquished by:

Print Name:

Date/Time:

Received by:

Print Name:

Date/Time:

Relinquished by:

Print Name:

Date/Time:

Received by:

Print Name:

Date/Time: 3-1-18 1345