

The order of this data package is as follows:

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

Comments:

SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 11605

EVENT NAME: Water/CdV (TA16 260) Q1 MY2018

SAMPLE ID: CAWA-18-148918

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>		<u>AS PLANNED</u>	<u>AS COLLECTED</u>
Date Collected (MM/DD/YYYY):	12/11/2017	OK	FIELD MATRIX:	WG	OK
TIME COLLECTED (HH:MM):	KT 12/11/17 1031		MEDIA:	NA	
PRS ID:	NA		SAMPLE TECH CODE:	GSP	
LOCATION ID:	R-68		FIELD PREP:	UF	
LOCATION TYPE:	NA		FIELD QC TYPE:	REG	
TOP DEPTH:			SAMPLE USAGE:	INV	
BOTTOM DEPTH:			EXCAVATED:		YES / NO (NA)

PRIORITY	ORDER	CONTAINER	#	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
NA	MSGP-Hg	500 ML POLY	1	HNO3	Y	NA
	WSP-8260B-VOA	40 ML SEPTUM AMBER GLASS	2	HCL		
	WSP-8270C-SVOA	1 LITER AMBER GLASS	2	ICE		
	WSP-8290-D/F	1 LITER AMBER GLASS	2	ICE		
	WSP-8330B-NMED HEXMOD	1 LITER AMBER GLASS	3	ICE		
	WSP-CN(T)	250 ML POLY	1	NAOH		
	WSP-GrossA/B	1 LITER POLY	1	HNO3		
	WSP-LL-H-3	1 LITER POLY	1	NONE		
	WSP-RAD	1 GAL POLY	1	HNO3		
	WSP-TKN+TOC	500 ML AMBER GLASS	1	H2SO4		

SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY**EVENT ID:** 11605**EVENT NAME:** Water/CdV (TA16 260) Q1 MY2018**SAMPLE ID:** CAWA-18-148918**WORK ORDER:****SAMPLE COMMENTS:** *Sampled 40 ft from running diesel generator***LOCATION COMMENTS:** *None***FIELD PARAMETERS:**

Sample Time	<u>1031</u>	HH:MM	Discharge Rate	<u>5.66</u>	Dissolved Oxygen	<u>5.68</u>
Groundwater Elevation	<u>6182.70</u>		Oxidation-Reduction Potential	<u>36.5</u>	Period Purge Volume	<u>NA</u>
pH	<u>7.45</u>		Purge Volume	<u>283.0</u>	Specific Conductance	<u>112.8</u>
Temperature	<u>13.9</u>		Total Volume Pumped	<u>339.60</u>	Turbidity	<u>7.02</u>

COLLECTED BY (PRINT): *T. Vander Vis*

RELINQUISHED BY (Printed Name) (Signature)	<i>Katrina Tow</i> <i>[Signature]</i>	Date/Time <i>12/11/17</i> <i>1156</i>	RECEIVED BY (Printed Name) (Signature)	<i>SSherwood</i> <i>[Signature]</i>	Date/Time <i>12/11/17</i> <i>1156</i>
RELINQUISHED BY (Printed Name) (Signature)		Date/Time	RECEIVED BY (Printed Name) (Signature)		Date/Time

SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 11605

EVENT NAME: Water/CdV (TA16 260) Q1 MY2018

SAMPLE ID: CAWA-18-148943

WORK ORDER:

	<u>AS PLANNED</u>	<u>AS COLLECTED</u>		<u>AS PLANNED</u>	<u>AS COLLECTED</u>
Date Collected (MM/DD/YYYY):	12/11/2017	OK	FIELD MATRIX:	WG	OK
TIME COLLECTED (HH:MM):	1031		MEDIA:	NA	
PRS ID:	NA		SAMPLE TECH CODE:	GSP	
LOCATION ID:	R-68		FIELD PREP:	UF	
LOCATION TYPE:	NA		FIELD QC TYPE:	FD	
TOP DEPTH:	↓		SAMPLE USAGE:	QC	
BOTTOM DEPTH:	↓	↓	EXCAVATED:		YES / NO / <u>NA</u>

PRIORITY	ORDER	CONTAINER	#	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
NA	MSGP-Hg	500 ML POLY	1	HNO3	Y	NA
↓	WSP-8260B-VOA	40 ML SEPTUM AMBER GLASS	2	HCL	↓	↓
↓	WSP-8270C-SVOA	1 LITER AMBER GLASS	2	ICE	↓	↓
↓	WSP-8290-D/F	1 LITER AMBER GLASS	2	ICE	↓	↓
↓	WSP-8330B-NMED HEXMOD	1 LITER AMBER GLASS	3	ICE	↓	↓
↓	WSP-CN(T)	250 ML POLY	1	NAOH	↓	↓
↓	WSP-Gross/AB	1 LITER POLY	1	HNO3	↓	↓
↓	WSP-LL-H-3	1 LITER POLY	1	NONE	↓	↓
↓	WSP-RAD	1 GAL POLY	1	HNO3	↓	↓
↓	WSP-TKN+TOC	500 ML AMBER GLASS	1	H2SO4	↓	↓

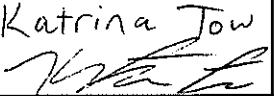

SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY**EVENT ID:** 11605**EVENT NAME:** Water/CdV (TA16 260) Q1 MY2018**SAMPLE ID:** CAWA-18-148943**WORK ORDER:****SAMPLE COMMENTS:**~~12/11/17~~ ^{KT 12/11/17} None**LOCATION COMMENTS:**~~12/11/17~~ ^{KT 12/11/17} None**FIELD PARAMETERS:**

~~KT 12/11/17~~

Sample Time	HH:MM	Discharge Rate		Dissolved Oxygen	
Groundwater Elevation		Oxidation-Reduction Potential		Period Purge Volume	
pH		Purge Volume		Specific Conductance	
Temperature		Total Volume Pumped		Turbidity	

COLLECTED BY (PRINT):

T. Vander Vis

RELINQUISHED BY (Printed Name) (Signature)	Katrina Tow 	Date/Time 12/11/17 1156	RECEIVED BY (Printed Name) (Signature)	MATT ENGERT 	Date/Time 12-11-17 1156
RELINQUISHED BY (Printed Name) (Signature)		Date/Time	RECEIVED BY (Printed Name) (Signature)		Date/Time

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"/>

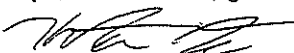
TEST - Chemical Preservation		YES	NO
Samples are chemically preserved?		<input checked="" type="checkbox"/>	
Field Team Member Statement		YES	NO
Chemical preservation exceeds limits given 40 CFR 136, Table II - Required Containers, Preservation Techniques and Holding Times (footnote 3). If YES - Do not 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 $\geq 160,000$	AT TA-1 and adjacent hillsides, TA-21, Acid Canyon, MDA C at TA-50, Area G at TA-54, TA-48, or TA-49		<input checked="" type="checkbox"/>
Alpha ≥ 125	AND Alpha $\geq 1,250,000$	AT other locations		<input checked="" type="checkbox"/>
Beta $\geq 1,500$	AND Beta $\geq 15,000,000$	AT any location		<input checked="" type="checkbox"/>
The sample Alpha $\geq 16,000,000$ dpm*g/100cm ² or Beta $\geq 160,000,000$ dpm*g/100cm ² . If YES - Do not ship.				<input checked="" type="checkbox"/>
On the external surface of the sample container, alpha activity ≥ 24 dpm/cm ² , beta activity ≥ 240 dpm/cm ² , or surface activity ≥ 0.5 mR/hr. If YES - Do not ship.				<input checked="" type="checkbox"/>
The sample is tentatively identified as DOT Hazard Class 7 (Radioactive). The shipment is labeled Radioactive Material, Excepted Package - Limited Quantity of Material - UN2910, based on field screening measurements of alpha and beta activity.				<input checked="" type="checkbox"/>

TEST - Location			YES	NO
Prior analytical measurements of radioactive isotopes are available?			<input checked="" type="checkbox"/>	
Sample Activity (pCi/g)	Shipment Activity (pCi)		YES	NO
• Am-241 ≥ 27 pCi/g	AND	Am-241 $\geq 270,000$ pCi Total		
• Cs-137 ≥ 270 pCi/g	AND	Cs-137 $\geq 270,000$ pCi Total		
• Pu-238 ≥ 27 pCi/g	AND	Pu-238 $\geq 270,000$ pCi Total		<input checked="" type="checkbox"/>
• Pu-239/240 ≥ 27 pCi/g	AND	Pu-239/240 $\geq 270,000$ pCi Total		
• Th-228 ≥ 27 pCi/g	AND	Th-228 $\geq 270,000$ pCi Total		
• U-234 ≥ 270 pCi/g	AND	U-234 $\geq 1,600,000,000$ pCi Total		
• U-238 ≥ 270 pCi/g	AND	U-238 \geq unlimited		
• H-3 $\geq 27,000,000$ pCi/g	AND	H-3 $\geq 27,000,000,000$ pCi Total		
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"/>
The sample is tentatively identified as DOT Hazard Class 7 (Radioactive). The shipment is labeled Radioactive Material, Excepted Package - Limited Quantity of Material - UN2910, based on prior analytical measurements of radioactive isotopes.				<input checked="" type="checkbox"/>

TEST - AK		YES	NO
The shippers documented knowledge of the sample positively identifies appropriate labeling.			<input checked="" type="checkbox"/>
Documented Field Team Member Statement		YES	NO
The sample is tentatively identified as DOT Hazard Class 7 (Radioactive). The shipment is labeled <i>Radioactive Material, Excepted Package - Limited Quantity of Material - UN2910</i> , and the sample is submitted to ARS or RP for hazard classification analysis.			<input checked="" type="checkbox"/>

These samples do not meet the criteria for classification in any hazard class according to regulation OSHA 29 CFR 1910.1200. The sample(s) contained in this shipment have been assigned a tentative proper DOT shipping name, hazard class, identification number, and packing group, based on the shipper's knowledge of the sample:

Hazard Assessment Completed By:	Date/Time
(Printed Name) Katrina Tow	12/11/17
(Signature) 	1156

Hazard Assessment Reviewed By:	Date/Time
(Printed Name) J. Sherwood	12/11/17
(Signature) 	1156

R-68

ER-SOP-10094, R1, Attachment

DATA VALIDATION REPORT

Chain Of Custody No. 2018-1275

1. Distribution Of Samples In EDD.

SDG	Analytical Method	Regular Samples	Field Duplicates	Trip Blanks	Field Blanks	Equipment Blanks
ARS1-17-03647	Generic:Low_Level_Tritium	1	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
ARS1-17-03647	Generic:Low_Level_Tritium	ARS1-B18-	ARS1-B18-	1	1				1					1	1						

2. Distribution Of Analytes In EDD.

Analytical Method	Analytical Method Category	Field Sample ID	Lab Sample ID	Sample Purpose	Target Analytes	Surrogates	Spiked Compounds	TICS
Generic:Low_Level_Tritium	RAD	CAWA-18-148918	ARS1-B18-00012-10	REG	1	0	0	0
Generic:Low_Level_Tritium	RAD	CAWA-18-148943	ARS1-B18-00012-11	FD	1	0	0	0
Generic:Low_Level_Tritium	RAD	LCS	ARS1-B18-00012-01	LCS	0	0	1	0
Generic:Low_Level_Tritium	RAD	LCSD	ARS1-B18-00012-02	LCSD	0	0	1	0
Generic:Low_Level_Tritium	RAD	MB	ARS1-B18-00012-03	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-B18-00012-01	ARS1-B18-00012-02	Generic:Low_Level_Tritium	Tritium	ARS1-B18-00012	03-07-2018	W	106.00	70.000	120.00	80.000		10	42.014	

9. Any Field Duplicate RPDs outside the desired limits?

No.

10. Any Lab Duplicate RPDs outside the desired limits?

No.

11. Any required reporting limits exceeded?

No.

12. Additional Validator's Comments.

DATA VALIDATION REPORT

13. Display Flagged Data.

Location ID	COC Number	Field Sample ID	Sample Purpose	Analysis Type Code	Analytical Suite	Analytical Method	Parameter Name	Lab Qualifier	Validation Qualifier	Validation Reason Codes	Detect Flag	Lab Result	Lab Units	Report Result	Report Units	Report MDA	Report Uncertainty	Lab Matrix	Sample Date	Percent	Analysis Lot ID	Validation Status Code	Use Flag
R-68	2018-1275	CAWA-18-148918	REG	INIT	RAD	Generic:Low_Level_Tritium	Tritium	U	U	R5	N	-0.853	pCi/L	-0.853	pCi/L	3.079	0.903	W	12/11/2017		ARS1-B18-00012	VAL	Y
R-68	2018-1275	CAWA-18-148943	FD	INIT	RAD	Generic:Low_Level_Tritium	Tritium	U	U	R5	N	1.206	pCi/L	1.206	pCi/L	2.151	0.681	W	12/11/2017		ARS1-B18-00012	VAL	Y

Reason Code

Description

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

14. Usable Result Count.

Field Sample ID	Location ID	Sample Purpose	Analytical Method	No. Unuseable Records	Total Records
CAWA-18-148918	R-68	REG	Generic:Low_Level_Tritium	0	1
CAWA-18-148943	R-68	FD	Generic:Low_Level_Tritium	0	1



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American Radiation Services Analytical Reports

for

Los Alamos National Laboratory

Request Number: 2018-1275

SDG: ARS1-17-03647



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American Radiation Services Analytical Reports

for

**Los Alamos National Laboratory
Request: 2018-1275**

Original COC



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American Radiation Services Analytical Reports

for

**Los Alamos National Laboratory
Request: 2018-1275**

Case Narrative



ARS International, LLC

Laboratory Analysis Report

ARS1-17-03647

Prepared for:

Los Alamos National Laboratory

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

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

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

A handwritten signature in cursive script, appearing to read 'Susan Hesse', is written over a horizontal line.

Project Manager Review

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

Contact Person: Questions regarding this analytical report should be addressed to:

**Project Manager
ProjectManagers@amrad.com**

**Phone: 225.381.2991
Fax: 225.381.2996**



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March 15, 2018

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

ARS SDG: **ARS1-17-03647**
COC Number: **2018-1275**
Charge Code: **ADEP**

Dear Nita,

On December 15, 2017, ARS International received two (2) samples to be analyzed for Enriched H-3.

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

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

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

Sincerely,

A handwritten signature in cursive script that reads 'Susan Leese'.

Susan Leese
Project Management
ARS International



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

Project ID	Client Sample ID NUMBER	American Radiation Services SAMPLE ID NUMBER(S)
2018-1275	CAWA-18-148918	ARS1-17-03647-001
2018-1275	CAWA-18-148943	ARS1-17-03647-002

SAMPLE RECEIPT/PREP

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

ANALYTICAL METHODS

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

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

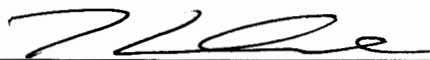
ANALYTICAL RESULTS

ARS1-B18-00012: RER and RPD were slightly elevated; data has been qualified with a "**"

American Radiation Services Laboratory Management's Comments:

"I certify that this sample data package is in compliance with SOW requirements, both technically and for completeness, other than the conditions detailed above. Release of the data contained in this sample data package and the computer-readable EDD, as applicable, submitted on diskette or by modem, has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature."

"I certify that this electronic image and all hardcopies produced from this image accurately represent the data and is in compliance with client specific requirements, both technically and for completeness, other than the conditions detailed above or in the sample data package narrative. Release, by submission through email, the data contained in this electronic image and the computer-readable EDD (as applicable), has been authorized by the laboratory Manager/Technical Director or the Manager's designee."


Signature

Laboratory Management, ARS International
Title

3-18-18
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).

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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American Radiation Services Analytical Reports

for

Los Alamos National Laboratory

Low Level Tritium by Low Level Liquid Scintillation Counting



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ARS Sample Delivery Group: ARS1-17-03647

Client Sample ID: CAWA-18-148918

Sample Collection Date: 12/11/17

Sample Matrix: Aqueous

Percent Solids: N/A

Request or PO Number: 2018-1275

ARS Sample ID: ARS1-17-03647-001

Date Received: 12/15/17

Report Date: 03/15/18

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	-0.853	0.903	3.079	1.496	3.221	U*	pCi/L	ARS-040/	03/09/18 4:37	MMORGAN	N/A

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

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ARS Sample Delivery Group: ARS1-17-03647

Client Sample ID: CAWA-18-148943

Sample Collection Date: 12/11/17

Sample Matrix: Aqueous

Percent Solids: N/A

Request or PO Number: 2018-1275

ARS Sample ID: ARS1-17-03647-002

Date Received: 12/15/17

Report Date: 03/15/18

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	1.206	0.681	2.151	1.045	3.221	U*	pCi/L	ARS-040/	03/09/18 10:20	MMORGAN	N/A

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

LELAP Certificate# 01949



QC Results per Analytical Batch

Analytical Batch	ARS1-B18-00012
SDG	ARS1-17-03647
Analysis	Low Level Tritium by Electrolytic Enrichment
Analysis Test Method	ARS-040/
Analysis Code	LSC-LLH3-AQ
Report Units	pCi/L

Acceptable QC Performance Ranges

QC Sample Type	Performance Items and Ranges		
Laboratory Control Sample	Recovery (%):	> 80	< 120
Matrix Spike	Recovery (%):	> 60	< 140
Duplicate	Replicate Error Ratio (RER):	< 1	
	Duplicate Error Ratio (DER):	< 3	
	Relative Percent Difference (RPD %):	≤ 25	

Laboratory Control Sample			Analysis Date	03/07/18 01:11	Analysis Technician	MMORGAN	
Analysis Batch Sample ID	QC Type	Analyte	Results	CSU (1s)	Expected Value	LCS Rec (%)	MDC
ARS1-B18-00012-01	LCS	ENRICHED H-3	34.429	5.369	32.401	106.3	3.320

Duplicate RER/DER/RPD			Analysis Date	03/07/18 06:54	Analysis Technician	MMORGAN	
Analyte	Results LCS	CSU LCS (1s)	Results LCSD	CSU LCSD (1s)	RER	DER	RPD
ENRICHED H-3	34.429	5.369	22.475	3.598	1.333	1.849	42.0

Method Blank			Analysis Date	03/07/18 12:36	Analysis Technician	MMORGAN	
Analysis Batch Sample ID	QC Type	Analyte	Results	CSU (1s)	MDC	Qual	
ARS1-B18-00012-03	MBL	ENRICHED H-3	-2.763	0.893	2.850	U	

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

LELAP Certificate# 01949



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American Radiation Services Analytical Reports

for

Los Alamos National Laboratory

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

Laboratory Records

Analytical Batch Report



Analysis Batch ID ARS1-B18-00012

<div><div></div><div>ARS Alert Analytical</div></div>		Method		Analysis		LSC-LLH3-AQ		Matrix		AQ									
		ARS-040																	
Description		Low Level Tritium by Electrolytic Enrichment		SDG		FR		Run		Prep Code		Filtered		Client ID		Group Name		Lab Deadline	
ABatch Sample ID	Type	Blind Iso1	Blind Iso2	Blind Iso3															
ARS1-B18-00012-01	LCS	B-24934																	
ARS1-B18-00012-02	LCSD	B-24935																	
ARS1-B18-00012-03	MBL																		
ARS1-B18-00012-04	TRG					ARS1-17-03645	001	1							BDW01-18-150415			01/24/18	
ARS1-B18-00012-05	TRG					ARS1-17-03645	002	1							BDW06-18-150416			01/24/18	
ARS1-B18-00012-06	TRG					ARS1-17-03645	003	1							BDW08-18-150417			01/24/18	
ARS1-B18-00012-07	TRG					ARS1-17-03645	004	1							BUCKPZ-18-150413			01/24/18	
ARS1-B18-00012-08	TRG					ARS1-17-03645	005	1							BUCKPZ-18-150414			01/24/18	
ARS1-B18-00012-09	TRG					ARS1-17-03646	001	1							CAWA-18-148944			01/24/18	
ARS1-B18-00012-10	TRG					ARS1-17-03647	001	1							CAWA-18-148918			01/24/18	
ARS1-B18-00012-11	TRG					ARS1-17-03647	002	1							CAWA-18-148943			01/24/18	
ARS1-B18-00012-12	TRG					ARS1-17-03648	001	1							CAWR-18-150421			01/24/18	
ARS1-B18-00012-13	TRG					ARS1-17-03648	002	1							CALA-18-150401			01/24/18	
ARS1-B18-00012-14	TRG					ARS1-17-03649	001	1							CALA-18-150112			01/24/18	
ARS1-B18-00012-15	TRG					ARS1-17-03649	002	1							CALA-18-150114			01/24/18	
ARS1-B18-00012-16	TRG					ARS1-17-03650	001	1							CALA-18-150107			01/24/18	
ARS1-B18-00012-17	TRG					ARS1-17-03650	002	1							CALA-18-150129			01/24/18	
ARS1-B18-00012-18	TRG					ARS1-17-03650	003	1							CALA-18-150115			01/24/18	
ARS1-B18-00012-19	TRG					ARS1-17-03650	004	1							CALA-18-150110			01/24/18	
ARS1-B18-00012-20	TRG					ARS1-17-03650	005	1							CALA-18-148968			01/24/18	

LCS Report

Analytical Batch: ARS1-B18-00012

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-24934	ARS1-B18-00012-01	B-H3	S-0324	H-3	5	2.48276	16.9931	21.9833	4.9902	2.46903	03/06/2018	12.32094	MMORGAN	01/29/2018
B-24935	ARS1-B18-00012-02	B-H3	S-0324	H-3	5	2.48276	16.771	21.7917	5.0207	2.46865	03/07/2018	12.39433	MMORGAN	01/29/2018

Tritium Assay in Water Samples Using Electrolytic Enrichment

Preparation Date: 02/06/2018 10:05
Prepared By: MMORGAN

Procedure Data		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)
ABatch Sample ID													
ARS1-B18-00012-01	LCS			327.8800	224.8400	605.1000	1.5000	380.2600	2/6/2018 1:30:00 PM	5.0000	2.0000	2/26/2018 9:00:00 AM	2.0000
ARS1-B18-00012-02	LCS			320.4000	237.2800	626.1700	1.5000	388.8900	2/6/2018 1:30:00 PM	5.0000	2.0000	2/26/2018 9:00:00 AM	2.0000
ARS1-B18-00012-03	MBL			324.8200	221.3700	600.5800	1.5000	379.2100	2/6/2018 1:30:00 PM	5.0000	2.0000	2/26/2018 9:00:00 AM	2.0000
ARS1-B18-00012-04	TRG	ARS1-17-03645-001		322.8600	228.7700	607.7900	1.5000	379.0200	2/6/2018 1:30:00 PM	5.0000	2.0000	2/26/2018 9:00:00 AM	2.0000
ARS1-B18-00012-05	TRG	ARS1-17-03645-002		323.3900	328.1700	707.5700	1.5000	379.4000	2/6/2018 1:30:00 PM	5.0000	2.0000	2/26/2018 9:00:00 AM	2.0000
ARS1-B18-00012-06	TRG	ARS1-17-03645-003		317.8700	226.2800	605.2000	1.5000	378.9200	2/6/2018 1:30:00 PM	5.0000	2.0000	2/26/2018 9:00:00 AM	2.0000
ARS1-B18-00012-07	TRG	ARS1-17-03645-004		320.8600	232.3700	613.0700	1.5000	380.7000	2/6/2018 1:30:00 PM	5.0000	2.0000	2/26/2018 9:00:00 AM	2.0000
ARS1-B18-00012-08	TRG	ARS1-17-03645-005		319.0500	223.6000	601.0300	1.5000	377.4300	2/6/2018 1:30:00 PM	5.0000	2.0000	2/26/2018 9:00:00 AM	2.0000
ARS1-B18-00012-09	TRG	ARS1-17-03646-001		316.4700	234.1000	611.0300	1.5000	376.9300	2/6/2018 1:30:00 PM	5.0000	2.0000	2/26/2018 9:00:00 AM	2.0000
ARS1-B18-00012-10	TRG	ARS1-17-03647-001		324.0100	227.1500	604.4000	1.5000	377.2500	2/6/2018 1:30:00 PM	5.0000	2.0000	2/26/2018 9:00:00 AM	2.0000
ARS1-B18-00012-11	TRG	ARS1-17-03647-002		322.0600	215.7600	595.4800	1.5000	379.7200	2/6/2018 1:30:00 PM	5.0000	2.0000	2/26/2018 9:00:00 AM	2.0000
ARS1-B18-00012-12	TRG	ARS1-17-03648-001		325.1500	230.4000	609.7200	1.5000	379.3200	2/6/2018 1:30:00 PM	5.0000	2.0000	2/26/2018 9:00:00 AM	2.0000
ARS1-B18-00012-13	TRG	ARS1-17-03648-002		322.7400	228.7200	611.8800	1.5000	383.1600	2/6/2018 1:30:00 PM	5.0000	2.0000	2/26/2018 9:00:00 AM	2.0000
ARS1-B18-00012-14	TRG	ARS1-17-03649-001		332.1300	259.3200	635.1700	1.5000	375.8500	2/6/2018 1:30:00 PM	5.0000	2.0000	2/26/2018 9:00:00 AM	2.0000
ARS1-B18-00012-15	TRG	ARS1-17-03649-002		321.9800	252.0900	632.3300	1.5000	380.2400	2/6/2018 1:30:00 PM	5.0000	2.0000	2/26/2018 9:00:00 AM	2.0000
ARS1-B18-00012-16	TRG	ARS1-17-03650-001		321.3600	217.2700	594.6200	1.5000	377.3500	2/6/2018 1:30:00 PM	5.0000	2.0000	2/26/2018 9:00:00 AM	2.0000
ARS1-B18-00012-17	TRG	ARS1-17-03650-002		318.3400	225.8100	603.2400	1.5000	377.4300	2/6/2018 1:30:00 PM	5.0000	2.0000	2/26/2018 9:00:00 AM	2.0000
ARS1-B18-00012-18	TRG	ARS1-17-03650-003		327.0400	224.9800	612.8100	1.5000	387.8300	2/6/2018 1:30:00 PM	5.0000	2.0000	2/26/2018 9:00:00 AM	2.0000
ARS1-B18-00012-19	TRG	ARS1-17-03650-004		321.5500	270.0400	653.8100	1.5000	383.7700	2/6/2018 1:30:00 PM	5.0000	2.0000	2/26/2018 9:00:00 AM	2.0000
ARS1-B18-00012-20	TRG	ARS1-17-03650-005		325.0900	244.9700	624.2100	1.5000	379.2400	2/6/2018 1:30:00 PM	5.0000	2.0000	2/26/2018 9:00:00 AM	2.0000

Tritium Assay in Water Samples Using Electrolytic Enrichment

Procedure Data		End Wt of Cell + Resv + Sample	Gross Sample Recovered	Enrichment Factor	Tare Wt Cryo-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-B18-00012-01	LCS	569.6000	16.8800	22.5273	121.3500	132.4000	11.0500	6.6300	16.7000	10.0700	16.7000	0.0000
ARS1-B18-00012-02	LCSID	573.7800	16.1000	24.1547	115.9800	127.0100	11.0300	6.6300	16.7000	10.0700	16.7000	0.0000
ARS1-B18-00012-03	MBL	561.2500	15.0600	25.1799	122.8700	134.7000	11.8300	6.6000	16.6900	10.0900	16.6900	0.0000
ARS1-B18-00012-04	TRG	566.8100	15.1800	24.9684	99.9800	112.2100	12.2300	6.6300	16.7900	10.1600	16.7900	0.0000
ARS1-B18-00012-05	TRG	666.7600	15.2000	24.9605	124.8000	136.8500	12.0500	6.6200	16.6700	10.0500	16.6700	0.0000
ARS1-B18-00012-06	TRG	561.0100	16.8600	22.4745	109.4100	123.6800	14.2700	6.7000	16.7200	10.0200	16.7200	0.0000
ARS1-B18-00012-07	TRG	570.3400	17.1100	22.2501	120.8300	134.6500	13.8200	6.6200	16.6500	10.0300	16.6500	0.0000
ARS1-B18-00012-08	TRG	557.5800	14.9300	25.2800	126.3300	137.1900	10.8600	6.6800	16.7000	10.0200	16.7000	0.0000
ARS1-B18-00012-09	TRG	563.5100	12.9400	29.1291	109.4200	118.6500	9.2300	6.5600	15.5100	8.9500	16.6300	1.1200
ARS1-B18-00012-10	TRG	567.1100	15.9500	23.6520	126.3800	139.7000	13.3200	6.5800	16.7000	10.1200	16.7000	0.0000
ARS1-B18-00012-11	TRG	549.6200	11.8000	32.1797	121.3300	133.2700	11.9400	6.6000	16.6600	10.0600	16.6600	0.0000
ARS1-B18-00012-12	TRG	573.0900	17.5400	21.6260	122.9000	137.1200	14.2200	6.7000	16.7400	10.0400	16.7400	0.0000
ARS1-B18-00012-13	TRG	567.1600	15.7000	24.4051	126.3400	138.8200	12.4800	6.6100	16.6800	10.0700	16.6800	0.0000
ARS1-B18-00012-14	TRG	607.5000	16.0500	23.4174	120.8400	133.8600	13.0200	6.6300	16.6500	10.0200	16.6500	0.0000
ARS1-B18-00012-15	TRG	589.7900	15.7200	24.1883	122.8500	135.3900	12.5400	6.5400	16.5600	10.0200	16.5600	0.0000
ARS1-B18-00012-16	TRG	554.7700	16.1400	23.3798	109.4300	123.1300	13.7000	6.6400	16.6600	10.0200	16.6600	0.0000
ARS1-B18-00012-17	TRG	560.2200	16.0700	23.4866	128.3800	141.8700	13.4900	6.5400	16.5600	10.0200	16.5600	0.0000
ARS1-B18-00012-18	TRG	565.8600	13.8400	29.0224	124.7900	135.6600	10.8700	6.4400	16.4500	10.0100	16.4500	0.0000
ARS1-B18-00012-19	TRG	606.8400	15.2500	25.1652	116.0400	127.5500	11.5100	6.5300	16.5800	10.0500	16.5800	0.0000
ARS1-B18-00012-20	TRG	586.1100	16.0500	23.6287	129.8500	141.7200	11.8700	6.6100	16.6600	10.0500	16.6600	0.0000

Tritium Assay in Water Samples Using Electrolytic Enrichment

Procedure Data				
Batch Sample ID	Type	Tare Wt b/f Cocktail	Gross Wt Vial + Cocktail	Net Wt of Cocktail Added
ARS1-B18-00012-01	LCS	16.7000	26.7300	10.0300
ARS1-B18-00012-02	LCSD	16.7000	26.7100	10.0100
ARS1-B18-00012-03	MBL	16.6900	26.7100	10.0200
ARS1-B18-00012-04	TRG	16.7900	26.7900	10.0000
ARS1-B18-00012-05	TRG	16.6700	26.6700	10.0000
ARS1-B18-00012-06	TRG	16.7200	26.7200	10.0000
ARS1-B18-00012-07	TRG	16.6500	26.6500	10.0000
ARS1-B18-00012-08	TRG	16.7000	26.7000	10.0000
ARS1-B18-00012-09	TRG	16.6300	26.6500	10.0200
ARS1-B18-00012-10	TRG	16.7000	26.7500	10.0500
ARS1-B18-00012-11	TRG	16.6600	26.7300	10.0700
ARS1-B18-00012-12	TRG	16.7400	26.7900	10.0500
ARS1-B18-00012-13	TRG	16.6800	26.6800	10.0000
ARS1-B18-00012-14	TRG	16.6500	26.7300	10.0800
ARS1-B18-00012-15	TRG	16.5600	26.5600	10.0000
ARS1-B18-00012-16	TRG	16.6600	26.7000	10.0400
ARS1-B18-00012-17	TRG	16.5600	26.6000	10.0400
ARS1-B18-00012-18	TRG	16.4500	26.4800	10.0300
ARS1-B18-00012-19	TRG	16.5800	26.5900	10.0100
ARS1-B18-00012-20	TRG	16.6600	26.7200	10.0600

Reagent Amounts			14.2.12		14.3.22
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-B18-00012-01	LCS		1.50	10.00	
ARS1-B18-00012-02	LCSD		1.50	10.00	
ARS1-B18-00012-03	MBL		1.50	10.00	
ARS1-B18-00012-04	TRG	ARS1-17-03645-001	1.50	10.00	
ARS1-B18-00012-05	TRG	ARS1-17-03645-002	1.50	10.00	
ARS1-B18-00012-06	TRG	ARS1-17-03645-003	1.50	10.00	
ARS1-B18-00012-07	TRG	ARS1-17-03645-004	1.50	10.00	
ARS1-B18-00012-08	TRG	ARS1-17-03645-005	1.50	10.00	
ARS1-B18-00012-09	TRG	ARS1-17-03646-001	1.50	10.00	
ARS1-B18-00012-10	TRG	ARS1-17-03647-001	1.50	10.00	
ARS1-B18-00012-11	TRG	ARS1-17-03647-002	1.50	10.00	
ARS1-B18-00012-12	TRG	ARS1-17-03648-001	1.50	10.00	
ARS1-B18-00012-13	TRG	ARS1-17-03648-002	1.50	10.00	
ARS1-B18-00012-14	TRG	ARS1-17-03649-001	1.50	10.00	
ARS1-B18-00012-15	TRG	ARS1-17-03649-002	1.50	10.00	
ARS1-B18-00012-16	TRG	ARS1-17-03650-001	1.50	10.00	
ARS1-B18-00012-17	TRG	ARS1-17-03650-002	1.50	10.00	
ARS1-B18-00012-18	TRG	ARS1-17-03650-003	1.50	10.00	
ARS1-B18-00012-19	TRG	ARS1-17-03650-004	1.50	10.00	
ARS1-B18-00012-20	TRG	ARS1-17-03650-005	1.50	10.00	

Tritium Assay in Water Samples Using Electrolytic Enrichment

Reagent Tracking	
Procedure Section	Reagent ID
14.2.12 DISTILLAT - Ionize & add O to electrolysis	R17-00924
14.3.22 DISTILLATION - Add scint cocktail	R17-00962

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_3\20180306_1100
Raw Results Path: C:\Packard\Tricarb\Results\ARS\Low Level H3_3\20180306_1100\20180306_1100.results
RTF File Name: C:\Packard\Tricarb\Results\ARS\Low Level H3_3\20180306_1100\LLH3.rtf
Comma-Delimited File Name: C:\Packard\Tricarb\Results\ARS\Low Level H3_3\20180306_1100\LLH3 Results.csv
Assay File Name: C:\Packard\TriCarb\Assays\Low Level H3_3.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): 330.00
Count Mode: Low Level
Assay Count Cycles: 1
Number of Vials/Sample: 1
Repeat Sample Count: 1
Calculate % Reference: Off

Background Subtract

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

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

Count Corrections

Static Controller: On	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

Quench Curve Block Data

Date Acquired: 08/18/2017

Date Modified:

LLH3 10ml in A

tSIE/AEC Count Efficiency (%)

380.12 26.09
 307.45 23.20
 245.66 20.44
 188.72 17.73
 151.46 14.93
 138.74 13.42
 120.63 11.00
 99.95 9.01
 90.27 7.44

P#	S#	SMPL ID	CPMA	DPM1	tSIE	Eff Nucl	In A	Count	Time	DATE	TIME	MESSAGES
5	1	BACKGROUND	1.201	5.72	258.36		21.00	330.00		3/6/2018	4:43:18 PM	
5	2	B18-00012-01	4.197	20.18	253.85		20.80	330.00		3/6/2018	10:25:44 PM	
5	3	B18-00012-02	3.285	15.92	249.98		20.63	330.00		3/7/2018	4:08:42 AM	
5	4	B18-00012-03	0.921	4.48	248.18		20.55	330.00		3/7/2018	9:51:10 AM	
5	5	B18-00012-04	0.838	4.10	245.21		20.41	330.00		3/7/2018	3:33:50 PM	
5	6	B18-00012-05	0.919	4.47	248.64		20.57	330.00		3/7/2018	9:16:46 PM	
5	7	B18-00012-06	1.057	5.39	228.60		19.63	330.00		3/8/2018	3:00:09 AM	
5	8	B18-00012-07	1.013	4.91	250.02		20.63	330.00		3/8/2018	8:43:27 AM	
5	9	B18-00012-08	1.141	5.51	251.83		20.71	330.00		3/8/2018	2:26:34 PM	
5	10	B18-00012-09	1.004	4.86	250.99		20.67	330.00		3/8/2018	8:09:31 PM	
5	11	B18-00012-10	1.121	5.48	245.98		20.45	330.00		3/9/2018	1:51:57 AM	
5	12	B18-00012-11	1.363	6.45	260.86		21.12	330.00		3/9/2018	7:34:42 AM	
5	13	B18-00012-12	1.185	5.64	258.55		21.01	330.00		3/9/2018	1:17:20 PM	
5	14	B18-00012-13	19.696	95.90	247.95		20.54	330.00		3/9/2018	7:00:26 PM	
5	15	B18-00012-14	1.402	6.67	258.87		21.03	330.00		3/10/2018	12:43:19 AM	
5	16	B18-00012-15	1.016	5.11	233.88		19.88	330.00		3/10/2018	6:26:35 AM	
5	17	B18-00012-16	1.123	5.38	255.25		20.86	330.00		3/10/2018	12:09:55 PM	
5	18	B18-00012-17	1.059	5.12	251.52		20.70	330.00		3/10/2018	5:52:52 PM	
5	19	B18-00012-18	1.010	4.82	257.10		20.95	330.00		3/10/2018	11:35:57 PM	
5	20	B18-00012-19	1.231	5.93	253.17		20.77	330.00		3/11/2018	6:18:46 AM	
5	21	B18-00012-20	6.849	32.70	257.09		20.95	330.00		3/11/2018	12:01:21 PM	

Assay Definition-

Assay Description:
Low Level H3

Assay Type: DPM (Single)

Report Name: Report1

Output Data Path: C:\Packard\Tricarb\Results\ARS\Low Low Level Tritium 4\20180312_1935

Raw Results Path: C:\Packard\Tricarb\Results\ARS\Low Low Level Tritium 4\20180312_1935\20180312_1935.results

RTF File Name: C:\Packard\Tricarb\Results\ARS\Low Low Level Tritium 4\20180312_1935\Report1.rtf

Comma-Delimited File Name: C:\Packard\Tricarb\Results\ARS\Low Low Level Tritium 4\20180312_1935\LLH3 Results.csv

Assay File Name: C:\Packard\Tricarb\Assays\Low Low Level Tritium 4.lsa

Count Conditions-

Nuclide: H-3 LL

Quench Indicator: tSIE/AEC

External Std Terminator (sec): 0.5 2s

Pre-Count Delay (min): 0.00

Quench Set:

Low Energy: ARS LL H3 10

Count Time (min): 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

Half Life-

Half Life Correction: Off
Regions Half Life

Units Reference Date Reference Time

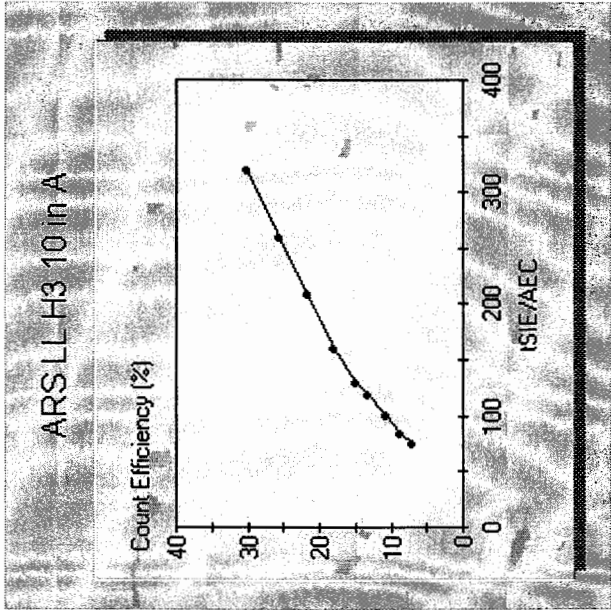
A

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	32.032
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
53	1	BACKGROUND	0.961	4.368	212.02		22.00	330.00	3/12/2018	7:43:59 PM	
53	2	B18-00012-13	1.054	4.809	210.77		21.91	330.00	3/13/2018	1:26:38 AM	

LSC Instrument Data Transfer Report										\\PACKARD3170_NEW\Results\ARS\Low Low Level Trial\BKG					
										Batch Sample ID		Non-BKG Samples Transferred		Samples Eligible To Save	
										ARS1-B18-00012		22		22	
LIMS Batch Sample ID	LSC P#	LSC PID	LSC SMPLE_ID	LSC Count Data	LSC CPMA	LSC TSIE	LSC EFF	LSC Count Dur	Analysis Batch	LIMS SDE	LIMS Run				
BKG	5	1	B18-GROUND	03/06/18 16:43	1.20	258.36	21.0000	330.00	ARS1-B18-00012						
ARS1-B18-00012-01	5	2	B18-00012-01	03/06/18 22:25	4.20	253.85	20.8000	330.00	ARS1-B18-00012						
ARS1-B18-00012-02	5	3	B18-00012-02	03/07/18 04:08	3.29	249.98	20.6300	330.00	ARS1-B18-00012						
ARS1-B18-00012-03	5	4	B18-00012-03	03/07/18 09:51	0.92	248.18	20.5500	330.00	ARS1-B18-00012						
ARS1-B18-00012-04	5	5	B18-00012-04	03/07/18 15:33	0.84	245.21	20.4100	330.00	ARS1-B18-00012	ARS1-17-03645	1				
ARS1-B18-00012-05	5	6	B18-00012-05	03/07/18 21:16	0.92	248.64	20.5700	330.00	ARS1-B18-00012	ARS1-17-03645	1				
ARS1-B18-00012-06	5	7	B18-00012-06	03/08/18 03:00	1.06	228.60	19.6300	330.00	ARS1-B18-00012	ARS1-17-03645	1				
ARS1-B18-00012-07	5	8	B18-00012-07	03/08/18 08:43	1.01	250.02	20.6300	330.00	ARS1-B18-00012	ARS1-17-03645	1				
ARS1-B18-00012-08	5	9	B18-00012-08	03/08/18 14:26	1.14	251.83	20.7100	330.00	ARS1-B18-00012	ARS1-17-03645	1				
ARS1-B18-00012-09	5	10	B18-00012-09	03/08/18 20:09	1.00	250.99	20.6700	330.00	ARS1-B18-00012	ARS1-17-03646	1				
ARS1-B18-00012-10	5	11	B18-00012-10	03/09/18 01:51	1.12	245.98	20.4500	330.00	ARS1-B18-00012	ARS1-17-03647	1				
ARS1-B18-00012-11	5	12	B18-00012-11	03/09/18 07:34	1.36	260.86	21.1200	330.00	ARS1-B18-00012	ARS1-17-03647	1				
ARS1-B18-00012-12	5	13	B18-00012-12	03/09/18 13:17	1.19	258.55	21.0100	330.00	ARS1-B18-00012	ARS1-17-03648	1				
ARS1-B18-00012-13	5	14	B18-00012-13	03/09/18 19:00	19.70	247.95	20.5400	330.00	ARS1-B18-00012	ARS1-17-03648	1				
ARS1-B18-00012-14	5	15	B18-00012-14	03/10/18 00:43	1.40	258.87	21.0300	330.00	ARS1-B18-00012	ARS1-17-03649	1				
ARS1-B18-00012-15	5	16	B18-00012-15	03/10/18 06:26	1.02	233.88	19.8800	330.00	ARS1-B18-00012	ARS1-17-03649	1				
ARS1-B18-00012-16	5	17	B18-00012-16	03/10/18 12:09	1.12	255.25	20.8600	330.00	ARS1-B18-00012	ARS1-17-03650	1				
ARS1-B18-00012-17	5	18	B18-00012-17	03/10/18 17:52	1.06	251.52	20.7000	330.00	ARS1-B18-00012	ARS1-17-03650	1				
ARS1-B18-00012-18	5	19	B18-00012-18	03/10/18 23:35	1.01	257.10	20.9500	330.00	ARS1-B18-00012	ARS1-17-03650	1				
ARS1-B18-00012-19	5	20	B18-00012-19	03/11/18 06:18	1.23	253.17	20.7700	330.00	ARS1-B18-00012	ARS1-17-03650	1				
ARS1-B18-00012-20	5	21	B18-00012-20	03/11/18 12:01	6.85	257.09	20.9500	330.00	ARS1-B18-00012	ARS1-17-03650	1				
ARS1-B18-00012-13	53	2	B18-00012-13	03/13/18 01:26	1.05	210.77	21.9100	330.00	ARS1-B18-00012	ARS1-17-03648	1				
ARS1-B18-00012-13	53	2	B18-00012-13	03/13/18 01:26	1.05	210.77	21.9100	330.00	ARS1-B18-00012	ARS1-17-03648	1				

LSC Instrument Data Transfer Report									
Batch Sample ID		Non-BKG Samples Transferred		Samples Eligible To Save		LSC 2			
ARS1-B18-00012		1		1					
LIMS Batch Sample ID	LSC P#	LSC PID	LSC S#	LSC SMPL ID	LSC Count Date	LSC CPMA	LSC LSE	LSC EFF	LSC Count Dur
BKG	53		1	BACKGROUND	03/12/18 19:43	0.96	212.02	22.0000	330.00
ARS1-B18-00012-13	53		2	B18-00012-13	03/13/18 01:26	1.05	210.77	21.9100	330.00
						Analysis Batch		LIMS SDG	LIMS Run
						ARS1-B18-00012		ARS1-17-03648	1

\\PACKARD3170_NEW\Results\ARS\Low Low Level Tritium

ARS-040 Calculation Results			
ARS1-B18-00012			
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-B18-00012-01	380.260	1.500	16.880	1.539	15.341	0.040	19.641
LSC-LLH3-AQ	ARS1-B18-00012-02	388.890	1.500	16.100	1.539	14.561	0.037	21.102
LSC-LLH3-AQ	ARS1-B18-00012-03	379.210	1.500	15.060	1.539	13.521	0.036	22.117
LSC-LLH3-AQ	ARS1-B18-00012-04	379.020	1.500	15.180	1.539	13.641	0.036	21.920
LSC-LLH3-AQ	ARS1-B18-00012-05	379.400	1.500	15.200	1.539	13.661	0.036	21.910
LSC-LLH3-AQ	ARS1-B18-00012-06	378.920	1.500	16.860	1.539	15.321	0.040	19.599
LSC-LLH3-AQ	ARS1-B18-00012-07	380.700	1.500	17.110	1.539	15.571	0.041	19.384
LSC-LLH3-AQ	ARS1-B18-00012-08	377.430	1.500	14.930	1.539	13.391	0.035	22.223
LSC-LLH3-AQ	ARS1-B18-00012-09	376.930	1.500	12.940	1.539	11.401	0.030	25.906
LSC-LLH3-AQ	ARS1-B18-00012-10	377.250	1.500	15.950	1.539	14.411	0.038	20.699
LSC-LLH3-AQ	ARS1-B18-00012-11	379.720	1.500	11.800	1.539	10.261	0.027	28.870
LSC-LLH3-AQ	ARS1-B18-00012-12	379.320	1.500	17.540	1.539	16.001	0.042	18.817
LSC-LLH3-AQ	ARS1-B18-00012-13	383.160	1.500	15.700	1.539	14.161	0.037	21.367
LSC-LLH3-AQ	ARS1-B18-00012-14	375.850	1.500	16.050	1.539	14.511	0.039	20.489
LSC-LLH3-AQ	ARS1-B18-00012-15	380.240	1.500	15.720	1.539	14.181	0.037	21.182
LSC-LLH3-AQ	ARS1-B18-00012-16	377.350	1.500	16.140	1.539	14.601	0.039	20.446
LSC-LLH3-AQ	ARS1-B18-00012-17	377.430	1.500	16.070	1.539	14.531	0.038	20.544
LSC-LLH3-AQ	ARS1-B18-00012-18	387.830	1.500	13.840	1.539	12.301	0.032	24.750
LSC-LLH3-AQ	ARS1-B18-00012-19	383.770	1.500	15.250	1.539	13.711	0.036	22.075
LSC-LLH3-AQ	ARS1-B18-00012-20	379.240	1.500	16.050	1.539	14.511	0.038	20.666

ARS-040 Calculation Results		
ARS1-B18-00012		
ACF	1	
UCF	2.22	
Sys Error	0.15	

AnalysisCode	ABatchSampleID	Average_Sample_CPM	Bkg_CPM	tsIE	Detector_Eff_decimal	Aliquot	AliqUnits	Activity_reference_date	Start_Date_of_Count	Sample_Count	Duration_min
LSC-LLH3-AQ	ARS1-B18-00012-01	4.197	1.201	253.850	0.208	0.01007	L	4/27/2017	3/6/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00012-02	3.285	1.201	249.980	0.206	0.01007	L	4/27/2017	3/7/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00012-03	0.921	1.201	248.180	0.206	0.01009	L	2/6/2018	3/7/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00012-04	0.838	1.201	245.210	0.204	0.01016	L	12/7/2017	3/7/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00012-05	0.919	1.201	248.640	0.206	0.01005	L	12/7/2017	3/7/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00012-06	1.057	1.201	228.600	0.196	0.01002	L	12/7/2017	3/8/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00012-07	1.013	1.201	250.020	0.206	0.01003	L	12/7/2017	3/8/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00012-08	1.141	1.201	251.830	0.207	0.01002	L	12/7/2017	3/8/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00012-09	1.004	1.201	250.990	0.207	0.00895	L	12/6/2017	3/8/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00012-10	1.121	1.201	245.980	0.205	0.01012	L	12/11/2017	3/9/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00012-11	1.363	1.201	260.860	0.211	0.01006	L	12/11/2017	3/9/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00012-12	1.185	1.201	258.550	0.210	0.01004	L	12/13/2017	3/9/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00012-13	1.054	1.201	210.770	0.219	0.01007	L	12/13/2017	3/13/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00012-14	1.402	1.201	258.870	0.210	0.01002	L	12/14/2017	3/10/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00012-15	1.016	1.201	233.880	0.199	0.01002	L	12/7/2017	3/10/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00012-16	1.123	1.201	255.250	0.209	0.01002	L	12/12/2017	3/10/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00012-17	1.058	1.201	251.520	0.207	0.01002	L	12/12/2017	3/10/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00012-18	1.010	1.201	257.100	0.210	0.01001	L	12/12/2017	3/10/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00012-19	1.231	1.201	253.170	0.208	0.01005	L	12/12/2017	3/11/2018		330.000
LSC-LLH3-AQ	ARS1-B18-00012-20	6.849	1.201	257.090	0.210	0.01005	L	12/12/2017	3/11/2018		330.000

ARS-040 Calculation Results			
ARS1-B18-00012			
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-B18-00012-01	330.000		0.95278	34.429	1.470	1.470	5.369	2.881	10.524	3.320	1.613	pCi
LSC-LLH3-AQ	ARS1-B18-00012-02	330.000		0.95278	22.475	1.257	1.257	3.598	2.465	7.052	3.116	1.514	pCi
LSC-LLH3-AQ	ARS1-B18-00012-03	330.000		0.99554	-2.763	0.791	0.791	0.893	1.551	1.751	2.850	1.385	pCi
LSC-LLH3-AQ	ARS1-B18-00012-04	330.000		0.98623	-3.648	0.790	0.790	0.961	1.548	1.883	2.903	1.410	pCi
LSC-LLH3-AQ	ARS1-B18-00012-05	330.000		0.98608	-2.844	0.808	0.808	0.914	1.584	1.792	2.914	1.415	pCi
LSC-LLH3-AQ	ARS1-B18-00012-06	330.000		0.98608	-1.706	0.980	0.980	1.013	1.921	1.986	3.423	1.663	pCi
LSC-LLH3-AQ	ARS1-B18-00012-07	330.000		0.98608	-2.141	0.933	0.933	0.987	1.828	1.934	3.290	1.598	pCi
LSC-LLH3-AQ	ARS1-B18-00012-08	330.000		0.98608	-0.594	0.834	0.834	0.839	1.636	1.645	2.862	1.390	pCi
LSC-LLH3-AQ	ARS1-B18-00012-09	330.000		0.98578	-1.878	0.779	0.779	0.829	1.528	1.624	2.755	1.338	pCi
LSC-LLH3-AQ	ARS1-B18-00012-10	330.000		0.98654	-0.853	0.894	0.894	0.903	1.752	1.770	3.079	1.496	pCi
LSC-LLH3-AQ	ARS1-B18-00012-11	330.000		0.98654	1.206	0.656	0.656	0.681	1.286	1.334	2.151	1.045	pCi
LSC-LLH3-AQ	ARS1-B18-00012-12	330.000		0.98684	-0.184	0.978	0.978	0.978	1.917	1.917	3.322	1.614	pCi
LSC-LLH3-AQ	ARS1-B18-00012-13	330.000		0.98623	-1.424	0.801	0.801	0.829	1.570	1.625	2.799	1.360	pCi
LSC-LLH3-AQ	ARS1-B18-00012-14	330.000		0.98684	2.125	0.939	0.939	0.992	1.840	1.944	3.054	1.484	pCi
LSC-LLH3-AQ	ARS1-B18-00012-15	330.000		0.98578	-2.003	0.888	0.888	0.937	1.740	1.837	3.129	1.520	pCi
LSC-LLH3-AQ	ARS1-B18-00012-16	330.000		0.98654	-0.833	0.897	0.897	0.905	1.757	1.774	3.087	1.500	pCi
LSC-LLH3-AQ	ARS1-B18-00012-17	330.000		0.98654	-1.522	0.887	0.887	0.916	1.738	1.795	3.096	1.504	pCi
LSC-LLH3-AQ	ARS1-B18-00012-18	330.000		0.98638	-1.680	0.720	0.720	0.763	1.412	1.496	2.542	1.235	pCi
LSC-LLH3-AQ	ARS1-B18-00012-19	330.000		0.98638	0.297	0.851	0.851	0.852	1.668	1.670	2.863	1.391	pCi
LSC-LLH3-AQ	ARS1-B18-00012-20	330.000		0.98638	59.276	1.639	1.639	9.041	3.213	17.721	3.032	1.473	pCi

ARS-040 Calculation Results

ARS1-B18-00012

ACF	1
UCF	2.22
Syn Error	0.15

AnalysisCode	ABatchSampleID	AliquotReportUnits	UserID	ModDate
LSC-LLH3-AQ	ARS1-B18-00012-01	L	AMRAD\mmorgan	3/13/2018
LSC-LLH3-AQ	ARS1-B18-00012-02	L	AMRAD\mmorgan	3/13/2018
LSC-LLH3-AQ	ARS1-B18-00012-03	L	AMRAD\mmorgan	3/13/2018
LSC-LLH3-AQ	ARS1-B18-00012-04	L	AMRAD\mmorgan	3/13/2018
LSC-LLH3-AQ	ARS1-B18-00012-05	L	AMRAD\mmorgan	3/13/2018
LSC-LLH3-AQ	ARS1-B18-00012-06	L	AMRAD\mmorgan	3/13/2018
LSC-LLH3-AQ	ARS1-B18-00012-07	L	AMRAD\mmorgan	3/13/2018
LSC-LLH3-AQ	ARS1-B18-00012-08	L	AMRAD\mmorgan	3/13/2018
LSC-LLH3-AQ	ARS1-B18-00012-09	L	AMRAD\mmorgan	3/13/2018
LSC-LLH3-AQ	ARS1-B18-00012-10	L	AMRAD\mmorgan	3/13/2018
LSC-LLH3-AQ	ARS1-B18-00012-11	L	AMRAD\mmorgan	3/13/2018
LSC-LLH3-AQ	ARS1-B18-00012-12	L	AMRAD\mmorgan	3/13/2018
LSC-LLH3-AQ	ARS1-B18-00012-13	L	AMRAD\mmorgan	3/13/2018
LSC-LLH3-AQ	ARS1-B18-00012-14	L	AMRAD\mmorgan	3/13/2018
LSC-LLH3-AQ	ARS1-B18-00012-15	L	AMRAD\mmorgan	3/13/2018
LSC-LLH3-AQ	ARS1-B18-00012-16	L	AMRAD\mmorgan	3/13/2018
LSC-LLH3-AQ	ARS1-B18-00012-17	L	AMRAD\mmorgan	3/13/2018
LSC-LLH3-AQ	ARS1-B18-00012-18	L	AMRAD\mmorgan	3/13/2018
LSC-LLH3-AQ	ARS1-B18-00012-19	L	AMRAD\mmorgan	3/13/2018
LSC-LLH3-AQ	ARS1-B18-00012-20	L	AMRAD\mmorgan	3/13/2018

Liquid Scintillation Count Log

Date	Time	ARS Sample I.D. Number	Batch Fraction Number	Liquid Scintillation File Number	Technician Initials	Notes Identifier
2/22/2018	15:00	Background	N/A	N/A	MM	
2/22/2018	15:00	B18-00131	1	1600	MM	
2/22/2018	15:00	B18-00131	2	1600	MM	
2/22/2018	15:00	B18-00131	3	1600	MM	
2/22/2018	15:00	B18-00131	4	1600	MM	
2/22/2018	15:00	B18-00131	5	1600	MM	
2/22/2018	15:00	B18-00131	6	1600	MM	
2/22/2018	15:00	B18-00131	7	1600	MM	
2/22/2018	15:00	B18-00131	8	1600	MM	
2/22/2018	15:00	B18-00131	9	1600	MM	
2/22/2018	15:00	B18-00131	10	1600	MM	
2/22/2018	15:00	B18-00131	11	1600	MM	
2/22/2018	15:00	B18-00131	12	1600	MM	
2/26/2018	15:00	SNC163	QA	1638	MM	
2/26/2018	15:00	Background	N/A	1638	MM	
2/26/2018	15:00	B18-00131	1	1638	MM	
2/26/2018	15:00	B18-00131	3	1638	MM	
2/26/2018	15:00	B18-00131	4	1638	MM	
2/26/2018	15:00	B18-00131	5	1638	MM	
2/26/2018	15:00	B18-00131	6	1638	MM	
2/26/2018	15:00	B18-00131	7	1638	MM	
2/26/2018	15:00	B18-00131	11	1638	MM	
2/28/2018	15:00	SNC163	QA	QA	MM	
2/28/2018	15:00	Background	N/A	1606	MM	
2/28/2018	15:00	B18-00442	1	1606	MM	
2/28/2018	15:00	B18-00442	4	1606	MM	
2/28/2018	15:00	B18-00442	5	1606	MM	
2/28/2018	15:00	B18-00442	6	1606	MM	
2/28/2018	15:00	B18-00442	7	1606	MM	
2/28/2018	15:00	B18-00442	8	1606	MM	
2/28/2018	15:00	B18-00442	9	1606	MM	
2/28/2018	15:00	B18-00442	10	1606	MM	
2/28/2018	15:00	B18-00442	11	1606	MM	
2/28/2018	15:00	B18-00442	12	1606	MM	
2/28/2018	15:00	B18-00442	13	1606	MM	
2/28/2018	15:00	B18-00442	14	1606	MM	
2/28/2018	15:00	B18-00442	15	1606	MM	
3/6/2018	9:30	SNC163	QA	QA	MM	
3/6/2018	9:30	Background	N/A	N/A	MM	
3/6/2018	9:30	B18-00012	1	1100	MM	
3/6/2018	9:30	B18-00012	2	1100	MM	
3/6/2018	9:30	B18-00012	3	1100	MM	
3/6/2018	9:30	B18-00012	4	1100	MM	
3/6/2018	9:30	B18-00012	5	1100	MM	
3/6/2018	9:30	B18-00012	6	1100	MM	
3/6/2018	9:30	B18-00012	7	1100	MM	
3/6/2018	9:30	B18-00012	8	1100	MM	
3/6/2018	9:30	B18-00012	9	1100	MM	
3/6/2018	9:30	B18-00012	10	1100	MM	
3/6/2018	9:30	B18-00012	11	1100	MM	
3/6/2018	9:30	B18-00012	12	1100	MM	

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	

Beta Liquid Scintillation Counter Log Book

Date	Time	ARS Sample I.D. Number	Batch Number	Liquid Scintillation File Number	Technician Initials
3-9-18	1243	Background	B18-00546	1338	<i>[Signature]</i>
↓	↓	B18-00546-01	↓	↓	<i>[Signature]</i>
↓	↓	-02	↓	↓	<i>[Signature]</i>
↓	↓	-03	↓	↓	<i>[Signature]</i>
↓	↓	-04	↓	↓	<i>[Signature]</i>
↓	↓	-05	↓	↓	<i>[Signature]</i>
↓	↓	-06	↓	↓	<i>[Signature]</i>
↓	↓	-07	↓	↓	<i>[Signature]</i>
↓	↓	-08	↓	↓	<i>[Signature]</i>
↓	↓	-09	↓	↓	<i>[Signature]</i>
3-9-18	1622	SNC 5	QA	QA	<i>[Signature]</i>
3-12-18	1845	SNC 5	QA	QA	MM
↓	↓	Background	B18-00012	1935	MM
↓	↓	B18-00012-13	B1800012	↓	MM
3-13-18	0815	SNC 5	QA	QA	MM



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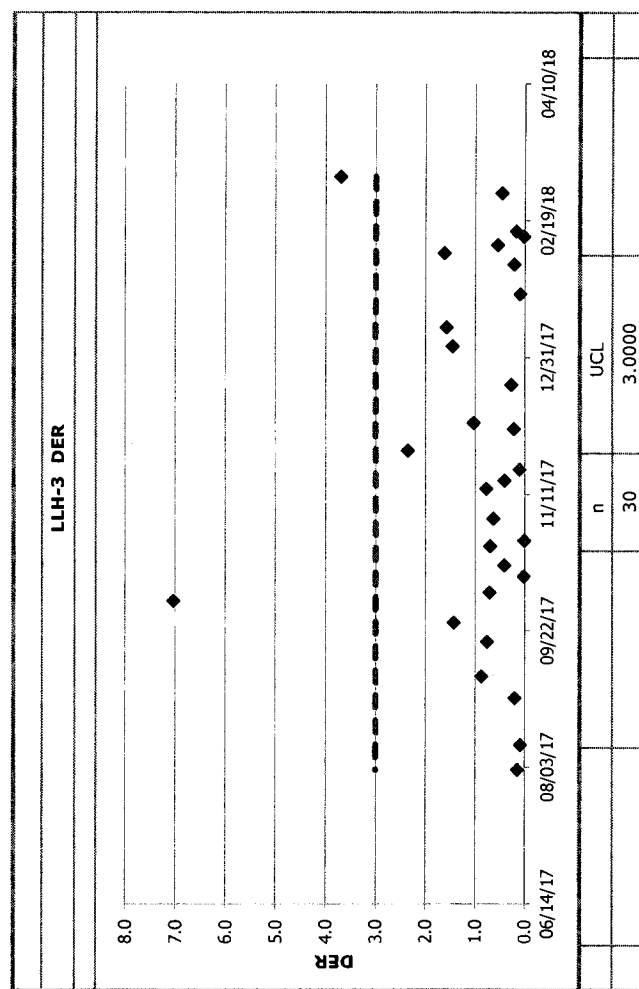
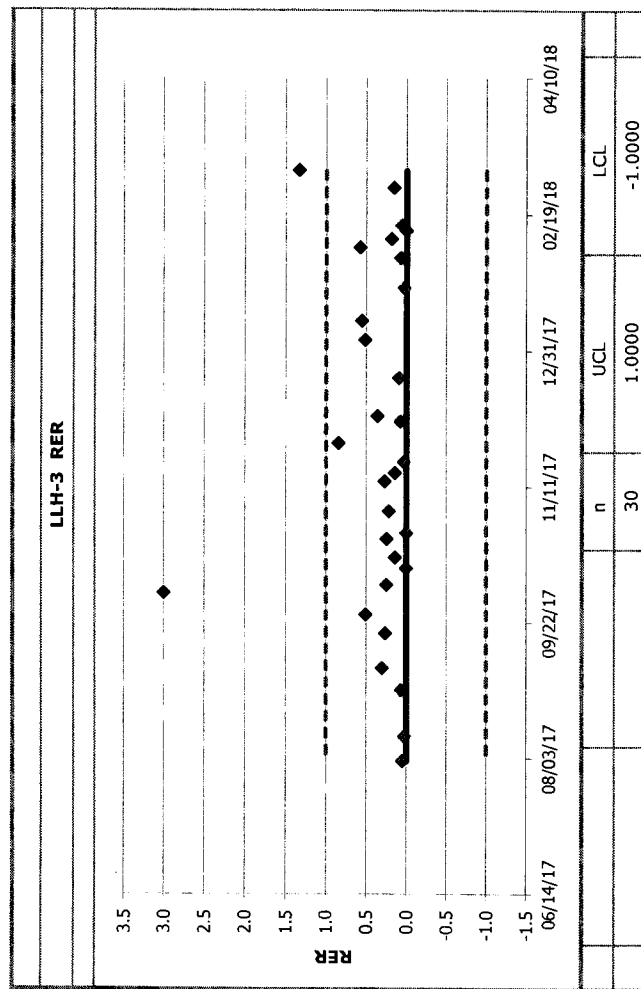
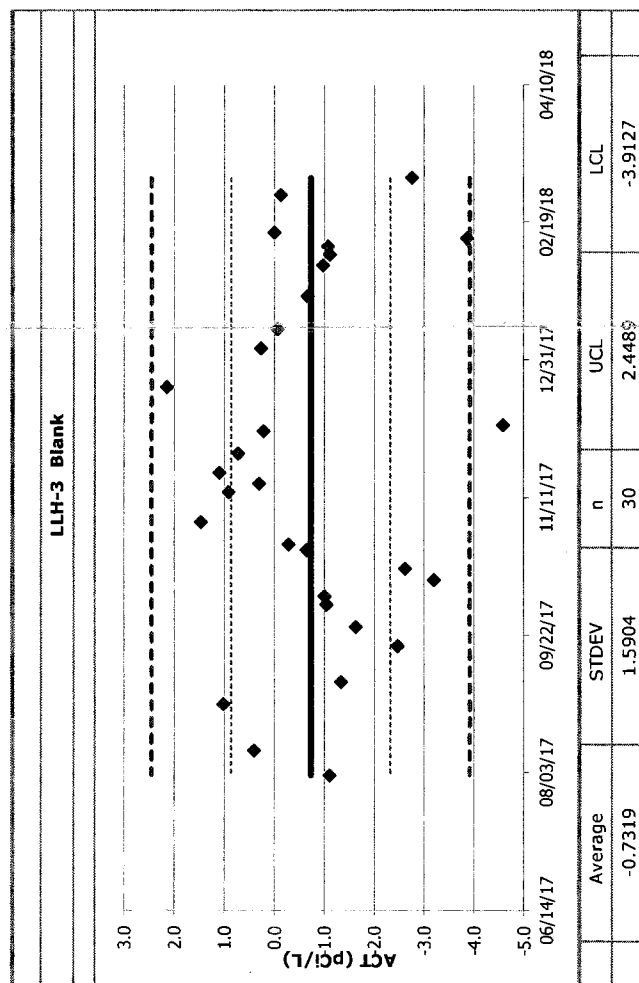
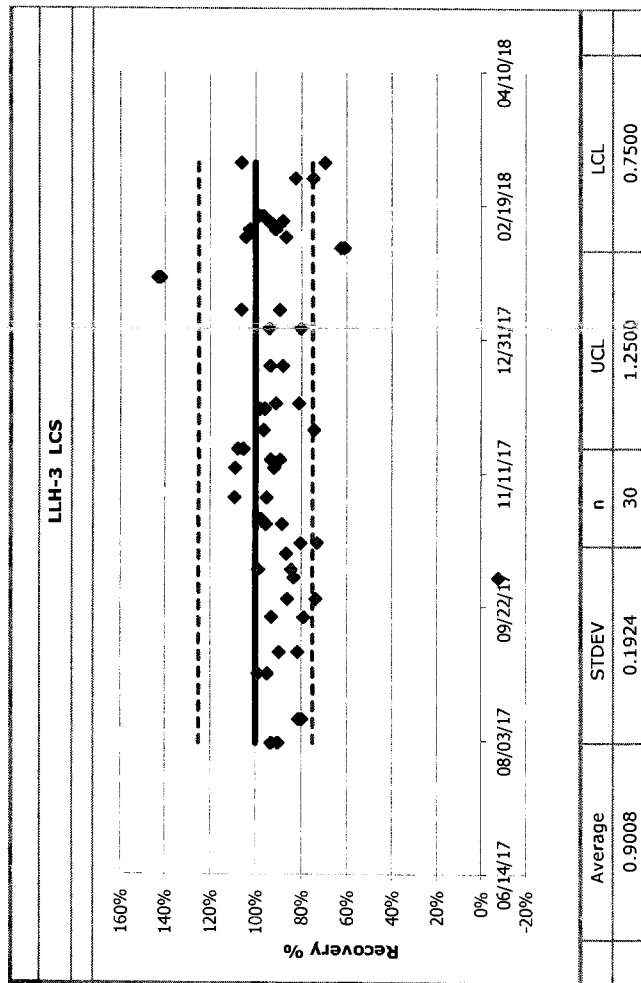
Low Level Tritium

by

**Low Level Liquid
Scintillation Counting**

Control Charts

QC Chart

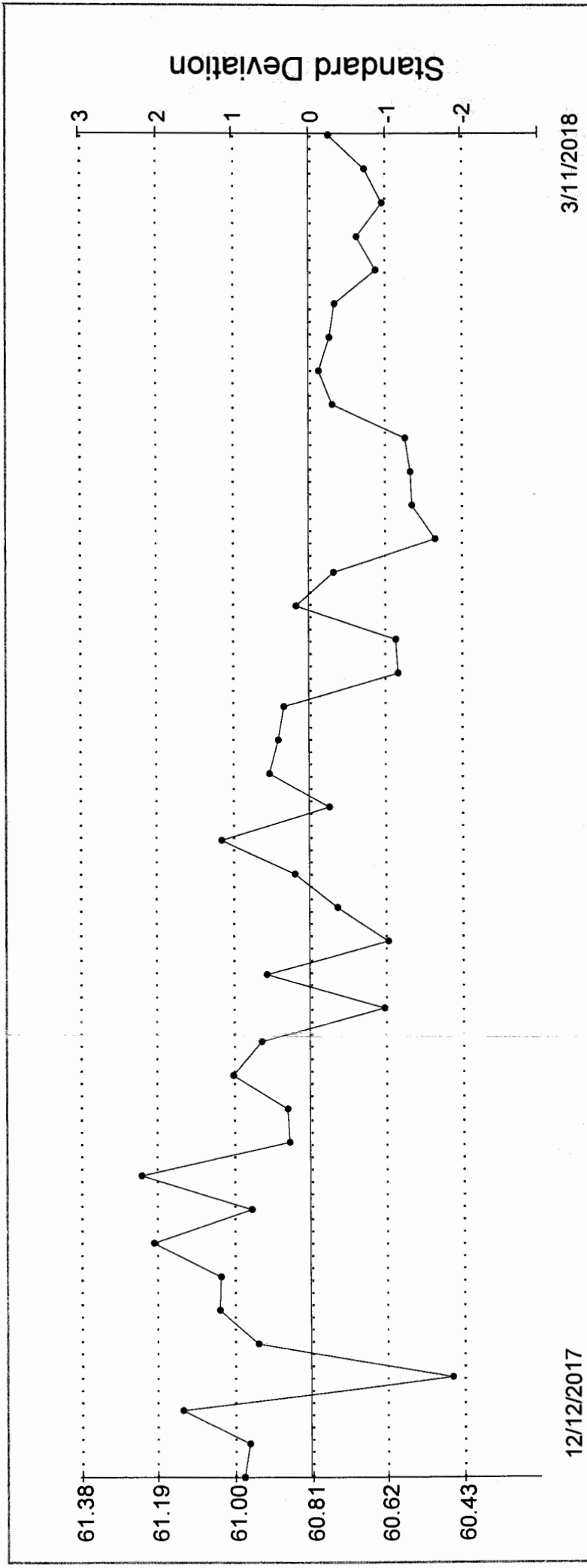


3H Efficiency

Total # pts : 95
Valid # pts : 41
Mean : 60.81
SD : 0.19

Date	Value	Include
Dec 12, 2017	60.98	X
Dec 17, 2017	60.96	X
Dec 19, 2017	61.13	X
Dec 20, 2017	60.46	X
Dec 22, 2017	60.94	X
Dec 27, 2017	61.04	X
Dec 31, 2017	61.03	X
Jan 03, 2018	61.20	X
Jan 04, 2018	60.96	X
Jan 06, 2018	61.23	X
Jan 08, 2018	60.86	X
Jan 10, 2018	60.87	X
Jan 11, 2018	61.00	X
Jan 14, 2018	60.93	X
Jan 15, 2018	60.63	X
Jan 15, 2018	60.92	X
Jan 16, 2018	60.62	X
Jan 18, 2018	60.74	X
Jan 20, 2018	60.85	X
Jan 22, 2018	61.03	X
Jan 26, 2018	60.76	X
Jan 26, 2018	60.91	X
Feb 01, 2018	60.89	X
Feb 02, 2018	60.87	X
Feb 02, 2018	60.59	X
Feb 05, 2018	60.60	X
Feb 06, 2018	60.84	X
Feb 09, 2018	60.75	X
Feb 11, 2018	60.50	X
Feb 12, 2018	60.56	X
Feb 13, 2018	60.56	X
Feb 14, 2018	60.57	X
Feb 14, 2018	60.75	X
Feb 16, 2018	60.79	X
Feb 22, 2018	60.76	X
Feb 25, 2018	60.75	X
Feb 26, 2018	60.65	X
Feb 28, 2018	60.69	X
Mar 03, 2018	60.63	X
Mar 06, 2018	60.67	X
Mar 11, 2018	60.76	X

3H Efficiency : 95
Total # pts : 41
Valid # pts : 60.81
Mean : 60.81
SD : 0.19

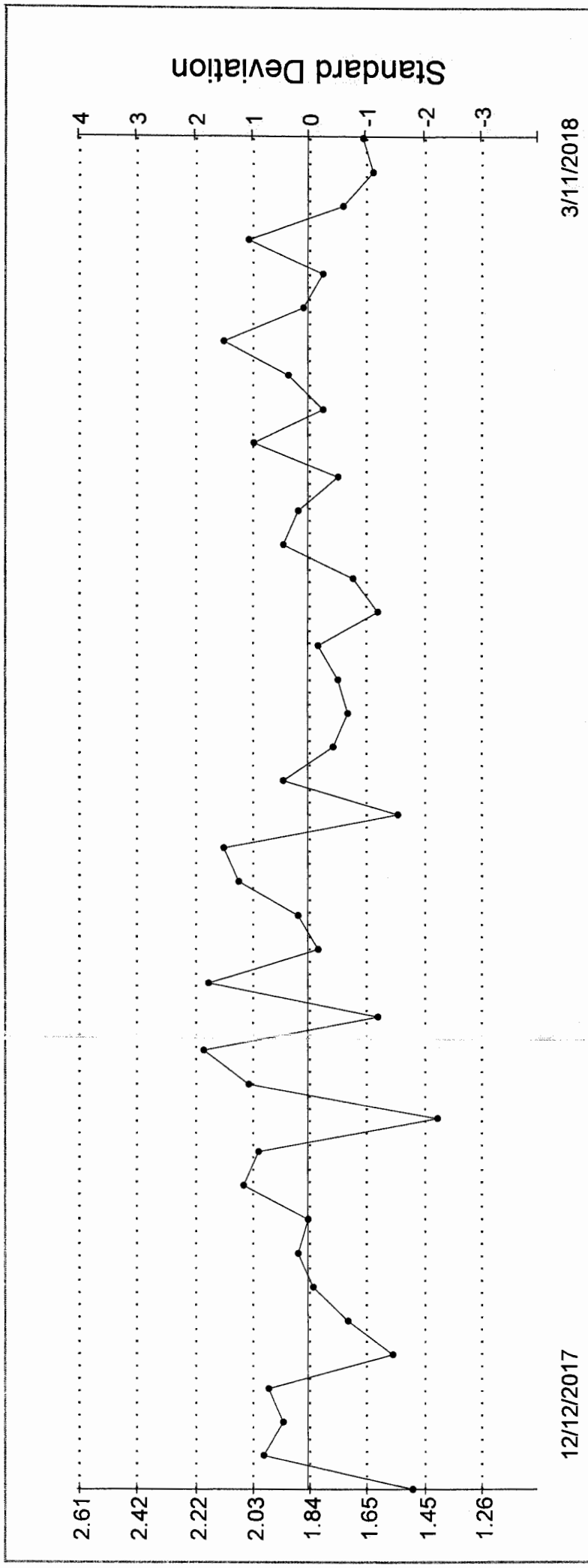


3H Background

Total # pts : 93
Valid # pts : 41
Mean : 1.85
SD : 0.19

Date	Value	Include
Dec 12, 2017	1.50	X
Dec 17, 2017	2.00	X
Dec 19, 2017	1.93	X
Dec 20, 2017	1.98	X
Dec 22, 2017	1.57	X
Dec 27, 2017	1.72	X
Dec 31, 2017	1.83	X
Jan 03, 2018	1.88	X
Jan 04, 2018	1.85	X
Jan 06, 2018	2.07	X
Jan 08, 2018	2.02	X
Jan 10, 2018	1.42	X
Jan 11, 2018	2.05	X
Jan 14, 2018	2.20	X
Jan 15, 2018	1.62	X
Jan 15, 2018	2.18	X
Jan 16, 2018	1.82	X
Jan 18, 2018	1.88	X
Jan 20, 2018	2.08	X
Jan 22, 2018	2.13	X
Jan 26, 2018	1.55	X
Jan 26, 2018	1.93	X
Feb 01, 2018	1.77	X
Feb 02, 2018	1.72	X
Feb 02, 2018	1.75	X
Feb 05, 2018	1.82	X
Feb 06, 2018	1.62	X
Feb 09, 2018	1.70	X
Feb 11, 2018	1.93	X
Feb 12, 2018	1.88	X
Feb 13, 2018	1.75	X
Feb 14, 2018	2.03	X
Feb 14, 2018	1.80	X
Feb 16, 2018	1.92	X
Feb 22, 2018	2.13	X
Feb 25, 2018	1.87	X
Feb 26, 2018	1.80	X
Feb 28, 2018	2.05	X
Mar 03, 2018	1.73	X
Mar 06, 2018	1.63	X
Mar 11, 2018	1.57	X

3H Background
Total # pts : 93
Valid # pts : 41
Mean : 1.85
SD : 0.19





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Tritium- Screening by Low Level Liquid Scintillation Counting



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

Samples



ARS Batch ID: ARS1-B17-02841

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



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

Laboratory Records

Analytical Batch Report



Analysis Batch ID **ARS1-B17-02841**

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-B17-02841-01	LCS											
ARS1-B17-02841-02	LCSD											
ARS1-B17-02841-03	MBL											
ARS1-B17-02841-04	TRG				ARS1-17-03645	001	1			BDW01-18-150415		01/24/18
ARS1-B17-02841-05	TRG				ARS1-17-03645	002	1			BDW06-18-150416		01/24/18
ARS1-B17-02841-06	TRG				ARS1-17-03645	003	1			BDW08-18-150417		01/24/18
ARS1-B17-02841-07	TRG				ARS1-17-03645	004	1			BUCKPZ-18-150413		01/24/18
ARS1-B17-02841-08	TRG				ARS1-17-03645	005	1			BUCKPZ-18-150414		01/24/18
ARS1-B17-02841-09	TRG				ARS1-17-03646	001	1			CAWA-18-148944		01/24/18
ARS1-B17-02841-10	TRG				ARS1-17-03647	001	1			CAWA-18-148918		01/24/18
ARS1-B17-02841-11	TRG				ARS1-17-03647	002	1			CAWA-18-148943		01/24/18
ARS1-B17-02841-12	TRG				ARS1-17-03648	001	1			CAWR-18-150421		01/24/18
ARS1-B17-02841-13	TRG				ARS1-17-03648	002	1			CALA-18-150401		01/24/18
ARS1-B17-02841-14	TRG				ARS1-17-03649	001	1			CALA-18-150112		01/24/18
ARS1-B17-02841-15	TRG				ARS1-17-03649	002	1			CALA-18-150114		01/24/18
ARS1-B17-02841-16	TRG				ARS1-17-03650	001	1			CALA-18-150107		01/24/18
ARS1-B17-02841-17	TRG				ARS1-17-03650	002	1			CALA-18-150129		01/24/18
ARS1-B17-02841-18	TRG				ARS1-17-03650	003	1			CALA-18-150115		01/24/18
ARS1-B17-02841-19	TRG				ARS1-17-03650	004	1			CALA-18-150110		01/24/18
ARS1-B17-02841-20	TRG				ARS1-17-03650	005	1			CALA-18-148968		01/24/18

Procedure Data

ABatch Sample ID	Client ID	Parent	ICOC ID	Aliquot 1 Vol/Wt	Aliquot 1 Units	Aliquot 2 Vol/Wt	Aliquot 2 Units	User ID
ARS1-B17-02841-01				1.0000				MMORGAN
ARS1-B17-02841-02				1.0000				MMORGAN
ARS1-B17-02841-03				1.0000				MMORGAN
ARS1-B17-02841-04	BDW01-18-150415		282648	0.0010 L				MMORGAN
ARS1-B17-02841-05	BDW06-18-150416		282649	0.0010 L				MMORGAN
ARS1-B17-02841-06	BDW08-18-150417		282650	0.0010 L				MMORGAN
ARS1-B17-02841-07	BUCKPZ-18-150413		282651	0.0010 L				MMORGAN
ARS1-B17-02841-08	BUCKPZ-18-150414		282652	0.0010 L				MMORGAN
ARS1-B17-02841-09	CAWA-18-148944		282653	0.0010 L				MMORGAN
ARS1-B17-02841-10	CAWA-18-148918		282654	0.0010 L				MMORGAN
ARS1-B17-02841-11	CAWA-18-148943		282655	0.0010 L				MMORGAN
ARS1-B17-02841-12	CAWR-18-150421		282656	0.0010 L				MMORGAN
ARS1-B17-02841-13	CALA-18-150401		282657	0.0010 L				MMORGAN
ARS1-B17-02841-14	CALA-18-150112		282658	0.0010 L				MMORGAN
ARS1-B17-02841-15	CALA-18-150114		282659	0.0010 L				MMORGAN
ARS1-B17-02841-16	CALA-18-150107		282660	0.0010 L				MMORGAN
ARS1-B17-02841-17	CALA-18-150129		282661	0.0010 L				MMORGAN
ARS1-B17-02841-18	CALA-18-150115		282662	0.0010 L				MMORGAN
ARS1-B17-02841-19	CALA-18-150110		282663	0.0010 L				MMORGAN
ARS1-B17-02841-20	CALA-18-148968		282664	0.0010 L				MMORGAN

Reagent Amounts

ABatch Sample ID	Client ID	14.1.5 OPTIONAL AQ W/O DIST - Add scint cocktail - Ultima Gold LLT Reagent Grade (mL)	User ID
ARS1-B17-02841-01		10.00	MMORGAN
ARS1-B17-02841-02		10.00	MMORGAN
ARS1-B17-02841-03		10.00	MMORGAN
ARS1-B17-02841-04	BDW01-18-150415	10.00	MMORGAN
ARS1-B17-02841-05	BDW06-18-150416	10.00	MMORGAN
ARS1-B17-02841-06	BDW08-18-150417	10.00	MMORGAN
ARS1-B17-02841-07	BUCKPZ-18-150413	10.00	MMORGAN
ARS1-B17-02841-08	BUCKPZ-18-150414	10.00	MMORGAN
ARS1-B17-02841-09	CAWA-18-148944	10.00	MMORGAN
ARS1-B17-02841-10	CAWA-18-148918	10.00	MMORGAN
ARS1-B17-02841-11	CAWA-18-148943	10.00	MMORGAN
ARS1-B17-02841-12	CAWR-18-150421	10.00	MMORGAN
ARS1-B17-02841-13	CALA-18-150401	10.00	MMORGAN
ARS1-B17-02841-14	CALA-18-150112	10.00	MMORGAN
ARS1-B17-02841-15	CALA-18-150114	10.00	MMORGAN
ARS1-B17-02841-16	CALA-18-150107	10.00	MMORGAN
ARS1-B17-02841-17	CALA-18-150129	10.00	MMORGAN
ARS1-B17-02841-18	CALA-18-150115	10.00	MMORGAN
ARS1-B17-02841-19	CALA-18-150110	10.00	MMORGAN
ARS1-B17-02841-20	CALA-18-148968	10.00	MMORGAN

Reagent Tracking

Procedure Section

14.1.5 OPTIONAL AQ W/O DIST - Add scint cocktail

Reagent ID

R17-00662

Protocol# 5 - Low Level H3_3.1sa

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_3\20171221_0310
Raw Results Path: C:\Packard\Tricarb\Results\ARS\Low Level H3_3\20171221_0310\20171221_0310.results
RTF File Name: C:\Packard\Tricarb\Results\ARS\Low Level H3_3\20171221_0310\LLH3.rtf
Comma-Delimited File Name: C:\Packard\Tricarb\Results\ARS\Low Level H3_3\20171221_0310\LLH3 Results.csv
Assay File Name: C:\Packard\Tricarb\Assays\Low Level H3_3.1sa

Count Conditions

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

Background Subtract

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

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

Count Corrections

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

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\20171231_0213
Raw Results Path: C:\Packard\Tricarb\Results\ARS\Low Level H3\20171231_0213\20171231_0213.results
RTF File Name: C:\Packard\Tricarb\Results\ARS\Low Level H3\20171231_0213\LLH3.rtf
Comma-Delimited File Name: C:\Packard\Tricarb\Results\ARS\Low Level H3\20171231_0213\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
Number of Vials/Sample: 1
Repeat Sample Count: 1
Calculate % Reference: Off

Background Subtract

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

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

Count Corrections

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

Protocol# 5 - Low Level H3_3.1sa

User: ARS

Cycle 1 Results

P#	S#	SMPL ID	CPMA	DPML	tSIE	Eff Nucl	In A	Count	Time	DATE	TIME	MESSAGES
5	1	BACKGROUND	1.288	6.16	256.37		20.91	120.00	12/21/2017	5:21:47 AM		
5	2	B17-02841-04	1.248	6.01	253.00		20.76	120.00	12/21/2017	7:32:36 AM		
5	3	B17-02841-05	1.183	5.70	252.97		20.76	120.00	12/21/2017	9:43:37 AM		
5	4	B17-02841-06	1.318	6.28	257.80		20.98	120.00	12/21/2017	11:54:59 AM		
5	5	B17-02841-07	1.117	5.33	257.23		20.95	120.00	12/21/2017	2:06:18 PM		
5	6	B17-02841-08	1.158	5.57	253.30		20.78	120.00	12/21/2017	4:17:15 PM		
5	7	B17-02841-09	1.312	6.36	250.15		20.64	120.00	12/21/2017	6:27:56 PM		
5	8	B17-02841-10	1.067	5.12	254.76		20.84	120.00	12/21/2017	8:39:23 PM		
5	9	B17-02841-11	1.220	5.88	252.76		20.75	120.00	12/21/2017	10:50:21 PM		
5	10	B17-02841-12	1.209	5.81	253.65		20.79	120.00	12/22/2017	1:00:57 AM		
5	11	B17-02841-13	1.419	6.83	253.14		20.77	120.00	12/22/2017	3:11:54 AM		
5	12	B17-02841-14	1.265	6.00	260.07		21.08	120.00	12/22/2017	5:23:23 AM		
5	13	B17-02841-15	1.227	5.91	252.63		20.75	120.00	12/22/2017	7:34:46 AM		
5	14	B17-02841-16	1.026	4.97	250.79		20.67	120.00	12/22/2017	9:45:50 AM		
5	15	B17-02841-17	1.115	5.38	252.27		20.73	120.00	12/22/2017	11:56:49 AM		
5	16	B17-02841-18	1.119	5.36	255.40		20.87	120.00	12/22/2017	2:07:34 PM		
5	17	B17-02841-19	1.181	5.71	251.45		20.69	120.00	12/22/2017	4:18:33 PM		
5	18	B17-02841-20	0.000	-0.00	0.00		-7.26	120.00	12/22/2017	6:40:57 PM		E

Cycle 1 Results

P#	S#	SMPL ID	CPMA	DPMI	tSIE	Eff	Nucl	In A	Count	Time	DATE	TIME	MESSAGES
8	1	BACKGROUND	1.443	6.98	251.11			20.68	120.00	12/31/2017	4:24:39 AM		
8	2	B17-02841-20	1.387	6.57	260.79			21.11	120.00	12/31/2017	6:36:05 AM		

Liquid Scintillation Count Log

Date	Time	ARS Sample I.D. Number	Batch Fraction Number	Liquid Scintillation File Number	Technician Initials	Notes Identifier
12/19/2017	14:003	B17-02667	3	1412	MM	
12/19/2017	14:004	B17-02667	4	1412	MM	
12/19/2017	14:005	B17-02667	5	1412	MM	
12/19/2017	14:006	B17-02667	6	1412	MM	
12/19/2017	14:007	B17-02667	7	1412	MM	
12/19/2017	14:00	B17-02667	8	1412	MM	
12/19/2017	14:00	SNC163	QA	QA	MM	
12/19/2017	14:00	Background	N/A	N/A	MM	
12/19/2017	14:00	B17-02852	4	2037	MM	
12/19/2017	14:00	B17-02852	5	2037	MM	
12/19/2017	14:00	Background	N/A	N/A	MM	
12/19/2017	14:00	B17-2841	4	310	MM	
12/19/2017	14:00	B17-2841	5	310	MM	
12/19/2017	14:00	B17-2841	6	310	MM	
12/19/2017	14:00	B17-2841	7	310	MM	
12/19/2017	14:00	B17-2841	8	310	MM	
12/19/2017	14:00	B17-2841	9	310	MM	
12/19/2017	14:00	B17-2841	10	310	MM	
12/19/2017	14:00	B17-2841	11	310	MM	
12/19/2017	14:00	B17-2841	12	310	MM	
12/19/2017	14:00	B17-2841	13	310	MM	
12/19/2017	14:00	B17-2841	14	310	MM	
12/19/2017	14:00	B17-2841	15	310	MM	
12/19/2017	14:00	B17-2841	16	310	MM	
12/19/2017	14:00	B17-2841	17	310	MM	
12/19/2017	14:00	B17-2841	18	310	MM	
12/19/2017	14:00	B17-2841	19	310	MM	
12/19/2017	14:00	B17-2841	20	310	MM	

Low Level Tritium pH Checks

SDG#	Fraction	pH	Date	Analyst
ARSI-17-03645	001	8	12-19-17	MM
↓	002	8	12-19-17	MM
↓	003	8	12-19-17	MM
↓	004	8	12-19-17	MM
↓	005	8	12-19-17	MM
ARSI-17-03646	001	8	12-19-17	MM
ARSI-17-03647	001	8	12-19-17	MM
↓	002	8	12-19-17	MM
ARSI-17-03648	001	8	12-19-17	MM
↓	002	8	12-19-17	MM
ARSI-17-03649	001	8	12-19-17	MM
↓	002	8	12-19-17	MM
ARSI-17-03650	001	8	12-19-17	MM
↓	002	8	12-19-17	MM
↓	003	8	12-19-17	MM
↓	004	8	12-19-17	MM
↓	005	8	12-19-17	MM
<div>NA</div> <div>12-19-17</div> <div>MM</div>				



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American Radiation Services Analytical Reports

for

Los Alamos National Laboratory

Tritium-Screening by Low Level Liquid Scintillation Counting

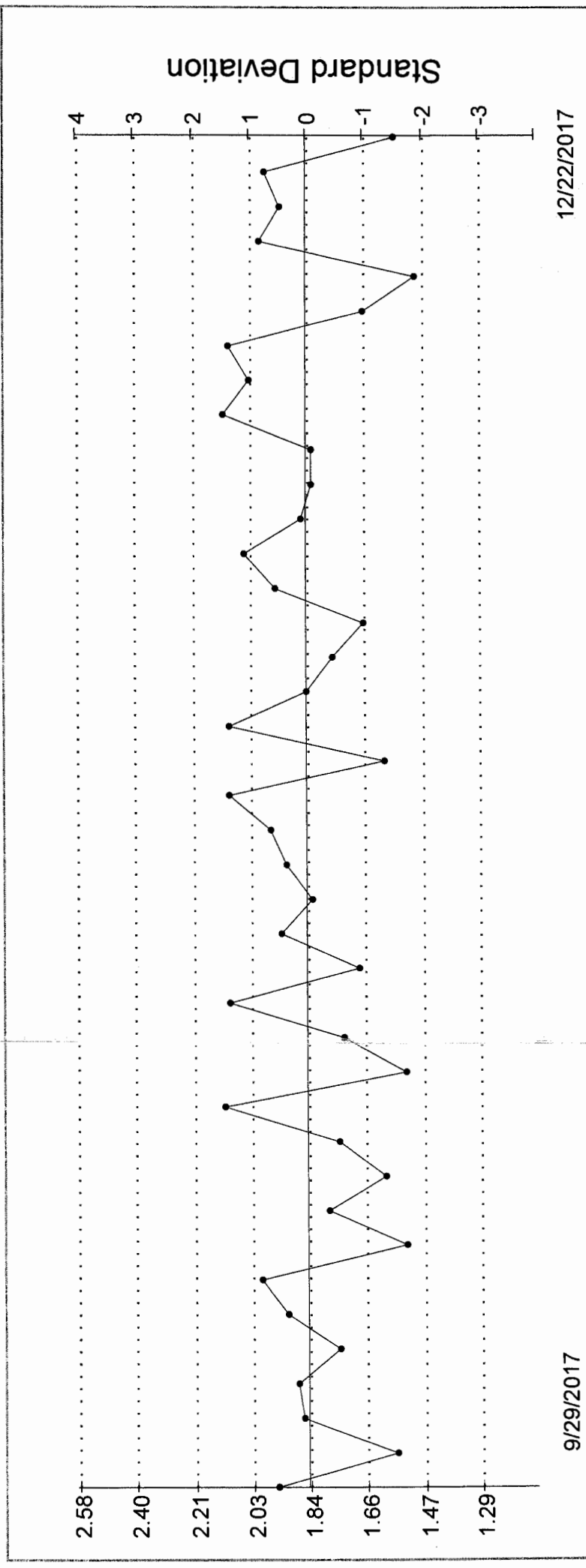
Control Charts

3H Background

Total # pts : 57
Valid # pts : 40
Mean : 1.85
SD : 0.19

Date	Value	Include
Sep 29, 2017	1.95	X
Oct 02, 2017	1.57	X
Oct 03, 2017	1.87	X
Oct 04, 2017	1.88	X
Oct 06, 2017	1.75	X
Oct 07, 2017	1.92	X
Oct 09, 2017	2.00	X
Oct 11, 2017	1.53	X
Oct 13, 2017	1.78	X
Oct 15, 2017	1.60	X
Oct 16, 2017	1.75	X
Oct 17, 2017	2.12	X
Oct 18, 2017	1.53	X
Oct 21, 2017	1.73	X
Oct 23, 2017	2.10	X
Oct 24, 2017	1.68	X
Oct 25, 2017	1.93	X
Oct 26, 2017	1.83	X
Oct 27, 2017	1.92	X
Oct 30, 2017	1.97	X
Nov 02, 2017	2.10	X
Nov 03, 2017	1.60	X
Nov 06, 2017	2.10	X
Nov 09, 2017	1.85	X
Nov 10, 2017	1.77	X
Nov 11, 2017	1.67	X
Nov 14, 2017	1.95	X
Nov 17, 2017	2.05	X
Nov 17, 2017	1.87	X
Nov 20, 2017	1.83	X
Nov 23, 2017	1.83	X
Nov 30, 2017	2.12	X
Dec 06, 2017	2.03	X
Dec 10, 2017	2.10	X
Dec 11, 2017	1.67	X
Dec 12, 2017	1.50	X
Dec 17, 2017	2.00	X
Dec 19, 2017	1.93	X
Dec 20, 2017	1.98	X
Dec 22, 2017	1.57	X

3H Background
 Total # pts : 57
 Valid # pts : 40
 Mean : 1.85
 SD : 0.19

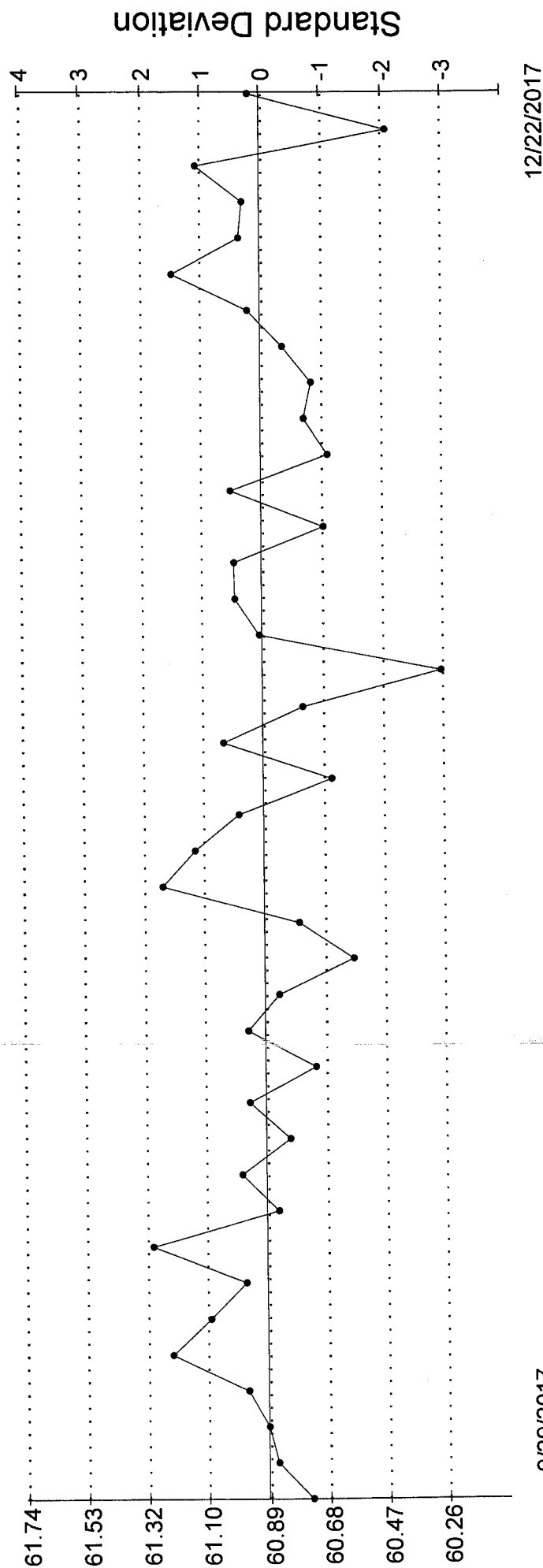


3H Efficiency

Total # pts : 59
Valid # pts : 40
Mean : 60.90
SD : 0.21

Date	Value	Include
Sep 29, 2017	60.75	X
Oct 02, 2017	60.87	X
Oct 03, 2017	60.90	X
Oct 04, 2017	60.97	X
Oct 06, 2017	61.24	X
Oct 07, 2017	61.10	X
Oct 09, 2017	60.98	X
Oct 11, 2017	61.30	X
Oct 13, 2017	60.86	X
Oct 15, 2017	60.99	X
Oct 16, 2017	60.82	X
Oct 17, 2017	60.96	X
Oct 18, 2017	60.73	X
Oct 21, 2017	60.96	X
Oct 23, 2017	60.85	X
Oct 24, 2017	60.59	X
Oct 25, 2017	60.78	X
Oct 26, 2017	61.26	X
Oct 27, 2017	61.14	X
Oct 30, 2017	60.99	X
Nov 02, 2017	60.66	X
Nov 03, 2017	61.04	X
Nov 06, 2017	60.76	X
Nov 09, 2017	60.28	X
Nov 10, 2017	60.91	X
Nov 11, 2017	61.00	X
Nov 14, 2017	61.00	X
Nov 17, 2017	60.68	X
Nov 17, 2017	61.01	X
Nov 20, 2017	60.67	X
Nov 23, 2017	60.75	X
Nov 30, 2017	60.73	X
Dec 06, 2017	60.83	X
Dec 10, 2017	60.95	X
Dec 11, 2017	61.21	X
Dec 12, 2017	60.98	X
Dec 17, 2017	60.96	X
Dec 19, 2017	61.13	X
Dec 20, 2017	60.46	X
Dec 22, 2017	60.94	X

3H Efficiency : 59
 Total # pts : 40
 Valid # pts : 60.90
 Mean : 60.90
 SD : 0.21



9/29/2017

12/22/2017



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American Radiation Services Analytical Reports

for

Los Alamos National Laboratory

Low Level Liquid Scintillation Counting

Calibration Information



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

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

Principal Radionuclide
H-3

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

OR --> Half Life, Days
4.4999E+03

Radionuclide **H-3**

Dilution Reference Date **4/27/2017 0:00**

Dilution Activity **2.59** pCi per gram ==> dpm/g **5.75**
 Verif. Date Decay Corrected **2.59** pCi per gram ==> dpm/g **5.75**

Minimum of 3 Required

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

10% Max

PASS

Standard Deviation percent of known concentration

5% Max

PASS

Average
 Two Sigma Uncertainty

Target Activity

% Diff

5.98	2.69
0.54	0.24
4.77%	4.77%
5.75	2.59
3.93%	3.93%

Verification Expiration Date: **April 27, 2018**

Prepared & Counted By

Date: **4/27/2017 0:00**

Verified & Approved By

Date: **4-28-17**

QC Approval

Date: **04-28-17**

S-0324



H-3

Verified **4/28/17**

SL

Expires 4/28/18

Manufacturer **NIST SRM 4927F**

Sol Matrix **H2O**

Ref No **NIST SRM 4927F**

Tech **Unknown**

Parent ID **S-0316**



RADIOACTIVE STANDARDS -- BATON ROUGE LABORATORY



Add / Edit Secondary Standards

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

Assay Definition

Assay Description:
 H3 Normal Lvl
 Assay Type: DPM (Single)
 Report Name: Report1
 Output Data Path: C:\Packard\Tricarb\Results\ARS\H3 Normal Lvl 2\20170427_1250
 Raw Results Path: C:\Packard\Tricarb\Results\ARS\H3 Normal Lvl 2\20170427_1250\20170427_1250.results
 RTE File Name: C:\Packard\Tricarb\Results\ARS\H3 Normal Lvl 2\20170427_1250\H3 Results.rtf
 Comma-Delimited File Name: C:\Packard\Tricarb\Results\ARS\H3 Normal Lvl 2\20170427_1250\H3 Results.csv
 Assay File Name: C:\Packard\Tricarb\Assays\H3 Normal Lvl 2.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): 120.00
 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										MESSAGES	
P#	S#	SMPL ID	CPMA	DPM1	tSIE	Eff Nucl	In A	Count	Time	DATE	TIME
11	1	BACKGROUND	9.00	29.71	381.35		30.28	120.00		4/27/2017	12:51:17 PM
11	2	S-0234-V1	18.75	62.31	378.81		30.09	120.00		4/27/2017	3:03:56 PM
11	3	S-0234-V2	17.76	59.04	378.52		30.07	120.00		4/27/2017	5:16:35 PM
11	4	S-0234-V3	18.32	60.43	381.90		30.33	120.00		4/27/2017	7:29:15 PM
11	5	S-0234-V4	17.74	58.34	382.99		30.41	120.00		4/27/2017	9:41:55 PM
11	6	S-0234-V5	18.62	61.34	382.40		30.36	120.00		4/27/2017	11:54:37 PM

0324

JB
 04-28-17

0324 JB 04-28-17

S-0234 Verification Weights

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

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

JB 0324
04-28-17



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**American Radiation Services
Analytical Reports**

for

Los Alamos National Laboratory

Folder Duplicate



Report Compilation Checklist

ARS SDG: 17-03647Client 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	

SDR
Report Generator Signature

3-16-18
Date

[Signature]
Management Review Signature

3-18-18
Date



LSC Technical Review Checklist

ARS SDG ARS1-17-03647

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: B17-02841 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): _____						
Melissa Morgan 12-19-17 Chemist Signature Date			[Signature] 12-19-17 Verifier Review Signature Date			

B. ANALYSIS REVIEW

	Analyst Review			QA Officer Review		
1) Calibrations Valid and Current?	<input checked="" type="radio"/> Yes	No	N/A	Yes	No	N/A
2) Backgrounds Valid and Current?	<input checked="" type="radio"/> Yes	No	N/A	Yes	No	N/A
3) Source Checks Completed and Acceptable?	<input checked="" type="radio"/> Yes	No	N/A	Yes	No	N/A
			QA Officer Signature		Date	
	Analyst Review			Technical Review		
4) Background Checks Complete and Acceptable?	<input checked="" type="radio"/> Yes	No	N/A	Yes	No	N/A
5) 100% of Manually Entered Parameters Verified Accurate?	<input checked="" type="radio"/> Yes	No	N/A	Yes	No	N/A
6) Appropriate QC samples initiated at required frequency?	<input checked="" type="radio"/> Yes	No	N/A	Yes	No	N/A
6) Test/Sample Specific Parameters (See ARS-059 for details)						
a) Analysis Parameters Checked and Correct and Peak Shapes are Acceptable?	<input checked="" type="radio"/> Yes	No	N/A	Yes	No	N/A
b) Spectra show no Evidence of Interferences?	<input checked="" type="radio"/> Yes	No	N/A	Yes	No	N/A
c) Sample Quench for All Samples within Range of Quench Curve?	<input checked="" type="radio"/> Yes	No	N/A	Yes	No	N/A
7) Analysis Anomaly? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (See Comments) NCR # (If initiated): _____						
Melissa Morgan 12-27-17 Analyst Signature Date			[Signature] Technical Reviewer Signature Date			



LSC
Technical Review Checklist

Batch A: B17-02841

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 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


<div></div>



LSC Technical Review Checklist

ARS SDG ARS1-17-03647Sample Matrix: AQ Aliquot (Circle One): Dry As Received ☒ Filtered Other: _____Required QC Samples (Mark all that apply): ☒ Blank ☒ LOS ☒ LOSD Sample Dup MS MSDARS A. Batch ID(s): Batch A: B18-00012 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 3-5-2018 Chemist Signature Date		 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
Jacal Byrd 3-12-18 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 3-12-18 Analyst Signature Date		Jacal Byrd 3-12-18 Technical Reviewer Signature Date

SDG Report - Samples and Containers

SDG Specific Data						
SDG	ARS1-17-03647		TAT Days	43	Project Type	Environmental
Sample Count	Rpt Level		Date Received	12/15/2017	COC Number	2018-1275
Client	Los Alamos National Laboratory		Client Deadline	1/27/2018	PO Number	
Client Code	114		Internal Deadline	1/26/2018	Job Number	
Profile Number	PN-00094		Lab Deadline	1/24/2018	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-18-148918	AQ	12/11/2017 10:31 AM	12/11/2017 10:31 AM	H	90	5	K6			
	IC_ID	Cnt	Volume (mL)	Container Type	pH Orig	pH Final	CPM	ur Hr	VOA	Head	Temp (C)
	282561	1	1000.00	HDP Container	0	0	80	20	N	N/A	
002	CAWA-18-148943	AQ	12/11/2017 10:31 AM	12/11/2017 10:31 AM	H	90	5	K6			
	IC_ID	Cnt	Volume (mL)	Container Type	pH Orig	pH Final	CPM	ur Hr	VOA	Head	Temp (C)
	282562	1	1000.00	HDP Container	0	0	80	20	N	N/A	

SDG Report - Analysis Assignments

SDG	ARS1-17-03647	Sample Count	2
Client	Los Alamos National Laboratory	Analysis Count	2-4

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

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

Client Name: Los Alamos National Laboratory

Profile Name: Nita Patel (Site Alias)

Report Level: 4

Analysis Code	Prep Type	Units	Aliquot	Prep Code	Procedure	Count Time														
LSC-LH3/SC-AQ	WRAD	PCI	L		ARS-054															
		Analyte			RDL	MS LL/UL	RadY LL/UL	Gray LL/UL	RER	RPO	Surr LL/UL									
	H-3				150 PCI/L	75/125	60/140	30/120	40/110	1	25	N/A								
LSC-LH3-AQ	WRAD	PCI	L		N/A	ARS-040														
		Analyte			RDL	LCS LL/UL	RadY LL/UL	Gray LL/UL	RER	RPO	Surr LL/UL									
	Enriched H-3				3.221 PCI/L	80/120	60/140	30/120	40/110	1	25	N/A								

Analysis Code	Fraction	Units	Aliquot	Conductivity	Analyte Count
LSC-LH3/SC-AQ	001	PCI	L	N/A	1
		Group			Analyte
				H-3	
LSC-LH3/SC-AQ	002	PCI	L	N/A	1
		Group			Analyte
				H-3	
LSC-LH3-AQ	001	PCI	L	N/A	1
		Group			Analyte
				Enriched H-3	
LSC-LH3-AQ	002	PCI	L	N/A	1
		Group			Analyte
				Enriched H-3	

ARS FILE TRACKING SHEET

SDG: ARS1-17-03647

Task	Date / Time	Initials
Date & Time Samples Received	12/15/17 15:27	MEC
ICOC Initiated/Storage Location: <u>K6</u>	12/18/17 07:48	MEC
Technical Checks Performed	<i>See Batch</i>	
Report Written / EDD Generated <i>3-12-18 / 1451 / 812</i>	<i>3-16-18 / 1317</i>	<i>SDH</i>
Report / EDD Reviewed for accuracy and completeness		
Quality Assurance Checks Performed on Report	<i>3-18-18</i>	
Management Checks Performed on Report	<i>18:K</i>	<i>JR</i>
<i>Preliminary Report Scan</i>		
Report E-mailed/Faxed		
Invoice Completed Invoice #: _____		
Requires Report Mailed Yes / No		
Requires Original COC mailed Yes / No		
Report Reviewed and Imaged		

SPECIAL REQUIREMENTS

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

NOTES :

SDG: ARSI-17-03647

SHIPPING CONTAINER

Good Condition ☒ Yes ☐ No
Radioactive ☐ Yes ☒ No
UN2910 ☐ Yes ☒ No
Sec. Seals ☒ Yes ☐ No
Seals Intact ☒ Yes ☐ No ☐ N/A
Air Bill ☐ Yes ☒ No

COC ☒ Yes ☐ No

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

Samples Rcv 2

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) 70 Max. Exposure Rate on Shipping Containers Externals (Plus Bkgd) 20 µR/hr

Background Count Rate (cpm)	80	Max. Removable Count Rate on Shipping Containers Externals (Plus Bkgd)	80	cpm
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Max. Removable Count Rate on
Shipping Containers Internals
(Plus Bkgd) 80 cpm

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

Surveyors' Name:

Date/Time Surveyed: 12-13-17 1327

[illegible]