

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]

R-29

Shipping Classification Determination Checklist

Page 3 of 3

Sampling Plan ID/Name: 11694

COC: 2018-2112

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
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 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 \geq 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 \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.				<input checked="" type="checkbox"/>	<input 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 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	NA
Am-241 \geq 27 pCi/g	AND	Am-241 \geq 270,000 pCi Total	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cs-137 \geq 270 pCi/g	AND	Cs-137 \geq 270,000 pCi Total	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pu-238 \geq 27 pCi/g	AND	Pu-238 \geq 270,000 pCi Total	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pu-239/240 \geq 27 pCi/g	AND	Pu-239/240 \geq 270,000 pCi Total	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Th-228 \geq 27 pCi/g	AND	Th-228 \geq 270,000 pCi Total	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
U-234 \geq 270 pCi/g	AND	U-234 \geq 1,600,000,000 pCi Total	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
U-238 \geq 270 pCi/g	AND	U-238 \geq unlimited	<input checked="" type="checkbox"/>	<input 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"/>	<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 \geq 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 <i>Radioactive Material, Excepted Package - Limited Quantity of Material - UN2910</i> , 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 <i>Radioactive Material, Excepted Package - Limited Quantity of Material - UN2910</i> , and the sample is submitted to ARS or RP for hazard classification analysis.				<input checked="" type="checkbox"/>	<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	Date/Time
(Printed Name) Tanya Vander Vliet (Signature) Tanya Vander Vliet	3-6-18 1320

Hazard Assessment Reviewed	Date/Time
(Printed Name) Elvira Pagan (Signature) Elvira Pagan	3-6-18 1320

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
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 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 type="checkbox"/>	<input checked="" type="checkbox"/>
Alpha \geq 125	AND Alpha \geq 1,250,000	AT	other locations	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Beta \geq 1,500	AND Beta \geq 15,000,000	AT	any location	<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.				<input type="checkbox"/>	<input checked="" type="checkbox"/>
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.				<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 checked="" type="checkbox"/>

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

TEST - AK		YES	NO	NA
The shippers documented knowledge of the sample positively identifies appropriate labeling.		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input 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 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	Date/Time
(Printed Name) Tanya Vanderk... (Signature) Tanya Vanderk...	3-7-18 1320

Hazard Assessment Reviewed	Date/Time
(Printed Name) Ramee Oshoff (Signature) Ramee Oshoff	3/7/18 1320

DATA VALIDATION REPORT

Chain Of Custody No. 2018-2112

1. Distribution Of Samples In EDD.

SDG	Analytical Method	Regular Samples	Field Duplicates	Trip Blanks	Field Blanks	Equipment Blanks
ARS1-18-00751	Generic:Low_Level_Tritium	1	1			
ARS1-18-00751	Generic:Low_Level_Tritium	1				

SDG	Analytical Method	Analysis Lot ID	Prep Lot ID	Regular Samples	Field Duplicates	Trip Blanks	Field Blanks	Equipment Blanks	Method Blanks	Matrix Spikes	Matrix Spike Dups	Analytical Spikes	Post-Digestion Spikes	Lab Control Samples	Lab Control Sample Dups	Blank Spike	Blank Spike Dups	Lab Duplicates	Storage Blanks	Preparation Blanks	Reagent Blanks
ARS1-18-00751	Generic:Low_Level_Tritium	ARS1-B18-	ARS1-B18-	2	1				1					1	1						

2. Distribution Of Analytes In EDD.

Analytical Method	Analytical Method Category	Field Sample ID	Lab Sample ID	Sample Purpose	Target Analytes	Surrogates	Spiked Compounds	TICS
Generic:Low_Level_Tritium	RAD	CAAN-18-151444	ARS1-B18-00609-06	REG	1	0	0	0
Generic:Low_Level_Tritium	RAD	CAAN-18-151451	ARS1-B18-00609-07	FD	1	0	0	0
Generic:Low_Level_Tritium	RAD	CAAN-18-151479	ARS1-B18-00609-08	PEB	1	0	0	0
Generic:Low_Level_Tritium	RAD	CAAN-18-151491	ARS1-B18-00609-09	REG	1	0	0	0
Generic:Low_Level_Tritium	RAD	LCS	ARS1-B18-00609-01	LCS	0	0	1	0
Generic:Low_Level_Tritium	RAD	LCSD	ARS1-B18-00609-02	LCSD	0	0	1	0
Generic:Low_Level_Tritium	RAD	MB	ARS1-B18-00609-03	MB	1	0	0	0

3. Are any analytes missing?

No.

4. Were any holding times exceeded?

No.

5. Any contaminants in blanks?

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

No.

6. Any surrogate recoveries outside the control limits?

No.

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

No.

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

No.

9. Any Field Duplicate RPDs outside the desired limits?

No.

10. Any Lab Duplicate RPDs outside the desired limits?

No.

11. Any required reporting limits exceeded?

No.

12. Additional Validator's Comments.

13. Display Flagged Data.

DATA VALIDATION REPORT

Location ID	COC Number	Field Sample ID	Sample Purpose	Analysis Type Code	Analytical Suite	Analytical Method	Paramter Name	Lab Qualifier	Validation Qualifier	Validation Reason Codes	Detect Flag	Lab Result	Lab Units	Report Result	Report Units	Report MDA	Report Uncertainty	Lab Matrix	Sample Date	Percent	Analysis Lot ID	Validation Status Code	Use Flag
R-29	2018-2112	CAAN-18-151444	REG	INIT	RAD	Generic:Low_Level_Tritiu	Tritium	U	U	R5	N	-0.827	pCi/L	-0.827	pCi/L	2.717	0.794	W	03/06/2018		ARS1-B18-00609	VAL	Y
R-29	2018-2112	CAAN-18-151451	FD	INIT	RAD	Generic:Low_Level_Tritiu	Tritium	U	U	R5	N	-0.340	pCi/L	-0.340	pCi/L	2.616	0.766	W	03/06/2018		ARS1-B18-00609	VAL	Y
R-30	2018-2112	CAAN-18-151479	PEB	INIT	RAD	Generic:Low_Level_Tritiu	Tritium	U	U	R5	N	0.479	pCi/L	0.479	pCi/L	2.687	0.804	W	03/07/2018		ARS1-B18-00609	VAL	Y
R-30	2018-2112	CAAN-18-151491	REG	INIT	RAD	Generic:Low_Level_Tritiu	Tritium	U	U	R5	N	-1.479	pCi/L	-1.479	pCi/L	2.118	0.635	W	03/07/2018		ARS1-B18-00609	VAL	Y

Reason Code

Description

R5 Analyte is not detected because the amount reported is less than the MDC.

14. Usable Result Count.

Field Sample ID	Location ID	Sample Purpose	Analytical Method	No. Unuseable Records	Total Records
CAAN-18-151444	R-29	REG	Generic:Low_Level_Tritium	0	1
CAAN-18-151451	R-29	FD	Generic:Low_Level_Tritium	0	1
CAAN-18-151479	R-30	PEB	Generic:Low_Level_Tritium	0	1
CAAN-18-151491	R-30	REG	Generic:Low_Level_Tritium	0	1



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ARS Aleut Analytical Reports

for

Los Alamos National Laboratory

Request Number: 2018-2112

SDG: ARS1-18-00751



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ARS Aleut Analytical Reports

for

**Los Alamos National Laboratory
Request: 2018-2112**

Original COC

[illegible]



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ARS Aleut Analytical Reports

for

**Los Alamos National Laboratory
Request: 2018-2112**

Case Narrative



ARS Aleut Analytical, LLC

Laboratory Analysis Report

ARS1-18-00751

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**



May 15, 2018

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

ARS SDG: **ARS1-18-00751**
Project Description: **2018-2112**
Cost Code: **ADEP**

Dear Nita,

On March 9, 2018, ARS Aleut Analytical, LLC received four (4) samples to be analyzed for Enriched H-3.

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

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

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

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
CAAN-18-151444	ARS1-18-00751-001
CAAN-18-151451	ARS1-18-00751-002
CAAN-18-151479	ARS1-18-00751-003
CAAN-18-151491	ARS1-18-00751-004

SAMPLE RECEIPT/PREP

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

ANALYTICAL METHODS

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

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

ANALYTICAL RESULTS

ARS1-B18-00609:

The Method Blank is elevated for this batch, but target samples are all non-detects; after technical review, data is being released as valid.

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

5-22-18
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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ARS Sample Delivery Group: ARS1-18-00751
Client Sample ID: CAAN-18-151444
Sample Collection Date: 03/06/18
Sample Matrix: Aqueous
Percent Solids: N/A

Request or PO Number: 2018-2112
ARS Sample ID: ARS1-18-00751-001
Date Received: 03/09/18
Report Date: 05/15/18

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	-0.827	0.794	2.717	1.317	3.221	U	pCi/L	ARS-040/ARS-040	05/11/18 4:35	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: ARS1-18-00751
Client Sample ID: CAAN-18-151451
Sample Collection Date: 03/06/18
Sample Matrix: Aqueous
Percent Solids: N/A

Request or PO Number: 2018-2112
ARS Sample ID: ARS1-18-00751-002
Date Received: 03/09/18
Report Date: 05/15/18

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	-0.340	0.766	2.616	1.268	3.221	U	pCi/L	ARS-040/ARS-040	05/11/18 10:17	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: ARS1-18-00751

Client Sample ID: CAAN-18-151479

Sample Collection Date: 03/07/18

Sample Matrix: Aqueous

Percent Solids: N/A

Request or PO Number: 2018-2112

ARS Sample ID: ARS1-18-00751-003

Date Received: 03/09/18

Report Date: 05/15/18

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	0.479	0.804	2.687	1.303	3.221	U	pCi/L	ARS-040/ARS-040	05/11/18 16:00	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: ARS1-18-00751

Client Sample ID: CAAN-18-151491

Sample Collection Date: 03/07/18

Sample Matrix: Aqueous

Percent Solids: N/A

Request or PO Number: 2018-2112

ARS Sample ID: ARS1-18-00751-004

Date Received: 03/09/18

Report Date: 05/15/18

Radiochemistry

Analysis Description	Analysis Results	CSU +/-1s	MDC	DLC	CRDL	Qual	Analysis Units	Method	Analysis Date/Time	Analysis Technician	Tracer/Chem Recovery
Enriched H-3	-1.479	0.635	2.118	1.027	3.221	U	pCi/L	ARS-040/ARS-040	05/11/18 21:42	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.

LELAP Certificate# 01949



QC Results per Analytical Batch

Analytical Batch	ARS1-B18-00609
SDG	ARS1-18-00751
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	05/10/18 00:02	Analysis Technician	SCAUSEY	
Analysis Batch Sample ID	QC Type	Analyte	Results	CSU (1s)	Expected Value	LCS Rec (%)	MDC
ARS1-B18-00609-01	LCS	ENRICHED H-3	33.228	5.110	34.850	95.3	2.234

Duplicate RER/DER/RPD			Analysis Date	05/10/18 05:46	Analysis Technician	SCAUSEY	
Analyte	Results LCS	CSU LCS (1s)	Results LCSD	CSU LCSD (1s)	RER	DER	RPD
ENRICHED H-3	33.228	5.110	32.758	5.074	0.046	0.065	1.4

Method Blank			Analysis Date	05/10/18 11:28	Analysis Technician	SCAUSEY	
Analysis Batch Sample ID	QC Type	Analyte	Results	CSU (1s)	MDC	Qual	
ARS1-B18-00609-03	MBL	ENRICHED H-3	3.309	0.988	2.692		

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

16 of 76

LCS Report

Analytical Batch: ARS1-B18-00609

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 Data	Known Value (pCi)	User ID	Mod Date
B-25165	ARS1-B18-00609-01	B-H3	S-0332	H-3	5	2.72210	17.0322	22.0139	4.9817	2.70747	05/09/2018	13.48779	MMORGAN	04/04/2018
B-25166	ARS1-B18-00609-02	B-H3	S-0332	H-3	5	2.72210	17.2473	22.2205	4.9732	2.70705	05/10/2018	13.46271	MMORGAN	04/04/2018

Tritium Assay in Water Samples Using Electrolytic Enrichment

Preparation Date: 04/19/2018 15:07
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-B18-00609-01	LCS		321.5800	228.1100	615.1300	1.5000	387.0200	4/19/2018 3:30:00 PM	5.0000	2.0000	5/7/2018 4:00:00 PM	2.0000
ARS1-B18-00609-02	LCSD		316.1300	226.5800	615.5600	1.5000	388.9800	4/19/2018 3:30:00 PM	5.0000	2.0000	5/7/2018 4:00:00 PM	2.0000
ARS1-B18-00609-03	MBL		316.3200	218.9000	594.6000	1.5000	375.7000	4/19/2018 3:30:00 PM	5.0000	2.0000	5/7/2018 4:00:00 PM	2.0000
ARS1-B18-00609-04	TRG	ARS1-18-00750-001	328.5300	217.1800	595.5100	1.5000	378.3300	4/19/2018 3:30:00 PM	5.0000	2.0000	5/7/2018 4:00:00 PM	2.0000
ARS1-B18-00609-05	TRG	ARS1-18-00750-002	323.6500	221.8000	599.2200	1.5000	377.4200	4/19/2018 3:30:00 PM	5.0000	2.0000	5/7/2018 4:00:00 PM	2.0000
ARS1-B18-00609-06	TRG	ARS1-18-00751-001	319.8800	226.8100	604.6900	1.5000	377.8800	4/19/2018 3:30:00 PM	5.0000	2.0000	5/7/2018 4:00:00 PM	2.0000
ARS1-B18-00609-07	TRG	ARS1-18-00751-002	318.5100	205.3800	581.9200	1.5000	376.5400	4/19/2018 3:30:00 PM	5.0000	2.0000	5/7/2018 4:00:00 PM	2.0000
ARS1-B18-00609-08	TRG	ARS1-18-00751-003	321.8100	215.8600	592.0300	1.5000	376.1700	4/19/2018 3:30:00 PM	5.0000	2.0000	5/7/2018 4:00:00 PM	2.0000
ARS1-B18-00609-09	TRG	ARS1-18-00751-004	321.2000	226.9200	604.5100	1.5000	377.5900	4/19/2018 3:30:00 PM	5.0000	2.0000	5/7/2018 4:00:00 PM	2.0000

Tritium Assay in Water Samples Using Electrolytic Enrichment

Procedure Data												
ABatch Sample ID	Type	End Wt of Cell + Resv + Sample	Gross Sample Recovered	Enrichment Factor	Tare Wt Cryo-distill flask	Gross Wt flask + Sample	Recovered Water	Tare Weight of LSC Vial	Vial + Sample	Net Sample	Gross Wt Vial + Dead Water If used	Net Dead Water Added
ARS1-B18-00609-01	LCS	561.5200	11.8300	32.7151	125.5700	134.3200	8.7500	6.5300	14.9500	8.4200	16.5300	1.5800
ARS1-B18-00609-02	LCSD	558.9400	16.2300	23.9667	109.4100	122.8600	13.4500	6.5700	16.6100	10.0400	16.6100	0.0000
ARS1-B18-00609-03	MBL	551.1300	15.9100	23.6141	115.3000	128.8100	13.5100	6.6200	16.6600	10.0400	16.6600	0.0000
ARS1-B18-00609-04	TRG	560.6100	14.9000	25.3913	129.7400	142.0300	12.2900	6.6300	16.7000	10.0700	16.7000	0.0000
ARS1-B18-00609-05	TRG	560.8000	15.3500	24.5876	122.8600	135.4700	12.6100	6.6800	16.7500	10.0700	16.7500	0.0000
ARS1-B18-00609-06	TRG	562.7500	16.0600	23.5293	126.3500	139.6700	13.3200	6.6600	16.6800	10.0200	16.6800	0.0000
ARS1-B18-00609-07	TRG	539.6600	15.7700	23.8770	128.3900	142.0700	13.6800	6.6700	16.7000	10.0300	16.7000	0.0000
ARS1-B18-00609-08	TRG	553.7400	16.0700	23.4082	129.7600	143.6900	13.9300	6.6400	16.7100	10.0700	16.7100	0.0000
ARS1-B18-00609-09	TRG	560.9200	12.8000	29.4992	125.6400	136.0600	10.4200	6.5700	16.6800	10.1100	16.6800	0.0000

Tritium Assay in Water Samples Using Electrolytic Enrichment

Procedure Data			
ABatch Sample ID	Type	Tare Wt b/f Cocktail	Gross Wt Vial + Cocktail
ARS1-B18-00609-01	LCS	16.5300	26.5600
ARS1-B18-00609-02	LCSD	16.6100	26.6900
ARS1-B18-00609-03	MBL	16.6600	26.7500
ARS1-B18-00609-04	TRG	16.7000	26.7500
ARS1-B18-00609-05	TRG	16.7500	26.8100
ARS1-B18-00609-06	TRG	16.6800	26.7400
ARS1-B18-00609-07	TRG	16.7000	26.7500
ARS1-B18-00609-08	TRG	16.7100	26.7700
ARS1-B18-00609-09	TRG	16.6800	26.7600
			Net Wt of Cocktail Added
			10.0300
			10.0800
			10.0900
			10.0500
			10.0600
			10.0600
			10.0500
			10.0600
			10.0800

Tritium Assay in Water Samples Using Electrolytic Enrichment

Reagent Amounts			
ABatch Sample ID	Type	SDG/Fraction	
ARS1-B18-00609-01	LCS		14.2.12 DISTILLAT - Ionize & add O to electrolysis - Sodium Peroxide (granular) Reagent Grade (g) 1.50
ARS1-B18-00609-02	LCS		14.3.22 DISTILLATION - Add scint cocktail - Ultima Gold LLT Reagent Grade (mL) 10.00
ARS1-B18-00609-03	MBL		1.50 10.00
ARS1-B18-00609-04	TRG	ARS1-18-00750-001	1.50 10.00
ARS1-B18-00609-05	TRG	ARS1-18-00750-002	1.50 10.00
ARS1-B18-00609-06	TRG	ARS1-18-00751-001	1.50 10.00
ARS1-B18-00609-07	TRG	ARS1-18-00751-002	1.50 10.00
ARS1-B18-00609-08	TRG	ARS1-18-00751-003	1.50 10.00
ARS1-B18-00609-09	TRG	ARS1-18-00751-004	1.50 10.00

ARS-040
Tritium Assay in Water Samples Using Electrolytic Enrichment

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

Assay Definition-

Assay Description:
Low Level H3

Assay Type: DPM (Single)

Report Name: Report1

Output Data Path: C:\Packard\Tricarb\Results\ARS\Low Low Level Tritium 3\20180509_1526
Raw Results Path: C:\Packard\Tricarb\Results\ARS\Low Low Level Tritium 3\20180509_1526\20180509_1526.results
RTF File Name: C:\Packard\Tricarb\Results\ARS\Low Low Level Tritium 3\20180509_1526\Report1.rtf
Comma-Delimited File Name: C:\Packard\Tricarb\Results\ARS\Low Low Level Tritium 3\20180509_1526\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
Luminescence Correction: Off
Heterogeneity Monitor: Off
Delay Before Burst (nsec): 200

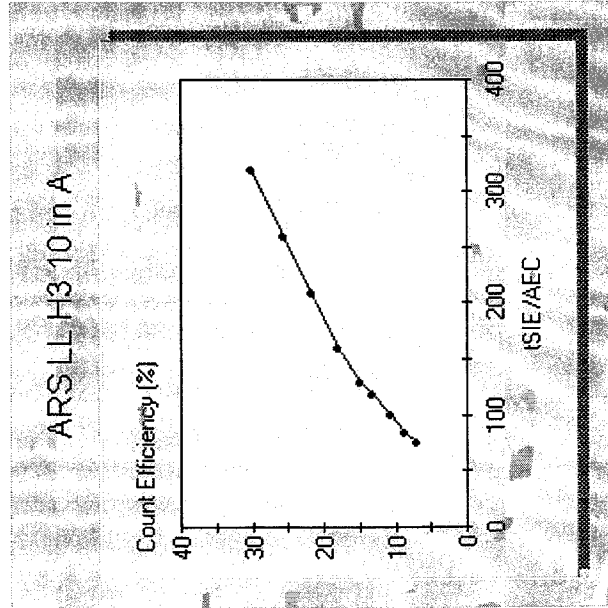
Half Life-

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

Protocol# 49 - Low Level Tritium 3.lsa

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	32.32
25.50	25.88
21.83	20.67
18.05	16.20
14.84	13.12
13.13	11.98
10.74	10.13
8.63	8.91
7.12	7.26

P#	S#	SMPL_ID	CPMA	DPM1	tSIE	Eff Nucl	In A	Count Time	DATE	TIME	MESSAGES
49	1	BACKGROUND	1.039	4.753	210.07	21.86		330.00	5/9/2018	3:35:26 PM	
49	2	B18-00609-01	5.045	22.767	214.21	22.16		330.00	5/9/2018	9:17:21 PM	
49	3	B18-00609-02	4.353	19.924	209.98	21.85		330.00	5/10/2018	3:00:34 AM	
49	4	B18-00609-03	1.370	6.290	209.08	21.78		330.00	5/10/2018	8:42:47 AM	
49	5	B18-00609-04	0.904	4.128	210.62	21.90		330.00	5/10/2018	2:24:59 PM	
49	6	B18-00609-05	0.920	4.230	208.64	21.75		330.00	5/10/2018	8:07:07 PM	
49	7	B18-00609-06	0.957	4.377	210.32	21.87		330.00	5/11/2018	1:50:15 AM	
49	8	B18-00609-07	1.004	4.497	216.50	22.33		330.00	5/11/2018	7:32:24 AM	
49	9	B18-00609-08	1.087	4.917	213.50	22.11		330.00	5/11/2018	1:14:37 PM	
49	10	B18-00609-09	0.851	3.906	209.20	21.79		330.00	5/11/2018	6:57:01 PM	



LSC Instrument Data Transfer Report

\\PACKARD03170_NEW\Results\ARS\Low Low Level Tritium

Batch Sample ID				Non-BKG Samples Transferred				Samples Eligible To Save				
ARS1-B18-00609				9				9				
LIMS Batch Sample ID	LSC P#	LSC PID	LSC S#	LSC SMPL_ID	LSC Count Date	LSC CPMA	LSC TSTC	LSC EFF	LSC Count Dur	Analysis Batch	LIMS SDG	LIMS Run
BKG	49		1	BACKGROUND	05/09/18 15:35	1.04	210.07	21.8600	330.00	ARS1-B18-00609		
ARS1-B18-00609-01	49		2	B18-00609-01	05/09/18 21:17	5.05	214.21	22.1600	330.00	ARS1-B18-00609		
ARS1-B18-00609-02	49		3	B18-00609-02	05/10/18 03:00	4.35	209.98	21.8500	330.00	ARS1-B18-00609		
ARS1-B18-00609-03	49		4	B18-00609-03	05/10/18 08:42	1.37	209.08	21.7800	330.00	ARS1-B18-00609		
ARS1-B18-00609-04	49		5	B18-00609-04	05/10/18 14:24	0.90	210.62	21.9000	330.00	ARS1-B18-00609	ARS1-18-00750	1
ARS1-B18-00609-05	49		6	B18-00609-05	05/10/18 20:07	0.92	208.64	21.7500	330.00	ARS1-B18-00609	ARS1-18-00750	1
ARS1-B18-00609-06	49		7	B18-00609-06	05/11/18 01:50	0.96	210.32	21.8700	330.00	ARS1-B18-00609	ARS1-18-00751	1
ARS1-B18-00609-07	49		8	B18-00609-07	05/11/18 07:32	1.00	216.50	22.3300	330.00	ARS1-B18-00609	ARS1-18-00751	1
ARS1-B18-00609-08	49		9	B18-00609-08	05/11/18 13:14	1.09	213.50	22.1100	330.00	ARS1-B18-00609	ARS1-18-00751	1
ARS1-B18-00609-09	49		10	B18-00609-09	05/11/18 18:57	0.85	209.20	21.7900	330.00	ARS1-B18-00609	ARS1-18-00751	1

ARS-040 Calculation Results			
ARS1-B18-00609			
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-B18-00609-01	387.020	1.500	11.830	1.539	10.291	0.027	29.321
LSC-LLH3-AQ	ARS1-B18-00609-02	388.980	1.500	16.230	1.539	14.691	0.038	20.927
LSC-LLH3-AQ	ARS1-B18-00609-03	375.700	1.500	15.910	1.539	14.371	0.038	20.673
LSC-LLH3-AQ	ARS1-B18-00609-04	378.330	1.500	14.900	1.539	13.361	0.035	22.322
LSC-LLH3-AQ	ARS1-B18-00609-05	377.420	1.500	15.350	1.539	13.811	0.037	21.572
LSC-LLH3-AQ	ARS1-B18-00609-06	377.880	1.500	16.060	1.539	14.521	0.038	20.582
LSC-LLH3-AQ	ARS1-B18-00609-07	376.540	1.500	15.770	1.539	14.231	0.038	20.913
LSC-LLH3-AQ	ARS1-B18-00609-08	376.170	1.500	16.070	1.539	14.531	0.039	20.479
LSC-LLH3-AQ	ARS1-B18-00609-09	377.590	1.500	12.800	1.539	11.261	0.030	26.259

ARS-040 Calculation Results

ARS1-B18-00609

ACF	1
UCF	2.22
Sys Error	0.15

AnalysisCode	ABatchSampleID	Average_Sample_CPM	Bkg_CPM	LSIE	Detector_Eff_decimal	Aliquot	Aliquots	Activity_reference_date	Start_Date_of_Count	Sample_Count	Duration_min
LSC-LLH3-AQ	ARS1-B18-00609-01	5.045	1.039	214.210	0.222	0.00842	L	3/23/2018	5/9/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00609-02	4.353	1.039	209.980	0.219	0.01004	L	3/23/2018	5/10/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00609-03	1.370	1.039	209.080	0.218	0.01004	L	4/19/2018	5/10/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00609-04	0.904	1.039	210.620	0.219	0.01007	L	3/8/2018	5/10/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00609-05	0.920	1.039	208.640	0.218	0.01007	L	3/8/2018	5/10/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00609-06	0.957	1.039	210.320	0.219	0.01002	L	3/6/2018	5/11/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00609-07	1.004	1.039	216.500	0.223	0.01003	L	3/6/2018	5/11/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00609-08	1.087	1.039	213.500	0.221	0.01007	L	3/7/2018	5/11/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00609-09	0.851	1.039	209.200	0.218	0.01011	L	3/7/2018	5/11/2018		330.000

ARS-040 Calculation Results			
ARS1-B18-00609			
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-B18-00609-01		330.000	0.99263	33.228	1.126	1.126	5.110	2.207	10.015	2.234	1.083	pCi
LSC-LLH3-AQ	ARS1-B18-00609-02		330.000	0.99263	32.758	1.264	1.264	5.074	2.477	9.944	2.662	1.290	pCi
LSC-LLH3-AQ	ARS1-B18-00609-03		330.000	0.99677	3.309	0.854	0.854	0.988	1.674	1.936	2.692	1.305	pCi
LSC-LLH3-AQ	ARS1-B18-00609-04		330.000	0.99034	-1.247	0.709	0.709	0.733	1.390	1.437	2.488	1.206	pCi
LSC-LLH3-AQ	ARS1-B18-00609-05		330.000	0.99019	-1.146	0.742	0.742	0.761	1.454	1.492	2.593	1.257	pCi
LSC-LLH3-AQ	ARS1-B18-00609-06		330.000	0.98989	-0.827	0.785	0.785	0.794	1.538	1.557	2.717	1.317	pCi
LSC-LLH3-AQ	ARS1-B18-00609-07		330.000	0.98989	-0.340	0.764	0.764	0.766	1.498	1.502	2.616	1.268	pCi
LSC-LLH3-AQ	ARS1-B18-00609-08		330.000	0.99004	0.479	0.801	0.801	0.804	1.570	1.576	2.687	1.303	pCi
LSC-LLH3-AQ	ARS1-B18-00609-09		330.000	0.98989	-1.479	0.595	0.595	0.635	1.167	1.245	2.118	1.027	pCi

ARS-040 Calculation Results			
ARS1-B18-00609			
ACF	1		
UCF	2.22		
Sys Error	0.15		

AnalysisCode	ABatchSampleID	AliquotReportUnits	UserID	ModDate
LSC-LLH3-AQ	ARS1-B18-00609-01	L	AMRAD\mmorgan	5/14/2018
LSC-LLH3-AQ	ARS1-B18-00609-02	L	AMRAD\mmorgan	5/14/2018
LSC-LLH3-AQ	ARS1-B18-00609-03	L	AMRAD\mmorgan	5/14/2018
LSC-LLH3-AQ	ARS1-B18-00609-04	L	AMRAD\mmorgan	5/14/2018
LSC-LLH3-AQ	ARS1-B18-00609-05	L	AMRAD\mmorgan	5/14/2018
LSC-LLH3-AQ	ARS1-B18-00609-06	L	AMRAD\mmorgan	5/14/2018
LSC-LLH3-AQ	ARS1-B18-00609-07	L	AMRAD\mmorgan	5/14/2018
LSC-LLH3-AQ	ARS1-B18-00609-08	L	AMRAD\mmorgan	5/14/2018
LSC-LLH3-AQ	ARS1-B18-00609-09	L	AMRAD\mmorgan	5/14/2018

Beta Liquid Scintillation Counter Log Book

Date	Time	ARS Sample I.D. Number	Batch Number	Liquid Scintillation File Number	Technician Initials
5-7-18	1629	B18-01020-06	R18-01020	1808	
		-07			
		-08			
		-09			
		-10			
		-11			
		-12			
		-13			
5-8-18	0758	SNC 5	QA	QA	
5-9-18	1023	SNC 5	QA	QA	MM
		Background	B18-00609	1526	MM
		B18-00609-01			MM
		-02			MM
		-03			MM
		-04			MM
		-05			MM
		-06			MM
		-07			MM
		-08			MM
		-09			MM

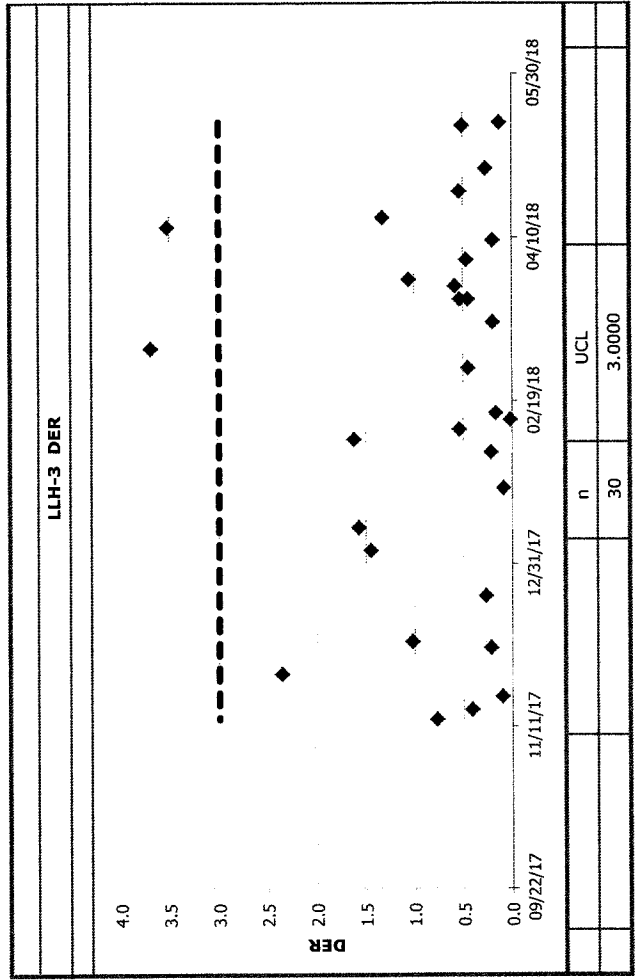
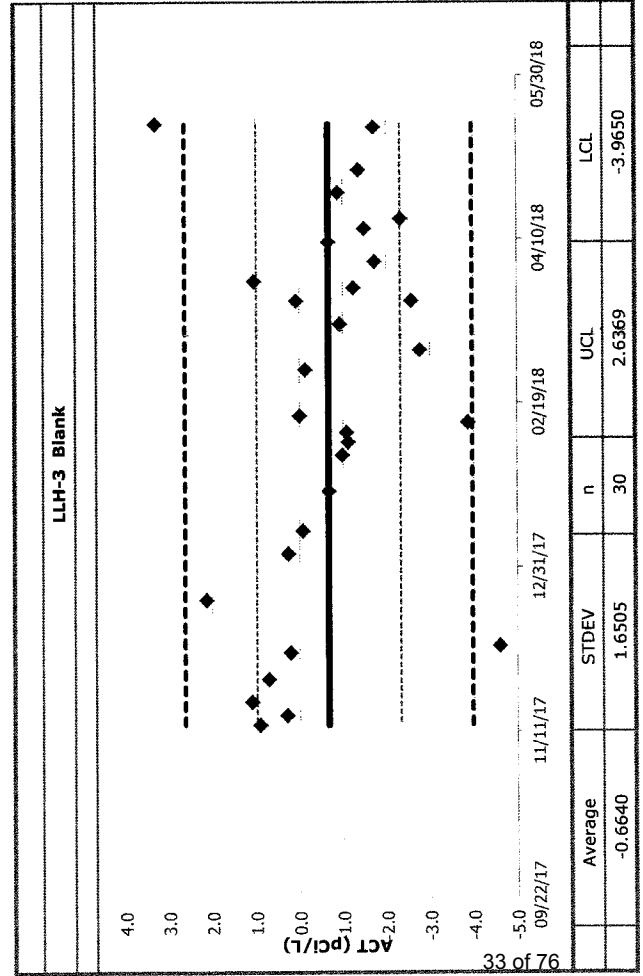
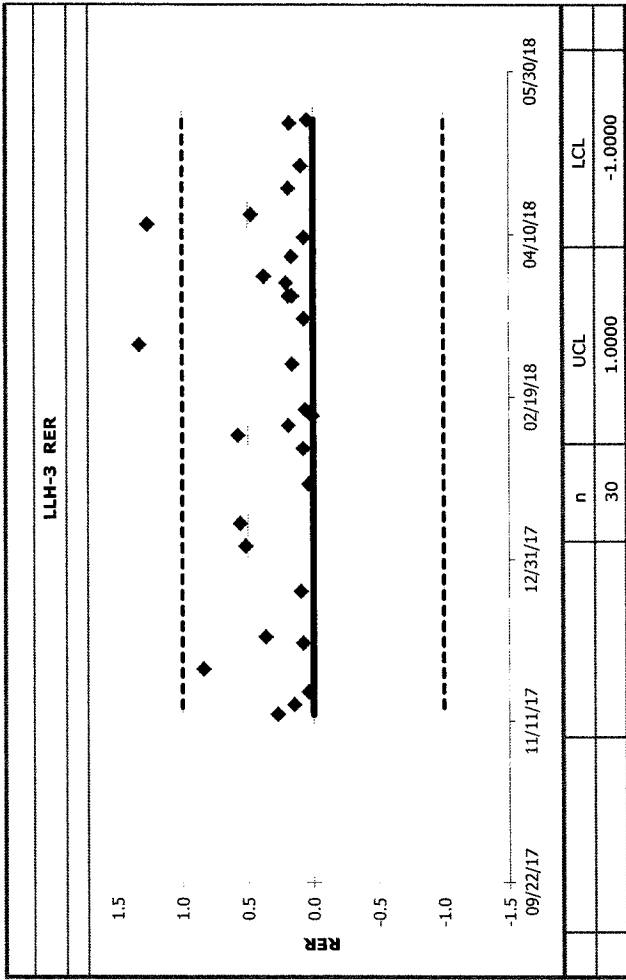
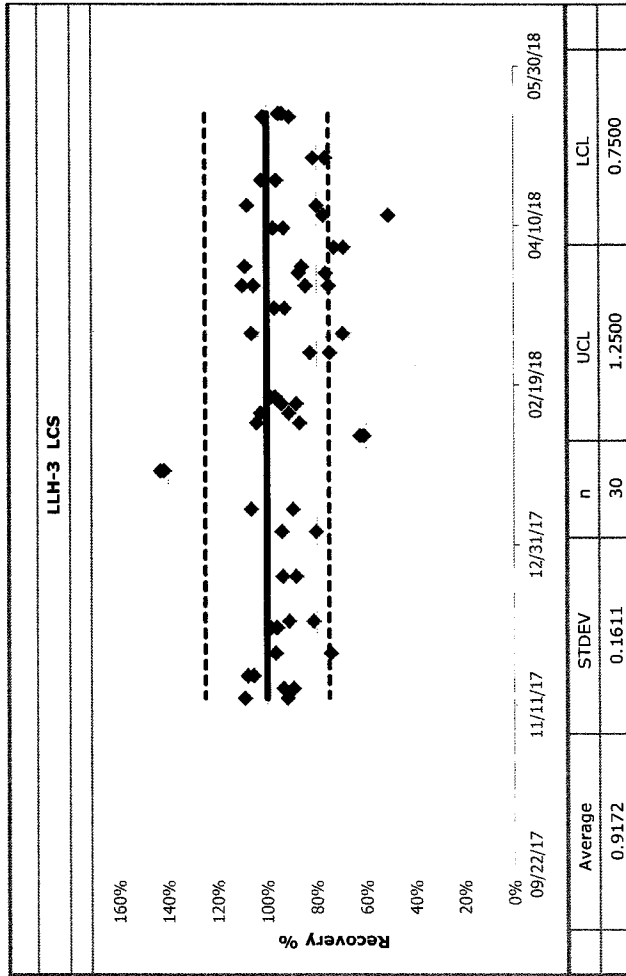


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**ARS Aleut
Analytical Reports
for
Los Alamos National Laboratory
Low Level Tritium
by
Low Level Liquid
Scintillation Counting
Control Charts**

QC Chart

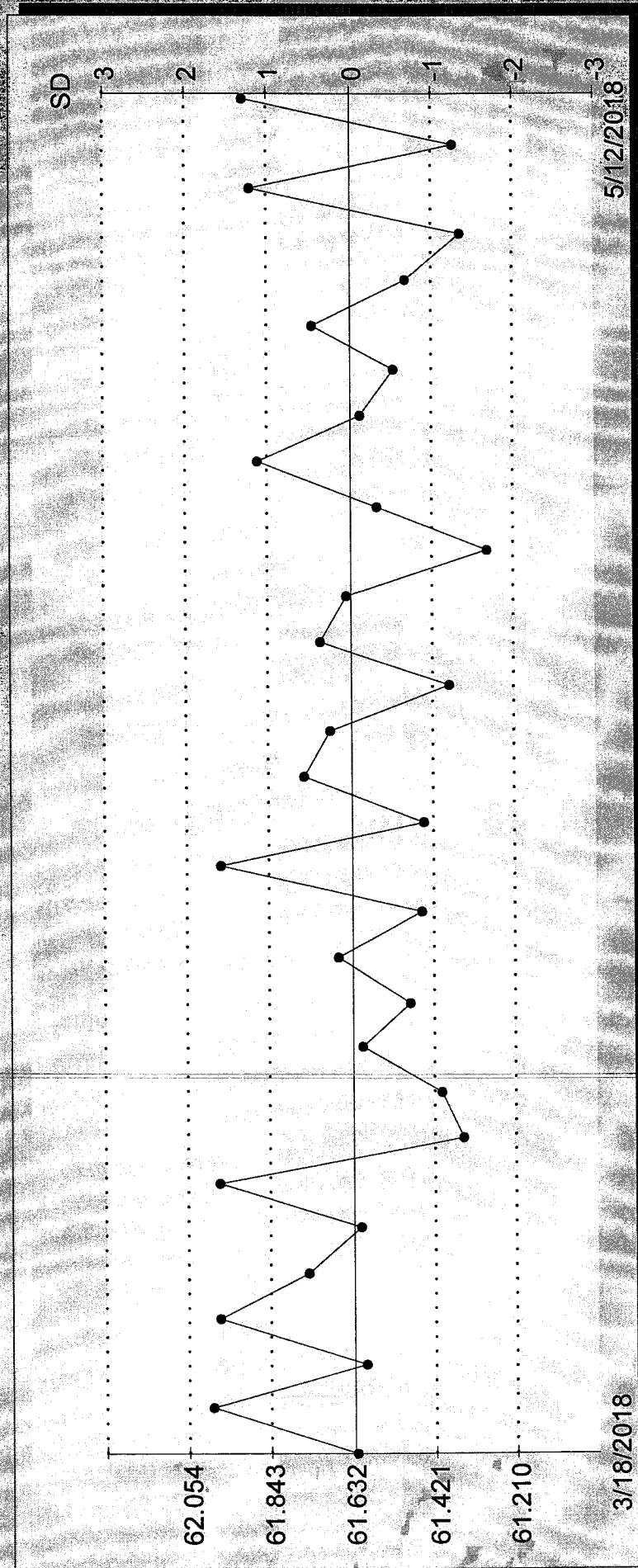


3H Efficiency

Total # pts : 2500
Valid # pts : 31
Mean : 61.63
SD : 0.21

Date	Value	Valid Pt
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
May 07, 2018	61.89	X
May 09, 2018	61.36	X
May 12, 2018	61.90	X

3H Efficiency
Total # pts : 2500
Valid # pts : 31
Mean : 61.63
SD : 0.21

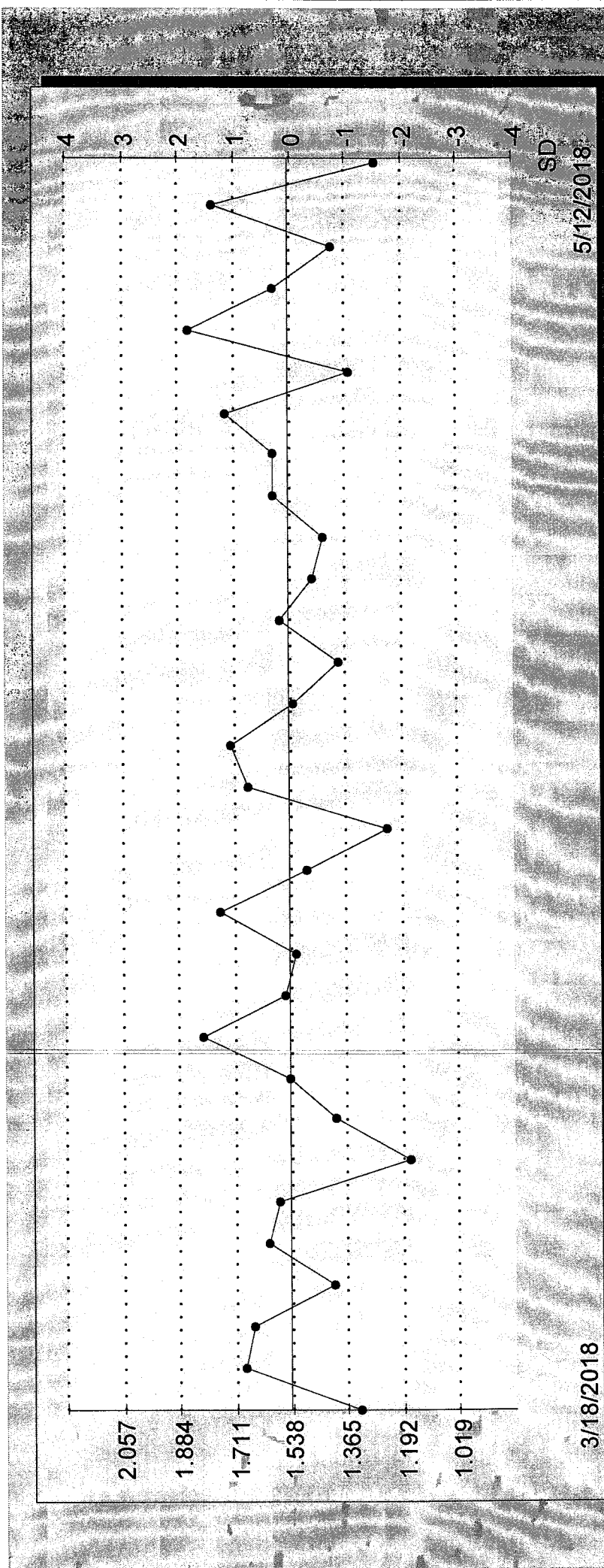


3H Background

Total # pts : 2453
Valid # pts : 31
Mean : 1.54
SD : 0.17

Date	Value	Valid Pt
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
May 07, 2018	1.41	X
May 09, 2018	1.78	X
May 12, 2018	1.27	X

3H Background
 Total # pts : 2453
 Valid # pts : 31
 Mean : 1.54
 SD : 0.17





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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: B18-00562

[illegible]



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ARS Aleut Analytical Reports

for

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

**Laboratory
Records**

Analytical Batch Report

ARS International
Baton Rouge Laboratory

Analysis Batch ID **ARS1-B18-00562**

Method		ARS-054		Analysis		LSC-LLH3/SC-AQ		Matrix		AQ	
Description		Low Level Tritium Screening		SDG		FR		Run		Prep Code	
Type	Blind Iso1	Blind Iso2	Blind Iso3								
ARS1-B18-00562-01	LCS										
ARS1-B18-00562-02	LCSD										
ARS1-B18-00562-03	MBL										
ARS1-B18-00562-04	TRG			ARS1-18-00750	001	1				CALA-18-151481	04/15/18
ARS1-B18-00562-05	TRG			ARS1-18-00750	002	1				CALA-18-151488	04/15/18
ARS1-B18-00562-06	TRG			ARS1-18-00751	001	1				CAAN-18-151444	04/15/18
ARS1-B18-00562-07	TRG			ARS1-18-00751	002	1				CAAN-18-151451	04/15/18
ARS1-B18-00562-08	TRG			ARS1-18-00751	003	1				CAAN-18-151479	04/15/18
ARS1-B18-00562-09	TRG			ARS1-18-00751	004	1				CAAN-18-151491	04/15/18

ARS-054
Tritium in Water

ARS Aleut Analytical, LLC
Baton Rouge Laboratory

Preparation Date: 03/14/2018 14:06

Prepared By: MMORGAN

Procedure Data						
ABatch Sample ID	Type	SDG/Fraction	ICOC ID	Aliquot 1 Vol/Wt	Aliquot 1 Units	Aliquot 2 Units
ARS1-B18-00562-01	LCS			1.0000		
ARS1-B18-00562-02	LCSD			1.0000		
ARS1-B18-00562-03	MBL			1.0000		
ARS1-B18-00562-04	TRG	ARS1-18-00750-001	288285	0.0100 L		
ARS1-B18-00562-05	TRG	ARS1-18-00750-002	288286	0.0100 L		
ARS1-B18-00562-06	TRG	ARS1-18-00751-001	288287	0.0100 L		
ARS1-B18-00562-07	TRG	ARS1-18-00751-002	288288	0.0100 L		
ARS1-B18-00562-08	TRG	ARS1-18-00751-003	288289	0.0100 L		
ARS1-B18-00562-09	TRG	ARS1-18-00751-004	288290	0.0100 L		

Reagent Amounts			
ABatch Sample ID	Type	SDG/Fraction	14.1.5 OPTIONAL AQ W/O DIST - Add scint cocktai - Ultima Gold LLT Reagent Grade (mL)
ARS1-B18-00562-01	LCS		1.00
ARS1-B18-00562-02	LCSD		1.00
ARS1-B18-00562-03	MBL		1.00
ARS1-B18-00562-04	TRG	ARS1-18-00750-001	10.00
ARS1-B18-00562-05	TRG	ARS1-18-00750-002	10.00
ARS1-B18-00562-06	TRG	ARS1-18-00751-001	10.00
ARS1-B18-00562-07	TRG	ARS1-18-00751-002	10.00
ARS1-B18-00562-08	TRG	ARS1-18-00751-003	10.00
ARS1-B18-00562-09	TRG	ARS1-18-00751-004	10.00

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

Protocol# 8 - Low Level H3.lsa

User: ARS

Assay Definition

Assay Description:
LLH3 Assay in DPM Mode
Assay Type: DPM (Single)
Report Name: Report1
Output Data Path: C:\Packard\Tricarb\Results\ARS\Low Level H3\20180314_1653
Raw Results Path: C:\Packard\Tricarb\Results\ARS\Low Level H3\20180314_1653\20180314_1653.results
RTF File Name: C:\Packard\Tricarb\Results\ARS\Low Level H3\20180314_1653\LLH3.rtf
Comma-Delimited File Name: C:\Packard\Tricarb\Results\ARS\Low Level H3\20180314_1653\LLH3 Results.csv
Assay File Name: C:\Packard\Tricarb\Assays\Low Level H3.lsa

Count Conditions

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

Background Subtract

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

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

Count Corrections

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

Cycle 1 Results

P#	S#	SMPL ID	CPMA	DPM1	tSIE	Eff	Nucl	In A	Count	Time	DATE	TIME	MESSAGES
8	1	BACKGROUND	1.122	5.33	259.59			21.06	120.00	3/14/2018	7:04:46 PM		
8	2	B18-00562-04	1.566	7.49	256.43			20.92	120.00	3/14/2018	9:16:24 PM		*
8	3	B18-00562-05	1.166	5.66	249.26			20.60	120.00	3/14/2018	11:27:36 PM		
8	4	B18-00562-06	1.134	5.41	257.26			20.95	120.00	3/15/2018	1:38:57 AM		
8	5	B18-00562-07	1.383	6.54	261.21			21.13	120.00	3/15/2018	3:50:18 AM		
8	6	B18-00562-08	1.200	5.80	251.29			20.69	120.00	3/15/2018	6:01:43 AM		
8	7	B18-00562-09	1.312	6.18	263.14			21.22	120.00	3/15/2018	8:13:05 AM		

LSC Instrument Data Transfer Report											
Batch Sample ID				Non-BKG Samples Transferred				Samples Eligible To Save			
ARS1-B18-00562				6				6			
LIMS Batch Sample ID	LSC P#	LSC PID	LSC S#	LSC SNPL ID	LSC Count Date	LSC CPM	LSC CSE	LSC EFF	LSC Count Dur	LSC Analysis Batch	LIMS SDC
BKG	8		1	BACKGROUND	03/14/18 19:04	1.12	259.59	21.0600	120.00	ARS1-B18-00562	
ARS1-B18-00562-04	8		2	B18-00562-04	03/14/18 21:16	1.57	256.43	20.9200	120.00	ARS1-B18-00562	ARS1-18-00750
ARS1-B18-00562-05	8		3	B18-00562-05	03/14/18 23:27	1.17	249.26	20.6000	120.00	ARS1-B18-00562	ARS1-18-00750
ARS1-B18-00562-06	8		4	B18-00562-06	03/15/18 01:38	1.13	257.26	20.9500	120.00	ARS1-B18-00562	ARS1-18-00751
ARS1-B18-00562-07	8		5	B18-00562-07	03/15/18 03:50	1.38	261.21	21.1300	120.00	ARS1-B18-00562	ARS1-18-00751
ARS1-B18-00562-08	8		6	B18-00562-08	03/15/18 06:01	1.20	251.29	20.6900	120.00	ARS1-B18-00562	ARS1-18-00751
ARS1-B18-00562-09	8		7	B18-00562-09	03/15/18 08:13	1.31	263.14	21.2200	120.00	ARS1-B18-00562	ARS1-18-00751

LSC Instrument Data Transfer Report

\\Tricarb\ars\Low Level H3\20180314



Low Level Tritium pH Checks

[illegible]

ARS-040-001.r0_06072013

Liquid Scintillation Count Log

Date	Time	ARS Sample I.D. Number	Batch Fraction Number	Liquid Scintillation File Number	Technician Initials	Notes Identifier
3/6/2018	9:30	B18-00012	13	1100	MM	
3/6/2018	9:30	B18-00012	14	1100	MM	
3/6/2018	9:30	B18-00012	15	1100	MM	
3/6/2018	9:30	B18-00012	16	1100	MM	
3/6/2018	9:30	B18-00012	17	1100	MM	
3/6/2018	9:30	B18-00012	18	1100	MM	
3/6/2018	9:30	B18-00012	19	1100	MM	
3/6/2018	9:30	B18-00012	20	1100	MM	
3/12/2018	13:45	SNC163	QA	QA	MM	
3/12/2018	13:45	Background	N/A	N/A	MM	
3/12/2018	13:45	B17-02878	1	1504	MM	
3/12/2018	13:45	B17-02878	2	1504	MM	
3/12/2018	13:45	B17-02878	3	1504	MM	
3/12/2018	13:45	B17-02878	4	1504	MM	
3/12/2018	13:45	B17-02878	5	1504	MM	
3/12/2018	13:45	B17-02878	6	1504	MM	
3/12/2018	13:45	B17-02878	7	1504	MM	
3/14/2018	16:45	SNC163	QA	QA	MM	
3/14/2018	16:45	Background	N/A	1653	MM	
3/14/2018	16:45	B18-00562	4	1653	MM	
3/14/2018	16:45	B18-00562	5	1653	MM	
3/14/2018	16:45	B18-00562	6	1653	MM	
3/14/2018	16:45	B18-00562	7	1653	MM	
3/14/2018	16:45	B18-00562	8	1653	MM	
3/14/2018	16:45	B18-00562	9	1653	MM	



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

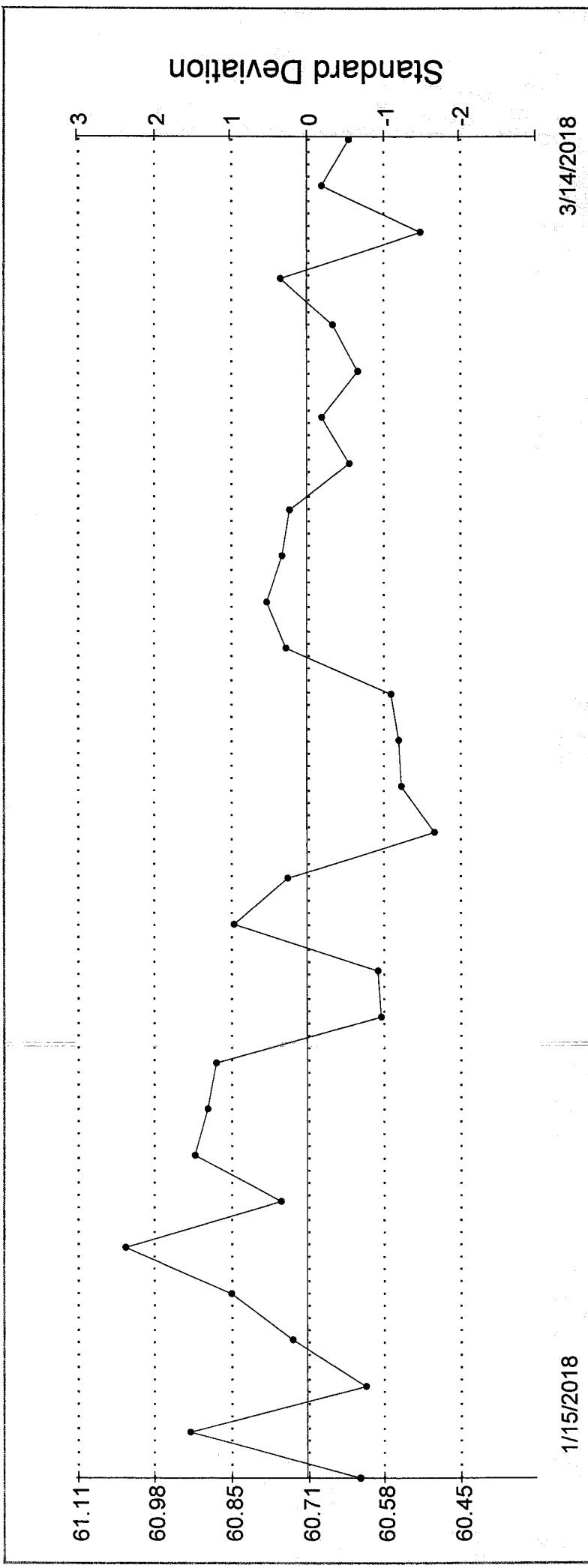
Control Charts

3H Efficiency

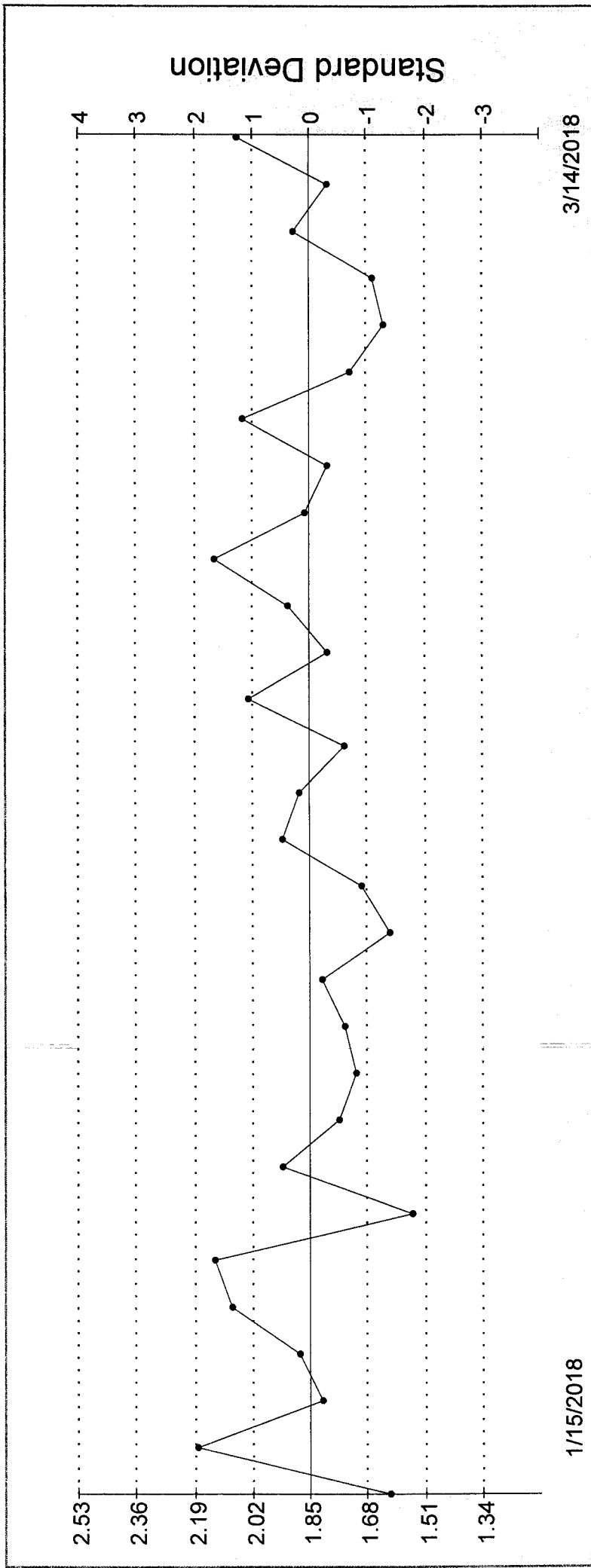
Total # pts : 98
Valid # pts : 30
Mean : 60.72
SD : 0.13

Date	Value	Include
Jan 15, 2018	60.63	X
Jan 15, 2018	60.92	X
Jan 16, 2018	60.62	X
Jan 18, 2018	60.74	X
Jan 20, 2018	60.85	X
Jan 22, 2018	61.03	X
Jan 26, 2018	60.76	X
Jan 26, 2018	60.91	X
Feb 01, 2018	60.89	X
Feb 02, 2018	60.87	X
Feb 02, 2018	60.59	X
Feb 05, 2018	60.60	X
Feb 06, 2018	60.84	X
Feb 09, 2018	60.75	X
Feb 11, 2018	60.50	X
Feb 12, 2018	60.56	X
Feb 13, 2018	60.56	X
Feb 14, 2018	60.57	X
Feb 14, 2018	60.75	X
Feb 16, 2018	60.79	X
Feb 22, 2018	60.76	X
Feb 25, 2018	60.75	X
Feb 26, 2018	60.65	X
Feb 28, 2018	60.69	X
Mar 03, 2018	60.63	X
Mar 06, 2018	60.67	X
Mar 11, 2018	60.76	X
Mar 12, 2018	60.52	X
Mar 14, 2018	60.69	X
Mar 14, 2018	60.65	X

3H Efficiency : 98
Total # pts : 30
Valid # pts : 60.72
Mean : 60.72
SD : 0.13



3H Background
Total # pts : 96
Valid # pts : 30
Mean : 1.85
SD : 0.17





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ARS Aleut Analytical Reports

for

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**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 6.24 2.81
 Two Sigma Uncertainty 0.57 0.26
 Standard Deviation percent of known concentration 4.82% 4.82%
 Target Activity 6.05 2.73
 % Diff 3.07% 3.07%

10% Max PASS **5% Max PASS**

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		
Technician	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	
Tracker ID:	S-0332 3-26-18	
Sample ID	Std. Weight(g)	Tracker Weight(g)
V1	5.0469	
V2	5.0210	
V3	5.0203	
V4	5.0107	
V5	5.0092	

Protocol# 7 - H3 Normal Lvl 2.lsa

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

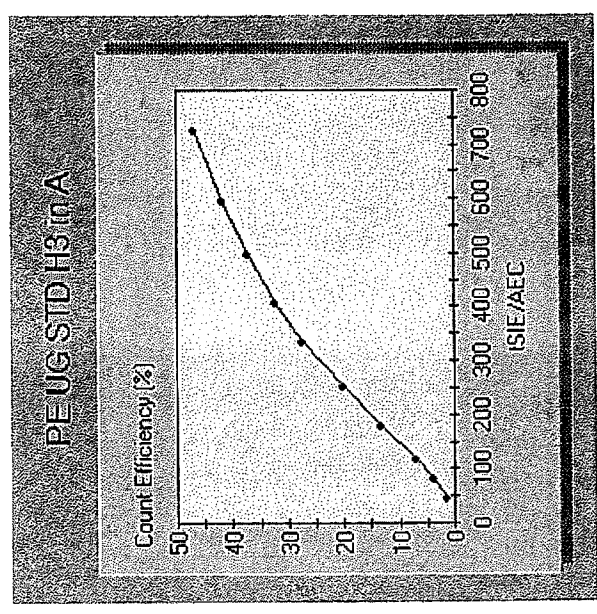
Background Subtract: Off
Low CPM Threshold: Off
2 Sigma % Terminator: On - Any Region

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
----	----	---------	------	------	------	---------------	------------	------	------	----------

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	Certd 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					

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		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	03/22/2018 13:14					



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**ARS Aleut
Analytical Reports
for
Los Alamos National Laboratory

Folder Duplicate**



Report Compilation Checklist

ARS SDG: 18-00751Client Name: LANLSample 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	

SOA
Report Generator Signature

5-15-18
Date

[Signature]
Management Review Signature

5-22-18
Date



LSC
Technical Review Checklist

ARS SDG ARS1-18-00751

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: B18-00562 Batch B: N/A Batch C: N/A

Test Method(s): LSC-1113/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	Yes	No	N/A
2) 100% of Manual Calculations Verified?	Yes	No	<input checked="" type="radio"/> N/A	Yes	No	N/A
3) Blank Composition/Configuration Matches Calibration?	Yes	No	<input checked="" type="radio"/> N/A	Yes	No	N/A
4) Deviations from procedure are documented and verified?	Yes	No	<input checked="" type="radio"/> N/A	Yes	No	N/A
5) Appropriate Cocktail Selected?	<input checked="" type="radio"/> Yes	No	N/A	Yes	No	N/A
6) Sample Prep Anomaly? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (See Tech Notes) NCR # (If initiated): _____						
Melisa Morgan 3-14-18 Chemist Signature Date		Ma 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
				3-15-18 QA Officer Signature Date		
	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): _____						
Melisa Morgan 3-15-18 Analyst Signature Date		3-15-18 Technical Reviewer Signature Date				

Batch A: B18-00562

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>n/a</u> Project Manager Signature	<u>n/a</u> QA Officer Signature	Date

GENERAL COMMENTS

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LSC
Technical Review Checklist

ARS SDG ARS1-18-00751

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

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

ARS A. Batch ID(s): Batch A: B18-00609 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): _____						
Melisa Morgan 5-9-18 Chemist Signature Date			[Signature] 5-9-18 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] 5-14-18 QA Officer Signature Date			
	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): _____						
Melisa Morgan 5-14-18 Analyst Signature Date			[Signature] 5-14-18 Technical Reviewer Signature Date			

Batch A: B18-00609

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): _____		
<u><i>[Signature]</i></u> Project Manager Signature	<u>5-15-18</u> Date	<u><i>[Signature]</i></u> QA Officer Signature
		<u>5-22-18</u> Date

GENERAL COMMENTS

DQO Report for SDG
ARS1-18-00751

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 75/125	MS LL/UL 60/140	RadY LL/UL 30/120	GravY LL/UL 40/110	RER	RPD
				150 pCi/L					1	25
LSC-LLH3-AQ		pCi	L	N/A	ARS-040					
	WRAD	Analyte		RDL	LCS LL/UL 80/120	MS LL/UL 60/140	RadY LL/UL 30/120	GravY LL/UL 40/110	RER	RPD
				3.221 pCi/L					1	25
Enriched H-3										

DQO Report for SDG

ARS1-18-00751

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

SDG Report - Samples and Containers

SDG Specific Data

SDG	ARS1-18-00751	TAT Days	40	Project Type	Environmental
Sample Count	4	Date Received	3/9/2018	COC Number	2018-2112
Client	Los Alamos National Laboratory	Client Deadline	4/18/2018	PO Number	
Client Code	114	Internal Deadline	4/17/2018	Job Number	
Profile Number	PN-00094	Lab Deadline	4/15/2018	Job Location	
Comment					

Samples and Containers Checked In Thus Far

FR	Name	Matrix	Start Date	End Date	Disp	Hold	Arch	Storage	Conductivity	Comments
001	CAAN-18-151444 IC_ID	AQ	3/6/2018 10:56 AM	3/6/2018 10:56 AM	H	90	5	L1		
	287872	Cnt	Volume (mL)	Container Type	pH Orig	pH Final	CPM	uR Hr	VOA	Head
		1	1135.00	HDP Container	7	7	80	22	N	N/A
										Temp (C)
										0
002	CAAN-18-151451 IC_ID	AQ	3/6/2018 10:56 AM	3/6/2018 10:56 AM	H	90	5	L1		
	287873	Cnt	Volume (mL)	Container Type	pH Orig	pH Final	CPM	uR Hr	VOA	Head
		1	1154.00	HDP Container	7	7	80	20	N	N/A
										Temp (C)
										0
003	CAAN-18-151479 IC_ID	AQ	3/7/2018 8:38 AM	3/7/2018 8:38 AM	H	90	5	L1		
	287874	Cnt	Volume (mL)	Container Type	pH Orig	pH Final	CPM	uR Hr	VOA	Head
		1	1139.00	HDP Container	7	7	80	20	N	N/A
										Temp (C)
										0
004	CAAN-18-151491 IC_ID	AQ	3/7/2018 11:24 PM	3/7/2018 11:24 PM	H	90	5	L1		
	287875	Cnt	Volume (mL)	Container Type	pH Orig	pH Final	CPM	uR Hr	VOA	Head
		1	1155.00	HDP Container	7	7	90	22	N	N/A
										Temp (C)

SDG Report - Analysis Assignments

SDG	ARS1-18-00751	Sample Count	4
Client	Los Alamos National Laboratory	Analysis Count	2-8

Sample Count Totals Per Analysis				
Analysis Code	Analysis Description	In/Out	Samples Count	
LSC-LLH3/SC-AQ	Low Level Tritium Screen in (Aqueous)	I	4	
LSC-LLH3-AQ	Low Level Tritium by Enrichment Process in (Aqueous [AQ])	I	4	

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

ARS FILE TRACKING SHEET

SDG: ARS1-18-00751

Task	Date / Time	Initials
Date & Time Samples Received	3/9/18 09:00	MC
ICOC Initiated/Storage Location: <u>L1</u>	3/9/18 10:35	MC
Technical Checks Performed	<i>See Patch</i>	
Report Written / EDD Generated <u>5-14-18/1221</u> <u>SDA</u>	<u>5-15-18/1611</u>	<u>SDA</u>
Report / EDD Reviewed for accuracy and completeness		
Quality Assurance Checks Performed on Report	<u>5-22-18</u>	
Management Checks Performed on Report	<u>12:45</u>	<i>RE</i>
Preliminary Report Scan	<u>na</u>	
Report E-mailed/Faxed		
Invoice Completed Invoice #: _____		
Requires Report Mailed Yes / No	<u>na</u>	
Requires Original COC mailed Yes / No		
Report Reviewed and Imaged		

EDD
Loaded
5-14-18
SDA

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: APS1-18-00751

SHIPPING CONTAINER

COC PRESENT WITH SAMPLES

COC ☒ Yes ☐ No

SAMPLE CONTAINER(S)

Good Condition ☒ Yes ☐ No
 Sec. Seals ☒ Yes ☐ No
 Seal Intact ☒ Yes ☐ No ☐ N/A
 Radioactive ☐ Yes ☒ No

Marked Radioactive

Samples Rcv

Matrix

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

Exposure Rate Meter:	M3 269264	Serial No.:	PR 256427	Calibration Due Date:	3/13/18
Count Rate Meter:	M2 154859	Serial No.:	PR 121649	Calibration Due Date:	3/9/18
Background Exposure Rate (μR/hr)	20	Max. Exposure Rate on Shipping Containers Externals (Plus Bkgd)	20	μR/hr	
Background Count Rate (cpm)	90	Max. Removable Count Rate on Shipping Containers Externals (Plus Bkgd)	90	cpm	
		Max. Removable Count Rate on Shipping Containers Internals (Plus Bkgd)	90	cpm	

[illegible]

Surveyors'
Name:

Date/Time Surveyed:

[illegible]