

Friday, February 03, 2012

REQUEST NUMBER: 12-714

**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:12-714  
Per Agreement Number:63641-001-10  
Project Cost Code: MR1A015AGWJ0

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
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Generic:Low\_Level\_Tritium 1

CAAN-12-2024

WG

2/2/2012

Final Page of REQUEST NUMBER 12-714

**SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY**

EVENT ID: 3734

EVENT NAME: Ancho, MDA AB Mon. Group Sampling Q2, January 2012, 2011  
Interim Plan rev. 1

SAMPLE ID: CAAN-12-2024

WORK ORDER:

AS PLANNED		AS COLLECTED		AS PLANNED		AS COLLECTED	
DATE COLLECTED(MM/DD/YYYY):		02/02/2012		MEDIA:		WGR	
TIME COLLECTED (HH:MM)		1035		SUB-MEDIA:		UA	
PRS ID: Ancho		OK		SAMPLE TECH CODE:		6SP	
LOCATION ID: R-29				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		WSP-8260B-VOA	40 ML SEPTUM AMBER GLASS	Hydrochloric Acid (HCL)	Y	NA
2	us 1/3/12	WSP-8270C-SVOA	1 LITER AMBER GLASS	Ice		
2		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)	NA 1/30/12	

SAMPLE DESC:

NA

SAMPLE COMMENTS:

Samples taken within 50 feet of a running diesel generator

LOCATION DESC:

NA

FIELD SCREENING/MEASUREMENT RESULTS:

Time (MST)	pH (SV)	Temp (°C)	SC (µS/cm)	DO (mg/L)	Turb (NTU)	ORP (mV)	Q (gpm)
1035	8.13	18.15	133	7.22	8.94	36.2	6.8

COLLECTED BY (PRINT) W Shaw

REVIEWED BY (PRINT) J Woody

RELINQUISHED BY

Date/Time

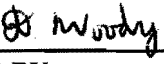
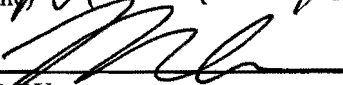
RECEIVED BY

Date/Time

**SAMPLE COLLECTION LOG/FIELD CHAIN OF CUSTODY**

EVENT ID: 3734

EVENT NAME: Ancho, MDA AB Mon. Group Sampling Q2, January 2012, 2011

(Printed Name) D Woody	02/02/12	(Printed Name) M. Martinez	02/02/12
(Signature) 	1200	(Signature) 	1200
<b>RELINQUISHED BY</b>	<b>Date/Time</b>	<b>RECEIVED BY</b>	<b>Date/Time</b>
(Printed Name)		(Printed Name)	
(Signature)		(Signature)	

3734

CAAN-12-2024

Friday, February 03, 2012

LAB CHAIN OF CUSTODY DOCUMENT NUMBER: 12-714C

LOS ALAMOS

REQUEST NUMBER: 12-714

NATIONAL LABORATORY

ATTN: Danny Coleman

TURNAROUND/REPORT DUE: 3/4/2012

American Radiation Services - Primary

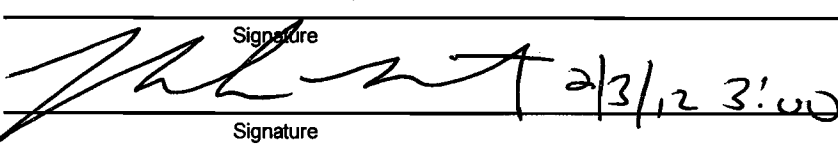
TURNAROUND REQ'D: 30

1726 Wooddale Court

Baton Rouge, LA 70806

LAB REQUEST COMMENTS:

SAMPLE ID	CTNR	CTNR DESC	ORDER	PRESERV	MATRIX
CAAN-12-2024	1	POLY	WSP-LL-H-3	None	WG

Relinquished By:	Date	Time	Received By:	Date	Time
					
Signature			Signature		
Signature			Signature		
Signature			Signature		

Received for DISPOSAL By:	Date	Time	Remarks:
Signature			



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: 12-714**



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# **American Radiation Services Analytical Reports**

**for**

**Los Alamos National Laboratory  
Request: 12-714**

# **Original COC**

Friday, February 03, 2012

REQUEST NUMBER: 12-714

**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: 12-714  
Per Agreement Number: 63641-001-10  
Project Cost Code: MR1A015AGWJ0

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

CAAN-12-2024

WG

2/2/2012

**Final Page of REQUEST NUMBER 12-714**

Friday, February 03, 2012

LAB CHAIN OF CUSTODY DOCUMENT NUMBER: 12-714C

LOS ALAMOS

REQUEST NUMBER: 12-714

NATIONAL LABORATORY

ATTN: Danny Coleman

TURNAROUND/REPORT DUE: 3/4/2012

American Radiation Services - Primary

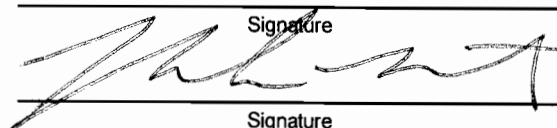
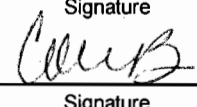
TURNAROUND REQ'D: 30

1726 Wooddale Court

Baton Rouge, LA 70806


LAB REQUEST COMMENTS:

SAMPLE ID	CTNR	CTNR DESC	ORDER	PRESERV	MATRIX
CAAN-12-2024	1	POLY	WSP-LL-H-3	None	WG

Relinquished By:	Date	Time	Received By:	Date	Time
 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: 12-714**

# **Case Narrative**



2609 North River Road • Port Allen, Louisiana 70767

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March 9, 2012

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

Request Number: **12-714**  
LANL Sample ID: **CAAN-12-2024**

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](mailto:LANL@amrad.com).

Sincerely,

A handwritten signature in black ink, appearing to read 'Eugene Mullen', is written over the printed name.

Laboratory Management  
**ARS International**



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## 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)
12-714	CAAN-12-2024	ARS1-12-00249-001

### ANALYTICAL METHODS

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

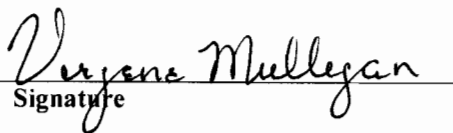
### ANALYTICAL RESULTS

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."*

  
Signature

Laboratory Management, ARS International  
Title

3-9-12  
Date



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# **American Radiation Services Analytical Reports**

**for**

**Los Alamos National Laboratory**

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



2609 North River Road, Port Allen, Louisiana 70767

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

ARS Sample Delivery Group: ARS1-12-00249

Client Sample ID: CAAN-12-2024

Sample Collection Date: 02/02/12

Sample Matrix: Aqueous

Request or PO Number: 12-714


ARS Sample ID: ARS1-12-00249-001

Date Received: 02/09/12

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	1.060	0.610	1.920	0.930	U	pCi/L	ARS-040	03/06/12 14:51	RU	NA

NOTES: Project Cost Code MR1A015AGWJ0

  
Project Manager Review

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

LELAP Certificate# 01949



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## QC Results Report

Sample Delivery Group: ARS1-12-00249

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 Acceptance Range
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 Acceptance Range
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

*Susan Heese*

Project Manager Review

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

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

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

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

Procedures  
ARS-040 - ARS-060  
ARS-112-00248; 249; 250; 251; 276  
ARS-112-00365

Sample ID	Initial Mass sample (g)	Final mass electrolyzed sample (g)	Mass equivalent NaOH (g)	Final mass electrolyzed sample (g)	Volume factor	Enrichment Factor	Average Sample CPM	Bkg CPM	QIP	Detector Eff (decimal)	Enter aliq. in final Rep. Units	Activity reference date	Start Date of Count	Total Sample Count Duration (min)	Total Bkg Count Duration (min)	Decay Correction to To	Sample Activity Conc.	Standard Counting Uncertainty	Counting Uncertainty	Combined Standard Uncertainty	Minimum Detectable Conc.	Decision Level Conc.	Reporting Units
	$V_i$	$m_i$	$V_f$	$m_f$	$V_f$	$X$	$Y$	$R_s$	$R_b$	$\pm SIE$	Aliquot	$T_o$	$T_c$	$t_{cnt}$ (min)	$t_{bkg}$ (min)	DF	$AC_i$	CU	$\pm s$ CU	$\pm s$ CSU	MDC	DLC	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	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	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	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	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	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	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	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	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  
Summerville

Reviewed 3-8-12  
VGM



## ARS Tritium Enrichment Calculations

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

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

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

Sample ID	Initial Mass sample (g)	Mass Na2O2 added (g)	Final mass electrolyzed sample w/ NaOH (g)	Mass equivalent NaOH (g)	Final Mass Electrolyzed sample (g pure H2O)	Enrichment			Average Sample			Detector		Enter		Total Bkg			Standard Counting Uncertainty	Combined Standard Uncertainty	Minimum Detectable Conc.	Decision Level Conc.	Reporting Units			
						Volume factor	X	Y	R <sub>s</sub>	R <sub>b</sub>	tSE	Eff	Aliquot	Rep. Units	Activity reference date	Start Date of Count	Duration (min)	Count (min)						Decay Correction to To	Sample Activity Conc.	CU
ARIS1-B12-00365-01	540.93	2.04	2.093	17.33	2.774	0.2982	28.79	27.74	4.236	1.127	399.89	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
ARIS1-B12-00365-02	544.94	2.09	2.144	16.91	28.79	0.0271	28.79	28.79	4.614	1.127	387.53	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
ARIS1-B12-00365-03	533.60	2.04	2.093	17.31	0.0285	0.0285	27.41	2.622	1.127	387.18	0.2677	0.01008	L	3/5/2012	3/6/2012	240	240	0.998933	0.82	0.61	1.19	1.22	2.01	0.97	pCi/L	
ARIS1-B12-00365-04	544.62	2.08	2.134	16.59	0.0285	0.0285	29.37	2.269	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	
ARIS1-B12-00365-05	537.13	2.07	2.124	16.21	0.0282	0.0282	29.71	2.130	1.127	375.15	0.2617	0.01002	L	2/2/2012	3/6/2012	240	240	0.984917	1.06	0.59	1.15	1.19	1.92	0.93	pCi/L	
ARIS1-B12-00365-06	545.66	2.02	2.073	17.13	0.0276	0.0276	28.29	2.244	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	
ARIS1-B12-00365-07	547.28	2.09	2.144	16.17	0.0256	0.0256	30.38	2.6713	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	
ARIS1-B12-00365-08	541.32	2.09	2.144	16.41	0.0264	0.0264	29.57	2.471	1.127	383.99	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 SDR  
3-7-12

Reviewed 3-8-12  
JFM

# 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

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

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

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

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

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

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

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

## Blank Information

	Act	CSU(2s)	MDA	Act>MDA	
AM-241					
U-234					*MDA should be below RDL
U-235					*Blank activity must be below MDA
U-238					*Blank activity must be < 1.65*CSU (DOE only)
Pu-238					
Pu-239/240					ACT = 0.82
Th-228					CSU = 1.22
Th-230					Is ACT<1.65*CSU? YES
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					

LANL

ARS Batch Number:

ARS1-B12 - 00365

Enter these values for LCS

Current ACT	5.5693
NetWt	5.0296
Aliquot	0.5409

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

Enter these values for LCSD

Current ACT	5.5693
NetWt	5.0085
Aliquot	0.5449

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

Expected Value Calculations

LANL  
ARS Batch Number: ARS1-B11 - 00365

LCS	CALCULATED	=	23.326	
	EXPECTED VALUE			
		Range	18.661	- 27.991
LCSD	CALCULATED	=	23.057	
	EXPECTED VALUE			
		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						
	Type	Blind Iso1	Blind Iso2	Blind Iso3	SDG	FR	Run	Client ID	Isotope Group	Lab Deadline	
ABatch Sample ID											
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	SidID	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	Sid ID	Isotope	PSCLT	Verification Date	Exp Date	Status	Ref Date	Ref ACT (dpm)	ACT at Date Above (dpm/g)	Half-life (days)	Parent ID	Expend Date	Comments
	S-0262	FE-55	SL	09/07/11	09/07/12	OK	09/07/11	57759E+00	5.5693	500E+03	S-0262		

LANL

ARS Batch Number:

ARS1-B12 - 00365

Enter  
these  
Values  
for  
LCS

Current ACT  
NetWt  
Aliquot

5.5693  
5.0296  
0.5409

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

Enter  
these  
Values  
for  
LCSD

Current ACT  
NetWt  
Aliquot

5.5693  
5.0085  
0.5449

Report Name	Field Name on the Report
Standards Report	ACT at Date Above (dpm/g)
LCS Report	NetWt
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  
#Vials/Sample: 1

Repeat Sample Count: 1  
Calculate % Reference: Off

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

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

Count Corrections-

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

Half Life-

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

A

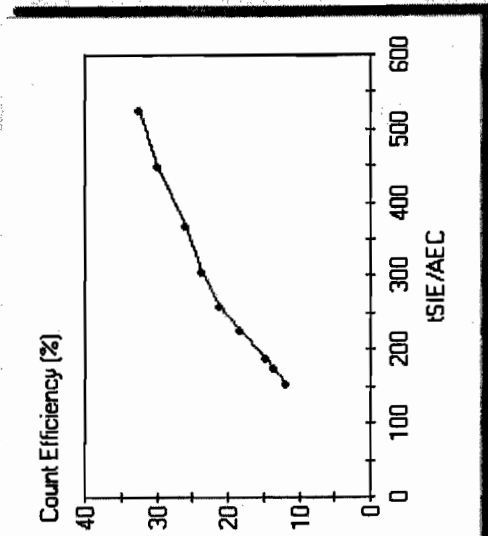
B

C

Cycle 1 Results

Quench Curve Block Data

ARS LL H3 10mL in A



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	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_WtNa202	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

*[Signature]* 3-5-12

S04_1_ElectroID	S04_2_StartAmp	S04_3_StartBathC	S05_1_ElectroIED	S05_2_EndBathC	S05_3_EndCellWt	C_GrossSmpIRec	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

*Raymond* 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

*Page 3-5-12*

# Beta Liquid Scintillation Counter Log Book

Date	Time	ARS Sample ID Number	Batch Number	Liquid Scintillation File Number	Technician Initials
2-20-12	1514	B12-00269-03	B12-00269	1648	RJU
↓	↓	B12-00269-04	↓	↓	RJU
↓	↓	B12-00269-10	↓	↓	RJU
↓	↓	B12-00269-11	↓	↓	RJU
2-21-12	↓	B12-00269-12	↓	↓	RJU
2-23-12	0804	SNC-16	QA	QA	RJU
2-23-12	0938	B12-00269-04	B12-00269	0947	RJU
↓	↓	B12-00269-12	↓	0947	RJU
<del>2-23-12</del>	<del>1415</del>	<del>B12-00269-04</del>	<del>B12-00269</del>		RJU
↓	↓	B12-00269-12	↓	12-24-12	RJU
<del>2-24-12</del>	0801	SNC-16	QA	QA	RJU
2-24-12	0802	B12-00269-04	B12-00269	0938	RJU
↓	↓	B12-00269-12	↓		RJU
3-5-12	1610	SNC-16	QA	QA	RJU
3-5-12	1613	Background	B12-00365	1746	RJU
↓	↓	B12-00365-01	↓	↓	RJU
↓	↓	B12-00365-02	↓	↓	RJU
↓	↓	B12-00365-03	↓	↓	RJU
↓	↓	B12-00365-04	↓	↓	RJU
↓	↓	B12-00365-05	↓	↓	RJU

**an**

**an**





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# **American Radiation Services Analytical Reports**

**for**

**Los Alamos National Laboratory**

**Low Level Tritium**

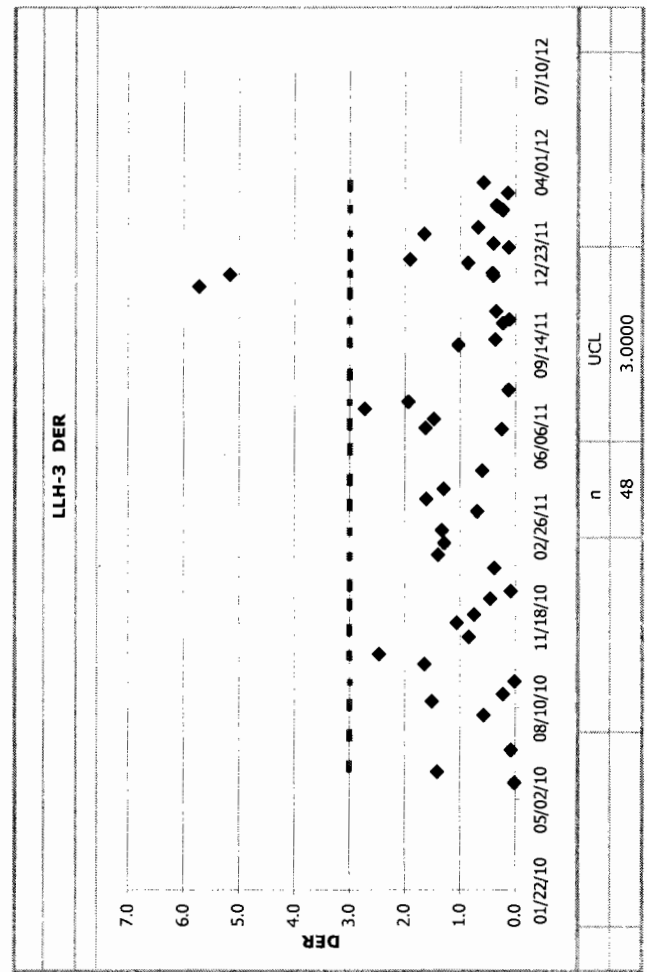
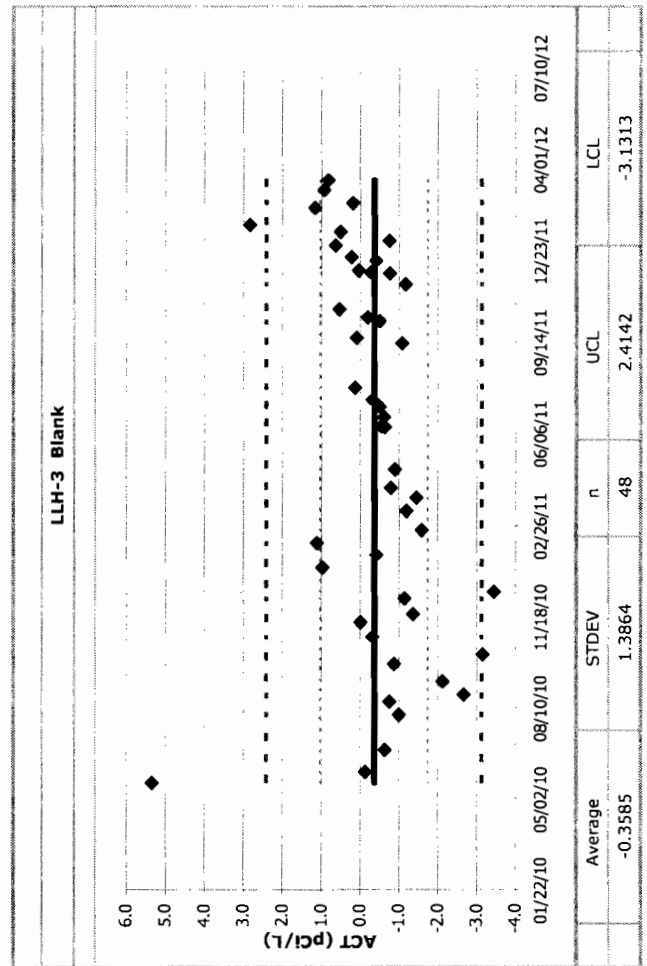
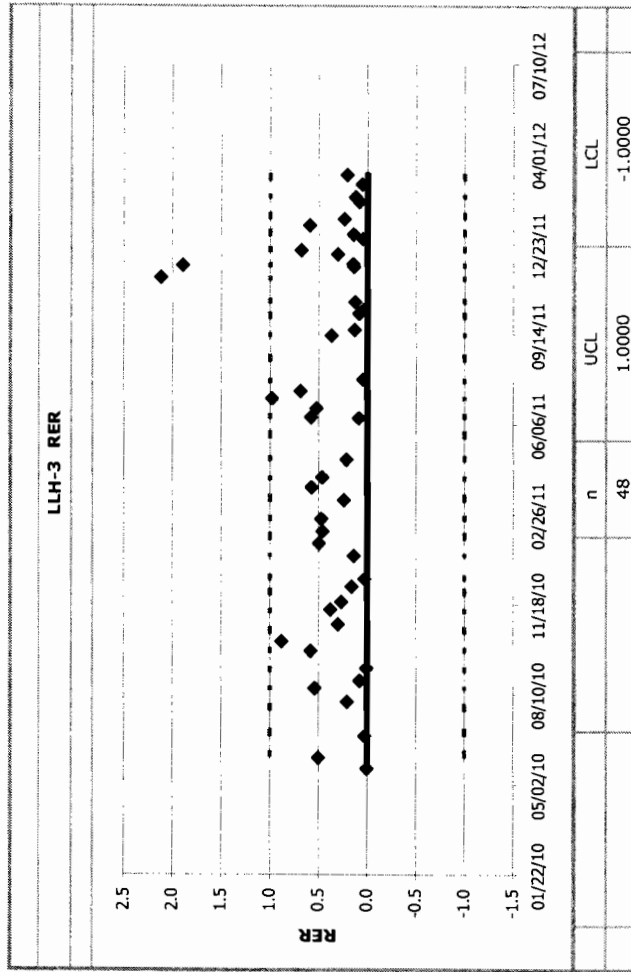
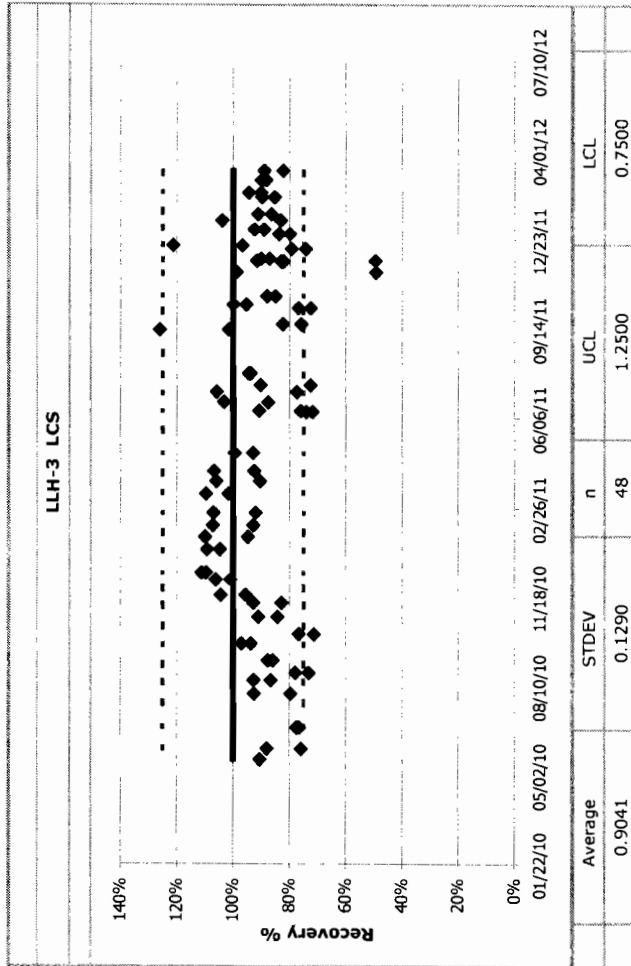
**by**

**Low Level Liquid**

**Scintillation Counting**

# **Control Charts**

# QC Chart

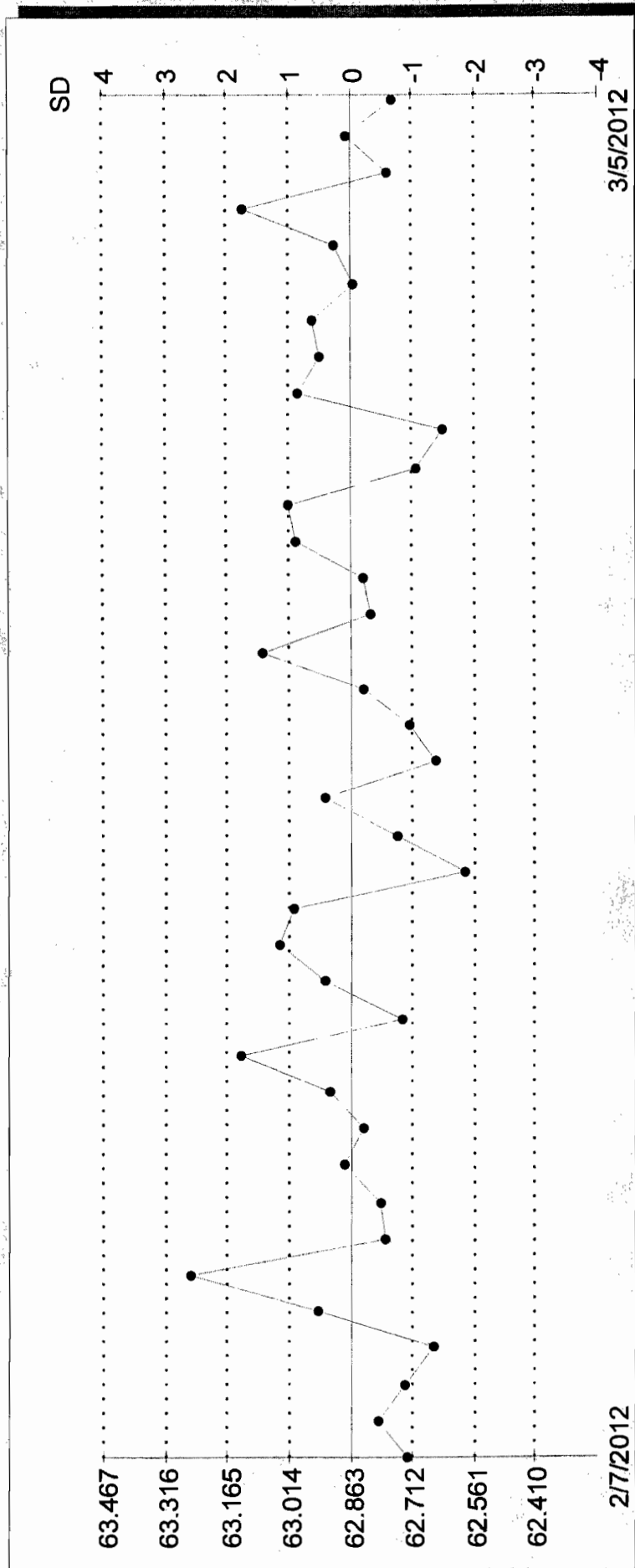


## 3H Efficiency

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

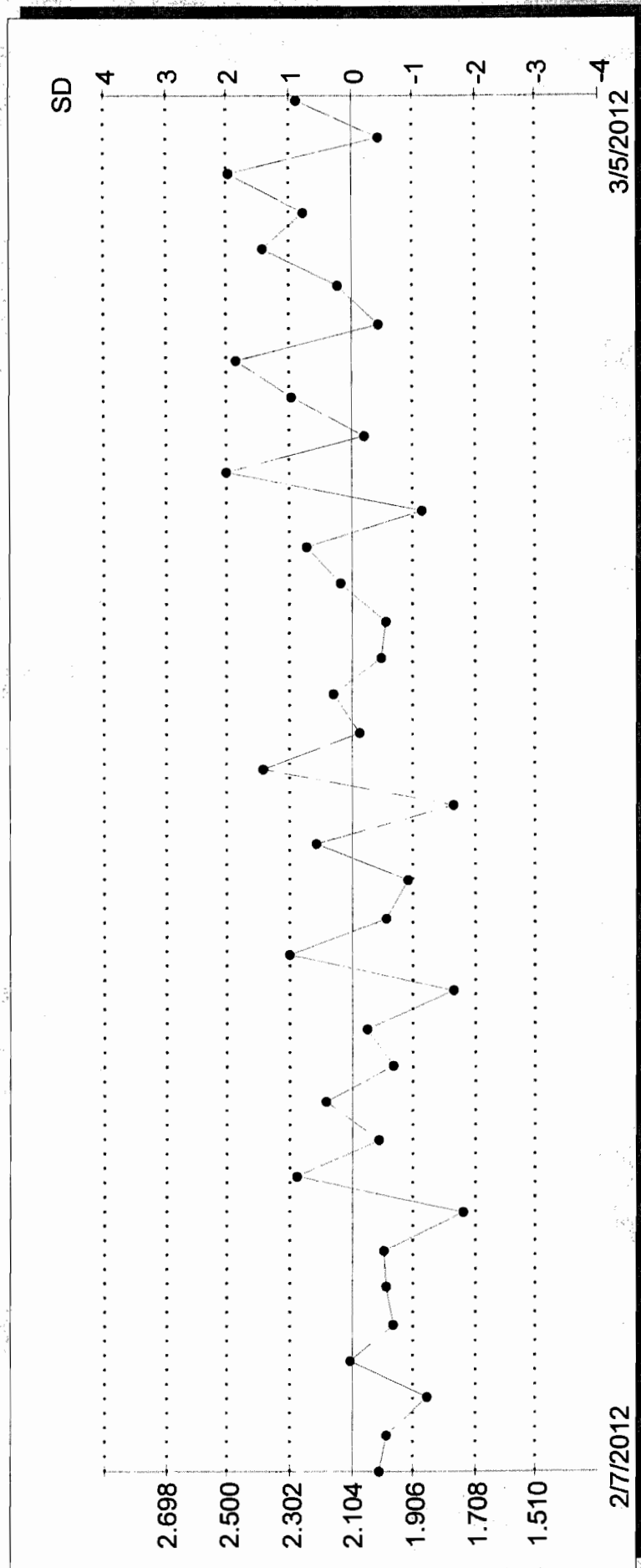


3H Background

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**



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!

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 <b>ARS1-B12-00312</b>										
ABatch Sample ID	Method				ARS-054		Analysis		LSC-A-021	
	Description				Low Level Tritium Screening		FR		Run	
Type	Blind Iso1	Blind Iso2	Blind Iso3	SDG	Run	Client ID	Isotope Group	Lab Deadline	Matrix	
ARS1-B12-00312-01										
ARS1-B12-00312-02										
ARS1-B12-00312-03										
ARS1-B12-00312-04										
ARS1-B12-00312-05										
ARS1-B12-00312-06										
ARS1-B12-00312-07										

  
**106216**  
12-00251-001-1  
**WRAD**

  
**106215**  
12-00250-001-1  
**WRAD**

  
**106214**  
12-00249-001-1  
**WRAD**

  
**106213**  
12-00248-001-1  
**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

#Vials/Sample: 1

Repeat Sample Count: 1

Calculate % Reference: Off

Background Subtract: Off

Low CPM Threshold: Off

2 Sigma % Terminator: On - Any Region

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

Count Corrections-

Static Controller: On

Colored Samples: Off

Coincidence Time (nsec): 18

Luminescence Correction: Off

Heterogeneity Monitor: Off

Delay Before Burst (nsec): 75

Half Life-

Half Life Correction: Off

Regions Half Life

Units Reference Date Reference Time

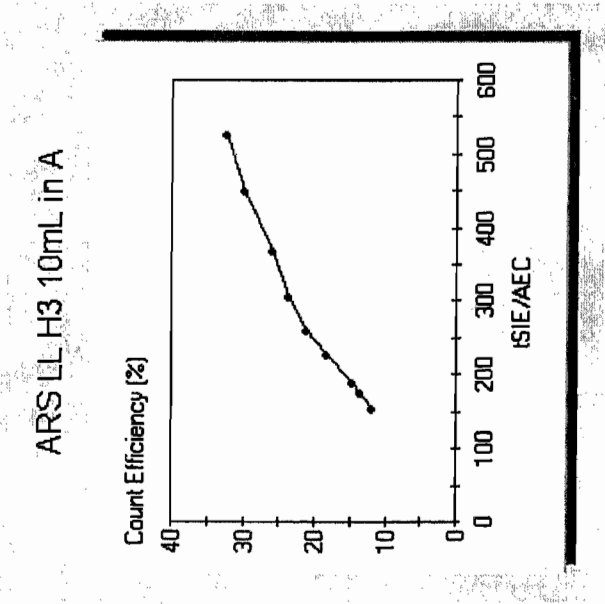
A

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 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	



# Beta Liquid Scintillation Counter Log Book

Date	Time	ARS Sample ID Number	Batch Number	Liquid Scintillation File Number	Technician Initials
1-31-12	1451	B12-00123-05	B12-00123	1638	RJH
2-2-12	0902	SNC-51	QA	QA	RJH
2-2-12	1532	Background	B12-00268	1535	RJH
↓	↓	B12-00268-04	↓	↓	RJH
↓	↓	B12-00268-05	↓	↓	RJH
↓	↓	B12-00268-06	↓	↓	RJH
↓	↓	B12-00268-07	↓	↓	RJH
↓	↓	B12-00268-08	↓	↓	RJH
↓	↓	B12-00268-09	↓	↓	RJH
2-3-12	0736	SNC-51	QA	QA	RJH
2-3-12	0737	B12-00268-09-15	B12-00268	0911	RJH
↓	↓	B12-00268-09	↓	↓	RJH
2-7-12	1401	SNC 116	QA	QA	RJH
2-10-12	1000	SNC 16	QA	QA	RJH
2-10-12	1002	Background	B12-00312	1136	RJH
↓	↓	B12-00312-04	↓	↓	RJH
↓	↓	B12-00312-05	↓	↓	RJH
↓	↓	B12-00312-06	↓	↓	RJH
↓	↓	B12-00312-07	↓	↓	RJH
2-10-12	1410	Background	B12-00202		RJH

## Analysis Batch Report

  
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

#Vials/Sample: 1

Repeat Sample Count: 1

Calculate % Reference: Off

Background Subtract: Off

Low CPM Threshold: Off

2 Sigma % Terminator: On - Any Region

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

Count Corrections-

Static Controller: On

Colored Samples: Off

Coincidence Time (nsec): 18

Luminescence Correction: Off

Heterogeneity Monitor: Off

Delay Before Burst (nsec): 75

Half Life-

Half Life Correction: Off

Regions Half Life

Units

Reference Date

Reference Time

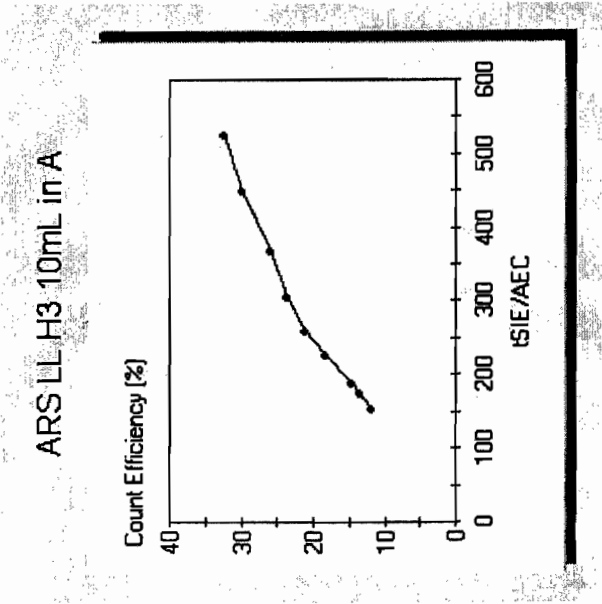
A

B

C

Cycle 1 Results

Quench Curve Block Data



Date Acquired: 11/18/2011

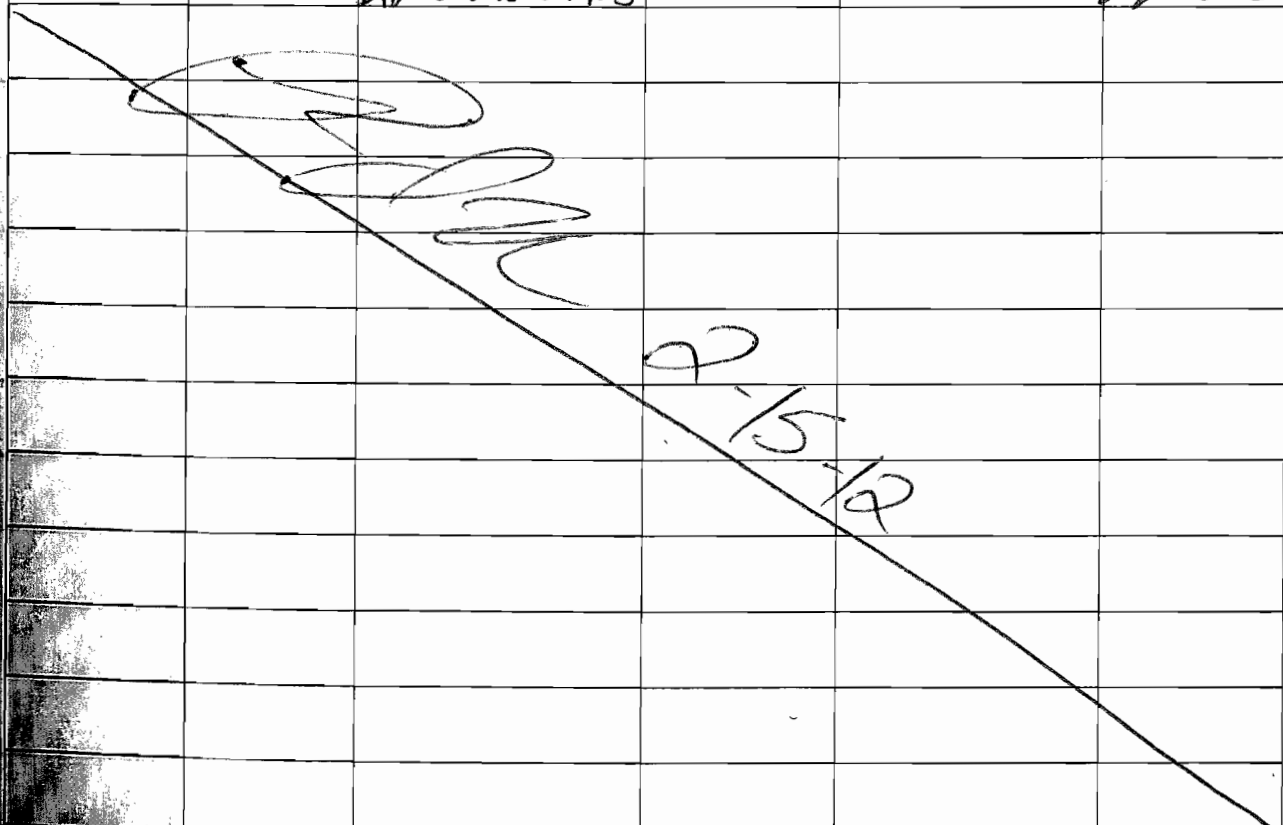
Date Modified:

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 Nucl	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 <del>B12-00202-01</del> 2-10-12	B12-00202	2228	DFM
↓	↓	B12-00202-02	↓	↓	DFM
↓	↓	B12-00202-03	↓	↓	DFM
↓	↓	B12-00202-04	↓	↓	DFM
↓	↓	B12-00202-05	↓	↓	DFM 2-15-12
2-15-12	1120	SNC-16	QA	QA	DFM
2-15-12	1228	Background	B12-00346	1259	DFM
↓	↓	B12-00346-04	↓	↓	DFM
↓	↓	B12-00346-04-RS	↓	↓	DFM
					



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# **American Radiation Services Analytical Reports**

**for**

**Los Alamos National Laboratory**

**Tritium-Screening  
by**

**Low Level Liquid  
Scintillation Counting**

**Control Charts**

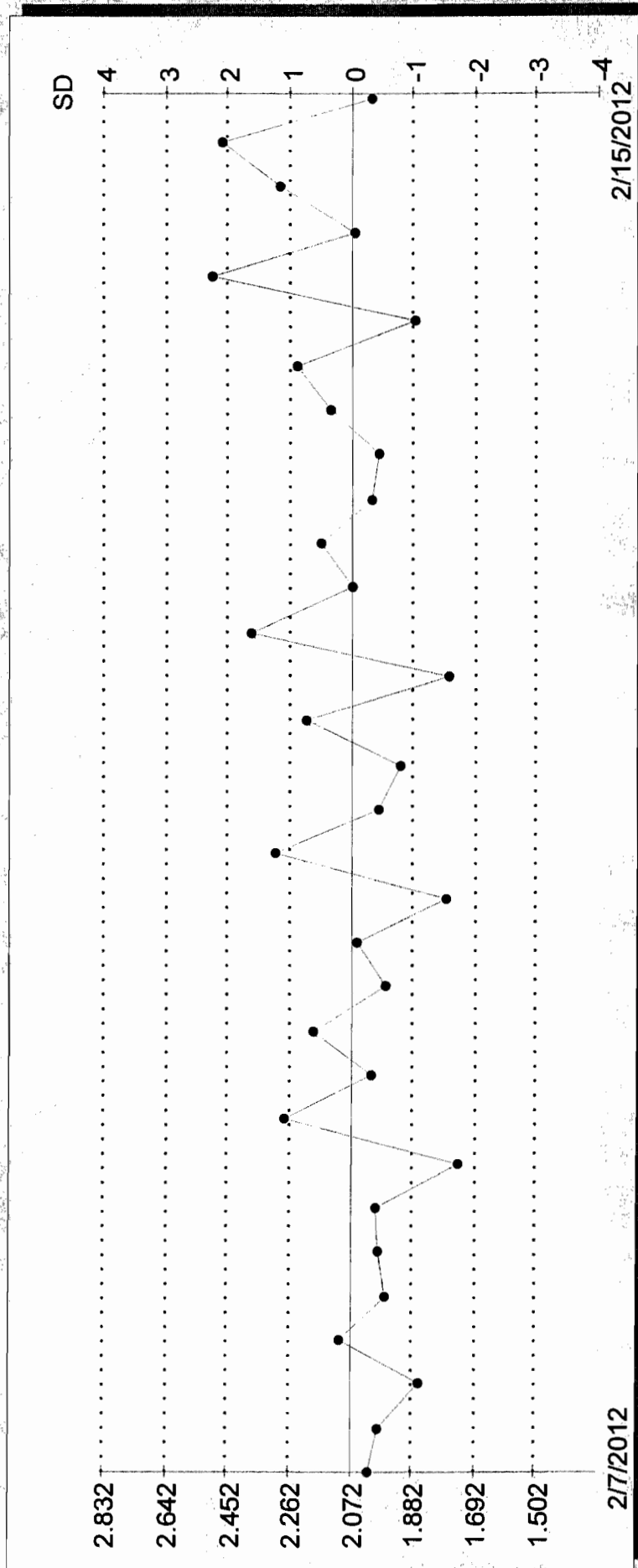


## 3H Background

Total # pts : 5375  
Valid # pts : 32  
Mean : 2.07  
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
Feb 15, 2012	2.01	X

3H Background  
Total # pts : 5375  
Valid # pts : 32  
Mean : 2.07  
SD : 0.19

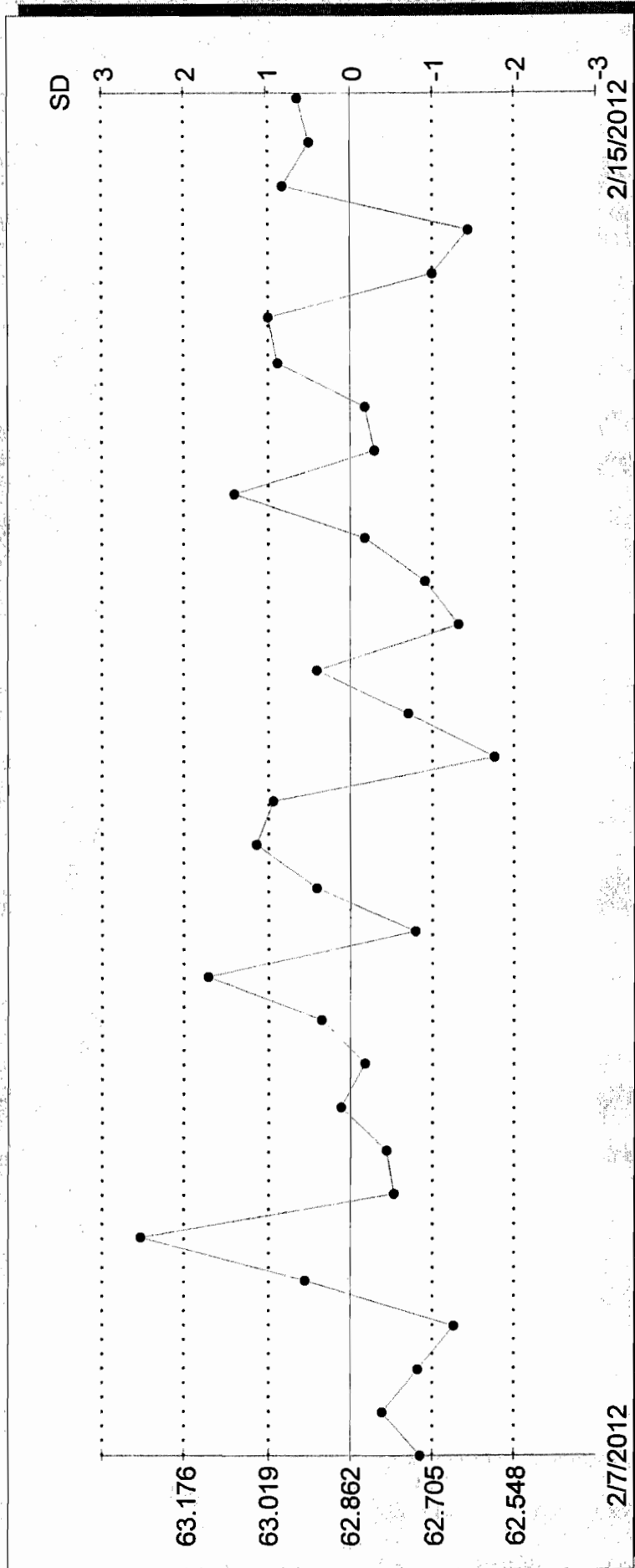


## 3H Efficiency

Total # pts : 5449  
Valid # pts : 32  
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
Feb 15, 2012	62.96	X

3H Efficiency  
 Total # pts : 5449  
 Valid # pts : 32  
 Mean : 62.86  
 SD : 0.16





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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	Parent Standard Data			
Planning		Parent Solution Reference #	NIST SRM 4927F			
Planning Comments	Create an H3 LCS stock solution.	Parent Solution #	S-0237			
Target dpm/g (on dil. date)	5.5	Parent Principal Radionuclide	H-3	Half Life (Days)	4499.8000000	
Target Final volume mL	2000	Parent Reference Date	03/22/2010 10:10			
Appx mass g of Parent Sol'n	3.408758506	Parent Certified Act	3503.682716	Certd Act/Vol Units	dpm	g
Appx vol ml of Parent Sol'n	3.414905335	Parent Cert Act Uncert 1 Sigma	0.0036			
Expected Addition for Analysis g	5	Parent Sp. Gravity G/ML	0.9982			
Standards Preparation / Dilution		Parent Supplier	NIST SRM 4927F			
Secondary Solution #	S-0262	Parent Date Recvd	01/02/00			
Dilution Date (New Ref Date)	09/07/2011 11:47	Parent Received By	Unknown			
Ampoule, Empty (g)		Parent Cert Exp Date				
Ampoule /Solution Gross (g)		Parent Matrix	H2O			
Net Wt Removed (g)		Certified dpm/g At Ref Date	3503.682716			
Transfer Container, empty (g)	13.352	Certified dpm/g on 09/07/2011 11:47	3226.981313			
Container Plus Solution (g)	16.889	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			
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)		Parent Tech	Unknown			
Test Mass of 5 ml of Diluent (g)		Is_Primary	FALSE			
Diluent Density Test - (g/mL)		Is_LCS	TRUE			
Dilution Empty Container Mass (g)	473.97	Is_Tracer	FALSE			
Dilution Full Cont g (if measured)	2467.33	Is_Calib	FALSE			
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					

S-0262



H-3

Verified 9/7/11

SL

Expires 9/7/12

Manufacturer

NIST SRM 4927F

Sol Matrix

H2O

Ref No

NIST SRM 4927F

Tech

Unknown

Parent ID

S-0237



RADIOACTIVE STANDARDS -- BATON ROUGE LABORATORY



**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  
**H-3**

ENTER → Half Life, Years  
**1.232E+01**

OR → Half Life, Days  
**4.4998E+03**  
**4.4998E+03**

Radionuclide **H-3**

Dilution Reference Date **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

**10% Max**

**PASS**

Standard Deviation percent of known concentration

**5% Max**

**PASS**

Average

Two Sigma Uncertainty

Target Activity

% Diff

5.49	2.47
0.52	0.24
4.66%	4.66%
5.72	2.58
-4.13%	-4.13%

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

Prepared & Counted By

Date: **9/13/2011 7:43**

Verified & Approved By

Date: **9-13-11**

QC Approval

Date: **9-13-11**

**S-0262**

**H-3**

**SL**

**Manufacturer**

**Sol Matrix**

**Ref No**

**Tech**

**Parent ID**

Verified **9/7/11**

**Expires 9/7/12**

**NIST SRM 4927F**

**H2O**

**NIST SRM 4927F**

**Unknown**

**S-0237**



**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.

Weight of Standard		
15mL of Ultima Gold added to 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: <u>H1331122173560P</u>



# 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/ABC

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

#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

Half Life-

Half Life

Half Life Correction: Off

Regions Half Life

Luminescence Correction: Off

Heterogeneity Monitor: Off

Delay Before Burst (nsec): 75

Units Reference Date Reference Time

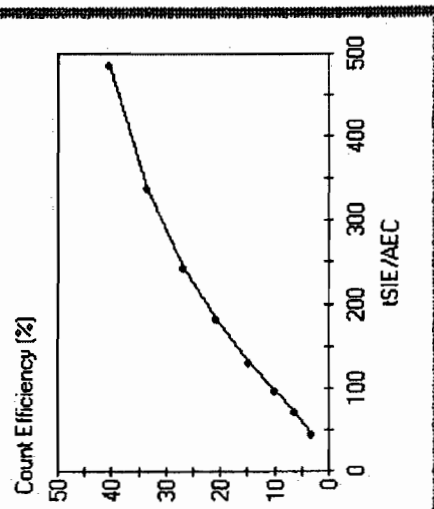
QuantasSmart (TM) - 2.0j - Serial# 06153j

9/13/2011 9:47:49 AM  
Protocol# 50 - H-3 Normal Lvl 3.1sa

A  
B  
C

Cycle 1 Results  
Quench Curve Block Data

UG STD H-3 in A



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

Protocol# 50 - H-3 Normal Lvl 3.lsa

User: ARS

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:

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

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

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

*See Certificate Revision History on Last Page*

Table 1. Properties of SRM 4927F

**Certified values**

<b>Radionuclide</b>	<b>Hydrogen-3</b>
<b>Reference time</b>	<b>1200 EST, 3 September 1998</b>
<b>Massic activity of the solution</b>	<b>634.7 kBq•g<sup>-1</sup></b>
<b>Relative expanded uncertainty (<i>k</i> = 2)</b>	<b>0.72 % (see Note 2)*</b>

**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 <sup>-1</sup> at 20 °C (see Note 3)
Solution mass	Approximately 5.0 g
Radionuclidic impurities	None detected (see Note 4)
Half-lives used	<sup>3</sup> H: (4500 ± 8) d (see Note 5)
Calibration method (and instruments)	The certified massic activity for <sup>3</sup> 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)

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

Uncertainty component		Assessment Type <sup>†</sup>	Relative standard uncertainty contribution on massic activity of <sup>3</sup> 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 <sup>3</sup> 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
<b>Relative combined standard uncertainty</b>			<b>0.36</b>
<b>Relative expanded uncertainty (<i>k</i> = 2)</b>			<b>0.72</b>

<sup>†</sup> = (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  $300 \text{ Bq}\cdot\text{g}^{-1}$

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: 12-00249 Client Name: LANL Sample Matrix: AQ

### LEVEL 1 COMPONENTS

	1st Reviewer			
1) Cover Page Complete and Accurate (see ARS-059)?	<del>Yes</del>	No	N/A	
2) Technical Review Checklist(s) Complete and Accurate?	<del>Yes</del>	No	N/A	
3) Case Narrative Complete and Accurate (see ARS-059)?	<del>Yes</del>	No	N/A	
4) Form 1s Present for all Samples and Tests?	<del>Yes</del>	No	N/A	
5) Client Specific Components are Present and Complete?	<del>Yes</del>	No	N/A	

### LEVEL 2 COMPONENTS

	1st Reviewer			
6) Batch Quality Control Report is Present and Accurate?	<del>Yes</del>	No	N/A	
7) DQO Report is Present and Accurate?	<del>Yes</del>	No	N/A	
8) Client Specific Batch QC Components are Present and Complete?	<del>Yes</del>	No	N/A	

### LEVEL 3 COMPONENTS

	1st Reviewer			
9) Efficiencies are Present?	<del>Yes</del>	No	N/A	
10) Calibrations are Present?	<del>Yes</del>	No	N/A	
11) Backgrounds are Present?	<del>Yes</del>	No	N/A	
12) Spectrum Analysis is Present?	<del>Yes</del>	No	N/A	
13) Spectral Plots are Present?	<del>Yes</del>	No	N/A	
14) Plateaus are Present?	<del>Yes</del>	No	N/A	
15) Control Charts are Present?	<del>Yes</del>	No	N/A	
16) Other:	Yes	No	<del>N/A</del>	

### LEVEL 4 COMPONENTS

	1st Reviewer			
17) Preparation Raw Data Present, Signed and Complete?	<del>Yes</del>	No	N/A	
18) Instrument Raw Data Present and Complete?	<del>Yes</del>	No	N/A	
19) Calibration Certificates Present?	<del>Yes</del>	No	N/A	
20) Copies of Log Book Pages Present?	<del>Yes</del>	No	N/A	
21) Sample Receiving Documentation Present?	<del>Yes</del>	No	N/A	
22) LIMS Reports Present?	<del>Yes</del>	No	N/A	
23) Applicable Correspondence Present?	<del>Yes</del>	No	N/A	
24) Other:	Yes	No	<del>N/A</del>	

Susan Hearn 3-9-12  
Report Generator Signature Date

Bfm 3-9-12  
Management Review Signature Date



# LSC Technical Review Checklist

ARS SDG ARS1-12-00249Sample 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: ARS1-B12-00365 Batch B: N/A Batch C: N/ATest Method(s): LSC-A-022 N/A N/A

## A. RADIOCHEMICAL PREPARATION REVIEW

	Chemist Review	Verifier Review
1) 100% of Manual Transcriptions Verified?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
2) 100% of Manual Calculations Verified?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
3) Blank Composition/Configuration Matches Calibration?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
4) Deviations from procedure are documented and verified?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
5) Appropriate Cocktail Selected?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
6) Sample Prep Anomaly? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (See Tech Notes) NCR # (If initiated): _____		
<div>Chemist Signature <u>[Signature]</u> Date <u>3-5-12</u></div> <div>Verifier Review Signature <u>[Signature]</u> Date <u>3-5-12</u></div>		

## B. ANALYSIS REVIEW

	Analyst Review	QA Officer Review
1) Calibrations Valid and Current?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
2) Backgrounds Valid and Current?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
3) Source Checks Completed and Acceptable?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
<div>QA Officer Signature <u>vtm</u> Date <u>3-9-12</u></div>		
	Analyst Review	Technical Review
4) Background Checks Complete and Acceptable?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
5) 100% of Manually Entered Parameters Verified Accurate?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
6) Appropriate QC samples initiated at required frequency?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> 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="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
b) Spectra show no Evidence of Interferences?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
c) Sample Quench for All Samples within Range of Quench Curve?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
7) Analysis Anomaly? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (See Comments) NCR # (If initiated): _____		
<div>Analyst Signature <u>[Signature]</u> Date <u>3-7-12</u></div> <div>Technical Reviewer Signature <u>[Signature]</u> Date <u>3-7-12</u></div>		

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 <del>No</del> N/A	Yes <del>No</del> N/A
2) RDL Criteria are Met?	<del>Yes</del> No N/A	<del>Yes</del> No N/A
3) Method Blank Criterion Met?	<del>Yes</del> No N/A	<del>Yes</del> No N/A
4) LCS/LCD Criteria Met?	<del>Yes</del> No N/A	<del>Yes</del> No N/A
5) Duplicate (Sample Duplicate, LCSD, MSD) Criteria Met?	<del>Yes</del> No N/A	<del>Yes</del> No N/A
6) MS/MSD Criteria Met?	Yes No <del>N/A</del>	Yes No <del>N/A</del>
7) Batch QC Anomaly? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (See Tech Notes)    NCR # (If initiated): _____		
<u>Susan Weisk</u> Project Manager Signature	<u>3-9-12</u> Date	<u>[Signature]</u> QA Officer Signature
<u>3-9-12</u> Date		

**GENERAL COMMENTS**



## LSC Technical Review Checklist

ARS SDG ARS1-12-00249

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? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (See Tech Notes) NCR # (If initiated): _____		
Chemist Signature <u>[Signature]</u> Date <u>2-10-12</u>		Verifier Review Signature <u>[Signature]</u> Date <u>2-10-12</u>

### 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 <u>[Signature]</u> Date <u>3-9-12</u>		
	Analyst Review	Technical 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? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (See Comments) NCR # (If initiated): _____		
Analyst Signature <u>[Signature]</u> Date <u>2-13-12</u>		Technical Reviewer Signature <u>[Signature]</u> Date _____

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 <del>N/A</del>	Yes   No <del>N/A</del>
2) RDL Criteria are Met?	Yes   No <del>N/A</del>	Yes   No <del>N/A</del>
3) Method Blank Criterion Met?	Yes   No <del>N/A</del>	Yes   No <del>N/A</del>
4) LCS/LCD Criteria Met?	Yes   No <del>N/A</del>	Yes   No <del>N/A</del>
5) Duplicate (Sample Duplicate, LCSD, MSD) Criteria Met?	Yes   No <del>N/A</del>	Yes   No <del>N/A</del>
6) MS/MSD Criteria Met?	Yes   No <del>N/A</del>	Yes   No <del>N/A</del>
7) Batch QC Anomaly? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes (See Tech Notes)   NCR # (If initiated): _____		
<div style="display: flex; justify-content: space-between;"><div><u>Susan Heese</u> Project Manager Signature</div><div><u>3-9-12</u> Date</div></div>	<div style="display: flex; justify-content: space-between;"><div><u>[Signature]</u> QA Officer Signature</div><div><u>3-9-12</u> Date</div></div>	

**GENERAL COMMENTS**

**DQO Report for SDG**  
ARS1-12-00249

Analysis Code	Group	Isotope	Activity Units	Aliquot Units	ProcedureNo	RDL	LCS_LL	LCS_UL	MS_LL	MS_UL	Rdy_LL	Rdy_UL	GravY_LL	GravY_UL	RER	RPD	DilutionReq	RoughPrepReq	BlankCorrectionMDA	BlankCorrectionAll	CountTimeReq	AliquotRequired
LSC-A-021	STC	H-3	pCi	g	ARS-054	0.00E+00	75	125	60	140	30	110	40	110	1.00	25	FALSE	FALSE	FALSE	FALSE		
LSC-A-022	STC	Enriched H-3	pCi	g	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	ARS1-12-00249	TAT Days	30	Project Type
Sample Count	Rpt Level	Date Received	2/9/2012	COC Number
Client	Los Alamos National Laboratory	Client Deadline	3/4/2012	PO Number
Client Code	114	Internal Deadline	3/8/2012	Job Number
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
001	CAAN-12-2024	AQ	02/02/12 12:00 PM	02/02/12 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
	106184	1	1000.00				60	24		N	N/A			
														AF Total Vol

### SDG Report - Analysis Assignments

Temp SDG	ARS1-12-00249	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: ARS1-12-00249

Task	Date / Time	Initials
Date & Time Samples Received	02-09-12/11:00	CWB
ICOC Initiated / Storage Location: <u>LL3H</u>	02-09-12/16:22	CWB
Technical Checks Performed	<i>See Batch</i>	_____
Report Written / EDD Generated: <u>3-9-12/1016</u>   <u>SKC</u> <small>Date/Time Initials</small>	<u>3-9-12/1008</u>	<u>SKC</u>
Quality Assurance Checks Performed on Report	<del>3-9-12</del>	<del>SKC</del>
Management Check Performed on Report	<del>1325</del>	<del>SKC</del>
<i>Preliminary Report Sent</i>		
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 <small>see notes</small> Mgmt. Approval: _____		✓

### NOTES:

SDG: ARSI-2-00249

## External and Internal Surveys

Exposure Rate Meter: <u>M3 242001</u>	Serial No.: <u>44-2 PR 26422015</u>	Calibration Due Date: <u>4-2012</u>
Count Rate Meter: <u>M2 154859</u>	Serial No.: <u>44-9 PR 184559</u>	Calibration Due Date: <u>4-2012</u>
Background Exposure Rate ( $\mu\text{R/hr}$ ) <u>30</u>	Max. Exposure Rate on Shipping Containers Externals (Plus Bkgd) <u>20</u> $\mu\text{R/hr}$	
Background Count Rate (cpm) <u>80</u>	Max. Removable Count Rate on Shipping Containers Externals (Plus Bkgd) <u>40</u> cpm	
	Max. Removable Count Rate on Shipping Containers Internals (Plus Bkgd) <u>40</u> cpm	

COC ☒ Yes ☐ No

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

# Samples Rcv

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

[illegible]

Surveyors' Name:

Date/Time Surveyed: