Friday, February 03, 2012 REQUEST NUMBER: 12-721

LOS ALAMOS
NATIONAL LABORATORY

ATTN: Danny Coleman
American Radiation Services - Primary
1726 Wooddale Court
Baton Rouge, LA 70806

These Samples are on:
LANL Request Number:12-721
Per Agreement Number:63641-001-10
Project Cost Code: MR1A015AGWH0

Please analyse the enclosed samples
according to the schedule indicated:

SHIP DATE: 2/3/2012
TURNAROUND/REPORT DUE: 3/4/2012
TURNAROUND REQ'D: 30 Days

RAD SCREENING: Yes, Below Background
LAB REQUEST COMMENTS:

LANL ER SMO CONTACT:
Signature:

PRIORITY	METHOD CODE	CNTNR	SAMPLE ID	SAMPLE MATRIX	DATE SAMPLED	SPECIAL INSTRUCTIONS
	Generic:Low_Level_Tritium	1	CAWA-12-2018	WG	2/3/2012	

Final Page of REQUEST NUMBER 12-721

Friday, February 03, 2012

LAB CHAIN OF CUSTODY DOCUMENT NUMBER: 12-721C

REQUEST NUMBER: 12-721

LOS ALAMOS
NATIONAL LABORATORY

ATTN: Danny Coleman
American Radiation Services - Primary
1726 Wooddale Court
Baton Rouge, LA 70806
LAB REQUEST COMMENTS:

TURNAROUND/REPORT DUE: 3/4/2012
TURNAROUND REQ'D: 30

SAMPLE ID	CTNR	CTNR DESC	ORDER	PRESERV	MATRIX
CAWA-12-2018	1	POLY	WSP-LL-H-3	None	WG

Relinquished By: **Date** **Time** **Received By:** **Date** **Time**

Signature — Signature

2/3/12 3:00

Signature — Signature

Signature — Signature

Received for DISPOSAL By: **Date** **Time** **Remarks:**

Signature

Los Alamos National Laboratory

SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 3733 **EVENT NAME:** Water/CdV, MDA AB Mon. Group Sampling Q2, January 2012, 2011 Interim Plan rev. 1

SAMPLE ID: CAWA-12-2018 **WORK ORDER:**

	AS PLANNED	AS COLLECTED		AS PLANNED	AS COLLECTED
DATE COLLECTED(MM/DD/YYYY):		02/03/2012	MEDIA:	WGI	OK
TIME COLLECTED (HH:MM)		1137	SUB-MEDIA:	UA	
PRS ID:	Water	OK	SAMPLE TECH CODE:	RSP	
LOCATION ID:	R-27i		FIELD QC TYPE:	NA	
LOCATION TYPE:	MON		FIELD PREP:	UF	
PORT:	SINGLE COMPLETION		SAMPLE USAGE:	INV	
			SCREEN/PORT DESC:		
FIELD MATRIX:	WG		EXCAVATED: YES / NO (NA)		

COMPOSITE TYPE: NA COMPOSITE TIME INTERVAL: NA WATER FLOWING: YES / NO (NA)

BOREHOLE: YES / NO (NA) BOREHOLE DECLINATION: NA BOREHOLE DIRECTION: NA

#	PRIORITY	ORDER	CNTNR	PRESERVATIVE	COLLECTED Y/N	SPECIAL INSTRUCTIONS
2	NA	WSP-8260B-VOA	40 ML SEPTUM AMBER GLASS	Hydrochloric Acid (HCL)	Y	NA
3		WSP-8270C-SVOA	1 LITER AMBER GLASS	Ice		
3		WSP-8321A-NMED HEXP	1 LITER AMBER GLASS	Ice		
1		WSP-GrossA/B	1 LITER POLY	None		
2		WSP-HEXMOD	1 LITER AMBER GLASS	Ice		
1		WSP-LL-H-3	1 LITER POLY	None		
1		WSP-RAD	1 GAL POLY	Nitric Acid (HNO3)		
1		WSP-TKN+TOC	500 ML AMBER GLASS	Sulfuric Acid (H2SO4)		
~~1~~		~~Ra226+228~~	~~1 GAL POLY~~	~~Nitric Acid (HNO3)~~	AU 1/30/12	

SAMPLE DESC: NA

SAMPLE COMMENTS: NA

LOCATION DESC: NA

FIELD SCREENING/MEASUREMENT RESULTS:

pH	Temp°C	SC uS/cm	DO mg/L	Turb(ntu)	ORP mV	Q gpm
7.08	12.93	102	8.16	0.45	193.1	0.55

COLLECTED BY (PRINT) W. Shaw **REVIEWED BY (PRINT)** D. Fellenz

RELINQUISHED BY	Date/Time	RECEIVED BY	Date/Time

SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY

EVENT ID: 3733 **EVENT NAME:** Water/CdV, MDA AB Mon. Group Sampling Q2, January 2012, 2011 Interim Plan rev. 1

(Printed Name) David Fellenz	2/3/12	(Printed Name) M. Martyn	2/3/12
(Signature)	1305	(Signature)	1305
RELINQUISHED BY	**Date/Time**	**RECEIVED BY**	**Date/Time**
(Printed Name)		(Printed Name)	
(Signature)		(Signature)	

CAWA-12-2018

2609 North River Road • Port Allen, Louisiana 70767
1 (800) 401-4277 • Fax (225) 381-2996

American Radiation Services Analytical Reports

for

Los Alamos National Laboratory

Request Number: 12-721

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American Radiation Services Analytical Reports

for

Los Alamos National Laboratory Request: 12-721

Original COC

Friday, February 03, 2012

REQUEST NUMBER: 12-721

LOS ALAMOS
NATIONAL LABORATORY

ATTN: Danny Coleman
American Radiation Services - Primary
1726 Wooddale Court
Baton Rouge, LA 70806

These Samples are on:
LANL Request Number:12-721
Per Agreement Number:63641-001-10
Project Cost Code: MR1A015AGWH0

Please analyse the enclosed samples
according to the schedule indicated:

SHIP DATE: 2/3/2012
TURNAROUND/REPORT DUE: 3/4/2012
TURNAROUND REQ'D: 30 Days

RAD SCREENING: Yes, Below Background
LAB REQUEST COMMENTS:

LANL ER SMO CONTACT:
Signature:

PRIORITY	METHOD CODE	CNTNR	SAMPLE ID	SAMPLE MATRIX	DATE SAMPLED	SPECIAL INSTRUCTIONS
	Generic:Low_Level_Tritium	1	CAWA-12-2018	WG	2/3/2012	

Final Page of REQUEST NUMBER 12-721

Friday, February 03, 2012

LOS ALAMOS
NATIONAL LABORATORY

LAB CHAIN OF CUSTODY DOCUMENT NUMBER: 12-721C

REQUEST NUMBER: 12-721

ATTN: Danny Coleman
American Radiation Services - Primary
1726 Wooddale Court
Baton Rouge, LA 70806
LAB REQUEST COMMENTS:

TURNAROUND/REPORT DUE: 3/4/2012
TURNAROUND REQ'D: 30

SAMPLE ID	CTNR	CTNR DESC	ORDER	PRESERV	MATRIX
CAWA-12-2018	1	POLY	WSP-LL-H-3	None	WG

Relinquished By:	Date	Time	Received By:	Date	Time
Signature			Signature		
Signature	2/3/12	3:00	Signature	2-9-12	11:00
Signature			Signature		

Received for DISPOSAL By: **Date** **Time** **Remarks:**

Signature

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American Radiation Services Analytical Reports

for

Los Alamos National Laboratory Request: 12-721

Case Narrative

ARS INTERNATIONAL

2609 North River Road • Port Allen, Louisiana 70767
1 (800) 401-4277 • Fax (225) 381-2996

March 9, 2012

LANL
Keith Greene
PO Box 1663 MS M992
Los Alamos, NM 87545

Request Number: **12-721**
LANL Sample ID: **CAWA-12-2018**

Dear Mr. Greene;

On February 9, 2012, ARS International received one (1) water sample to be analyzed for Low Level Tritium.

The sample underwent enrichment and was counted using the appropriate counting equipment and QA/QC for this type of analysis. Results of the analysis and QA/QC 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 225.381.2991 or email LANL@amrad.com.

Sincerely,

Virginia Mulligan

Laboratory Management
ARS International

ARS INTERNATIONAL
2609 North River Road • Port Allen, Louisiana 70767
1 (800) 401-4277 • Fax (225) 381-2996

COVER PAGE

PROJECT SAMPLE IDENTIFICATION CROSS-REFERENCE
TO ARS SAMPLE LABORATORY IDs
Subcontract (LANL Agreement Number) 63641-001-10

Request Number	LANL PROJECT SAMPLE ID NUMBER	American Radiation Services SAMPLE ID NUMBER(S)
12-721	CAWA-12-2018	ARS1-12-00248-001

ANALYTICAL METHODS
Tritium analyses were performed using **ARS-040 Tritium Assay in Water Samples Using Electrolytic Enrichment.**

ANALYTICAL RESULTS
The result data that are flagged with "U" indicate that the activity is below the MDC.

American Radiation Services Project Manager/Laboratory Director'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 the LANL 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."

Virginia Mullegan — Signature
Laboratory Management, ARS International — Title
3-9-12 — Date

ARS INTERNATIONAL

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American Radiation Services Analytical Reports

for

Los Alamos National Laboratory

Low Level Tritium by Low Level Liquid Scintillation Counting

ARS INTERNATIONAL
2609 North River Road, Port Allen, Louisiana 70767
1 (800) 401-4277 FAX (225) 381-2996

ARS Sample Delivery Group:	ARS1-12-00248	**Request or PO Number:**	12-721
Client Sample ID:	CAWA-12-2018	**ARS Sample ID:**	ARS1-12-00248-001
Sample Collection Date:	02/03/12	**Date Received:**	02/09/12
Sample Matrix:	Aqueous	**Report Date:**	03/09/12

Analysis Description	Analysis Results	Analysis Error +/- 1 s	MDC	DLC	Qual	Analysis Units	Analysis Test Method	Analysis Date/Time	Analysis Technician	Tracer/Chem Recovery
Enriched H-3	0.830	0.600	1.930	0.930	U	pCi/L	ARS-040	03/06/12 10:40	RU	NA

NOTES: Project Cost Code MR1A015AGWH0

Project Manager Review

LELAP Certificate# 01949

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1 (800) 401-4277 FAX (225) 381-2996

QC Results Report

Sample Delivery Group: ARS1-12-00248
Date Received: 2/9/2012

Laboratory Control Sample Evaluation

Analysis Batch	QC Type	Analyte	Analysis Results	CSU 1 (1s)	MDC	Expected Value	Qual	Report Units	Analysis Test Method	Analysis Date/Time	Analysis Technician	Percent Recovery (%)	LCS Acceptance Range
ARS1-B12-00365	LCS	H3	20.500	3.210	1.940	23.057		pCi/L	ARS-040	3/6/12 2:17	RU	89	75%-125%

Blank Evaluation

Analysis Batch	QC Type	Analyte	Analysis Results	CSU 1 (1s)	MDC	Expected Value	Qual	Report Units	Analysis Test Method	Analysis Date/Time	Analysis Technician
ARS1-B12-00365	MBL	H3	0.820	0.620	2.010	NA	U	pCi/L	ARS-040	3/6/12 6:28	RU

Sample RER Duplicate Evaluation

Analysis Batch	QC Type	Analysis Description	Result 1	CSU 1 (1s)	Result 2	CSU 2 (2s)	Qual	Analysis Units	Analysis Test Method	Analysis Date/Time	Analysis Technician	RER	RER AcceptanceRange
ARS1-B12-00365	LCSD	H3	20.500	3.210	19.220	3.030		pCi/L	ARS-040	3/6/12 2:17	RU	0.21	< 1

Sample DER Duplicate Evaluation

Analysis Batch	QC Type	Analysis Description	Result 1	CSU 1 (1s)	Result 2	CSU 2 (2s)	Qual	Analysis Units	Analysis Test Method	Analysis Date/Time	Analysis Technician	DER	DER AcceptanceRange
ARS1-B12-00365	LCSD	H3	20.500	3.210	19.220	3.030		pCi/L	ARS-040	3/6/12 2:17	RU	0.58	< 3

Project Manager Review

LELAP Certificate# 01949 NELAP Certificate # E87558

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American Radiation Services Analytical Reports

for

Los Alamos National Laboratory

Low Level Tritium by Low Level Liquid Scintillation Counting

Samples

ARS Tritium Enrichment Calculations

Procedures	**ARS-040 , ARS-060**
ARS File ID Number	**ARS1-12-00248; 249; 250; 251; 276**
ARS Batch ID Number	**ARS1-B12-00365**

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

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

Sample ID	initial Mass sample (g) V_i	Mass Na2O2 added (g) mi	Final mass electrolyzed sample w/ NaOH (g) V_f	Mass equivalent NaOH (g) m_f	Final Mass Electrolyzed sample (g pure H2O) V_f	Volume factor X	Enrichment Factor Y	Average Sample CPM R_s	Bkg CPM R_b	QIP tSIE	Detector Eff (decimal) Eff	Aliquot Aliquot	Enter aliq. in final Rep. Units Units	Activity reference date T_o	Start Date of Count T_c	Total Sample Count Duration (min) t cnt (min)	Total Bkg Count Duration (min) t cnt (min)	Decay Correction to To DF	Sample Activity Conc. AC_i	Standard Counting Uncertainty CU	Counting Uncertainty 1s CU	Combined Standard Uncertainty 1s CSU	Minimum Detectable Conc. MDC	Decision Level Conc. DLC	Reporting Units Units
ARS1-B12-00365-01	540.93	2.04	17.33	2.093	15.24	0.0282	27.74	4.236	1.127	389.89	0.2690	0.01004	L	9/7/2011	3/5/2012	240	240	0.972642	19.22	0.92	0.92	3.03	2.04	0.99	pCi/L
ARS1-B12-00365-02	544.94	2.09	16.91	2.144	14.77	0.0271	28.79	4.614	1.127	397.53	0.2728	0.01003	L	9/7/2011	3/6/2012	240	240	0.972493	20.50	0.91	0.91	3.21	1.94	0.94	pCi/L
ARS1-B12-00365-03	533.60	2.04	17.31	2.093	15.22	0.0285	27.41	1.262	1.127	387.18	0.2677	0.01008	L	3/5/2012	3/6/2012	240	240	0.999833	0.82	0.61	0.61	0.62	2.01	0.97	pCi/L
ARS1-B12-00365-04	544.62	2.08	16.59	2.134	14.46	0.0265	29.37	1.269	1.127	377.55	0.2629	0.01003	L	2/3/2012	3/6/2012	240	240	0.99507	0.83	0.58	0.58	0.60	1.93	0.93	pCi/L
ARS1-B12-00365-05	537.13	2.07	16.21	2.124	14.09	0.0262	29.71	1.310	1.127	375.15	0.2617	0.01002	L	2/2/2012	3/6/2012	240	240	0.994917	1.06	0.59	0.59	0.61	1.92	0.93	pCi/L
ARS1-B12-00365-06	545.66	2.02	17.13	2.073	15.06	0.0276	28.29	1.244	1.127	385.09	0.2667	0.01003	L	2/3/2012	3/6/2012	240	240	0.99507	0.70	0.59	0.59	0.60	1.97	0.95	pCi/L
ARS1-B12-00365-07	547.28	2.09	16.17	2.144	14.03	0.0256	30.38	6.713	1.127	382.93	0.2656	0.01002	L	2/7/2012	3/6/2012	240	240	0.995684	31.26	1.01	1.01	4.80	1.85	0.89	pCi/L
ARS1-B12-00365-08	541.32	2.09	16.41	2.144	14.27	0.0264	29.57	1.471	1.127	383.39	0.2658	0.01004	L	2/8/2012	3/7/2012	240	240	0.995684	1.97	0.60	0.60	0.67	1.89	0.91	pCi/L

Reviewed 3-7-12
Susan Reese

Reviewed 3-8-12
DZM

ARS Tritium Enrichment Calculations

Procedures	**ARS-040 , ARS-060**
ARS File ID Number	**ARS1-12-00248; 249; 250; 251; 276**
ARS Batch ID Number	**ARS1-B12-00365**

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

lambda	1.5403E-04	**ACF (def. = 1)**	1
Syserror (%)	15%	**Reporting Units**	pCi
Coverage Factor	1.96	**UCF**	2.22

Sample ID	Initial Mass sample (g) V_i	Mass Na2O2 added (g) mi	Final mass electrolyzed sample w/ NaOH (g) V_f'	Mass equivalent NaOH (g) m_f	Final Mass Electrolyzed sample (g pure H2O) V_f	Volume factor X	Enrichment Factor Y	Average Sample CPM R_s	Bkg CPM R_b	QIP tSIE	Detector Eff (decimal) Eff	Aliquot Aliquot	Enter aliq. in final Rep. Units Units	Activity reference date T_o	Start Date of Count T_c	Total Sample Count Duration (min) t cnt (min)	Total Bkg Count Duration (min) t cnt (min)	Decay Correction to To DF	Sample Activity Conc. AC_i	Standard Counting Uncertainty CU	Counting Uncertainty 1.96s CU	Combined Standard Uncertainty 1.96s CSU	Minimum Detectable Conc. MDC	Decision Level Conc. DLC	Reporting Units Units
ARS1-B12-00365-01	540.93	2.04	17.33	2.093	15.24	0.0282	27.74	4.236	1.127	389.89	0.2690	0.01004	L	9/7/2011	3/5/2012	240	240	0.972642	19.22	0.92	1.81	5.93	2.04	0.99	pCi/L
ARS1-B12-00365-02	544.94	2.09	16.91	2.144	14.77	0.0271	28.79	4.614	1.127	397.53	0.2728	0.01003	L	9/7/2011	3/6/2012	240	240	0.972493	20.50	0.91	1.78	6.28	1.94	0.94	pCi/L
ARS1-B12-00365-03	533.60	2.04	17.31	2.093	15.22	0.0285	27.41	1.262	1.127	387.18	0.2677	0.01008	L	3/5/2012	3/6/2012	240	240	0.999833	0.82	0.61	1.19	1.22	2.01	0.97	pCi/L
ARS1-B12-00365-04	544.62	2.08	16.59	2.134	14.46	0.0265	29.37	1.269	1.127	377.55	0.2629	0.01003	L	2/3/2012	3/6/2012	240	240	0.99507	0.83	0.58	1.14	1.17	1.93	0.93	pCi/L
ARS1-B12-00365-05	537.13	2.07	16.21	2.124	14.09	0.0262	29.71	1.310	1.127	375.15	0.2617	0.01002	L	2/2/2012	3/6/2012	240	240	0.994917	1.06	0.59	1.15	1.19	1.92	0.93	pCi/L
ARS1-B12-00365-06	545.66	2.02	17.13	2.073	15.06	0.0276	28.29	1.244	1.127	385.09	0.2667	0.01003	L	2/3/2012	3/6/2012	240	240	0.99507	0.70	0.59	1.17	1.18	1.97	0.95	pCi/L
ARS1-B12-00365-07	547.28	2.09	16.17	2.144	14.03	0.0256	30.38	6.713	1.127	382.93	0.2656	0.01002	L	2/7/2012	3/6/2012	240	240	0.995684	31.26	1.01	1.98	9.40	1.85	0.89	pCi/L
ARS1-B12-00365-08	541.32	2.09	16.41	2.144	14.27	0.0264	29.57	1.471	1.127	383.39	0.2658	0.01004	L	2/8/2012	3/7/2012	240	240	0.995684	1.97	0.60	1.17	1.30	1.89	0.91	pCi/L

Reviewed SDA
3-7-12
Reviewed 3-8-12
DFM

QC Evaluation

Method: ARS-040
Batch ID: ARS1-B12-00365
SDG's: ARS1-12-00248; 249; 250; 251; 276

LCS	19.2200	**CSU (2s)**	5.9300
LCSD	20.5000	**CSU-D (2s)**	6.2800

DER = $\frac{\text{abs(LSC-LSCD)}}{\text{sqr((2s CSU/2)^2)+((2s CSU-D/2)^2) } \textit{at 1 sigma}}$ = **< 3**

DER $\frac{1.28}{4.31866}$ = 0.296388 **< 3**

% RPD= $\frac{\text{ABS(LCS - LSCD)}}{\text{(LCS+LCSD)/2}}$ * 100 = **< 25%**

%RPD $\frac{1.28}{19.86}$ *100 = 6.445116 **< 25%**

The *RPD* shall be less than 25% or other client-applied criteria

RER= $\frac{\text{abs((LCS-LCSD))}}{\text{(CSU)+(CSD) } \textit{at 2 sigma}}$ = **<1** ***<--LANL Requirement***

RER = $\frac{1.28}{12.2100}$ 0.104832105 **<1**

Blank Information

	Act	CSU(2s)	MDA	Act>MDA
AM-241				
U-234				
U-235				
U-238				
Pu-238				
Pu-239/240				
Th-228				
Th-230				
Th-232				
H3	0.82	1.22	2.01	
Ra-226				
Ra-228				
Total U				
Pb-210				
Po-209				
Sr-90				
TC-99				
NI-63				

*MDA should be below RDL
*Blank activity must be below MDA
*Blank activity must be < 1.65*CSU (DOE only)

ACT = 0.82
CSU = 1.22
Is ACT<1.65*CSU? YES

LANL

ARS Batch Number: ARS1-B12 - 00365

Enter these Values for LCS

		Report Name	Field Name on the Report
Current ACT	5.5693	Standards Report	ACT at Date Above (dpm/g)
NetWt	5.0296	LCS Report	NetWt
Aliquot	0.5409	Tritium Enrichment Data	Gross Sample Added/1000

Enter these Values for LCSD

		Report Name	Field Name on the Report
Current ACT	5.5693	Standards Report	ACT at Date Above (dpm/g)
NetWt	5.0085	LCS Report	NetWt
Aliquot	0.5449	Tritium Enrichment Data	Gross Sample Added/1000

Expected Value Calculations

LANL

ARS Batch Number: ARS1-B11 - 00365

LCS	**CALCULATED EXPECTED VALUE**	=	23.326			
			Range	18.661	-	27.991
LCSD	**CALCULATED EXPECTED VALUE**	=	23.057			
			Range	18.446	-	27.669

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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

Analysis Batch Report

Analysis Batch ID **ARS1-B12-00365**

					Method	**ARS-040**	**Analysis**	**LSC-A-022**	**Matrix**	**AQ**
					Description	**Low Level Tritium by Electrolytic Enrichment**				
ABatch Sample ID	Type	Blind Iso1	Blind Iso2	Blind Iso3	SDG	FR	Run	Client ID	Isotope Group	Lab Deadline
ARS1-B12-00365-01	LCS	B-13373								
ARS1-B12-00365-02	LCSD	B-13374								
ARS1-B12-00365-03	MBL									
ARS1-B12-00365-04	TRG				**ARS1-12-00248**	001	1	CAWA-12-2018	STD	03/08/12
ARS1-B12-00365-05	TRG				**ARS1-12-00249**	001	1	CAAN-12-2024	STD	03/08/12
ARS1-B12-00365-06	TRG				**ARS1-12-00250**	001	1	CAWA-12-2023	STD	03/08/12
ARS1-B12-00365-07	TRG				**ARS1-12-00251**	001	1	CAMO-12-2229	STD	03/08/12
ARS1-B12-00365-08	TRG				**ARS1-12-00276**	001	1	CAMO-12-2232	STD	03/13/12

108180
12-00248-001-1
WRAD

108182
12-00249-001-1
WRAD

108184
12-00250-001-1
WRAD

108186
12-00251-001-1
WRAD

108188
12-00276-001-1
WRAD

LCS Report
Analytical Batch: ARS1-B12-00365

BlindID	ABatch	ABatchSampleID	BlindGroup	StdID	Isotope	ExpectedAddition	ExpectedValue	EmptyWt	GrossWt	NetWt	UserID	ModDate	ExpectedValue_CT	MidPointCountDate	KnownValue
B-13373	ARS1-B12-00365	ARS1-B12-00365-01	B-H3	S-0262	H-3	5	2.516841889	13.4938	18.5234	5.0296	BSTEFFENS	2/13/2012	2.508713488	3/5/2012	12.61782536
B-13374	ARS1-B12-00365	ARS1-B12-00365-02	B-H3	S-0262	H-3	5	2.516841889	13.3949	18.4034	5.0085	BSTEFFENS	2/13/2012	2.508327077	3/6/2012	12.56295616

Standards Activity as of: 03/05/12 10:06

Active	Std ID	Isotope	PSCLT	Verification Date	Exp Date	Status	Ref Date	Ref ACT (dpm)	ACT at Date Above (dpm/g)	Halflife (days)	Parent ID	Expended Date	Comments
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

LANL

ARS Batch Number: ARS1-B12 - 00365

Enter these Values for LCS

		Report Name	Field Name on the Report
Current ACT	5.5693	Standards Report	ACT at Date Above (dpm/g)
NetWt	5.0296	LCS Report	NetWt
Aliquot	0.5409	Tritium Enrichment Data	Gross Sample Added/1000

Enter these Values for LCSD

		Report Name	Field Name on the Report
Current ACT	5.5693	Standards Report	ACT at Date Above (dpm/g)
NetWt	5.0085	LCS Report	NetWt
Aliquot	0.5449	Tritium Enrichment Data	Gross Sample Added/1000

Expected Value Calculations

LANL

ARS Batch Number: ARS1-B11 - 00365

LCS	**CALCULATED EXPECTED VALUE**	=	23.326		
			Range	18.661 -	27.991
LCSD	**CALCULATED EXPECTED VALUE**	=	23.057		
			Range	18.446 -	27.669

Assay Definition-

Assay Description:
LLH3 Assay in DPM Mode

Assay Type: DPM (Single)
Report Name: Report1
Output Data Path: C:\Packard\Tricarb\Results\H3 Low Level\Low Level H3\20120305_1746
Raw Results Path: C:\Packard\Tricarb\Results\H3 Low Level\Low Level H3\20120305_1746\20120305_1746.results
RTF File Name: C:\Packard\Tricarb\Results\H3 Low Level\Low Level H3\20120305_1746\LLH3.rtf
Comma-Delimited File Name: C:\Packard\Tricarb\Results\H3 Low Level\Low Level H3\20120305_1746\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: ARS LL H3 10mL
Count Time (min): 240.00
Count Mode: Low Level
Assay Count Cycles: 1 Repeat Sample Count: 1
#Vials/Sample: 1 Calculate % Reference: Off

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

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

Count Corrections-

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

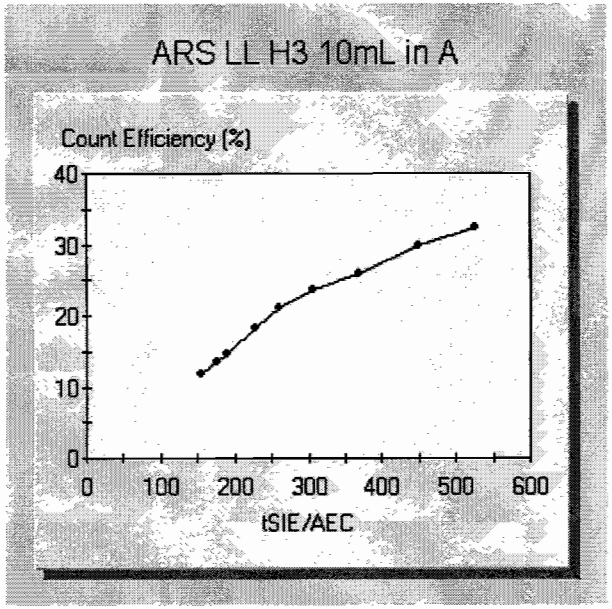
Half Life-

Half Life Correction: Off

Regions	Half Life	Units	Reference Date	Reference Time

A
B
C

Cycle 1 Results
Quench Curve Block Data



Date Acquired: 11/18/2011
Date Modified:
ARS LL H3 10mL in A

tSIE/AEC	Count Efficiency (%)
526.29	32.47
450.16	29.90
370.15	25.92
306.68	23.60
260.68	20.99
228.69	18.21
189.46	14.53
177.14	13.64
155.73	11.73

Protocol# 2 - Low Level H3.lsa User: H3 Low Level

P#	S#	SMPL_ID	CPMA	DPM1	tSIE	Eff Nucl In A	Count Time	DATE	TIME	MESSAGES
2	1	BACKGROUND	1.127	4.19	389.56	26.89	240.00	3/5/2012	5:54:56 PM	
2	2	B12-00365-01	4.236	15.74	389.89	26.90	240.00	3/5/2012	10:06:04 PM	
2	3	B12-00365-02	4.614	16.91	397.53	27.28	240.00	3/6/2012	2:17:22 AM	
2	4	B12-00365-03	1.262	4.71	387.18	26.77	240.00	3/6/2012	6:28:41 AM	
2	5	B12-00365-04	1.269	4.83	377.55	26.29	240.00	3/6/2012	10:40:00 AM	
2	6	B12-00365-05	1.310	5.01	375.15	26.17	240.00	3/6/2012	2:51:12 PM	
2	7	B12-00365-06	1.244	4.66	385.09	26.67	240.00	3/6/2012	7:02:28 PM	
2	8	B12-00365-07	6.713	25.28	382.93	26.56	240.00	3/6/2012	11:13:43 PM	
2	9	B12-00365-08	1.471	5.54	383.39	26.58	240.00	3/7/2012	3:25:00 AM	

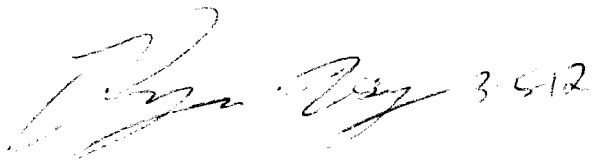
ID_31001_040	ABatch	AnalysisCode	ABatchSampleID	ClientID	IC_ID	S01_1_EnrichCellNo	S01_2_TareCell	S01_3_TareResv	S02_GrossWtResv	S03_1_WtNa2O2	C_GrossSampleAdded
121	ARS1-B12-00365	LSC-A-022	ARS1-B12-00365-01			44	329.56	197.86	738.79	2.04	540.93
122	ARS1-B12-00365	LSC-A-022	ARS1-B12-00365-02			39	330.39	202.15	747.09	2.09	544.94
123	ARS1-B12-00365	LSC-A-022	ARS1-B12-00365-03			12	330.46	212.82	746.42	2.04	533.6
124	ARS1-B12-00365	LSC-A-022	ARS1-B12-00365-04	CAWA-12-2018		19	330.08	213.51	758.13	2.08	544.62
125	ARS1-B12-00365	LSC-A-022	ARS1-B12-00365-05	CAAN-12-2024		66	334.95	206.34	743.47	2.07	537.13
126	ARS1-B12-00365	LSC-A-022	ARS1-B12-00365-06	CAWA-12-2023		68	334.94	213.78	759.44	2.02	545.66
127	ARS1-B12-00365	LSC-A-022	ARS1-B12-00365-07	CAMO-12-2229		84	334.65	204.9	752.18	2.09	547.28
128	ARS1-B12-00365	LSC-A-022	ARS1-B12-00365-08	CAMO-12-2232		52	327.9	225.74	767.06	2.09	541.32

3-5-12

S04_1_ElectrolSD	S04_2_StartAmp	S04_3_StartBathC	S05_1_ElectrolED	S05_2_EndBathC	S05_3_EndCellWt	C_GrossSmplRec	C_EnrichmentF	S06_TareWt	S07_GrossWt	C_RecoveredWa	S08_TearWtLSCVial
02/17/2012 15:00:00	5	1.8	03/02/2012 10:31:00	1.8	544.75	17.33	31.2135026	102.86	115.94	13.08	6.62
02/17/2012 15:00:00	5	1.8	03/02/2012 11:56:00	1.8	549.45	16.91	32.22590183	109.67	122.09	12.42	6.62
02/17/2012 15:00:00	5	1.8	03/02/2012 10:33:00	1.8	560.59	17.31	30.82611207	107.45	120.49	13.04	6.55
02/17/2012 15:00:00	5	1.8	03/01/2012 10:18:00	1.8	560.18	16.59	32.82820976	108.53	120.72	12.19	6.61
02/17/2012 15:00:00	5	1.8	03/01/2012 13:50:00	1.8	557.5	16.21	33.13571869	101.65	112.56	10.91	6.52
02/17/2012 15:00:00	5	1.8	03/02/2012 13:06:00	1.8	565.85	17.13	31.85405721	110.63	123.61	12.98	6.58
02/17/2012 15:00:00	5	1.8	03/02/2012 13:08:00	1.8	555.72	16.17	33.8453927	117.6	129.33	11.73	6.61
02/17/2012 15:00:00	5	1.8	03/02/2012 13:04:00	1.8	570.05	16.41	32.98720293	112.01	124.07	12.06	6.47

3-5-12

S09_VialPlusSmpl	C_NetSample	S10_1_WtVislSmplDrWatFill	C_NetDeadWaterAdded	C_TareWtBFCocktail	S10_2_GrossWtVSC	C_NetWtCocktailAdded	UserID	ModDate
16.66	10.04	0	0	16.66	27.33	10.67	AMRAD\RUSEY	03/05/2012 11:25:28
16.65	10.03	0	0	16.65	27.31	10.66	AMRAD\RUSEY	03/05/2012 11:28:02
16.63	10.08	0	0	16.63	27.29	10.66	AMRAD\RUSEY	03/05/2012 11:30:41
16.64	10.03	0	0	16.64	27.3	10.66	AMRAD\RUSEY	03/05/2012 11:33:59
16.54	10.02	0	0	16.54	27.16	10.62	AMRAD\RUSEY	03/05/2012 15:45:22
16.61	10.03	0	0	16.61	27.3	10.69	AMRAD\RUSEY	03/05/2012 15:48:09
16.63	10.02	0	0	16.63	27.34	10.71	AMRAD\RUSEY	03/05/2012 15:50:29
16.51	10.04	0	0	16.51	27.23	10.72	AMRAD\RUSEY	03/05/2012 15:53:38



Beta Liquid Scintillation Counter Log Book

Date	Time	ARS Sample I.D. Number	Batch Number	Liquid Scintillation File Number	Technician Initials
2-20-12	1514	B12-00269-08	B12-00269	1648	RJH
↓	↓	B12-00269-09	↓	↓	RJH
↓	↓	B12-00269-10	↓	↓	RJH
↓	↓	B12-00269-11	↓	↓	RJH
RJH 2-21-12 ↓	↓	B12-00269-12	↓	↓	RJH
2-23-12	0804	SNC-16	QA	QA	RJH
2-23-12	0938	B12-00269-04	B12-00269	0947	RJH
↓	↓	B12-00269-12	↓	0947	RJH
2-23-12	1415	~~B12-00269-01~~	~~B12-00269~~ RJH 12-24-12		RJH
↓	↓	B12-00269-12	↓		RJH
RJH 2-24-12 ~~2-24-12~~ SN	0801	SNC-16	QA	QA	RJH
2-24-12	0802	B12-00269-04	B12-00269	0938	RJH
D.d not count RJH 2-24-12 ↓	↓	~~B12-00269-12~~	↓		~~RJH~~
3-5-12	1610	SNC-16	QA	QA	RJH
3-5-12	1613	Background	B12-00365	1746	RJH
↓	↓	B12-00365-01	↓	↓	RJH
↓	↓	B12-00365-02	↓	↓	RJH
↓	↓	B12-00365-03	↓	↓	RJH
↓	↓	B12-00365-04	↓	↓	RJH
↓	↓	B12-00365-05	↓	↓	RJH

Reviewed By: SCH Initials Date: 3-7-12

Beta Liquid Scintillation Counter Log Book

Date	Time	ARS Sample I.D. Number	Batch Number	Liquid Scintillation File Number	Technician Initials
3-5-12	1613	B12-00365-06	B12-00365	1746	
↓	↓	B12-00365-07	↓	↓	
↓	↓	B12-00365-08	↓	↓	

3-6-12

Reviewed By: _____ Date: 3-7-12
Initials

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for

Los Alamos National Laboratory

Low Level Tritium by Low Level Liquid Scintillation Counting

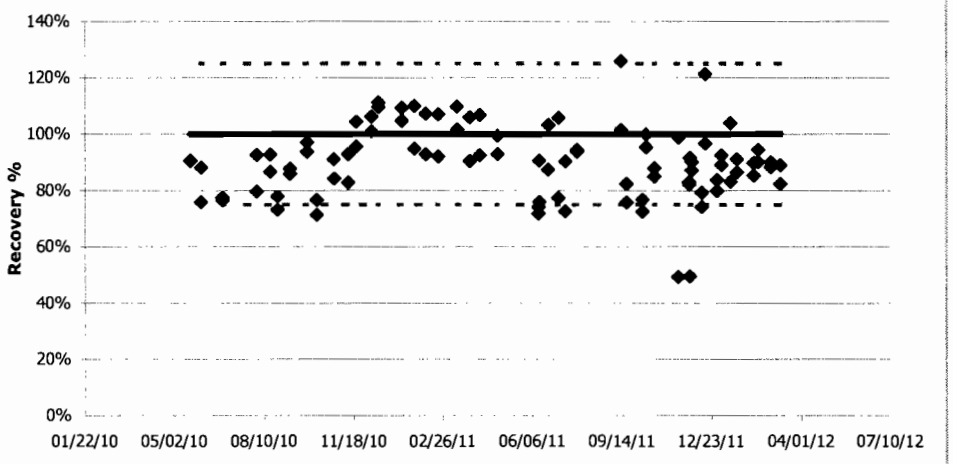
Control Charts

American Radiation Services
Baton Rouge Laboratory

QC Chart

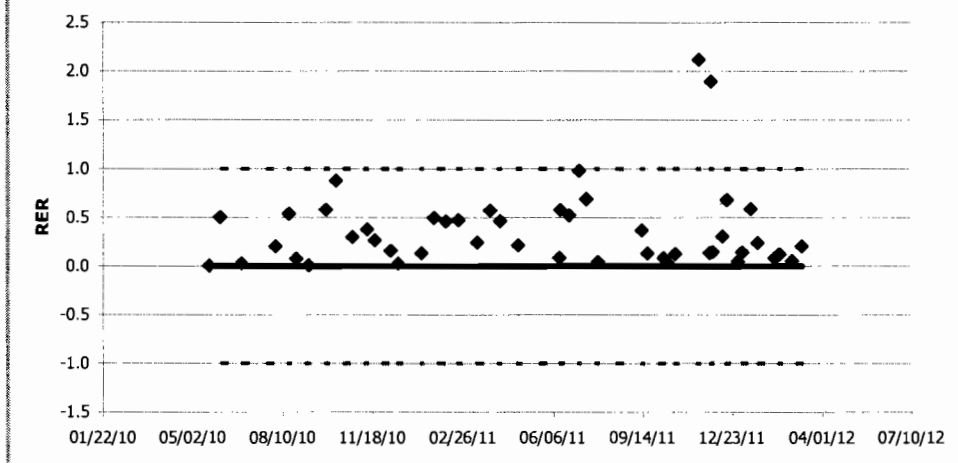
Printed: 3/9/2012 9:36 AM
Page 1 of 1

LLH-3 LCS



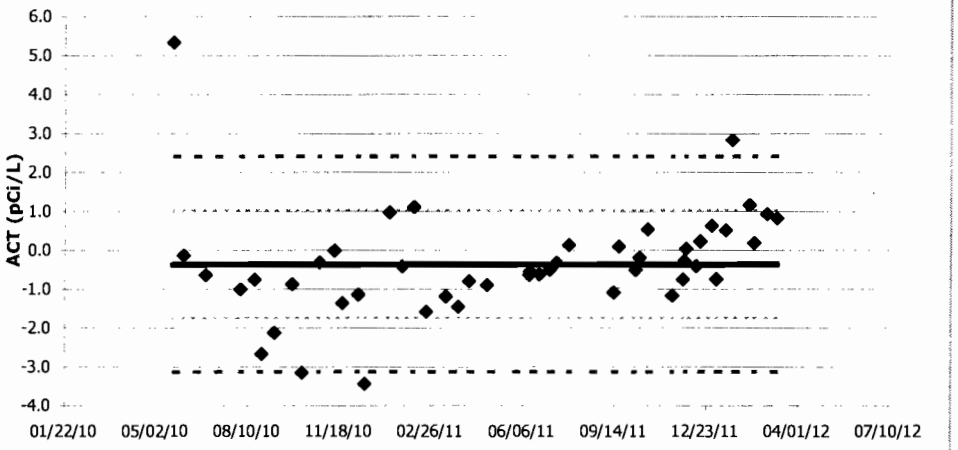
Average	STDEV	n	UCL	LCL
0.9041	0.1290	48	1.2500	0.7500

LLH-3 RER



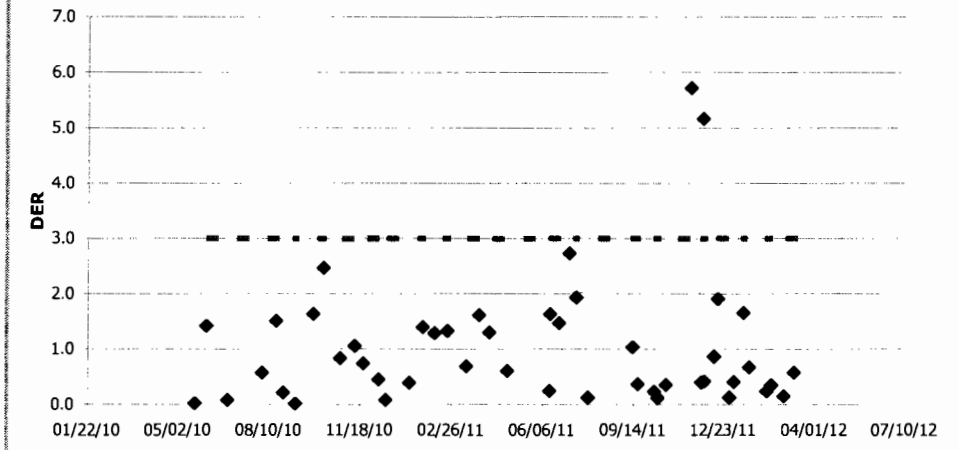
n	UCL	LCL
48	1.0000	-1.0000

LLH-3 Blank



Average	STDEV	n	UCL	LCL
-0.3585	1.3864	48	2.4142	-3.1313

LLH-3 DER

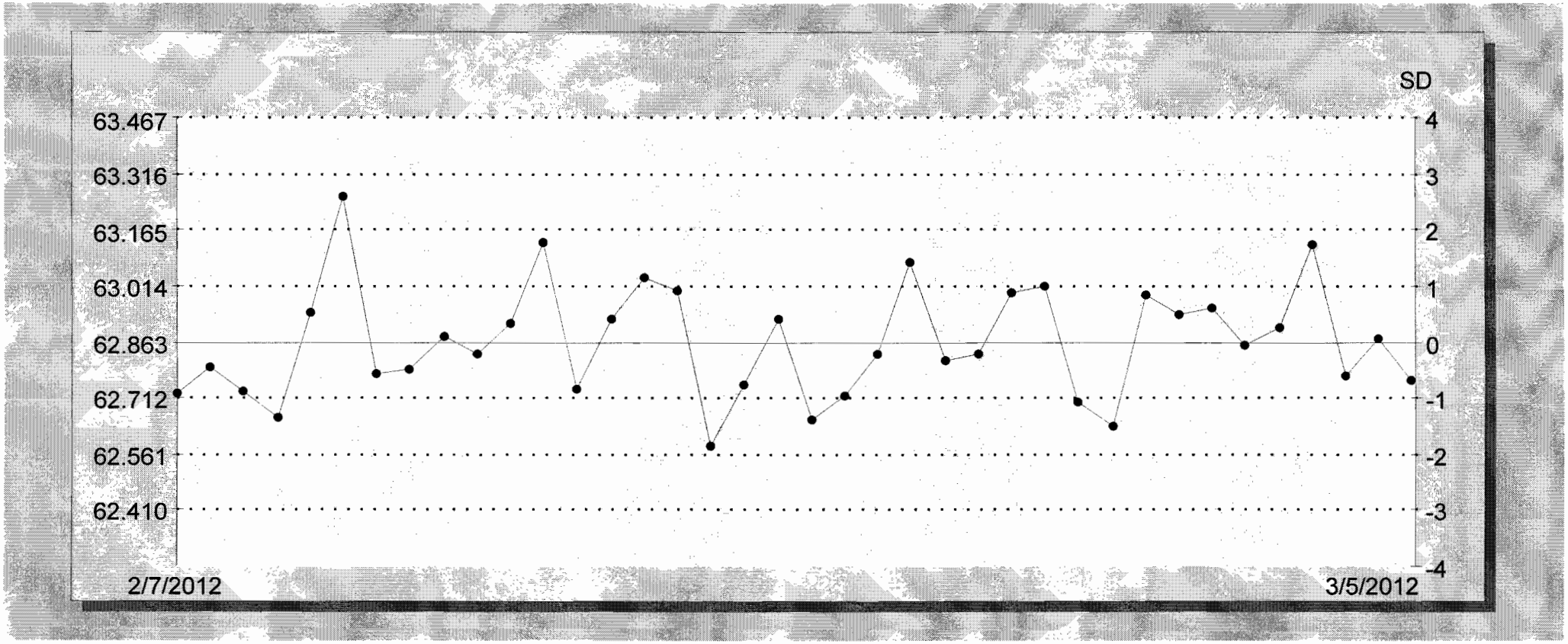


n	UCL
48	3.0000

3H Efficiency
Total # pts : 5455
Valid # pts : 38
Mean : 62.86
SD : 0.15

Date	Value	Valid Pt
Feb 07, 2012	62.72	X
Feb 07, 2012	62.80	X
Feb 07, 2012	62.73	X
Feb 07, 2012	62.66	X
Feb 07, 2012	62.95	X
Feb 08, 2012	63.26	X
Feb 08, 2012	62.78	X
Feb 08, 2012	62.79	X
Feb 08, 2012	62.88	X
Feb 08, 2012	62.83	X
Feb 08, 2012	62.91	X
Feb 08, 2012	63.13	X
Feb 08, 2012	62.74	X
Feb 08, 2012	62.92	X
Feb 08, 2012	63.04	X
Feb 08, 2012	63.00	X
Feb 08, 2012	62.59	X
Feb 08, 2012	62.75	X
Feb 08, 2012	62.92	X
Feb 08, 2012	62.65	X
Feb 09, 2012	62.72	X
Feb 09, 2012	62.83	X
Feb 09, 2012	63.08	X
Feb 09, 2012	62.81	X
Feb 09, 2012	62.83	X
Feb 09, 2012	62.99	X
Feb 09, 2012	63.02	X
Feb 09, 2012	62.70	X
Feb 09, 2012	62.64	X
Feb 09, 2012	62.99	X
Feb 10, 2012	62.94	X
Feb 15, 2012	62.96	X
Feb 16, 2012	62.86	X
Feb 17, 2012	62.90	X
Feb 20, 2012	63.13	X
Feb 23, 2012	62.77	X
Feb 24, 2012	62.87	X
Mar 05, 2012	62.76	X

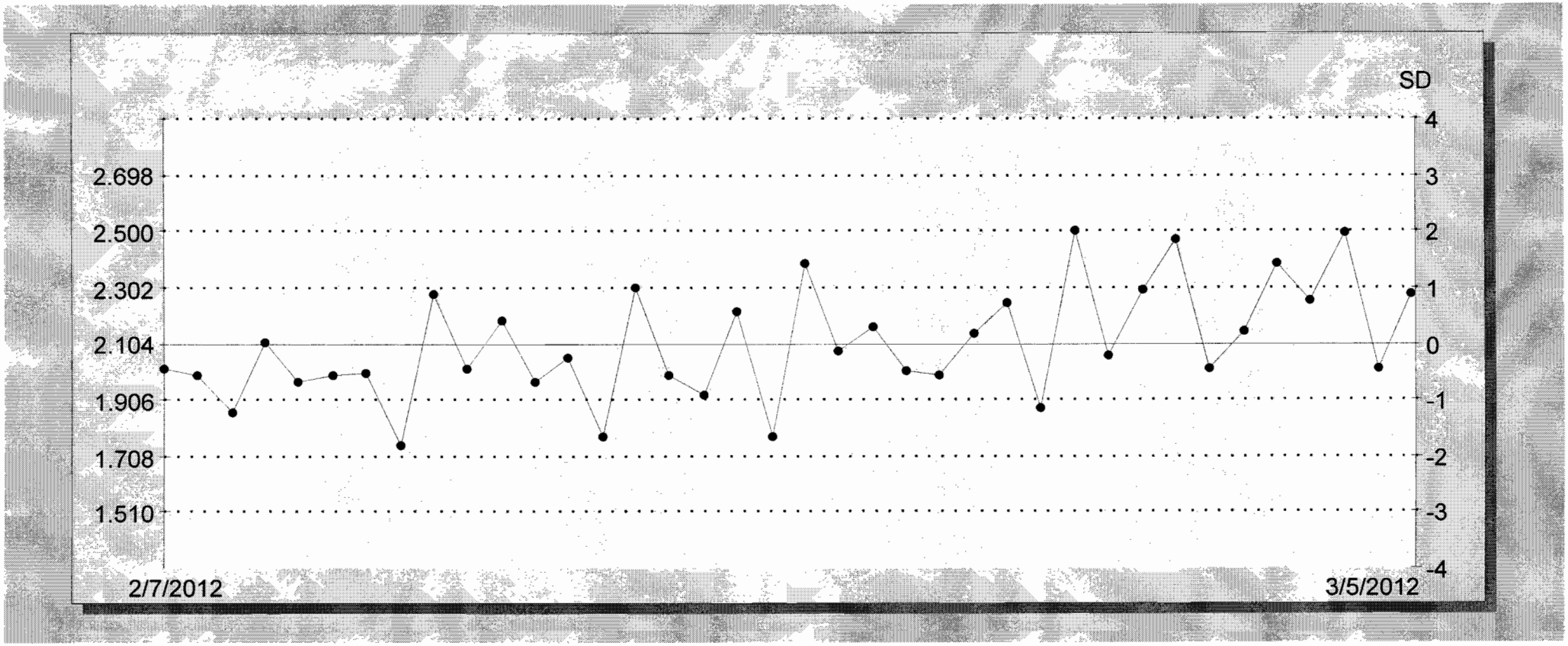
3H Efficiency
Total # pts : 5455
Valid # pts : 38
Mean : 62.86
SD : 0.15



3H Background
Total # pts : 5381
Valid # pts : 38
Mean : 2.10
SD : 0.20

Date	Value	Valid Pt
Feb 07, 2012	2.02	X
Feb 07, 2012	1.99	X
Feb 07, 2012	1.86	X
Feb 07, 2012	2.10	X
Feb 07, 2012	1.97	X
Feb 08, 2012	1.99	X
Feb 08, 2012	2.00	X
Feb 08, 2012	1.74	X
Feb 08, 2012	2.28	X
Feb 08, 2012	2.01	X
Feb 08, 2012	2.19	X
Feb 08, 2012	1.97	X
Feb 08, 2012	2.05	X
Feb 08, 2012	1.78	X
Feb 08, 2012	2.30	X
Feb 08, 2012	1.99	X
Feb 08, 2012	1.92	X
Feb 08, 2012	2.21	X
Feb 08, 2012	1.77	X
Feb 08, 2012	2.39	X
Feb 09, 2012	2.07	X
Feb 09, 2012	2.16	X
Feb 09, 2012	2.01	X
Feb 09, 2012	1.99	X
Feb 09, 2012	2.14	X
Feb 09, 2012	2.24	X
Feb 09, 2012	1.88	X
Feb 09, 2012	2.50	X
Feb 09, 2012	2.06	X
Feb 09, 2012	2.29	X
Feb 10, 2012	2.47	X
Feb 15, 2012	2.01	X
Feb 16, 2012	2.15	X
Feb 17, 2012	2.39	X
Feb 20, 2012	2.25	X
Feb 23, 2012	2.50	X
Feb 24, 2012	2.01	X
Mar 05, 2012	2.28	X

3H Background
Total # pts : 5381
Valid # pts : 38
Mean : 2.10
SD : 0.20



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American Radiation Services Analytical Reports

for

Los Alamos National Laboratory

Tritium- Screening by Low Level Liquid Scintillation Counting

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American Radiation Services Analytical Reports

for

Los Alamos National Laboratory

Tritium-Screening by Low Level Liquid Scintillation Counting

Samples

Procedures: **ARS-060** **ARS-040** *Section 14.1 Tritium Screen in Clean Water without Distillation*

ARS File ID Numbers: ARS1-12-00248; 249; 250; 251
ARS Batch ID: ARS1-B12-00312

	Sample ID:	COUNT TIME	CPMA	Background CPMA	Eff Nucl In A	Aliquot (grams)	ACTIVITY	units	MDA	Sample Must be analyzed as LSC-A-001
1	ARS1-B12-00312-04	120	1.815	1.29	26.11	10.09	89.765	pCi/L	105.039	NO
2	ARS1-B12-00312-05	120	1.437	1.29	25.99	10.02	25.427	pCi/L	106.2612	NO
3	ARS1-B12-00312-06	120	1.744	1.29	26.53	10.09	76.397	pCi/L	103.3761	NO
4	ARS1-B12-00312-07	120	1.792	1.29	26.03	10.04	86.525	pCi/L	105.8866	NO
5							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
6							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
7							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
8							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
9							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
10							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
11							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
12							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
13							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
14							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
15							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
16							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
17							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
18							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
19							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
20							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
21							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
22							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
23							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!

Procedures: **ARS-060** **ARS-040** *Section 14.1 Tritium Screen in Clean Water without Distillation*

ARS File ID Numbers: ARS1-12-00276
ARS Batch ID: ARS1-B12-00346

	Sample ID:	COUNT TIME	CPMA	Background CPMA	Eff Nucl In A	Aliquot (grams)	ACTIVITY	units	MDA	Sample Must be analyzed as LSC-A-001
1	ARS1-B12-00346-04	120	1.391	1.239	27.25	10.00	25.126	pCi/L	99.59743	NO
2	ARS1-B12-00346-04 dup	120	1.436	1.239	27.13	10.00	32.709	pCi/L	100.038	NO
3							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
4							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
5							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
6							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
7							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
8							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
9							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
10							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
11							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
12							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
13							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
14							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
15							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
16							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
17							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
18							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
19							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
20							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
21							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
22							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!
23							#DIV/0!	pCi/L	#DIV/0!	#DIV/0!

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American Radiation Services Analytical Reports

for

Los Alamos National Laboratory

Tritium-Screening by Low Level Liquid Scintillation Counting

Laboratory Records

Analysis Batch Report

Analysis Batch ID **ARS1-B12-00312**

					Method	**ARS-054**	**Analysis**	**LSC-A-021**	**Matrix**	**AQ**
					Description	**Low Level Tritium Screening**				
ABatch Sample ID	Type	Blind Iso1	Blind Iso2	Blind Iso3	SDG	FR	Run	Client ID	Isotope Group	Lab Deadline
ARS1-B12-00312-01	LCS									
ARS1-B12-00312-02	LCSD									
ARS1-B12-00312-03	MBL									
ARS1-B12-00312-04	TRG				**ARS1-12-00248**	001	1	CAWA-12-2018	STD	03/06/12
ARS1-B12-00312-05	TRG				**ARS1-12-00249**	001	1	CAAN-12-2024	STD	03/06/12
ARS1-B12-00312-06	TRG				**ARS1-12-00250**	001	1	CAWA-12-2023	STD	03/06/12
ARS1-B12-00312-07	TRG				**ARS1-12-00251**	001	1	CAMO-12-2229	STD	03/06/12

106213
12-00248-001-1
WRAD

106214
12-00249-001-1
WRAD

106215
12-00250-001-1
WRAD

106216
12-00251-001-1
WRAD

ID_31001_054	ABatch	ABatchSampleID	ClientID	Aliquot1	AliquotUnits1	IC_ID1	Aliquot2	AliquotUnits2	IC_ID2	UserID	ModDate
10996	ARS1-B12-00312	ARS1-B12-00312-01		1	g					RUSEY	02/10/2012 09:44:57
10997	ARS1-B12-00312	ARS1-B12-00312-02		1	g					RUSEY	02/10/2012 09:44:58
10998	ARS1-B12-00312	ARS1-B12-00312-03		1	g					RUSEY	02/10/2012 09:44:58
10999	ARS1-B12-00312	ARS1-B12-00312-04	CAWA-12-2018	10.09	g	106213				RUSEY	02/10/2012 09:44:58
11000	ARS1-B12-00312	ARS1-B12-00312-05	CAAN-12-2024	10.02	g	106214				RUSEY	02/10/2012 09:44:58
11001	ARS1-B12-00312	ARS1-B12-00312-06	CAWA-12-2023	10.09	g	106215				RUSEY	02/10/2012 09:44:58
11002	ARS1-B12-00312	ARS1-B12-00312-07	CAMO-12-2229	10.04	g	106216				RUSEY	02/10/2012 09:44:58

Assay Definition-

Assay Description:
LLH3 Assay in DPM Mode

Assay Type: DPM (Single)
Report Name: Report1
Output Data Path: C:\Packard\Tricarb\Results\H3 Low Level\Low Level H3\20120210_1136
Raw Results Path: C:\Packard\Tricarb\Results\H3 Low Level\Low Level H3\20120210_1136\20120210_1136.results
RTF File Name: C:\Packard\Tricarb\Results\H3 Low Level\Low Level H3\20120210_1136\LLH3.rtf
Comma-Delimited File Name: C:\Packard\Tricarb\Results\H3 Low Level\Low Level H3\20120210_1136\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: ARS LL H3 10mL
Count Time (min): 120.00
Count Mode: Low Level
Assay Count Cycles: 1 Repeat Sample Count: 1
#Vials/Sample: 1 Calculate % Reference: Off

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

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

Count Corrections-

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

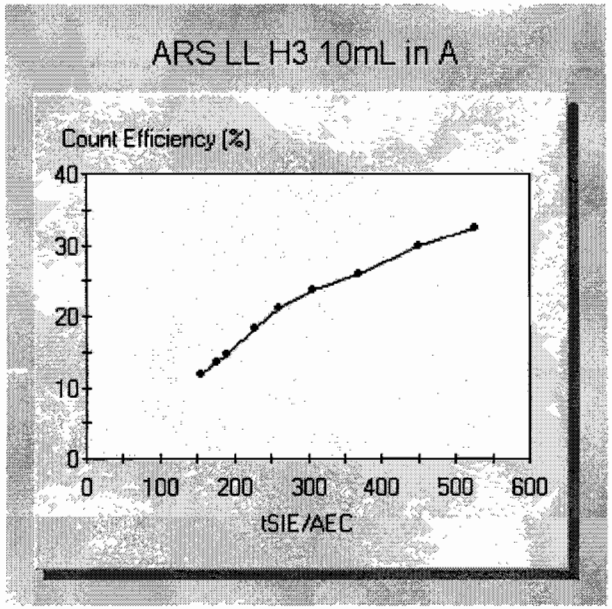
Half Life-

Half Life Correction: Off

Regions	Half Life	Units	Reference Date	Reference Time

A
B
C

Cycle 1 Results
Quench Curve Block Data



Date Acquired: 11/18/2011
Date Modified:
ARS LL H3 10mL in A

tSIE/AEC	Count Efficiency (%)
526.29	32.47
450.16	29.90
370.15	25.92
306.68	23.60
260.68	20.99
228.69	18.21
189.46	14.53
177.14	13.64
155.73	11.73

Beta Liquid Scintillation Counter Log Book

Date	Time	ARS Sample I.D. Number	Batch Number	Liquid Scintillation File Number	Technician Initials
1-31-12	1457	B12-00123-05	B12-00123	1638	
2-2-12	0902	SNC-51	QA	QA	
2-2-12	1532	Background	B12-00268	1535	
↓	↓	B12-00268-04	↓	↓	
↓	↓	B12-00268-05	↓	↓	
↓	↓	B12-00268-06	↓	↓	
↓	↓	B12-00268-07	↓	↓	
↓	↓	B12-00268-08	↓	↓	
↓	↓	B12-00268-09	↓	↓	
2-3-12	0736	SNC-51	QA	QA	
2-3-12	0737	B12-00268-09-RS	B12-00268	0911	
↓	↓	B12-00268-09	↓	↓	
2-7-12	1401	SNC 16	QA	QA	
2-10-12	1000	SNC 16	QA	QA	
2-10-12	1002	Background	B12-00312	1136	
↓	↓	B12-00312-04	↓	↓	
↓	↓	B12-00312-05	↓	↓	
↓	↓	B12-00312-06	↓	↓	
↓	↓	B12-00312-07	↓	↓	
2-10-12	1410	Background	B12-00202		

Reviewed By: _____ Date: 3-9-12
Initials

Analysis Batch Report

Analysis Batch ID **ARS1-B12-00346**

					Method	**ARS-054**	**Analysis**	**LSC-A-021**	**Matrix**	**AQ**
					Description	**Low Level Tritium Screening**				
ABatch Sample ID	Type	Blind Iso1	Blind Iso2	Blind Iso3	SDG	FR	Run	Client ID	Isotope Group	Lab Deadline
ARS1-B12-00346-01	LCS									
ARS1-B12-00346-02	LCSD									
ARS1-B12-00346-03	MBL									
ARS1-B12-00346-04	TRG				**ARS1-12-00276**	001	1	CAMO-12-2232	STD	03/13/12

106548
12-00276-001-1
WRAD

ID_31001_054	ABatch	ABatchSampleID	ClientID	Aliquot1	AliquotUnits1	IC_ID1	Aliquot2	AliquotUnits2	IC_ID2	UserID	ModDate
11009	ARS1-B12-00346	ARS1-B12-00346-01		1	g					RUSEY	02/15/2012 12:21:34
11010	ARS1-B12-00346	ARS1-B12-00346-02		1	g					RUSEY	02/15/2012 12:21:34
11011	ARS1-B12-00346	ARS1-B12-00346-03		1	g					RUSEY	02/15/2012 12:21:34
11012	ARS1-B12-00346	ARS1-B12-00346-04	CAMO-12-2232	10	g	106548				RUSEY	02/15/2012 12:21:34

Assay Definition-

Assay Description:
LLH3 Assay in DPM Mode

Assay Type: DPM (Single)
Report Name: Report1
Output Data Path: C:\Packard\Tricarb\Results\H3 Low Level\Low Level H3\20120215_1259
Raw Results Path: C:\Packard\Tricarb\Results\H3 Low Level\Low Level H3\20120215_1259\20120215_1259.results
RTF File Name: C:\Packard\Tricarb\Results\H3 Low Level\Low Level H3\20120215_1259\LLH3.rtf
Comma-Delimited File Name: C:\Packard\Tricarb\Results\H3 Low Level\Low Level H3\20120215_1259\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: ARS LL H3 10mL
Count Time (min): 120.00
Count Mode: Low Level
Assay Count Cycles: 1 Repeat Sample Count: 1
#Vials/Sample: 1 Calculate % Reference: Off

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

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

Count Corrections-

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

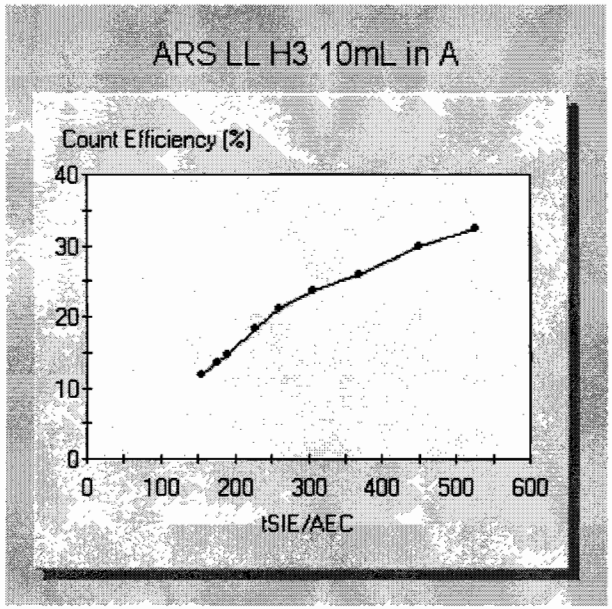
Half Life-

Half Life Correction: Off

Regions	Half Life	Units	Reference Date	Reference Time

A
B
C

Cycle 1 Results
Quench Curve Block Data



Date Acquired: 11/18/2011
Date Modified:
ARS LL H3 10mL in A

tSIE/AEC	Count Efficiency (%)
526.29	32.47
450.16	29.90
370.15	25.92
306.68	23.60
260.68	20.99
228.69	18.21
189.46	14.53
177.14	13.64
155.73	11.73

P#	S#	SMPL_ID	CPMA	DPM1	tSIE	Eff Nuc1 In A	Count Time	DATE	TIME	MESSAGES
2	1	BACKGROUND	1.239	4.43	411.74	27.99	120.00	2/15/2012	1:08:01 PM	
2	2	B12-00346-04	1.391	5.10	396.86	27.25	120.00	2/15/2012	3:18:10 PM	
2	3	B12-00346-04-RS	1.436	5.29	394.41	27.13	120.00	2/15/2012	5:28:13 PM	

Beta Liquid Scintillation Counter Log Book

Date	Time	ARS Sample I.D. Number	Batch Number	Liquid Scintillation File Number	Technician Initials
2-10-12	1410	B12-00202-01 ~~B12-00202~~ 2-10-12	B12-00202	2228	
↓	↓	B12-00202-02	↓	↓	
↓	↓	B12-00202-03	↓	↓	
↓	↓	B12-00202-04	↓	↓	
↓	↓	B12-00202-05	↓	↓	2-15-12
2-15-12	1120	SNC-16	QA	QA	
2-15-12	1228	Background	B12-00346	1259	
↓	↓	B12-00346-04	↓	↓	
↓	↓	B12-00346-04-RS	↓	↓	

2-15-12

Reviewed By: _____ Date: 3-9-12
Initials

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American Radiation Services Analytical Reports

for

Los Alamos National Laboratory

Tritium-Screening by Low Level Liquid Scintillation Counting

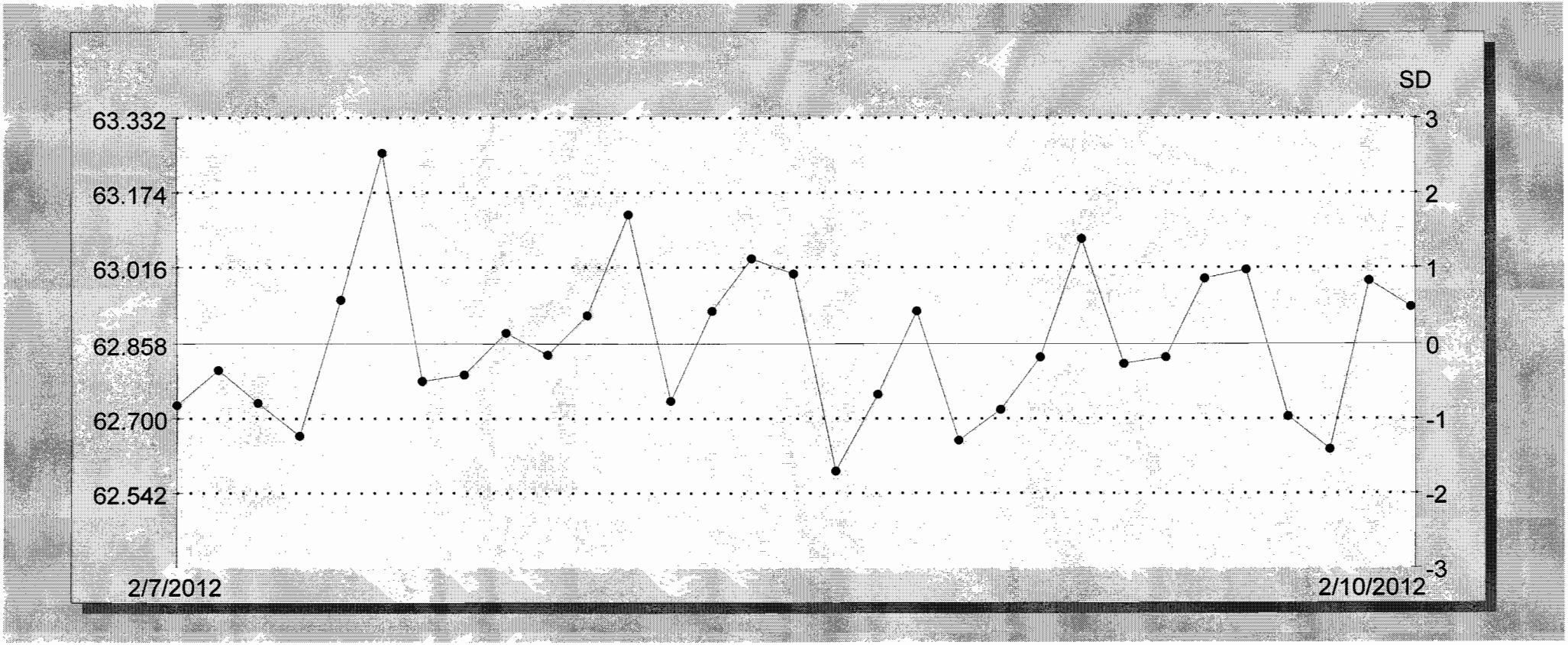
Control Charts

3H Efficiency
Total # pts : 5448
Valid # pts : 31
Mean : 62.86
SD : 0.16

Date	Value	Valid Pt
Feb 07, 2012	62.72	X
Feb 07, 2012	62.80	X
Feb 07, 2012	62.73	X
Feb 07, 2012	62.66	X
Feb 07, 2012	62.95	X
Feb 08, 2012	63.26	X
Feb 08, 2012	62.78	X
Feb 08, 2012	62.79	X
Feb 08, 2012	62.88	X
Feb 08, 2012	62.83	X
Feb 08, 2012	62.91	X
Feb 08, 2012	63.13	X
Feb 08, 2012	62.74	X
Feb 08, 2012	62.92	X
Feb 08, 2012	63.04	X
Feb 08, 2012	63.00	X
Feb 08, 2012	62.59	X
Feb 08, 2012	62.75	X
Feb 08, 2012	62.92	X
Feb 08, 2012	62.65	X
Feb 09, 2012	62.72	X
Feb 09, 2012	62.83	X
Feb 09, 2012	63.08	X
Feb 09, 2012	62.81	X
Feb 09, 2012	62.83	X
Feb 09, 2012	62.99	X
Feb 09, 2012	63.02	X
Feb 09, 2012	62.70	X
Feb 09, 2012	62.64	X
Feb 09, 2012	62.99	X
Feb 10, 2012	62.94	X

3H Efficiency

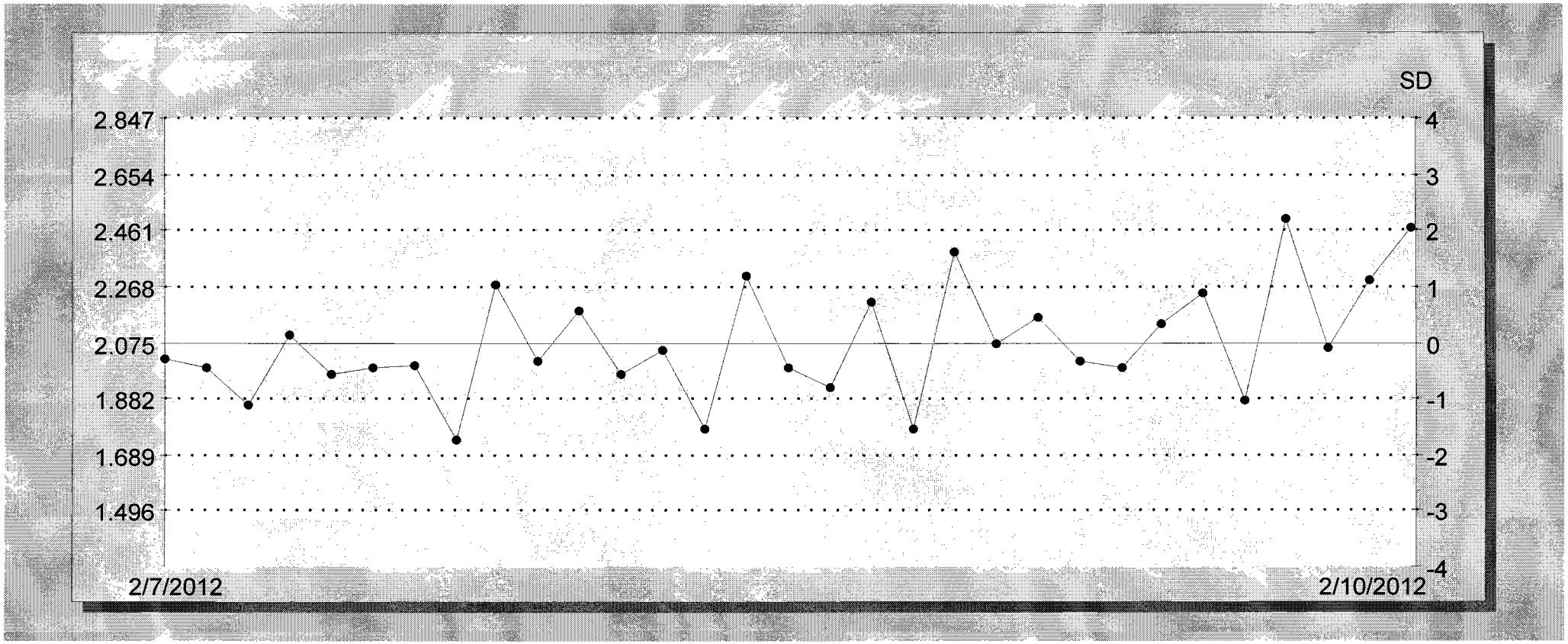
Total # pts	: 5448
Valid # pts	: 31
Mean	: 62.86
SD	: 0.16



3H Background
Total # pts : 5374
Valid # pts : 31
Mean : 2.08
SD : 0.19

Date	Value	Valid Pt
Feb 07, 2012	2.02	X
Feb 07, 2012	1.99	X
Feb 07, 2012	1.86	X
Feb 07, 2012	2.10	X
Feb 07, 2012	1.97	X
Feb 08, 2012	1.99	X
Feb 08, 2012	2.00	X
Feb 08, 2012	1.74	X
Feb 08, 2012	2.28	X
Feb 08, 2012	2.01	X
Feb 08, 2012	2.19	X
Feb 08, 2012	1.97	X
Feb 08, 2012	2.05	X
Feb 08, 2012	1.78	X
Feb 08, 2012	2.30	X
Feb 08, 2012	1.99	X
Feb 08, 2012	1.92	X
Feb 08, 2012	2.21	X
Feb 08, 2012	1.77	X
Feb 08, 2012	2.39	X
Feb 09, 2012	2.07	X
Feb 09, 2012	2.16	X
Feb 09, 2012	2.01	X
Feb 09, 2012	1.99	X
Feb 09, 2012	2.14	X
Feb 09, 2012	2.24	X
Feb 09, 2012	1.88	X
Feb 09, 2012	2.50	X
Feb 09, 2012	2.06	X
Feb 09, 2012	2.29	X
Feb 10, 2012	2.47	X

3H Background
Total # pts : 5374
Valid # pts : 31
Mean : 2.08
SD : 0.19



P#	S#	SMPL_ID	CPMA	DPM1	tSIE	Eff Nucl In A	Count Time	DATE	TIME	MESSAGES
2	1	BACKGROUND	1.290	4.93	375.48	26.19	120.00	2/10/2012	11:45:41 AM	
2	2	B12-00312-04	1.815	6.95	373.84	26.11	120.00	2/10/2012	1:55:45 PM	
2	3	B12-00312-05	1.437	5.53	371.47	25.99	120.00	2/10/2012	4:05:50 PM	
2	4	B12-00312-06	1.744	6.57	382.38	26.53	120.00	2/10/2012	6:15:57 PM	*
2	5	B12-00312-07	1.792	6.88	372.22	26.03	120.00	2/10/2012	8:25:59 PM	

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American Radiation Services Analytical Reports

for

Los Alamos National Laboratory

Low Level Liquid Scintillation Counting

Calibration Information

STD ID: S-0262

ARS INTERNATIONAL

Add/Edit *Secondary Stds*

Planning	
Planning Comments	Create an H3 LCS stock solution.
Target dpm/g (on dil. date)	5.5
Target Final volume mL	2000
Appx mass g of Parent Sol'n	3.408758506
Appx vol ml of Parent Sol'n	3.414905335
Expected Addition for Analysis g	5
Standards Preparation / Dilution	
Secondary Solution #	S-0262
Dilution Date (New Ref Date)	09/07/2011 11:47
Ampoule, Empty (g)	
Ampoule /Solution Gross (g)	
Net Wt Removed (g)	
Transfer Container, empty (g)	13.352
Container Plus Solution (g)	16.889
Net Wt Transferred (g)	3.537
DPM Xferred on 09/07/2011 11:47	11413.83291
Diluent/matrix	Dead H2O
Diluent Density Cont, empty (g)	
Test Mass of 5 ml of Diluent (g)	
Diluent Density Test - (g/mL)	
Dilution Empty Container Mass (g)	473.97
Dilution Full Cont g (if measured)	2467.33
Dilution Final Volume ml (if measured)	2000
Final Dilution Density (g/mL)	0.99668
Final Dilution Measured Mass g	1993.36
Comments	H3 LCS stock solution dilution performed as stated above by B Steffens. -BJS 9/7/11
Final Dilution dpm/g	5.725926529
Final Dil New Ref Date/Time	09/07/2011 11:47

Parent Standard Data

Parent Solution Reference #	NIST SRM 4927F			
Parent Solution #	S-0237			
Parent Principal Radionuclide	H-3	Half Life (Days)	4499.8600000	
Parent Reference Date	03/22/2010 10:10			
Parent Certified Act	3503.682716	Certi Act/Vol Units	dpm	g
Parent Cert Act Uncert 1 Sigma	0.0036			
Parent Sp. Gravity G/Ml	0.9982			
Parent Supplier	NIST SRM 4927F			
Parent Date Recvd	01/02/00			
Parent Received By	Unknown			
Parent Cert Exp Date				
Parent Matrix	H2O			
Certified dpm/g At Ref Date	3503.682716			
Certified dpm/g on 09/07/2011 11:47	3226.981313			
Parent Comments	Intermediate level H-3 standard for creating LCS solutions and matrix spikes. Dilution performed as stated above by B Steffens. -BJS 3/22/10			
Parent Tech	Unknown			
Is_Primary	FALSE			
Is_LCS	TRUE			
Is_Tracer	FALSE			
Is_Calib	FALSE			

S-0262	
H-3	Verified 9/7/11
SL	Expires 9/7/12
Manufactuer	NIST SRM 4927F
Sol Matrix	H2O
Ref No	NIST SRM 4927F
Tech	Unknown
Parent ID	S-0237

ARS INTERNATIONAL

RADIOACTIVE STANDARDS -- BATON ROUGE LABORATORY

ARS INTERNATIONAL

QUALITY CONTROL PROGRAM

AMERICAN RADIATION SERVICES
RADIOACTIVE REFERENCE SOLUTIONS

ANNUAL ACTIVITY VERIFICATION

VERIFICATION DATE: 9/13/2011 7:43 *date counted*
STANDARD REFERENCE #: S-0262

Principal Radionuclide		Half Life, Years		Half Life, Days
H-3	*ENTER -->*		*OR -->*	4.4998E+03
		1.232E+01		4.4998E+03

Radionuclide: H-3 Dilution Reference Date: 9/7/2011 11:47

Dilution Activity	2.58 pCi per gram ===> dpm/g	5.73
Verif. Date Decay Corrected	2.58 pCi per gram ===> dpm/g	5.72

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-0262-V1	16.07	1	LSC	0.3754	5.40	5.050	5.63	2.54
S-0262-V2	16.39	1	LSC	0.3770	5.40	5.037	5.79	2.61
S-0262-V3	15.70	1	LSC	0.3763	5.40	5.035	5.44	2.45
S-0262-V4	15.00	1	LSC	0.3768	5.40	5.022	5.07	2.29
S-0262-V5	15.85	1	LSC	0.3774	5.40	5.019	5.52	2.49

Average	5.49	2.47
Two Sigma Uncertainty	0.52	0.24
Standard Deviation percent of known concentration	4.66%	4.66%
Target Activity	5.72	2.58
% Diff	-4.13%	-4.13%

10% Max *PASS*

5% Max *PASS*

Verification Expiration Date: ##########

Prepared & Counted By: [signature] Date: 9/13/2011 7:43

Verified & Approved By: Dwayne Mulligan Date: 9-13-11

QC Approval: DWMulligan Date: 9-13-11

S-0262	
H-3	Verified 9/7/11
SL	Expires 9/7/12
Manufactuer	NIST SRM 4927F
Sol Matrix	H2O
Ref No	NIST SRM 4927F
Tech	Unknown
Parent ID	S-0237

ARS INTERNATIONAL
RADIOACTIVE STANDARDS -- BATON ROUGE LABORATORY

H-3 Standard Verification

Verifier's Name: Brian Steffens **Date:** 9/7/2011

Pipettor ID: FJ40469

Pipettor ID: Auto-pipettor

Pipettor ID: na

Standard ID: S-0262

Standard ID: N/A

Standards brought up to ~5g with distilled dead water.
Standards made in glass vials.

15mL of Ultima Gold added to standard

	Weight of Standard
S-0262-V1	5.050 g
S-0262-V2	5.037 g
S-0262-V3	5.035 g
S-0262-V4	5.022 g
S-0262-V5	5.019 g

Balance ID: H1331122173560P

Assay Definition-

Assay Description:
H-3 Normal Level Assay

Assay Type: DPM (Single)
Report Name: Report1
Output Data Path: C:\Packard\Tricarb\Results\ARS\H-3 Normal Lvl 3\20110912_2059
Raw Results Path: C:\Packard\Tricarb\Results\ARS\H-3 Normal Lvl 3\20110912_2059\20110912_2059.results
RTF File Name: C:\Packard\Tricarb\Results\ARS\H-3 Normal Lvl 3\20110912_2059\H-3 Results.rtf
Comma-Delimited File Name: C:\Packard\Tricarb\Results\ARS\H-3 Normal Lvl 3\20110912_2059\H-3 Results.csv
Assay File Name: C:\Packard\TriCarb\Assays\H-3 Normal Lvl 3.lsa

Count Conditions-

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

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

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

Count Corrections-

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

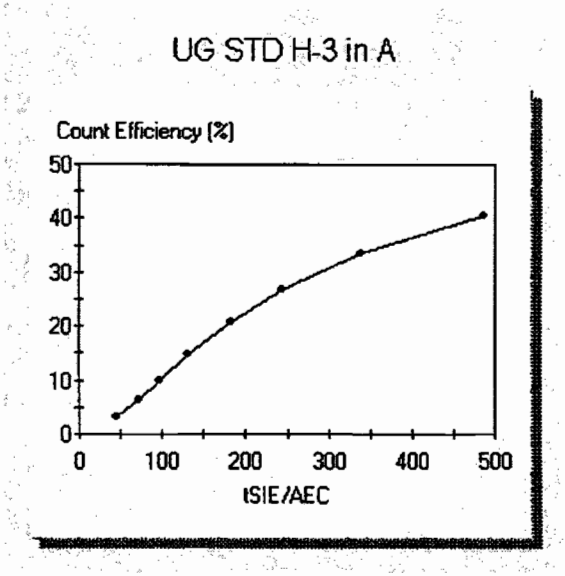
Half Life-

Half Life Correction: Off

Regions	Half Life	Units	Reference Date	Reference Time

A
B
C

Cycle 1 Results
Quench Curve Block Data



Date Acquired: 06/15/2011
Date Modified:
UG STD H-3 in A

tSIE/AEC	Count Efficiency (%)
487.53	40.41
339.12	33.51
243.83	26.83
182.60	20.93
130.85	14.63
96.86	9.97
71.30	6.34
46.31	3.09

P#	S#	SMPL_ID	CPMA	DPM1	tSIE	Eff Nucl In A	Count Time	DATE	TIME	MESSAGES
50	1	BACKGROUND	5.40	14.31	429.68	37.72	120.00	9/12/2011	9:04:58 PM	
50	2	S-0262-V1	16.07	42.82	425.91	37.54	120.00	9/12/2011	11:12:00 PM	
50	3	S-0262-V2	16.39	43.48	429.27	37.70	120.00	9/13/2011	1:19:59 AM	
50	4	S-0262-V3	15.70	41.73	427.79	37.63	120.00	9/13/2011	3:27:57 AM	
50	5	S-0262-V4	15.00	39.81	428.81	37.68	120.00	9/13/2011	5:35:55 AM	
50	6	S-0262-V5	15.85	42.00	430.24	37.74	120.00	9/13/2011	7:43:52 AM	

National Institute of Standards & Technology

Certificate

Standard Reference Material 4927F

Hydrogen-3 Radioactivity Standard

This Standard Reference Material (SRM) consists of tritiated water, having a standardized and certified quantity of radioactive hydrogen-3. It is intended primarily for the calibration of instruments that are used to measure radioactivity and for the monitoring of radiochemical procedures. The solution, whose composition is specified in Table 1, is contained in a flame-sealed, 5 mL, NIST, borosilicate-glass ampoule (see Note 1)*.

The certified **hydrogen-3** massic activity value, at a **Reference Time of 1200 EST, 3 September 1998**, is:

$$\mathbf{(634.7 \pm 4.6)\ kBq \cdot g^{-1}}$$

Additional physical, chemical, and radiological properties for the SRM, as well as details on the standardization method, are given in Table 1. Uncertainty intervals for certified quantities are expanded ($k = 2$) uncertainties calculated according to the ISO and NIST Guidelines (see Note 2). Table 2 contains a specification of the components that comprise the uncertainty analyses.

The certification of this SRM, within the measurement uncertainties specified, is valid for at least five (5) years after receipt. The solution matrix, in an unopened ampoule, is believed to be indefinitely homogeneous and stable, within its half-life-dependent, useful lifetime. NIST will monitor this material and will report any substantive changes in certification to the purchaser. Should any of the certified values change, purchasers of this SRM will be notified of the change by NIST.

This SRM may represent a radiological hazard. Hydrogen-3 decays by beta particle emission. None of the beta particles escape from the SRM vial. During the decay process no photons are emitted. The SRM should be stored and used at a temperature between 5 and 35 °C. See Note 1

This Standard Reference Material was prepared in the Physics Laboratory, Ionizing Radiation Division, Radioactivity Group, Dr. M.P Unterweger, Acting Group Leader. The overall technical direction and physical measurements leading to certification were provided by Drs. L.L. Lucas and M.P Unterweger of the Radioactivity Group. The support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program.

Lisa R. Karam, Deputy Chief
Ionizing Radiation Division

Gaithersburg, Maryland 20899
May 2008
See Certificate Revision History on Last Page

Robert L. Watters, Jr., Chief
Measurement Services Division

*Notes and references are on page 4

Table 1. Properties of SRM 4927F

Certified values

Radionuclide	**Hydrogen-3**
Reference time	**1200 EST, 3 September 1998**
Massic activity of the solution	**634.7 kBq•g^{-1}**
Relative expanded uncertainty ($k = 2$)	**0.72 %** (see Note 2)*

Uncertified information

Source description	Liquid in flame-sealed, 5 mL NIST borosilicate ampoule (see Note 1)
Solution composition	Distilled water
Solution density	(0.998 ± 0.002) g•mL^{-1} at 20 °C (see Note 3)
Solution mass	Approximately 5.0 g
Radionuclidic impurities	None detected (see Note 4)
Half-lifes used	^{3}H: (4500 ± 8) d (see Note 5)
Calibration method (and instruments)	The certified massic activity for ^{3}H was obtained by 4πβ gas counting of SRM 4927E using the NIST length-compensated internal gas proportional counters and intercomparison of SRMs 4927E/4927F using two 4πβ liquid-scintillation (LS) counting systems (see Note 6)

*Notes and references are on page 4

Table 2. Uncertainty evaluation for the massic activity for SRM 4927F

	Uncertainty component	Assessment Type †	Relative standard uncertainty contribution on massic activity of ^{3}H (%)
1	Massic count rate of SRM 4927E, corrected for background and decay; standard deviation of the mean for 23 sets of gas counting measurements (see Note 6)	A	0.18
2	LS intercomparison of SRM 4927F and SRM 4927E; standard deviation of the mean for 7 sets of LS measurements	A	0.06
3	Decay corrections for ^{3}H; (for half-life uncertainty of 0.18%)	A	0.002
4	Gram-mole determinations based on pressure, volume and temperature measurements	B	0.20
5	Livetime determinations	B	0.10
6	Extrapolation of count-rate-versus-energy to zero energy	B	0.20
7	Limit for radionuclidic impurities	B	0.05
Relative combined standard uncertainty			**0.36**
Relative expanded uncertainty ($k = 2$)			**0.72**

† = (A) denotes evaluation by statistical methods; (B) denotes evaluation by other methods.

NOTES

Note 1. Refer to http://physics.nist.gov/Divisions/Div846/srm.html for the standardized ampoule dimensions and for assistance and instructions on how to properly open an ampoule. Information on additional storage and handling requirements is also included in the website.

Note 2. The uncertainties on certified values are expanded uncertainties, $U = ku_c$. The quantity u_c is the combined standard uncertainty calculated according to the ISO and NIST Guides (see references [1] and [2]). The combined standard uncertainty is multiplied by a coverage factor of $k = 2$ and was chosen to obtain an approximate 95 % level of confidence.

Note 3. The stated uncertainty is two times the standard uncertainty. See reference [2]

Note 4. The estimated lower limit of detection for radionuclidic impurities is 300 $Bq \cdot g^{-1}$

Note 5. The stated uncertainty is the standard uncertainty. See reference [2] and [3].

Note 6. Extensive gas-counting measurements were made on the SRM 4927E solution during 1998 and 1999. The SRM 4927F solution was intercompared with the SRM 4927E using LS counting.

REFERENCES

[1] International Organization for Standardization (ISO), *Guide to the Expression of Uncertainty in Measurement*, 1993 (corrected and reprinted, 1995). Available from Global Engineering Documents, 12 Inverness Way East, Englewood, CO 80112, U.S.A. Telephone 1-800-854-7179.

[2] B. N. Taylor and C. E. Kuyatt, *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*, NIST Technical Note 1297, 1994. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20407, U.S.A.

[3] L.L Lucas and M.P. Unterweger, *Comprehensive Review and Critical Evaluation of the Half-Life of Tritium*, J. Res. Natl. Inst. Stand. Technol. **105**, 541-549 (2000)

Certificate Revision History: May 2008 (Text revised); February 2007 (Text revised and expiration date extended); October 2000 (Half-life and text revised); June 1999 (Original certificate date).

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American Radiation Services Analytical Reports

for

Los Alamos National Laboratory

Folder Duplicate

Report Compilation Checklist

ARS SDG: 12-00248 **Client Name:** LANL **Sample Matrix:** AQ

LEVEL 1 COMPONENTS	1st Reviewer	
1) Cover Page Complete and Accurate (see ARS-059)?	Yes No N/A	
2) Technical Review Checklist(s) Complete and Accurate?	Yes No N/A	
3) Case Narrative Complete and Accurate (see ARS-059)?	Yes No N/A	
4) Form 1s Present for all Samples and Tests?	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?	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	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	1st Reviewer	
17) Preparation Raw Data Present, Signed 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	

Susan Nicks — Report Generator Signature — 3-9-12 — Date

VJM — Management Review Signature — 3-9-12 — Date

ARS-059
07/03/2009

LSC
Technical Review Checklist

ARS SDG ARS1-12-00248

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:** ARS1-B12-00365 **Batch B:** N/A **Batch C:** N/A

Test Method(s): LSC-A-022 N/A N/A

A. RADIOCHEMICAL PREPARATION REVIEW

	Chemist Review			Verifier Review		
1) 100% of Manual Transcriptions Verified?	Yes	No	N/A	Yes	No	N/A
2) 100% of Manual Calculations Verified?	Yes	No	N/A	Yes	No	N/A
3) Blank Composition/Configuration Matches Calibration?	Yes	No	N/A	Yes	No	N/A
4) Deviations from procedure are documented and verified?	Yes	No	N/A	Yes	No	N/A
5) Appropriate Cocktail Selected?	Yes	No	N/A	Yes	No	N/A

6) **Sample Prep Anomaly?** ☑ **No** ☐ **Yes** (See Tech Notes) **NCR #** (If initiated): _____

3-5-12
Chemist Signature **Date**

3-5-12
Verifier Review Signature **Date**

B. ANALYSIS REVIEW

	Analyst Review			QA Officer Review		
1) Calibrations Valid and Current?	Yes	No	N/A	Yes	No	N/A
2) Backgrounds Valid and Current?	Yes	No	N/A	Yes	No	N/A
3) Source Checks Completed and Acceptable?	Yes	No	N/A	Yes	No	N/A

3-9-12
QA Officer Signature **Date**

	Analyst Review			Technicial Review		
4) Background Checks Complete and Acceptable?	Yes	No	N/A	Yes	No	N/A
5) 100% of Manually Entered Parameters Verified Accurate?	Yes	No	N/A	Yes	No	N/A
6) Appropriate QC samples initiated at required frequency?	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?	Yes	No	N/A	Yes	No	N/A
b) Spectra show no Evidence of Interferences?	Yes	No	N/A	Yes	No	N/A
c) Sample Quench for All Samples within Range of Quench Curve?	Yes	No	N/A	Yes	No	N/A

7) **Analysis Anomaly?** ☑ **No** ☐ **Yes** (See Comments) **NCR #** (If initiated): _____

3-7-12
Analyst Signature **Date**

3-7-12
Technicial Reviewer Signature **Date**

ARS INTERNATIONAL

Batch A: ARS1-B12-00365

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? ☑ No ☐ Yes (See Tech Notes) NCR # (If initiated): _____

Project Manager Signature	Date	QA Officer Signature	Date
[signature]	3-9-12	VM	3-9-12

GENERAL COMMENTS

LSC
Technical Review Checklist

ARS SDG ARS1-12-00248

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:** ARS1-B12-00312 **Batch B:** N/A **Batch C:** N/A

Test Method(s): LSC-A-021 N/A N/A

A. RADIOCHEMICAL PREPARATION REVIEW

	Chemist Review	Verifier Review
1) 100% of Manual Transcriptions Verified?	Yes No N/A	Yes No N/A
2) 100% of Manual Calculations Verified?	Yes No N/A	Yes No N/A
3) Blank Composition/Configuration Matches Calibration?	Yes No N/A	Yes No N/A
4) Deviations from procedure are documented and verified?	Yes No N/A	Yes No N/A
5) Appropriate Cocktail Selected?	Yes No N/A	Yes No N/A

6) **Sample Prep Anomaly?** ☑ **No** ☐ **Yes** (See Tech Notes) **NCR #** (If initiated): _____

Chemist Signature 2-10-12 Date

Verifier Review Signature 2-10-12 Date

B. ANALYSIS REVIEW

	Analyst Review	QA Officer Review
1) Calibrations Valid and Current?	Yes No N/A	Yes No N/A
2) Backgrounds Valid and Current?	Yes No N/A	Yes No N/A
3) Source Checks Completed and Acceptable?	Yes No N/A	Yes No N/A

QA Officer Signature 3-9-12 Date

	Analyst Review	Technicial Review
4) Background Checks Complete and Acceptable?	Yes No N/A	Yes No N/A
5) 100% of Manually Entered Parameters Verified Accurate?	Yes No N/A	Yes No N/A
6) Appropriate QC samples initiated at required frequency?	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?	Yes No N/A	Yes No N/A
b) Spectra show no Evidence of Interferences?	Yes No N/A	Yes No N/A
c) Sample Quench for All Samples within Range of Quench Curve?	Yes No N/A	Yes No N/A

7) **Analysis Anomaly?** ☑ **No** ☐ **Yes** (See Comments) **NCR #** (If initiated): _____

Analyst Signature 2-13-12 Date

N/A

Technicial Reviewer Signature Date

ARS INTERNATIONAL

Batch A: ARS1-B12-00312

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? ☑ No ☐ Yes (See Tech Notes) NCR # (If initiated): _____		

Susan Heise 3-9-12
Project Manager Signature Date

VPM 3-9-12
QA Officer Signature Date

GENERAL COMMENTS

DQO Report for SDG

ARS1-12-00248

Analysis Code	Group	Isotope	Activity Units	Aliquot Units	ProcedureNo	RDL	LCS_LL	LCS_UL	MS_LL	MS_UL	RadY_LL	RadY_UL	GravY_LL	GravY_UL	RER	RPD	DiltionReq	RoughPrepReq	BlankCorrectionMDA	BlankCorrectionAll	CountTimeReq	AliquotRequired
LSC-A-021	STD	H-3	pCi	L	ARS-054	0.00E+00	75	125	60	140	30	110	40	110	1.00	25	FALSE	FALSE	FALSE	FALSE		
LSC-A-022	STD	Enriched H-3	pCi	L	ARS-040	0.00E+00	75	125	60	140	30	110	40	110	1.00	25	FALSE	FALSE	FALSE	FALSE		

SDG Report - Samples and Containers

SDG Specific Data

SDG	ARS1-12-00248	TAT Days	30	Project Type	Environmental
Sample Count	1 Rpt Level 4	Date Received	2/9/2012	COC Number	12-721
Client	Los Alamos National Laboratory	Client Deadline	3/4/2012	PO Number	63641-001-10
Client Code	114	Internal Deadline	3/8/2012	Job Number	MR1A015AGWH0
Profile Number	PN-00094	Lab Deadline	3/6/2012	Job Location	
Comments					

Samples and Containers (→) Checked In Thus Far

FR	ClientID	Matrix	SampleStartDate	SampleEndDate	Disp	Hold	Arch	Storage	X	Units	Y	Units	Z	Units	Comments
001	CAWA-12-2018	AQ	02/03/12 12:00 PM	02/03/12 12:00 PM	H	90	5	LL3H							
→	IC_ID	Cnt	Volume_mL	Wt_g	pH_Orig	pH_Final	CPM	uR_Hr	Storage	VOA	Head Sp	AF Units	AF Rate	AF Mins	AF Total Vol
	106183	1	1000.00				80	24		N	N/A				

SDG Report - Analysis Assignments

Temp SDG	**ARS1-12-00248**	**Sample Count**	**1**
Client	**Los Alamos National Laboratory**	**Analysis Count**	**2-2**

Samples Count Totals per Analysis

Analysis Code	Analysis Description	Samples Count
LSC-A-021	Low Level Tritium Screen in (Aqueous)	1
LSC-A-022	Low Level Tritium by Enrichment Process in (Aqueous [AQ])	1

Analyses Assigned Per Fraction

Fraction	Analysis Code	X = Assigned
001	LSC-A-021	X
001	LSC-A-022	X

ARS FILE TRACKING SHEET

SDG: ARS1-12-00248

Task	Date / Time	Initials
Date & Time Samples Received	02-09-12/11:00	CWB
ICOC Initiated / Storage Location: LL3H	02-09-12/16:18	CWB
Technical Checks Performed	See Batch	———
Report Written / EDD Generated: 3-9-12/944 / SCL (Date/Time / Initials)	3-9-12/939	SCL
Quality Assurance Checks Performed on Report	3-9-12 1327	YM
Management Check Performed on Report		
Preliminary Report Sent		
Report E-mailed		
Report Faxed		
Report Reviewed		
Report Mailed		
Invoice Completed Invoice #:_____		
Report Imaged		

SPECIAL REQUIREMENTS

Requirement	Yes	No
3 Hour Rush		✓
24 Hour Rush		✓
48 Hour Rush		✓
Special Invoicing *see notes* Mgmt. Approval:_____		✓

NOTES:

ARS-062
04/23/2010

COMPANY NAME: LANL

SDG: ARSH2-00248

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 PRESENT WITH SAMPLES

COC	☑ Yes	☐ No

SAMPLE CONTAINER(S)

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

Samples Rcv: 1

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

External and Internal Surveys

Exposure Rate Meter: M3 242801 Serial No.: 44-2 PR2602/2206 Calibration Due Date: 4-2012

Count Rate Meter: M2 154859 Serial No.: 44-9 PR154559 Calibration Due Date: 4/2012

Background Exposure Rate (µR/hr): 30

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): 40 cpm

Max. Removable Count Rate on Shipping Containers Internals (Plus Bkgd): 40 cpm

Sample Label/Comments/Notes	pH Orig	pH Final	Mark if Preserve	Acid Lot #	Weight(g) / Volume(mL)	Acceptance Limits <500 µR/hr µR/hr	Acceptance Limits <100 cpm/cm² cpm
	pH ≤ 2 is Acceptable						
CANA-12-2018	—	CWB	2-8-12 CWB 2-9-12		1000 mL	24	80

Surveyors' Name: [signature]

Date/Time Surveyed: 2-8-12 / 12:29 CWB 2-9-12