

ALS Laboratory Group

ANALYTICAL CHEMISTRY & TESTING SERVICES



Environmental Division

December 15, 2009

Mr. Mike Barsa
Cabrera Services, Inc.
103 E Mount Royal Ave. Ste. 2B
Baltimore, MD 21202

Re: ALS Workorder: 09-11-228
Project Name: Forest Glen Rad Scoping Survey
Project Number: 08-3800.04

Dear Mr. Barsa:

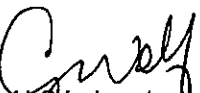
Twenty wipe samples were received from Cabrera Services, Inc. on November 23, 2009. The samples were scheduled for the following analysis:

Tritium pages 1-121

The results for this analysis are contained in the enclosed reports.

Thank you for your confidence in ALS Laboratory Group. Should you have any questions, please call.

Sincerely,

for 
ALS Laboratory Group
Lance Steere
Senior Project Manager

LRS/eh
Enclosure (s): Report

ALS Laboratory Group -- FC

Sample Number(s) Cross-Reference Table

Paragon OrderNum: 0911228

Client Name: Cabrera Services Inc.

Client Project Name: Forest Glen Rad Scoping Survey

Client Project Number: 08-3800.04

Client PO Number:

Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
SU02-55	0911228-1		WIPE	17-Nov-09	11:10
SU02-56	0911228-2		WIPE	17-Nov-09	11:15
SU02-57	0911228-3		WIPE	17-Nov-09	11:20
SU02-58	0911228-4		WIPE	17-Nov-09	11:25
SU02-59	0911228-5		WIPE	17-Nov-09	11:30
SU02-60	0911228-6		WIPE	17-Nov-09	11:35
SU02-BIAS	0911228-7		WIPE	17-Nov-09	11:40
SU03-61	0911228-8		WIPE	18-Nov-09	10:00
SU03-62	0911228-9		WIPE	18-Nov-09	10:05
SU03-63	0911228-10		WIPE	18-Nov-09	10:10
SU03-64	0911228-11		WIPE	18-Nov-09	10:15
SU03-65	0911228-12		WIPE	18-Nov-09	10:20
SU03-66	0911228-13		WIPE	18-Nov-09	10:25
SU03-67	0911228-14		WIPE	18-Nov-09	10:30
SU03-68	0911228-15		WIPE	18-Nov-09	10:35
SU03-69	0911228-16		WIPE	18-Nov-09	10:40
SU03-70	0911228-17		WIPE	18-Nov-09	10:45
SU03-71	0911228-18		WIPE	18-Nov-09	10:50
SU03-72	0911228-19		WIPE	18-Nov-09	10:55
SU03-73	0911228-20		WIPE	18-Nov-09	11:00

0911228

Chain-of-Custody

ALS Laboratory Group

Project Name / No.: Forest Glen Rad Scoping Survey
 Sampler(s): KK, AC, MB, AW (circle one) Turnaround Standard or Rush (Due) Dispose or Return to Client

Report To: Michael Barsa
 Phone: 410-332-8177
 Fax: 410-332-8183
 Company: Cabrera Services
 Address: 103 E. Mount Royal Ave, Suite 2B
 Baltimore, MD 21202

Sample ID	Date	Time *	Lab ID	Matrix	No. of Containers	circle method or specify under comments														
SU02-55	11/17/09	11:10	1	SM	1	X														
SU02-56	11/17/09	11:15	1	SM	1	X														
SU02-57	11/17/09	11:20	1	SM	1	X														
SU02-58	11/17/09	11:25	1	SM	1	X														
SU02-59	11/17/09	11:30	1	SM	1	X														
SU02-60	11/17/09	11:35	1	SM	1	X														
SU02-BIAS	11/17/09	11:40	1	SM	1	X														
SU03-61	11/18/09	10:00	1	SM	1	X														
SU03-62	11/18/09	10:05	1	SM	1	X														
SU03-63	11/18/09	10:10	1	SM	1	X														

Comments: 08-3800.04, Task 2
 WRAMC Forest Glen Annex Radiological Survey
 SM=Smeat

Total number of containers: 10

Relinquished By: Michael Barsa
 Signature: [Signature]
 Printed Name: Michael Barsa
 Date: 11/20 Time: 1400
 Company: Cabrera

Relinquished By: (1)
 Signature: [Signature]
 Printed Name: [Name]
 Date: [Date] Time: [Time]
 Company: [Company]

Received By: [Signature]
 Signature: [Signature]
 Printed Name: [Name]
 Date: 11/23/09 Time: 0915
 Company: [Company]

Received By: (1)
 Signature: [Signature]
 Printed Name: [Name]
 Date: [Date] Time: [Time]
 Company: [Company]

ALS Laboratory Group

Chain-of-Custody

Project Name / No.: Forest Glen Rad Scoping Survey Sampler(s): KK, AC, MB, AW (circle one) Turnaround: Standard or Rush (Due) Dispose or Return to Client

Report To: Michael Barsa
Phone: 410-332-8177
Fax: 410-332-8183
Company: Cabrera Services
Address: 103 E. Mount Royal Ave, Suite 2B
Baltimore, MD 21202

circle method or specify under comments

Sample ID	Date	Time *	Lab ID	Matrix	No. of Containers	H-3 via Liquid Scintillation	E906.0
SU03-64	11/18/09	10:15	(1)	SM	1	X	
SU03-65	11/18/09	10:20	(2)	SM	1	X	
SU03-66	11/18/09	10:25	(3)	SM	1	X	
SU03-67	11/18/09	10:30	(4)	SM	1	X	
SU03-68	11/18/09	10:35	(5)	SM	1	X	
SU03-69	11/18/09	10:40	(6)	SM	1	X	
SU03-70	11/18/09	10:45	(7)	SM	1	X	
SU03-71	11/18/09	10:50	(8)	SM	1	X	
SU03-72	11/18/09	10:55	(9)	SM	1	X	
SU03-73	11/18/09	11:00	(10)	SM	1	X	

Comments: 08-3800.04, Task 2
WRAMC Forest Glen Annex Radiological Survey
SM=Smear
Total number of containers: 10

Relinquished By: (1)
Signature: *Michael Barsa*
Printed Name: Michael Barsa
Date: 11/20 Time: 1400
Company: Cabrera

Relinquished By: (2)
Signature: _____
Printed Name: _____
Date: _____ Time: _____
Company: _____

Received By: (1)
Signature: *Lauren Schmitz*
Printed Name: Lauren Schmitz
Date: 11/23/09 Time: 0915
Company: ALS

Received By: (2)
Signature: _____
Printed Name: _____
Date: _____ Time: _____
Company: _____



CONDITION OF SAMPLE UPON RECEIPT FORM

Client: Cabrera

Workorder No: 0911228

Project Manager: LRS

Initials: LAS Date: 11/23/09

1. Does this project require any special handling in addition to standard Paragon procedures?		YES	<input checked="" type="radio"/> NO
2. Are custody seals on shipping containers intact?	NONE	<input checked="" type="radio"/> YES	NO
3. Are Custody seals on sample containers intact?	<input checked="" type="radio"/> NONE	YES	NO
4. Is there a COC (Chain-of-Custody) present or other representative documents?		<input checked="" type="radio"/> YES	NO
5. Are the COC and bottle labels complete and legible?		<input checked="" type="radio"/> YES	NO
6. Is the COC in agreement with samples received? (IDs, dates, times, no. of samples, no. of containers, matrix, requested analyses, etc.)		<input checked="" type="radio"/> YES	NO
7. Were airbills / shipping documents present and/or removable?	DROP OFF	<input checked="" type="radio"/> YES	NO
8. Are all aqueous samples requiring preservation preserved correctly? (excluding volatiles)	<input checked="" type="radio"/> N/A	YES	NO
9. Are all aqueous non-preserved samples pH 4-9?	<input checked="" type="radio"/> N/A	YES	NO
10. Is there sufficient sample for the requested analyses?		<input checked="" type="radio"/> YES	NO
11. Were all samples placed in the proper containers for the requested analyses?		<input checked="" type="radio"/> YES	NO
12. Are all samples within holding times for the requested analyses?		<input checked="" type="radio"/> YES	NO
13. Were all sample containers received intact? (not broken or leaking, etc.)		<input checked="" type="radio"/> YES	NO
14. Are all samples requiring no headspace (VOC, GRO, RSK/MEE, Rx CN/S, radon) headspace free? Size of bubble: ___ < green pea ___ > green pea	<input checked="" type="radio"/> N/A	YES	NO
15. Do perchlorate LCMS-MS samples have headspace? (at least 1/3 of container required)	<input checked="" type="radio"/> N/A	YES	NO
16. Were samples checked for and free from the presence of residual chlorine? (Applicable when PM has indicated samples are from a chlorinated water source; note if field preservation with sodium thiosulfate was not observed.)	<input checked="" type="radio"/> N/A	YES	NO
17. Were the samples shipped on ice?		YES	<input checked="" type="radio"/> NO
18. Were cooler temperatures measured at 0.1-6.0°C? IR gun used*: <input checked="" type="radio"/> #2 #4 RAD ONLY		YES	<input checked="" type="radio"/> NO
Cooler #: <u>1</u>			
Temperature (°C): <u>Ambient (18.4°)</u>			
No. of custody seals on cooler: <u>2</u>			
External µR/hr reading: <u>16</u>			
Background µR/hr reading: <u>12</u>			
Were external µR/hr readings ≤ two times background and within DOT acceptance criteria? <input checked="" type="radio"/> YES / NO / NA (If no, see Form 008.)			

Additional Information: PROVIDE DETAILS BELOW FOR A NO RESPONSE TO ANY QUESTION ABOVE, EXCEPT #1 AND #16

* Samples will be cooled in-house

If applicable, was the client contacted? YES / NO / NA Contact: _____ Date/Time: _____

Project Manager Signature / Date: [Signature] 11/24/09

*IR Gun #2: Oakton, SN 29922500201-0066

*IR Gun #4: Oakton, SN 2372220101-0002

0911228

From: Origin ID: ODMA (410) 332-8177
Mike Barsa
CABRERA SERVICES
103 E. Mount Royal Ave
Ste 2B
Baltimore, MD 21202



J09300907312023

Ship Date: 20NOV09
Act/Wgt: 10.0 LB
CAD: 4239785/INET9090
Account#: S *****

Delivery Address Bar Code



Ref # 08-3800.04-T2
Invoice #
PO #
Dept #

16

SHIP TO: (800) 443-1511 BILL SENDER

Lance Steere
Paragon Analytics
225 Commerce Dr.

Fort Collins, CO 80524

1 of 2

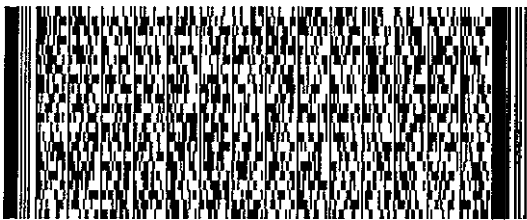
MON - 23NOV

A2

TRK# 7930 3751 2435
0201

STANDARD OVERNIGHT

MASTER



80524
CO-US
DEN

2

XH FTCA



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Tritium Case Narrative

Cabrera Services Inc.

Forest Glen Rad Scoping Survey – 08-3800.04

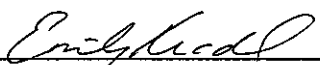
Work Order Number: 0911228

1. This report consists of the analytical results and supporting documentation for 20 wipe samples received by ALS on 11/23/09.
2. These samples were prepared according to procedure SOP700R10.
3. The samples were analyzed for the presence of tritium according to procedure SOP704R9. The analyses were completed on 12/01/09.
4. Upon analysis of samples 0911228-8, -12, and -17, it was noted that the quench factor (H#) was outside of the current usable calibration range. Thus, an approximate volume of 5 μL of nitro-methane was added to the samples and 10 μL to the associated QC to bring them into the usable calibration range.
5. The analysis results for these samples are reported on an 'as received' basis in units of pCi/sample.
6. Sample volume was insufficient to allow preparation of a duplicate. A laboratory control sample duplicate (LCSD) was prepared in lieu of a client sample duplicate.
7. The magnitude of the negative activity for samples 0911228-12 and -16 is greater than the 2 sigma TPU. The analyst's review of the data does not indicate a problem with the instrument data or the subsequent reporting systems. It is believed that the data quality is unaffected and the results are submitted without qualification. Under typical conditions, where background level sample data is normally distributed and analyzed by paired observations, this event is likely to occur at least 2.5% of the time.



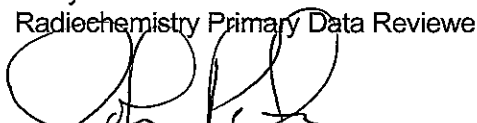
8. For sample 0911228-11, the "Window 2" count rate was observed below the lower threshold, determined from calibration on 11/30/09. For this analysis, "Window 2" is monitored for high-energy beta contamination, therefore no contamination is observed and the data quality is not believed to be affected.
9. No further anomalous situations were encountered during the preparation or analysis of these samples. All remaining quality control criteria were met.

The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.



Emily Knødel
Radiochemistry Primary Data Reviewer

12-11-09
Date



Radiochemistry Final Data Reviewer

12/11/09
Date



Section 1

CHAIN OF CUSTODY

ALS Laboratory Group -- FC

Sample Number(s) Cross-Reference Table

Paragon OrderNum: 0911228

Client Name: Cabrera Services Inc.

Client Project Name: Forest Glen Rad Scoping Survey

Client Project Number: 08-3800.04

Client PO Number:

Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
SU02-55	0911228-1		WIPE	17-Nov-09	11:10
SU02-56	0911228-2		WIPE	17-Nov-09	11:15
SU02-57	0911228-3		WIPE	17-Nov-09	11:20
SU02-58	0911228-4		WIPE	17-Nov-09	11:25
SU02-59	0911228-5		WIPE	17-Nov-09	11:30
SU02-60	0911228-6		WIPE	17-Nov-09	11:35
SU02-BIAS	0911228-7		WIPE	17-Nov-09	11:40
SU03-61	0911228-8		WIPE	18-Nov-09	10:00
SU03-62	0911228-9		WIPE	18-Nov-09	10:05
SU03-63	0911228-10		WIPE	18-Nov-09	10:10
SU03-64	0911228-11		WIPE	18-Nov-09	10:15
SU03-65	0911228-12		WIPE	18-Nov-09	10:20
SU03-66	0911228-13		WIPE	18-Nov-09	10:25
SU03-67	0911228-14		WIPE	18-Nov-09	10:30
SU03-68	0911228-15		WIPE	18-Nov-09	10:35
SU03-69	0911228-16		WIPE	18-Nov-09	10:40
SU03-70	0911228-17		WIPE	18-Nov-09	10:45
SU03-71	0911228-18		WIPE	18-Nov-09	10:50
SU03-72	0911228-19		WIPE	18-Nov-09	10:55
SU03-73	0911228-20		WIPE	18-Nov-09	11:00

0911228

ALS Laboratory Group

Chain-of-Custody

Project Name / No.: Forest Glen Rad Scoping Survey Sampler(s): KK, AC, MB, AW (circle one) Turnaround: Standard or Rush (Due) Dispose or Return to Client

Report To: Michael Barsa
 Phone: 410-332-8177
 Fax: 410-332-8183
 Company: Cabrera Services
 Address: 103 E. Mount Royal Ave, Suite 2B
 Ballimore, MD 21202

Sample ID	Date	Time *	Lab ID	Matrix	No. of Containers	circle method or specify under comments														
						1	2	3	4	5	6	7	8	9	10					
SU02-55	11/17/09	11:10	1	SM	1															X
SU02-56	11/17/09	11:15	2	SM	1															X
SU02-57	11/17/09	11:20	3	SM	1															X
SU02-58	11/17/09	11:25	4	SM	1															X
SU02-59	11/17/09	11:30	5	SM	1															X
SU02-60	11/17/09	11:35	6	SM	1															X
SU02-BIAS	11/17/09	11:40	7	SM	1															X
SU03-61	11/18/09	10:00	8	SM	1															X
SU03-62	11/18/09	10:05	9	SM	1															X
SU03-63	11/18/09	10:10	10	SM	1															X

Comments: 08-3800.04, Task 2 Total number of containers: 10
 WRAMC Forest Glen Annex Radiological Survey
 SM=Smear

Relinquished By: (1) Signature: [Signature] Printed Name: Michael Barsa Date: 11/20 Time: 1400 Company: Cabrera
 Relinquished By: (2) Signature: _____ Printed Name: _____ Date: _____ Time: _____ Company: _____
 Received By: (1) Signature: [Signature] Printed Name: Lauren Schmitt Date: 11/23/09 Time: 0915 Company: ALS
 Received By: (2) Signature: _____ Printed Name: _____ Date: _____ Time: _____ Company: _____

Chain-of-Custody

ALS Laboratory Group

Project Name / No.: Forest Glen Rad Scoping Survey Sampler(s): KK, AC, MB, AW Turnaround Standard or Rest-Use: Dispose & Return to Client

Report To: Michael Barsa
Phone: 410-332-8177
Fax: 410-332-8183
Company: Cabrera Services
Address: 103 E. Mount Royal Ave, Suite 2B
Baltimore, MD 21202

H-3 via Liquid Scintillation E906.0

Sample ID	Date	Time *	Lab ID	Matrix	No. of Containers	circle method or specify under comments	
SU03-64	11/18/09	10:15	11	SM	1	X	
SU03-65	11/18/09	10:20	12	SM	1	X	
SU03-66	11/18/09	10:25	13	SM	1	X	
SU03-67	11/18/09	10:30	14	SM	1	X	
SU03-68	11/18/09	10:35	15	SM	1	X	
SU03-69	11/18/09	10:40	16	SM	1	X	
SU03-70	11/18/09	10:45	17	SM	1	X	
SU03-71	11/18/09	10:50	18	SM	1	X	
SU03-72	11/18/09	10:55	19	SM	1	X	
SU03-73	11/18/09	11:00	20	SM	1	X	

Comments: 08-3800.04, Task 2
WRAMC Forest Glen Annex Radiological Survey
SM=Smear

Total number of containers: 10

Relinquished By: Michael Barsa
Signature Michael Barsa
Printed Name Michael Barsa
Date 11/20 Time 1400
Company Cabrera

Relinquished By: Lawrence Schmitz
Signature Lawrence Schmitz
Printed Name Lawrence Schmitz
Date 11/23/09 Time 0915
Company ALS

Relinquished By: _____
Signature _____
Printed Name _____
Date _____ Time _____
Company _____

Received By: _____
Signature _____
Printed Name _____
Date _____ Time _____
Company _____

Form 2024.xls (1/2/01)



CONDITION OF SAMPLE UPON RECEIPT FORM

Client: Cabrera

Workorder No: 0911228

Project Manager: LRS

Initials: LAS Date: 11/23/09

1. Does this project require any special handling in addition to standard Paragon procedures?		YES	<input checked="" type="radio"/> NO
2. Are custody seals on shipping containers intact?	NONE	<input checked="" type="radio"/> YES	NO
3. Are Custody seals on sample containers intact?	<input checked="" type="radio"/> NONE	YES	NO
4. Is there a COC (Chain-of-Custody) present or other representative documents?		<input checked="" type="radio"/> YES	NO
5. Are the COC and bottle labels complete and legible?		<input checked="" type="radio"/> YES	NO
6. Is the COC in agreement with samples received? (IDs, dates, times, no. of samples, no. of containers, matrix, requested analyses, etc.)		<input checked="" type="radio"/> YES	NO
7. Were airbills / shipping documents present and/or removable?	DROP OFF	<input checked="" type="radio"/> YES	NO
8. Are all aqueous samples requiring preservation preserved correctly? (excluding volatiles)	<input checked="" type="radio"/> N/A	YES	NO
9. Are all aqueous non-preserved samples pH 4-9?	<input checked="" type="radio"/> N/A	YES	NO
10. Is there sufficient sample for the requested analyses?		<input checked="" type="radio"/> YES	NO
11. Were all samples placed in the proper containers for the requested analyses?		<input checked="" type="radio"/> YES	NO
12. Are all samples within holding times for the requested analyses?		<input checked="" type="radio"/> YES	NO
13. Were all sample containers received intact? (not broken or leaking, etc.)		<input checked="" type="radio"/> YES	NO
14. Are all samples requiring no headspace (VOC, GRO, RSK/MEE, Rx CN/S, radon) headspace free? Size of bubble: _____ < green pea _____ > green pea	<input checked="" type="radio"/> N/A	YES	NO
15. Do perchlorate LCMS-MS samples have headspace? (at least 1/3 of container required)	<input checked="" type="radio"/> N/A	YES	NO
16. Were samples checked for and free from the presence of residual chlorine? (Applicable when PM has indicated samples are from a chlorinated water source; note if field preservation with sodium thiosulfate was not observed.)	<input checked="" type="radio"/> N/A	YES	NO
17. Were the samples shipped on ice?		YES	<input checked="" type="radio"/> NO
18. Were cooler temperatures measured at 0.1-6.0°C? IR gun used*: <input checked="" type="radio"/> #2 #4 RAD ONLY		YES	<input checked="" type="radio"/> NO
Cooler #: <u>1</u>			
Temperature (°C): <u>Ambient (18.4)</u>			
No. of custody seals on cooler: <u>2</u>			
External µR/hr reading: <u>16</u>			
Background µR/hr reading: <u>12</u>			
Were external µR/hr readings ≤ two times background and within DOT acceptance criteria? <input checked="" type="radio"/> YES / NO / NA (If no, see Form 008.)			

Additional Information: PROVIDE DETAILS BELOW FOR A NO RESPONSE TO ANY QUESTION ABOVE, EXCEPT #1 AND #16

* Samples will be cooled in-house

If applicable, was the client contacted? YES / NO / NA Contact: _____ Date/Time: _____

Project Manager Signature / Date: [Signature] - 11/24/09

*IR Gun #2: Oakton, SN 29922500201-0066

*IR Gun #4: Oakton, SN 2372220101-0002

0911228

From: Origin ID: ODMA (410) 332-8177
Mike Barsa
CABRERA SERVICES
103 E. Mount Royal Ave
Ste 2B
Baltimore, MD 21202



Ship Date: 20NOV09
ActWgt: 10.0 LB
CAD: 4239785/NET9090
Account#: S*****

Delivery Address Bar Code



Ref # 08-3800.04-T2
Invoice #
PO #
Dept #

SHIP TO: (800) 443-1511 BILL SENDER
Lance Steere
Paragon Analytics
225 Commerce Dr.

Fort Collins, CO 80524

1 of 2

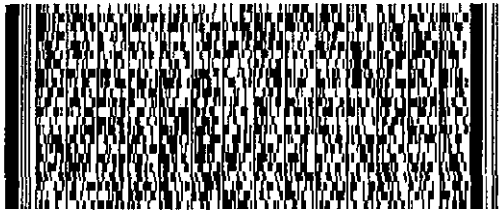
MON - 23NOV A2

TRK# 7930 3751 2435

STANDARD OVERNIGHT

0201

MASTER

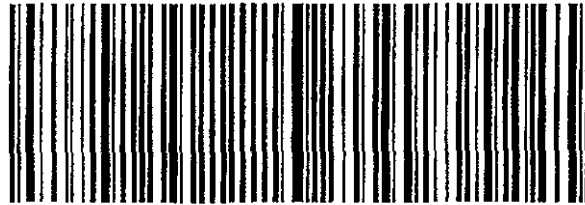


80524

CO-US

DEN

XH FTCA



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Section 2

2

SAMPLE RESULTS SUMMARY

Tritium Analysis By Liquid Scintillation Sample Results Summary

Client Name: Cabrera Services Inc.

Laboratory Name: ALS Laboratory Group -- FC

Page: 1 of 3

Client Project Name: Forest Glen Rad Scoping Survey

PAI Work Order: 0911228

Reported on: Thursday, December 10, 2009

Client Project Number: 08-3800.04

1:50:19 PM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0911228-1	SU02-55	Sample	H-3	-0.2 +/- 2.8	4.9	pCi/sample	WIPE	3H091124-7	11/30/2009	U
0911228-2	SU02-56	Sample	H-3	0.7 +/- 2.9	4.9	pCi/sample	WIPE	3H091124-7	11/30/2009	U
0911228-3	SU02-57	Sample	H-3	-2.0 +/- 2.9	5.1	pCi/sample	WIPE	3H091124-7	11/30/2009	U
0911228-4	SU02-58	Sample	H-3	0.2 +/- 2.8	4.8	pCi/sample	WIPE	3H091124-7	11/30/2009	U
0911228-5	SU02-59	Sample	H-3	-1.1 +/- 2.6	4.6	pCi/sample	WIPE	3H091124-7	11/30/2009	U
0911228-6	SU02-60	Sample	H-3	-0.5 +/- 3.0	5.1	pCi/sample	WIPE	3H091124-7	11/30/2009	U
0911228-7	SU02-BIAS	Sample	H-3	-2.1 +/- 3.2	5.5	pCi/sample	WIPE	3H091124-7	11/30/2009	U
0911228-8	SU03-61	Sample	H-3	-0.5 +/- 2.7	4.7	pCi/sample	WIPE	3H091124-7	12/1/2009	U
0911228-9	SU03-62	Sample	H-3	-0.9 +/- 2.7	4.7	pCi/sample	WIPE	3H091124-7	11/30/2009	U

Comments:

Data Package ID: H30911228-1

Qualifiers/Flags:

U - Result is less than the sample specific MDC.

LT - Result is less than Requested MDC, greater than sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Date Printed: Thursday, December 10, 2009

ALS Laboratory Group -- FC

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LIMS Version: 6.318A

Tritium Analysis By Liquid Scintillation Sample Results Summary

Client Name: Cabrera Services Inc.

Laboratory Name: ALS Laboratory Group -- FC

Page: 2 of 3

Client Project Name: Forest Glen Rad Scoping Survey

PAI Work Order: 0911228

Reported on: Thursday, December 10, 2009

Client Project Number: 08-3600.04

1:50:19 PM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0911228-10	SU03-63	Sample	H-3	-1.8 +/- 2.6	4.5	pCi/sample	WIPE	3H091124-7	11/30/2009	U
0911228-11	SU03-64	Sample	H-3	-0.2 +/- 3.2	5.5	pCi/sample	WIPE	3H091124-7	11/30/2009	U
0911228-12	SU03-65	Sample	H-3	-2.8 +/- 2.7	4.7	pCi/sample	WIPE	3H091124-7	12/2/2009	U
0911228-13	SU03-66	Sample	H-3	-0.2 +/- 2.7	4.6	pCi/sample	WIPE	3H091124-7	11/30/2009	U
0911228-14	SU03-67	Sample	H-3	-0.6 +/- 2.7	4.6	pCi/sample	WIPE	3H091124-7	11/30/2009	U
0911228-15	SU03-68	Sample	H-3	0.8 +/- 2.7	4.5	pCi/sample	WIPE	3H091124-7	11/30/2009	U
0911228-16	SU03-69	Sample	H-3	-2.8 +/- 2.6	4.6	pCi/sample	WIPE	3H091124-7	11/30/2009	U
0911228-17	SU03-70	Sample	H-3	0.6 +/- 2.8	4.7	pCi/sample	WIPE	3H091124-7	12/2/2009	U
0911228-18	SU03-71	Sample	H-3	-1.8 +/- 2.6	4.6	pCi/sample	WIPE	3H091124-7	11/30/2009	U

Comments:

Data Package ID: *H30911228-1*

Qualifiers/Flags:

U - Result is less than the sample specific MDC.

LT - Result is less than Requested MDC, greater than sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

BDL - Below Detection Limit

Tritium Analysis By Liquid Scintillation Sample Results Summary

Client Name: Cabrera Services Inc.

Laboratory Name: ALS Laboratory Group -- FC

Page: 3 of 3

Client Project Name: Forest Glen Rad Scoping Survey

PAI Work Order: 0911228

Reported on: Thursday, December 10, 2009

Client Project Number: 08-3800.04

1:50:19 PM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0911228-19	SU03-72	Sample	H-3	-0.9 +/- 2.7	4.7	pCi/sample	WIPE	3H091124-7	11/30/2009	U
0911228-20	SU03-73	Sample	H-3	-1.2 +/- 2.8	4.9	pCi/sample	WIPE	3H091124-7	11/30/2009	U

Comments:

Data Package ID: H30911228-1

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit



Section 3

QC RESULTS SUMMARY



Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9

Method Blank Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911228
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Lab ID: 3H091124-7MB

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 24-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 30-Nov-09

Prep Batch: 3H091124-7
QCBatchID: 3H091124-7-1
Run ID: 3H091124-7A
Count Time: 30 minutes

Final Aliquot: 1.00 sample
Result Units: pCi/sample
File Name: B60_04_113001

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-1.0 +/- 2.8	4.9	20	U

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC.
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
Y2 - Chemical Yield outside default limits.
LT - Result is less than Requested MDC, greater than sample specific MDC.

Abbreviations:

TPU - Total Propagated Uncertainty
MDC - Minimum Detectable Concentration
BDL - Below Detection Limit

M - Requested MDC not met.
B - Analyte concentration greater than MDC.
B3 - Analyte concentration greater than MDC but less than Requested MDC.

Data Package ID: H30911228-1

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9

Laboratory Control Sample(s)

Lab Name: ALS Laboratory Group -- FC

Work Order Number: 0911228

Client Name: Cabrera Services Inc.

ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Lab ID: 3H091124-7LCS	Sample Matrix: WIPE Prep SOP: PAI 700 Rev 10 Date Collected: 24-Nov-09 Date Prepared: 24-Nov-09 Date Analyzed: 30-Nov-09	Prep Batch: 3H091124-7 QCBatchID: 3H091124-7-1 Run ID: 3H091124-7A Count Time: 30 minutes	Final Aliquot: 1.00 sample Result Units: pCi/sample File Name: B60_04_113001
-----------------------	--	--	--

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
10028-17-8	H-3	119 +/- 19	5	114	104	85 - 115	P

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS Recovery within control limits.
- M - The requested MDC was not met.
- M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration

Data Package ID: H30911228-1

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9

Laboratory Control Sample(s)

Lab Name: ALS Laboratory Group -- FC

Work Order Number: 0911228

Client Name: Cabrera Services Inc.

ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Lab ID: 3H091124-7LCSD

Sample Matrix: WIPE

Prep Batch: 3H091124-7

Final Aliquot: 1.00 sample

Prep SOP: PAI 700 Rev 10

QCBatchID: 3H091124-7-1

Result Units: pCi/sample

Date Collected: 24-Nov-09

Run ID: 3H091124-7A

File Name: B60_04_113001

Date Prepared: 24-Nov-09

Count Time: 30 minutes

Date Analyzed: 30-Nov-09

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
10028-17-8	H-3	118 +/- 19	5	114	104	85 - 115	P

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC.

LT - Result is less than Requested MDC, greater than sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS Recovery within control limits.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

Data Package ID: H30911228-1

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9

Duplicate Sample Results (DER)

Lab Name: ALS Laboratory Group -- FC

Work Order Number: 0911228

Client Name: Cabrera Services Inc.

ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID:
Lab ID: 3H091124-7LCSD

Sample Matrix: WIPE
 Prep SOP: PAI 700 Rev 10
 Date Collected: 24-Nov-09
 Date Prepared: 24-Nov-09
 Date Analyzed: 30-Nov-09

Prep Batch: 3H091124-7
 QC Batch ID: 3H091124-7-1
 Run ID: 3H091124-7A
 Count Time: 30 minutes

Final Aliquot: 1.00 sample
 Prep Basis: As Received
 Moisture(%): NA
 Result Units: pCi/sample
 File Name: B60_04_113001

CASNO	Analyte	Sample			Duplicate			DER	DER Lim
		Result +/- 2 s TPU	MDC	Flags	Result +/- 2 s TPU	MDC	Flags		
10028-17-8	H-3	119 +/- 19	5	P	118 +/- 19	5	P	0.0224	2.13

Comments:

Duplicate Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- LT - Result is less than Request MDC, greater than sample specific MDC
- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits

Abbreviations:

- TPU - Total Propagated Uncertainty
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit
- NR - Not Reported

Data Package ID: H30911228-1



Section 4

INDIVIDUAL SAMPLE RESULTS

4

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9
Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911228
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU02-55
Lab ID: 0911228-1

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 17-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 30-Nov-09

Prep Batch: 3H091124-7
QCBatchID: 3H091124-7-1
Run ID: 3H091124-7A
Count Time: 30 minutes
Report Basis: As Received

Final Aliquot: 1.00 sample
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/sample
File Name: B60_04_112901

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-0.2 +/- 2.8	4.9	20	U

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Data Package ID: H30911228-1

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9
Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911228
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU02-56
Lab ID: 0911228-2

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 17-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 30-Nov-09

Prep Batch: 3H091124-7
QCBatchID: 3H091124-7-1
Run ID: 3H091124-7A
Count Time: 30 minutes
Report Basis: As Received

Final Aliquot: 1.00 sample
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/sample
File Name: B60_04_112901

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	0.7 +/- 2.9	4.9	20	U

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Data Package ID: H30911228-1

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9
Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911228
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU02-57 Lab ID: 0911228-3	Sample Matrix: WIPE Prep SOP: PAI 700 Rev 10 Date Collected: 17-Nov-09 Date Prepared: 24-Nov-09 Date Analyzed: 30-Nov-09	Prep Batch: 3H091124-7 QCBatchID: 3H091124-7-1 Run ID: 3H091124-7A Count Time: 30 minutes Report Basis: As Received	Final Aliquot: 1.00 sample Prep Basis: As Received Moisture(%): NA Result Units: pCi/sample File Name: B60_04_112901
--	--	---	--

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-2.0 +/- 2.9	5.1	20	U

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Data Package ID: H30911228-1

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9
Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911228
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU02-58
Lab ID: 0911228-4

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 17-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 30-Nov-09

Prep Batch: 3H091124-7
QCBatchID: 3H091124-7-1
Run ID: 3H091124-7A
Count Time: 30 minutes
Report Basis: As Received

Final Aliquot: 1.00 sample
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/sample
File Name: B60_04_112901

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	0.2 +/- 2.8	4.8	20	U

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Data Package ID: H30911228-1

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9
Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911228
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU02-59
Lab ID: 0911228-5

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 17-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 30-Nov-09

Prep Batch: 3H091124-7
QCBatchID: 3H091124-7-1
Run ID: 3H091124-7A
Count Time: 30 minutes
Report Basis: As Received

Final Aliquot: 1.00 sample
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/sample
File Name: B60_04_112901

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-1.1 +/- 2.6	4.6	20	U

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Data Package ID: H30911228-1

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9
Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911228
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU02-60 Lab ID: 0911228-6	Sample Matrix: WIPE Prep SOP: PAI 700 Rev 10 Date Collected: 17-Nov-09 Date Prepared: 24-Nov-09 Date Analyzed: 30-Nov-09	Prep Batch: 3H091124-7 QC Batch ID: 3H091124-7-1 Run ID: 3H091124-7A Count Time: 30 minutes Report Basis: As Received	Final Aliquot: 1.00 sample Prep Basis: As Received Moisture(%): NA Result Units: pCi/sample File Name: B60_04_112901
--	--	---	--

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-0.5 +/- 3.0	5.1	20	U

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Data Package ID: H30911228-1

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9
Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911228
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU02-BIAS	Sample Matrix: WIPE	Prep Batch: 3H091 124-7	Final Aliquot: 1.00 sample
Lab ID: 0911228-7	Prep SOP: PAI 700 Rev 10	QCBatchID: 3H091 124-7-1	Prep Basis: As Received
	Date Collected: 17-Nov-09	Run ID: 3H091 124-7A	Moisture(%): NA
	Date Prepared: 24-Nov-09	Count Time: 30 minutes	Result Units: pCi/sample
	Date Analyzed: 30-Nov-09	Report Basis: As Received	File Name: B60_04_112901

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-2.1 +/- 3.2	5.5	20	U

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Data Package ID: H30911228-1

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9
Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911228
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU03-61
Lab ID: 0911228-8

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 18-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 01-Dec-09

Prep Batch: 3H091 124-7
QCBatchID: 3H091 124-7-1
Run ID: 3H091 124-7A
Count Time: 30 minutes
Report Basis: As Received

Final Aliquot: 1.00 sample
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/sample
File Name: B60_04_120101

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-0.5 +/- 2.7	4.7	20	U

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Data Package ID: H30911228-1

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9
Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911228
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU03-62
Lab ID: 0911228-9

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 18-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 30-Nov-09

Prep Batch: 3H091 124-7
QCBatchID: 3H091 124-7-1
Run ID: 3H091 124-7A
Count Time: 30 minutes
Report Basis: As Received

Final Aliquot: 1.00 sample
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/sample
File Name: B60_04_112901

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-0.9 +/- 2.7	4.7	20	U

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Data Package ID: H30911228-1

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9
Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911228
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU03-63 Lab ID: 0911228-10	Sample Matrix: WIPE Prep SOP: PAI 700 Rev 10 Date Collected: 18-Nov-09 Date Prepared: 24-Nov-09 Date Analyzed: 30-Nov-09	Prep Batch: 3H091124-7 QCBatchID: 3H091124-7-1 Run ID: 3H091124-7A Count Time: 30 minutes Report Basis: As Received	Final Aliquot: 1.00 sample Prep Basis: As Received Moisture(%): NA Result Units: pCi/sample File Name: B60_04_112901
---	--	---	--

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-1.8 +/- 2.6	4.5	20	U

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Data Package ID: H30911228-1

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9
Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911228
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU03-64 Lab ID: 0911228-11	Sample Matrix: WIPE Prep SOP: PAI 700 Rev 10 Date Collected: 18-Nov-09 Date Prepared: 24-Nov-09 Date Analyzed: 30-Nov-09	Prep Batch: 3H091124-7 QCBatchID: 3H091124-7-1 Run ID: 3H091124-7A Count Time: 30 minutes Report Basis: As Received	Final Aliquot: 1.00 sample Prep Basis: As Received Moisture(%): NA Result Units: pCi/sample File Name: B60_04_112901
---	--	---	--

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-0.2 +/- 3.2	5.5	20	U

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Data Package ID: H30911228-1

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9
Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911228
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU03-65
Lab ID: 0911228-12

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 18-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 02-Dec-09

Prep Batch: 3H091124-7
QCBatchID: 3H091124-7-1
Run ID: 3H091124-7A
Count Time: 30 minutes
Report Basis: As Received

Final Aliquot: 1.00 sample
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/sample
File Name: B60_04_120101

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-2.8 +/- 2.7	4.7	20	U

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Data Package ID: H30911228-1

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9
Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911228
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU03-66 Lab ID: 0911228-13	Sample Matrix: WIPE Prep SOP: PAI 700 Rev 10 Date Collected: 18-Nov-09 Date Prepared: 24-Nov-09 Date Analyzed: 30-Nov-09	Prep Batch: 3H091124-7 QCBatchID: 3H091124-7-1 Run ID: 3H091124-7A Count Time: 30 minutes Report Basis: As Received	Final Aliquot: 1.00 sample Prep Basis: As Received Moisture(%): NA Result Units: pCi/sample File Name: B60_04_112901
---	--	---	--

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-0.2 +/- 2.7	4.6	20	U

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Data Package ID: H30911228-1

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9
Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911228
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU03-67
Lab ID: 0911228-14

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 18-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 30-Nov-09

Prep Batch: 3H091124-7
QCBatchID: 3H091124-7-1
Run ID: 3H091124-7A
Count Time: 30 minutes
Report Basis: As Received

Final Aliquot: 1.00 sample
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/sample
File Name: B60_04_112901

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-0.6 +/- 2.7	4.6	20	U

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Data Package ID: H30911228-1

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9
Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911228
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU03-68
Lab ID: 0911228-15

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 18-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 30-Nov-09

Prep Batch: 3H091124-7
QCBatchID: 3H091124-7-1
Run ID: 3H091124-7A
Count Time: 30 minutes
Report Basis: As Received

Final Aliquot: 1.00 sample
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/sample
File Name: B60_04_112901

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	0.8 +/- 2.7	4.5	20	U

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Data Package ID: H30911228-1

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9

Sample Results

Lab Name: ALS Laboratory Group -- FC

Work Order Number: 0911228

Client Name: Cabrera Services Inc.

ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU03-69
Lab ID: 0911228-16

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 18-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 30-Nov-09

Prep Batch: 3H091124-7
QC Batch ID: 3H091124-7-1
Run ID: 3H091124-7A
Count Time: 30 minutes
Report Basis: As Received

Final Aliquot: 1.00 sample
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/sample
File Name: B60_04_112901

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-2.8 +/- 2.6	4.6	20	U

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Data Package ID: H30911228-1

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9
Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911228
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU03-70
Lab ID: 0911228-17

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 18-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 02-Dec-09

Prep Batch: 3H091124-7
QCBatchID: 3H091124-7-1
Run ID: 3H091124-7A
Count Time: 30 minutes
Report Basis: As Received

Final Aliquot: 1.00 sample
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/sample
File Name: B60_04_120101

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	0.6 +/- 2.8	4.7	20	U

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Data Package ID: H30911228-1

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9
Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911228
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU03-71 Lab ID: 0911228-18	Sample Matrix: WIPE Prep SOP: PAI 700 Rev 10 Date Collected: 18-Nov-09 Date Prepared: 24-Nov-09 Date Analyzed: 30-Nov-09	Prep Batch: 3H091124-7 QCBatchID: 3H091124-7-1 Run ID: 3H091124-7A Count Time: 30 minutes Report Basis: As Received	Final Aliquot: 1.00 sample Prep Basis: As Received Moisture(%): NA Result Units: pCi/sample File Name: B60_04_113001
---	--	---	--

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-1.8 +/- 2.6	4.6	20	U

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Data Package ID: H30911228-1

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9 Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911228
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU03-72
Lab ID: 0911228-19

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 18-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 30-Nov-09

Prep Batch: 3H091 124-7
QCBatchID: 3H091 124-7-1
Run ID: 3H091 124-7A
Count Time: 30 minutes
Report Basis: As Received

Final Aliquot: 1.00 sample
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/sample
File Name: B60_04_113001

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-0.9 +/- 2.7	4.7	20	U

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Data Package ID: H30911228-1

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9 Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911228
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU03-73	Sample Matrix: WIPE	Prep Batch: 3H091124-7	Final Aliquot: 1.00 sample
Lab ID: 0911228-20	Prep SOP: PAI 700 Rev 10	QC Batch ID: 3H091124-7-1	Prep Basis: As Received
	Date Collected: 18-Nov-09	Run ID: 3H091124-7A	Moisture(%): NA
	Date Prepared: 24-Nov-09	Count Time: 30 minutes	Result Units: pCi/sample
	Date Analyzed: 30-Nov-09	Report Basis: As Received	File Name: B60_04_113001

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-1.2 +/- 2.8	4.9	20	U

Comments:

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.
- Y2 - Chemical Yield outside default limits.
- LT - Result is less than Requested MDC, greater than sample specific MDC.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- M - The requested MDC was not met.

Abbreviations:

- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- BDL - Below Detection Limit

Data Package ID: H30911228-1



Section 5

RAW DATA

5

Tritium Analysis By Liquid Scintillation Raw Data Report

Laboratory Name: ALS Laboratory Group -- FC
PAI Work Order: 0911228

Prep SOP: PAI 700
Analytical SOP: PAI 704

Reported on: Wednesday, December 02, 2009
1:35:25 PM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QC Batch ID	Ingrowth Date /Time	Quench Factor %Lum	Matrix %Moist	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	GrossCPM BkgCPM	BaseEff ProgEff	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
0911228-1	H-3	11/17/2009	3H091124-7	NA	128.8	WIPE	1 S	LS6000	3H091124-7A	11/30/2009	7.530	22.68%	30	-0.2	4.9	pCi/sample	NA	
SMP	Trg. Analyte	11:10:00 AM	3H091124-7-1	NA	0.48	NA	1 S	60-8	B60_04_112901	4:40 AM	7.642	NA	NA	2.8	NA	As Received	NA	U
0911228-2	H-3	11/17/2009	3H091124-7	NA	132	WIPE	1 S	LS6000	3H091124-7A	11/30/2009	8.000	22.32%	30	0.7	4.9	pCi/sample	NA	
SMP	Trg. Analyte	11:15:00 AM	3H091124-7-1	NA	0.87	NA	1 S	60-9	B60_04_112901	5:11 AM	7.664	NA	NA	2.9	NA	As Received	NA	U
0911228-3	H-3	11/17/2009	3H091124-7	NA	138.3	WIPE	1 S	LS6000	3H091124-7A	11/30/2009	6.730	21.61%	30	-2.0	5.1	pCi/sample	NA	
SMP	Trg. Analyte	11:20:00 AM	3H091124-7-1	NA	0.36	NA	1 S	60-10	B60_04_112901	5:42 AM	7.708	NA	NA	2.9	NA	As Received	NA	U
0911228-4	H-3	11/17/2009	3H091124-7	NA	126.8	WIPE	1 S	LS6000	3H091124-7A	11/30/2009	7.730	22.90%	30	0.2	4.8	pCi/sample	NA	
SMP	Trg. Analyte	11:25:00 AM	3H091124-7-1	NA	2.06	NA	1 S	60-11	B60_04_112901	6:13 AM	7.628	NA	NA	2.8	NA	As Received	NA	U
0911228-5	H-3	11/17/2009	3H091124-7	NA	117.4	WIPE	1 S	LS6000	3H091124-7A	11/30/2009	6.970	23.96%	30	-1.1	4.6	pCi/sample	NA	
SMP	Trg. Analyte	11:30:00 AM	3H091124-7-1	NA	0.51	NA	1 S	60-12	B60_04_112901	6:44 AM	7.562	NA	NA	2.6	NA	As Received	NA	U
0911228-6	H-3	11/17/2009	3H091124-7	NA	139.5	WIPE	1 S	LS6000	3H091124-7A	11/30/2009	7.500	21.47%	30	-0.5	5.1	pCi/sample	NA	
SMP	Trg. Analyte	11:35:00 AM	3H091124-7-1	NA	0.82	NA	1 S	34-1	B60_04_112901	7:15 AM	7.717	NA	NA	3.0	NA	As Received	NA	U
0911228-7	H-3	11/17/2009	3H091124-7	NA	152.3	WIPE	1 S	LS6000	3H091124-7A	11/30/2009	6.870	20.03%	30	-2.1	5.5	pCi/sample	NA	
SMP	Trg. Analyte	11:40:00 AM	3H091124-7-1	NA	0.6	NA	1 S	34-2	B60_04_112901	7:46 AM	7.805	NA	NA	3.2	NA	As Received	NA	U
0911228-8	H-3	11/18/2009	3H091124-7	NA	122.4	WIPE	1 S	LS6000	3H091124-7A	12/1/2009	7.330	23.40%	30	-0.5	4.7	pCi/sample	NA	
SMP	Trg. Analyte	10:00:00 AM	3H091124-7-1	NA	0.53	NA	1 S	50-4	B60_04_120101	11:51 PM	7.597	NA	NA	2.7	NA	As Received	NA	U
0911228-9	H-3	11/18/2009	3H091124-7	NA	121.1	WIPE	1 S	LS6000	3H091124-7A	11/30/2009	7.100	23.54%	30	-0.9	4.7	pCi/sample	NA	
SMP	Trg. Analyte	10:05:00 AM	3H091124-7-1	NA	0.39	NA	1 S	34-4	B60_04_112901	8:48 AM	7.588	NA	NA	2.7	NA	As Received	NA	U
0911228-10	H-3	11/18/2009	3H091124-7	NA	114.3	WIPE	1 S	LS6000	3H091124-7A	11/30/2009	6.570	24.31%	30	-1.8	4.5	pCi/sample	NA	
SMP	Trg. Analyte	10:10:00 AM	3H091124-7-1	NA	0.37	NA	1 S	34-5	B60_04_112901	9:19 AM	7.541	NA	NA	2.6	NA	As Received	NA	U
0911228-11	H-3	11/18/2009	3H091124-7	NA	149.7	WIPE	1 S	LS6000	3H091124-7A	11/30/2009	7.700	20.32%	30	-0.2	5.5	pCi/sample	NA	
SMP	Trg. Analyte	10:15:00 AM	3H091124-7-1	NA	0.38	NA	1 S	34-6	B60_04_112901	9:50 AM	7.788	NA	NA	3.2	NA	As Received	NA	U

Comments:

Data Package ID: H30911228-1

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- * - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'.
- # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

Notes:

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

Abbreviations:

- TR - Tracer TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

Tritium Analysis By Liquid Scintillation Raw Data Report

Laboratory Name: ALS Laboratory Group -- FC
PAI Work Order: 0911228

Prep SOP: PAI 700
Analytical SOP: PAI 704

Reported on: Wednesday, December 02, 2009
1:35:25 PM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QCBatchID	Ingrowth Date /Time	Quench Factor %Lum	Matrix %Moist	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	GrossCPM BkgCPM	BaseEff ProgEff	CntDur(min) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
0911228-12	H-3	11/18/2009	3H091124-7	NA	124	WIPE	1 S	LS6000	3H091124-7A	12/2/2009	6.170	23.22%	30	-2.8	4.7	pCi/sample	NA	
SMP	Trg. Analyte	10:20:00 AM	3H091124-7-1	NA	0.48	NA	1 S	50-5	B60_04_120101	12:22 AM	7.608	NA	NA	2.7	NA	As Received	NA	U
0911228-13	H-3	11/18/2009	3H091124-7	NA	117.8	WIPE	1 S	LS6000	3H091124-7A	11/30/2009	7.470	23.92%	30	-0.2	4.6	pCi/sample	NA	
SMP	Trg. Analyte	10:25:00 AM	3H091124-7-1	NA	0.42	NA	1 S	34-9	B60_04_112901	11:22 AM	7.565	NA	NA	2.7	NA	As Received	NA	U
0911228-14	H-3	11/18/2009	3H091124-7	NA	117.7	WIPE	1 S	LS6000	3H091124-7A	11/30/2009	7.270	23.93%	30	-0.6	4.6	pCi/sample	NA	
SMP	Trg. Analyte	10:30:00 AM	3H091124-7-1	NA	0.43	NA	1 S	34-10	B60_04_112901	11:53 AM	7.565	NA	NA	2.7	NA	As Received	NA	U
0911228-15	H-3	11/18/2009	3H091124-7	NA	116.2	WIPE	1 S	LS6000	3H091124-7A	11/30/2009	7.970	24.10%	30	0.8	4.5	pCi/sample	NA	
SMP	Trg. Analyte	10:35:00 AM	3H091124-7-1	NA	0.39	NA	1 S	34-11	B60_04_112901	12:24 PM	7.554	NA	NA	2.7	NA	As Received	NA	U
0911228-16	H-3	11/18/2009	3H091124-7	NA	117.3	WIPE	1 S	LS6000	3H091124-7A	11/30/2009	6.070	23.97%	30	-2.8	4.6	pCi/sample	NA	
SMP	Trg. Analyte	10:40:00 AM	3H091124-7-1	NA	0.39	NA	1 S	34-12	B60_04_112901	12:55 PM	7.562	NA	NA	2.6	NA	As Received	NA	U
0911228-17	H-3	11/18/2009	3H091124-7	NA	124.5	WIPE	1 S	LS6000	3H091124-7A	12/2/2009	7.900	23.16%	30	0.6	4.7	pCi/sample	NA	
SMP	Trg. Analyte	10:45:00 AM	3H091124-7-1	NA	0.61	NA	1 S	50-6	B60_04_120101	12:52 AM	7.612	NA	NA	2.8	NA	As Received	NA	U
0911228-18	H-3	11/18/2009	3H091124-7	NA	118.1	WIPE	1 S	LS6000	3H091124-7A	11/30/2009	6.630	23.88%	30	-1.8	4.6	pCi/sample	NA	
SMP	Trg. Analyte	10:50:00 AM	3H091124-7-1	NA	0.59	NA	1 S	48-2	B60_04_113001	1:57 PM	7.567	NA	NA	2.6	NA	As Received	NA	U
0911228-19	H-3	11/18/2009	3H091124-7	NA	121.5	WIPE	1 S	LS6000	3H091124-7A	11/30/2009	7.130	23.50%	30	-0.9	4.7	pCi/sample	NA	
SMP	Trg. Analyte	10:55:00 AM	3H091124-7-1	NA	0.58	NA	1 S	48-3	B60_04_113001	2:28 PM	7.591	NA	NA	2.7	NA	As Received	NA	U
0911228-20	H-3	11/18/2009	3H091124-7	NA	130.3	WIPE	1 S	LS6000	3H091124-7A	11/30/2009	7.070	22.51%	30	-1.2	4.9	pCi/sample	NA	
SMP	Trg. Analyte	11:00:00 AM	3H091124-7-1	NA	0.73	NA	1 S	48-4	B60_04_113001	2:59 PM	7.652	NA	NA	2.8	NA	As Received	NA	U
3H091124-7	H-3	11/24/2009	3H091124-7	NA	129.9	WIPE	1 S	LS6000	3H091124-7A	11/30/2009	7.170	22.55%	30	-1.0	4.9	pCi/sample	NA	
MB	Trg. Analyte	11:15:45 AM	3H091124-7-1	NA	0.62	NA	1 S	48-5	B60_04_113001	3:30 PM	7.650	NA	NA	2.8	NA	As Received	NA	U
3H091124-7	H-3	11/24/2009	3H091124-7	NA	130.6	WIPE	1 S	LS6000	3H091124-7A	11/30/2009	66.770	22.47%	30	119	5	pCi/sample	NA	104
LCS	Trg. Analyte	11:15:45 AM	3H091124-7-1	NA	0.28	NA	1 S	48-6	B60_04_113001	4:01 PM	7.654	NA	NA	19	NA	As Received	NA	P

Comments:

Data Package ID: H30911228-1

Qualifiers/Flags:

- U - Result is less than the sample specific MDC.
- Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
- Y2 - Chemical Yield outside default limits.
- W - DER is greater than Warning Limit of 1.42
- D - DER is greater than Control Limit of 2.13
- + - Duplicate RPD not within limits.
- LT - Result is less than Request MDC, greater than sample specific MDC
- * - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'.
- # - Allquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

- M - Requested MDC not met.
- M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
- L - LCS Recovery below lower control limit.
- H - LCS Recovery above upper control limit.
- P - LCS, Matrix Spike Recovery within control limits.
- N - Matrix Spike Recovery outside control limits
- NC - Not Calculated for duplicate results less than 5 times MDC
- B - Analyte concentration greater than MDC.
- B3 - Analyte concentration greater than MDC but less than Requested MDC.

Notes:

- 1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
- 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

Abbreviations:

- TR - Tracer TA - Target Analyte
- TPU - Total Propagated Uncertainty
- MDC - Minimum Detectable Concentration
- DER - Duplicate Error Ratio
- BDL - Below Detection Limit

Tritium Analysis By Liquid Scintillation Raw Data Report

Laboratory Name: ALS Laboratory Group -- FC
PAI Work Order: 0911228

Prep SOP: PAI 700
Analytical SOP: PAI 704

Reported on: Wednesday, December 02, 2009
1:35:25 PM

Sample ID QC Type	Nuclide Type	Sample Date/Time	Prep Batch QC Batch ID	Ingrowth Date /Time	Quench Factor %Lum	Matrix %Moist.	Samp Alq Analy Alq	Inst ID Det ID	AnRunID File Name	Count Date/Time	GrossCPM BkgCPM	BaseEff ProgEff	CntDur(mIn) Yield	Activity +/- 2 s TPU	MDC DecLev	ReportUnits ReportBasis	DER RPD	%Spk. Recov Flags
3H091124-7	H-3	11/24/2009	3H091124-7	NA	125.2	WIPE	1 s	LS6000	3H091124-7A	11/30/2009	68.030	23.08%	30	118	5	pCi/sample	0.02	104
LCSD	Trg. Analyte	11:18:45 AM	3H091124-7-1	NA	0.28	NA	1 s	48-7	B80_04_113001	4:32 PM	7.617	NA	NA	19	NA	As Received	NA	P

Comments:

Data Package ID: H30911228-1

Qualifiers/Flags:

U - Result is less than the sample specific MDC.
 Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.
 Y2 - Chemical Yield outside default limits.
 W - DER is greater than Warning Limit of 1.42
 D - DER is greater than Control Limit of 2.13
 + - Duplicate RPD not within limits.
 LT - Result is less than Request MDC, greater than sample specific MDC
 * - Aliquot Basis is 'As Received' while the Report Basis is 'Dry Weight'.
 # - Aliquot Basis is 'Dry Weight' while the Report Basis is 'As Received'

M - Requested MDC not met
 M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.
 L - LCS Recovery below lower control limit.
 H - LCS Recovery above upper control limit.
 P - LCS, Matrix Spike Recovery within control limits.
 N - Matrix Spike Recovery outside control limits
 NC - Not Calculated for duplicate results less than 5 times MDC
 B - Analyte concentration greater than MDC.
 B3 - Analyte concentration greater than MDC but less than Requested MDC.

Notes:

1) The Tracer results are not yield corrected (i.e. activity measured not activity added).
 2) Where sample time is not available, 12:00 PM (Mountain) is used for decay correction.

Abbreviations:

TR- Tracer TA - Target Analyte
 TPU - Total Propagated Uncertainty
 MDC - Minimum Detectable Concentration
 DER - Duplicate Error Ratio
 BDL - Below Detection Limit

ID: 3H-5-ML, 10-ML

29 NOV 2009 12:39

USER: 4 COMMENT: LS6000

PRESET TIME : 30.00
 DATA CALC : CPM H# : YES SAMPLE REPEATS: 1 PRINTER : STD
 COUNT BLANK : NO IC# : NO REPLICATES : 1 RS232 : EDIT
 TWO PHASE : NO AQC : NO CYCLE REPEATS : 1
 SCINTILLATOR: LIQUID LUMEX: NO LOW SAMPLE REJ: 0
 LOW LEVEL : YES HALF LIFE CORRECTION DATE: none

CHAN: 50.0 - 250.0 %ERROR: 1.75 FACTOR: 1.000000 BKG. SUB: 0
 CHAN: 450.0 - 900.0 %ERROR: 20.00 FACTOR: 1.000000 BKG. SUB: 0

ALPHA-BETA DISCRIMINATION: NO

SAM NO	POS	TIME MIN	H#	WIND1		WIND2		LUMEX %	ELAPSED TIME
				CPM	%ERROR	CPM	%ERROR		
1	26-1	30.00	135.3	6.77	14.04	29.90	6.68	0.59	30.80
2	26-2	30.00	136.8	68.17	4.42	30.27	6.64	0.24	61.72
3	26-3	30.00	133.2	69.73	4.37	28.53	6.84	0.24	92.61
53-4	26-4	30.00	135.8	7.50	13.33	28.97	6.78	0.49	123.50
61-5	26-5	30.00	138.9	7.30	13.51	29.60	6.71	0.49	154.41
6	26-6	30.00	131.5	7.30	13.51	26.43*	7.10	1.76	185.39
7	26-7	30.00	127.0	7.07	13.74	26.77	7.06	1.02	216.32
8	26-8	30.00	131.5	6.80	14.00	26.77	7.06	0.59	247.24
9	26-9	30.00	131.2	7.13	13.67	27.13	7.01	0.62	278.16
10	26-10	30.00	118.3	6.30	14.55	28.50	6.84	0.83	309.11
11	26-11	30.00	123.1	6.77	14.04	26.57	7.08	0.64	340.03
12	26-12	30.00	127.0	7.50	13.33	26.37	7.11	1.13	370.99
13	35-1	30.00	132.6	7.37	13.45	28.07	6.89	0.81	402.02
14	35-2	30.00	139.1	10.93	11.04	27.77	6.93	7.44 ^o	433.19
15	35-3	30.00	128.4	7.20	13.61	27.87	6.92	0.64	464.11
16	35-4	30.00	129.3	6.67	14.14	28.17	6.88	0.41	495.01
62-17	35-5	30.00	138.2	7.37	13.45	29.00	6.78	0.55	525.90
18	35-6	30.00	114.2	8.67	12.40	26.53	7.09	1.03	556.84
19	35-7	30.00	112.5K	7.27	13.55	25.43*	7.24	0.87	587.78
20	35-8	30.00	112.0K	6.87	13.93	28.07	6.89	0.81	618.71
21	35-9	30.00	114.5	7.03	13.77	26.03*	7.16	1.66	649.69
22	35-10	30.00	108.0K	7.13	13.67	26.73	7.06	0.78	680.63
23	35-11	30.00	124.4	8.80	12.31	25.93*	7.17	4.28	711.70
24	35-12	30.00	109.0K	8.13	12.80	27.60	6.95	1.97	742.69
25	60-1	30.00	112.7K	7.23	13.58	27.67	6.94	0.60	773.71
26	60-2	30.00	112.1K	7.63	13.22	26.47	7.10	1.30	804.67
27	60-3	30.00	137.5	6.63	14.18	28.47	6.84	0.53	835.60
28	60-4	30.00	132.4	68.13	4.42	29.93	6.67	0.24	866.51
29	60-5	30.00	130.9	64.13	4.56	29.77	6.69	0.24	897.41
63-30	60-6	30.00	139.4	6.87	13.93	29.17	6.76	0.50	928.31
71-31	60-7	30.00	138.8	8.10	12.83	29.53	6.72	0.49	959.24
32	60-8	30.00	128.8	7.53	13.30	27.43	6.97	0.48	990.14
33	60-9	30.00	132.0	8.00	12.91	28.10	6.89	0.87	1021.08
34	60-10	30.00	138.3	6.73	14.07	28.20	6.88	0.36	1051.96
35	60-11	30.00	126.8	7.73	13.13	26.73	7.06	2.06	1082.98
36	60-12	30.00	117.4	6.97	13.83	27.83	6.92	0.51	1113.88
37	34-1	30.00	139.5	7.50	13.33	27.23	7.00	0.82	1144.92
38	34-2	30.00	152.3	6.87	13.93	26.37	7.11	0.60	1175.82
39	34-3	30.00	113.4K	7.93	12.96	27.30	6.99	0.37	1206.74
40	34-4	30.00	121.1	7.10	13.70	26.90	7.04	0.39	1237.61
41	34-5	30.00	114.3	6.57	14.25	27.53	6.96	0.37	1268.51
42	34-6	30.00	149.7	7.70	13.16	25.20*	7.27	0.38	1299.40
72-43	34-7	30.00	140.4	7.73	13.13	28.17	6.88	0.49	1330.32

040-04-112901
 11-2-09

SAM NO	POS	TIME MIN	H#	WIND1		WIND2		LUMEX %	ELAPSED TIME
				CPM	%ERROR	CPM	%ERROR		
44	34-8	30.00	111.7K	7.50	13.33	28.10	6.89	0.36	1361.20
45	34-9	30.00	117.8	7.47	13.36	26.03	7.16	0.42	1392.11
46	34-10	30.00	117.7	7.27	13.55	25.80	7.19	0.43	1423.01
47	34-11	30.00	116.2	7.97	12.94	25.90	7.17	0.39	1453.91
48	34-12	30.00	117.3	6.07	14.82	26.13	7.14	0.39	1484.82

660-04-112901

Mar 12-2-89

X Recount, H # Low

0 Recount, Lumex > 5%

* < LCL of ~~25.26, 25.27~~ Mar 11-2-89
26.29, 25.47

B60_04_112901

```

BSF Version           : 3
Instrument Type       : LS 6000
Data Capture Date    : 29 Nov 2009 12:40:49
User Filename        : C:\...\LS WINCONNECTION\DATA\USER04\UN112901.BSF
User Number         : 4
User Id             : 3H:5-ML,10-ML
User Comments        : LS6000
Preset Count Time    : 30.00
Calculation Mode     : CPM
H# Selected          : YES
Sample Repeats       : 1
Printer Output Mode  : STD
Blank Count          : NO
IC# or SCR Selected  : NO
Replicates           : 1
RS232 Output Mode    : EDIT
Two-Phase Selected   : NO
AQC Choice           : NO
Cycle Repeats        : 1
Scintillator Choice  : LIQUID
Lumex Selected       : NO
Low Sample Reject Count : 0
Low Level Selection  : YES
Half Life Correction Date : none
Window Limits Window 1 : 50.00
Preset %Error Iso1   : 1.75
Norm Multiplier Iso1 : 1.00000
Background CPM 1     : 0.00
Window Limits Window 2 : 450.00
Preset %Error Iso2   : 20.00
Norm Multiplier Iso2 : 1.00000
Background CPM 2     : 0.00
Alpha/Beta Discrimination : NO
    
```

Sam	Rack	Time	H#	CPM Iso1	%Err1	CPM Iso2	%Err2	LumEX	ElTime
1	26-1	30.00	135.3	6.77	14.04	29.90	6.68	0.59	30.80
2	26-2	30.00	136.8	68.17	4.42	30.27	6.64	0.24	61.72
3	26-3	30.00	133.2	69.73	4.37	28.53	6.84	0.24	92.61
4	26-4	30.00	135.8	7.50	13.33	28.97	6.78	0.49	123.50
5	26-5	30.00	138.9	7.30	13.51	29.60	6.71	0.49	154.41
6	26-6	30.00	131.5	7.30	13.51	26.43	7.10	1.76	185.39
7	26-7	30.00	127.0	7.07	13.74	26.77	7.06	1.02	216.32
8	26-8	30.00	131.5	6.80	14.00	26.77	7.06	0.59	247.24
9	26-9	30.00	131.2	7.13	13.67	27.13	7.01	0.62	278.16
10	26-10	30.00	118.3	6.30	14.55	28.50	6.84	0.83	309.11
11	26-11	30.00	123.1	6.77	14.04	26.57	7.08	0.64	340.03
12	26-12	30.00	127.0	7.50	13.33	26.37	7.11	1.13	370.99
13	35-1	30.00	132.6	7.37	13.45	28.07	6.89	0.81	402.02
14	35-2	30.00	139.1	10.93	11.04	27.77	6.93	7.44	433.19
15	35-3	30.00	128.4	7.20	13.61	27.87	6.92	0.64	464.11
16	35-4	30.00	129.3	6.67	14.14	28.17	6.88	0.41	495.01
17	35-5	30.00	138.2	7.37	13.45	29.00	6.78	0.55	525.90
18	35-6	30.00	114.2	8.67	12.40	26.53	7.09	1.03	556.84
19	35-7	30.00	112.5	7.27	13.55	25.43	7.24	0.87	587.78
20	35-8	30.00	112.0	6.87	13.93	28.07	6.89	0.81	618.71
21	35-9	30.00	114.5	7.03	13.77	26.03	7.16	1.66	649.69
22	35-10	30.00	108.0	7.13	13.67	26.73	7.06	0.78	680.63
23	35-11	30.00	124.4	8.80	12.31	25.93	7.17	4.28	711.70
24	35-12	30.00	109.0	8.13	12.80	27.60	6.95	1.97	742.69
25	60-1	30.00	112.7	7.23	13.58	27.67	6.94	0.60	773.71
26	60-2	30.00	112.1	7.63	13.22	26.47	7.10	1.30	804.67
27	60-3	30.00	137.5	6.63	14.18	28.47	6.84	0.53	835.60

Page 1

HR 12-2-09

B60_04_112901

28	60-4	30.00	132.4	68.13	4.42	29.93	6.67	0.24	866.51
29	60-5	30.00	130.9	64.13	4.56	29.77	6.69	0.24	897.41
30	60-6	30.00	139.4	6.87	13.93	29.17	6.76	0.50	928.31
31	60-7	30.00	138.8	8.10	12.83	29.53	6.72	0.49	959.24
32	60-8	30.00	128.8	7.53	13.30	27.43	6.97	0.48	990.14
33	60-9	30.00	132.0	8.00	12.91	28.10	6.89	0.87	1021.08
34	60-10	30.00	138.3	6.73	14.07	28.20	6.88	0.36	1051.96
35	60-11	30.00	126.8	7.73	13.13	26.73	7.06	2.06	1082.98
36	60-12	30.00	117.4	6.97	13.83	27.83	6.92	0.51	1113.88
37	34-1	30.00	139.5	7.50	13.33	27.23	7.00	0.82	1144.92
38	34-2	30.00	152.3	6.87	13.93	26.37	7.11	0.60	1175.82
39	34-3	30.00	113.4	7.93	12.96	27.30	6.99	0.37	1206.74
40	34-4	30.00	121.1	7.10	13.70	26.90	7.04	0.39	1237.61
41	34-5	30.00	114.3	6.57	14.25	27.53	6.96	0.37	1268.51
42	34-6	30.00	149.7	7.70	13.16	25.20	7.27	0.38	1299.40
43	34-7	30.00	140.4	7.73	13.13	28.17	6.88	0.49	1330.32
44	34-8	30.00	111.7	7.50	13.33	28.10	6.89	0.36	1361.20
45	34-9	30.00	117.8	7.47	13.36	26.03	7.16	0.42	1392.11
46	34-10	30.00	117.7	7.27	13.55	25.80	7.19	0.43	1423.01
47	34-11	30.00	116.2	7.97	12.94	25.90	7.17	0.39	1453.91
48	34-12	30.00	117.3	6.07	14.82	26.13	7.14	0.39	1484.82

um 12-2-09

ID: 3H: 5-ML, 10-ML
 USER: 4 COMMENT: LS6000

30 NOV 2009 13:24

PRESET TIME : 30.00
 DATA CALC : CPM H# : YES SAMPLE REPEATS: 1 PRINTER : STD
 COUNT BLANK : NO IC# : NO REPLICATES : 1 RS232 : EDIT
 TWO PHASE : NO AGC : NO CYCLE REPEATS : 1
 SCINTILLATOR: LIQUID LUMEX: NO LOW SAMPLE REJ: 0
 LOW LEVEL : YES HALF LIFE CORRECTION DATE: none

CHAN: 50.0 - 250.0 %ERROR: 1.75 FACTOR: 1.000000 BKG. SUB: 0
 CHAN: 450.0 - 900.0 %ERROR: 20.00 FACTOR: 1.000000 BKG. SUB: 0

ALPHA-BETA DISCRIMINATION: NO

SAM NO	POS	TIME MIN	H#	WIND1		WIND2		LUMEX %	ELAPSED TIME
				CPM	%ERROR	CPM	%ERROR		
1	48-1	30.00	112.7X	7.33	13.48	26.43	7.10	0.74	30.84
2	48-2	30.00	118.1	6.63	14.18	27.13	7.01	0.59	61.75
3	48-3	30.00	121.5	7.13	13.67	27.83	6.92	0.58	92.66
4	48-4	30.00	130.3	7.07	13.74	26.53	7.09	0.73	123.56
5	48-5	30.00	129.9	7.17	13.64	27.20	7.00	0.62	154.46
6	48-6	30.00	130.6	66.77	4.47	29.17	6.76	0.28	185.36
7	48-7	30.00	125.2	68.03	4.43	28.03	6.90	0.28	216.25
73	48-8	30.00	136.5	7.30	13.51	27.47	6.97	0.58	247.16
8/1	48-9	30.00	132.7	6.97	13.83	29.07	6.77	0.57	278.08
10	48-10	30.00	118.4	8.00	12.91	27.53	6.96	0.43	308.96
11	48-11	30.00	119.5	7.97	12.94	27.13	7.01	0.41	339.87
12	48-12	30.00	121.0	6.77	14.04	28.10	6.89	0.41	370.76
13	31-1	30.00	116.0	7.20	13.61	28.47	6.84	0.44	401.78
14	31-2	30.00	118.2	6.73	14.07	27.03	7.02	0.44	432.68
15	31-3	30.00	140.3	7.30	13.51	27.53	6.96	0.43	463.58
16	31-4	30.00	116.8	6.03	14.87	27.10	7.01	0.44	494.50
17	31-5	30.00	121.2	7.03	13.77	27.10	7.01	0.40	525.40
18	31-6	30.00	114.5	7.57	13.27	25.43*	7.24	0.43	556.30
19	31-7	30.00	122.3	7.60	13.25	26.33	7.12	0.46	587.21
20	31-8	30.00	124.2	7.07	13.74	27.60	6.95	0.50	618.11
8/2	21-9	30.00	130.2	7.47	13.36	29.23	6.75	0.51	649.03
22	31-10	30.00	120.5	6.83	13.97	27.50	6.96	0.40	679.93
23	31-11	30.00	123.1	7.23	13.58	29.13	6.77	0.44	710.83
24	31-12	30.00	132.2	7.57	13.27	27.07	7.02	0.60	741.74
25	16-1	30.00	119.2	8.13	12.80	28.53	6.84	0.43	772.75
26	16-2	30.00	118.2	5.87	15.08	28.33	6.86	0.49	803.65
27	16-3	30.00	114.8	6.90	13.90	28.00	6.90	0.51	834.57
28	16-4	30.00	111.4X	7.73	13.13	28.13	6.88	0.45	865.47
29	16-5	30.00	106.4X	7.17	13.64	26.97	7.03	0.52	896.35
30	16-6	30.00	114.9	7.30	13.51	27.13	7.01	0.47	927.28
31	16-7	30.00	131.0	7.70	13.16	29.40	6.73	0.63	958.19
32	16-8	30.00	134.1	70.17	4.36	30.37	6.63	0.29	989.10
33	16-9	30.00	131.6	68.70	4.41	31.10	6.55	0.29	1020.01
8/3	34-10	30.00	135.1	7.17	13.64	27.63	6.95	0.68	1050.96
9-1	35-11	30.00	133.9	8.60	12.45	30.67	6.59	0.68	1081.93
36	16-12	30.00	122.6	9.80	11.66	26.77	7.06	2.39	1112.91
37	29-1	30.00	111.3X	8.57	12.48	29.00	6.78	0.53	1143.94
38	29-2	30.00	135.9	7.50	13.33	28.90	6.79	0.63	1174.85
9-2	39-3	30.00	133.9	7.80	13.07	28.87	6.80	0.58	1205.75
40	29-4	30.00	127.8	63.53	4.58	29.57	6.72	0.29	1236.66
41	29-5	30.00	131.2	66.27	4.49	27.23	7.00	0.27	1267.56
9-3	42-6	30.00	132.4	7.27	13.55	29.73	6.70	0.53	1298.46

X Recount, H # Low

660-04-113001
 * < LCL of 25.71

ML 12-2-89
 47

B60_04_113001

```

BSF Version           : 3
Instrument Type       : LS 6000
Data Capture Date    : 30 Nov 2009 13:25:54
User Filename        : C:\...\LS WINCONNECTION\DATA\USER04\UN113001.BSF
User Number          : 4
User Id              : 3H:5-ML,10-ML
User Comments        : LS6000
Preset Count Time    : 30.00
Calculation Mode     : CPM
H# Selected          : YES
Sample Repeats       : 1
Printer Output Mode  : STD
Blank Count          : NO
IC# or SCR Selected  : NO
Replicates           : 1
RS232 Output Mode   : EDIT
Two-Phase Selected  : NO
AQC Choice           : NO
Cycle Repeats        : 1
Scintillator Choice  : LIQUID
Lumex Selected       : NO
Low Sample Reject Count : 0
Low Level Selection  : YES
Half Life Correction Date : none
Window Limits Window 1 : 50.00
Preset %Error Iso1   : 1.75
Norm Multiplier Iso1 : 1.00000
Background CPM 1     : 0.00
Window Limits Window 2 : 450.00
Preset %Error Iso2   : 20.00
Norm Multiplier Iso2 : 1.00000
Background CPM 2     : 0.00
Alpha/Beta Discrimination : NO
    
```

Sam	Rack	Time	H#	CPM	Iso1	%Err1	CPM	Iso2	%Err2	LumEX	ElTime
1	48-1	30.00	112.7	7.33	13.48		26.43	7.10	0.74	30.84	
2	48-2	30.00	118.1	6.63	14.18		27.13	7.01	0.59	61.75	
3	48-3	30.00	121.5	7.13	13.67		27.83	6.92	0.58	92.66	
4	48-4	30.00	130.3	7.07	13.74		26.53	7.09	0.73	123.56	
5	48-5	30.00	129.9	7.17	13.64		27.20	7.00	0.62	154.46	
6	48-6	30.00	130.6	66.77	4.47		29.17	6.76	0.28	185.36	
7	48-7	30.00	125.2	68.03	4.43		28.03	6.90	0.28	216.25	
8	48-8	30.00	136.5	7.30	13.51		27.47	6.97	0.58	247.16	
9	48-9	30.00	132.7	6.97	13.83		29.07	6.77	0.57	278.08	
10	48-10	30.00	118.4	8.00	12.91		27.53	6.96	0.43	308.96	
11	48-11	30.00	119.5	7.97	12.94		27.13	7.01	0.41	339.87	
12	48-12	30.00	121.0	6.77	14.04		28.10	6.89	0.41	370.76	
13	31-1	30.00	116.0	7.20	13.61		28.47	6.84	0.44	401.78	
14	31-2	30.00	118.2	6.73	14.07		27.03	7.02	0.44	432.68	
15	31-3	30.00	140.3	7.30	13.51		27.53	6.96	0.43	463.58	
16	31-4	30.00	116.8	6.03	14.87		27.10	7.01	0.44	494.50	
17	31-5	30.00	121.2	7.03	13.77		27.10	7.01	0.40	525.40	
18	31-6	30.00	114.5	7.57	13.27		25.43	7.24	0.43	556.30	
19	31-7	30.00	122.3	7.60	13.25		26.33	7.12	0.46	587.21	
20	31-8	30.00	124.2	7.07	13.74		27.60	6.95	0.50	618.11	
21	31-9	30.00	130.2	7.47	13.36		29.23	6.75	0.51	649.03	
22	31-10	30.00	120.5	6.83	13.97		27.50	6.96	0.40	679.93	
23	31-11	30.00	123.1	7.23	13.58		29.13	6.77	0.44	710.83	
24	31-12	30.00	132.2	7.57	13.27		27.07	7.02	0.60	741.74	
25	16-1	30.00	119.2	8.13	12.80		28.53	6.84	0.43	772.75	
26	16-2	30.00	118.2	5.87	15.08		28.33	6.86	0.49	803.65	
27	16-3	30.00	114.8	6.90	13.90		28.00	6.90	0.51	834.57	

Page 1

msk 12-2-09

B60_04_113001										
28	16-4	30.00	111.4	7.73	13.13	28.13	6.88	0.45	865.47	
29	16-5	30.00	106.4	7.17	13.64	26.97	7.03	0.52	896.35	
30	16-6	30.00	114.9	7.30	13.51	27.13	7.01	0.47	927.28	
31	16-7	30.00	131.0	7.70	13.16	29.40	6.73	0.63	958.19	
32	16-8	30.00	134.1	70.17	4.36	30.37	6.63	0.29	989.10	
33	16-9	30.00	131.6	68.70	4.41	31.10	6.55	0.29	1020.01	
34	16-10	30.00	135.1	7.17	13.64	27.63	6.95	0.68	1050.96	
35	16-11	30.00	133.9	8.60	12.45	30.67	6.59	0.68	1081.93	
36	16-12	30.00	122.6	9.80	11.66	26.77	7.06	2.39	1112.91	
37	29-1	30.00	111.3	8.57	12.48	29.00	6.78	0.53	1143.94	
38	29-2	30.00	135.9	7.50	13.33	28.90	6.79	0.63	1174.85	
39	29-3	30.00	133.9	7.80	13.07	28.87	6.80	0.58	1205.75	
40	29-4	30.00	127.8	63.53	4.58	29.57	6.72	0.29	1236.66	
41	29-5	30.00	131.2	66.27	4.49	27.23	7.00	0.27	1267.56	
42	29-6	30.00	132.4	7.27	13.55	29.73	6.70	0.53	1298.46	

12-2-09

ID: 3H = 5-ML, 10-ML

1 DEC 2009 16:05

USER: 4

COMMENT: LS6000

PRESET TIME : 30.00

DATA CALC : CPM H# : YES SAMPLE REPEATS: 1 PRINTER : STD
 COUNT BLANK : NO IC# : NO REPLICATES : 1 RS232 : EDIT
 TWO PHASE : NO AQC : NO CYCLE REPEATS : 1
 SCINTILLATOR: LIQUID LUMEX: NO LOW SAMPLE REJ: 0
 LOW LEVEL : YES HALF LIFE CORRECTION DATE: none

CHAN: 50.0 - 250.0 %ERROR: 1.75 FACTOR: 1.000000 BKG. SUB: 0
 CHAN: 450.0 - 900.0 %ERROR: 20.00 FACTOR: 1.000000 BKG. SUB: 0

ALPHA-BETA DISCRIMINATION: NO

SAM NO	PDS	TIME MIN	H#	WIND1		WIND2		LUMEX %	ELAPSED TIME
				CPM	%ERROR	CPM	%ERROR		
1	37-1	30.00	131.3	7.57	13.27	28.30	6.86	0.77	30.81
2	37-2	30.00	127.3	7.47	13.36	26.30	7.12	0.91	61.73
3	37-3	30.00	125.0	7.07	13.74	28.53	6.84	0.59	92.65
4	37-4	30.00	128.7	7.47	13.36	28.77	6.81	0.67	123.55
5	37-5	30.00	139.4	7.80	13.07	27.03	7.02	0.74	154.47
6	37-6	30.00	127.3	7.43	13.39	29.17	6.76	0.47	185.35
7	37-7	30.00	135.3	7.03	13.77	28.63	6.82	0.44	216.27
8	37-8	30.00	136.5	6.73	14.07	26.40	7.11	0.82	247.20
9	37-9	30.00	136.7	6.97	13.83	29.87	6.68	1.13	278.13
10	37-10	30.00	141.1	7.83	13.05	29.20	6.76	1.01	309.08
11	37-11	30.00	133.1	7.83	13.05	28.57	6.83	1.04	340.00
12	37-12	30.00	131.3	8.80	12.31	28.57	6.83	0.90	370.93
13	50-1	30.00	143.9	8.53	12.50	29.23	6.75	1.95	402.01
14	50-2	30.00	132.5	7.03	13.77	28.77	6.81	0.83	432.92
15	50-3	30.00	139.0	6.77	14.04	30.57	6.60	1.46	463.89
16	50-4	30.00	122.4	7.33	13.48	27.90	6.91	0.53	494.78
17	50-5	30.00	124.0	6.17	14.70	28.70	6.82	0.48	525.67
18	50-6	30.00	124.5	7.90	12.99	28.00	6.90	0.61	556.58
19	50-7	30.00	122.5	6.27	14.59	27.97	6.90	0.61	587.49
20	50-8	30.00	124.9	7.47	13.36	29.13	6.77	0.62	618.40
21	50-9	30.00	127.6	7.30	13.51	28.37	6.86	0.64	649.31

B60-04-120101

MAR 12-2-09

B60_04_120101

```

BSF Version           : 3
Instrument Type       : LS 6000
Data Capture Date    : 01 Dec 2009 16:06:25
User Filename        : C:\...\LS WINCONNECTION\DATA\USER04\UN120101.BSF
User Number         : 4
User Id             : 3H:5-ML,10-ML
User Comments       : LS6000
Preset Count Time   : 30.00
Calculation Mode    : CPM
H# Selected         : YES
Sample Repeats      : 1
Printer Output Mode : STD
Blank Count         : NO
IC# or SCR Selected : NO
Replicates          : 1
RS232 Output Mode   : EDIT
Two-Phase Selected  : NO
AQC Choice          : NO
Cycle Repeats       : 1
Scintillator Choice : LIQUID
Lumex Selected      : NO
Low Sample Reject Count : 0
Low Level Selection : YES
Half Life Correction Date : none
Window Limits Window 1 : 50.00
Preset %Error Iso1  : 1.75
Norm Multiplier Iso1 : 1.00000
Background CPM 1    : 0.00
Window Limits Window 2 : 450.00
Preset %Error Iso2  : 20.00
Norm Multiplier Iso2 : 1.00000
Background CPM 2    : 0.00
Alpha/Beta Discrimination : NO
  
```

Sam	Rack	Time	H#	CPM	Iso1	%Err1	CPM	Iso2	%Err2	LumEX	ElTime
1	37-1	30.00	131.3	7.57	13.27	28.30	6.86	0.77	30.81		
2	37-2	30.00	127.3	7.47	13.36	26.30	7.12	0.91	61.73		
3	37-3	30.00	125.0	7.07	13.74	28.53	6.84	0.59	92.65		
4	37-4	30.00	128.7	7.47	13.36	28.77	6.81	0.67	123.55		
5	37-5	30.00	139.4	7.80	13.07	27.03	7.02	0.74	154.47		
6	37-6	30.00	127.3	7.43	13.39	29.17	6.76	0.47	185.35		
7	37-7	30.00	135.3	7.03	13.77	28.63	6.82	0.44	216.27		
8	37-8	30.00	136.5	6.73	14.07	26.40	7.11	0.82	247.20		
9	37-9	30.00	136.7	6.97	13.83	29.87	6.68	1.13	278.13		
10	37-10	30.00	141.1	7.83	13.05	29.20	6.76	1.01	309.08		
11	37-11	30.00	133.1	7.83	13.05	28.57	6.83	1.04	340.00		
12	37-12	30.00	131.3	8.80	12.31	28.57	6.83	0.90	370.93		
13	50-1	30.00	143.9	8.53	12.50	29.23	6.75	1.95	402.01		
14	50-2	30.00	132.5	7.03	13.77	28.77	6.81	0.83	432.92		
15	50-3	30.00	139.0	6.77	14.04	30.57	6.60	1.46	463.89		
16	50-4	30.00	122.4	7.33	13.48	27.90	6.91	0.53	494.78		
17	50-5	30.00	124.0	6.17	14.70	28.70	6.82	0.48	525.67		
18	50-6	30.00	124.5	7.90	12.99	28.00	6.90	0.61	556.58		
19	50-7	30.00	122.5	6.27	14.59	27.97	6.90	0.61	587.49		
20	50-8	30.00	124.9	7.47	13.36	29.13	6.77	0.62	618.40		
21	50-9	30.00	127.6	7.30	13.51	28.37	6.86	0.64	649.31		

Handwritten: 12-2-09

LSC Run Log

Instrument ID: LS6000

379845

ALS Laboratory Group - Fort Collins

	Date	Sample ID	CountTime (min.)	Rack & Position	Test	User #	Batch ID	Position Check	Initials	Comments
1	11-29-09	0911227-7	30	26 - 12	H ₃ Sml	4	3H091124-6	✓	✓	NA
2		-8		35 - 1						↓
3		-9		- 2						Lumex > 5%, Recount
4		-10		- 3						NA
5		-11		- 4						↓
6		3H091124-6 CBS2		- 5						
7		0911227-12		- 6						↓
8		-13		- 7						Recount, H # low
9		-14		- 8						↓
10		-15		- 9						NA
11		-16		- 10						Recount, H # low
12		-17		- 11						NA
13		-18		- 12						Recount, H # low
14		-19		60 - 1						↓
15		-20		- 2						↓
16		3H091124-6 MB		- 3						NA
17		-6 LCS		- 4						
18		-6 LCSB		- 5						
19		-6 CBS		- 6						
20		-7 CBS1		- 7			3H091124-7			↓
21		0911228 -1		- 8						
22		-2		- 9						
23		-3		- 10						
24		-4		- 11						
25		-5		↓ - 12						
26		-6		34 - 1						
27		-7		- 2						↓
28		-8		- 3						Recount, H # low
29		-9		- 4						NA
30		-10		- 5						↓

Analyst / Date W 12-2-09

FORM 762r6.xls (3/7/09)

Note: Each page is copied as completed and included with the workorder/run documentation, reviewed subsequently.

LSC Run Log

Instrument ID: LS6000 **379846**

ALS Laboratory Group - Fort Collins

	Date	Sample ID	CountTime (min.)	Rack & Position	Test	User #	Batch ID	Position Check	Initials	Comments
1	11-29-09	0911228-11	30	34 - 6	H3 Sm1	4	3H091124-7	NA	NA	NA
2		3H091124-7CB2		- 7						↓
3		0911228-12		- 8						Record, H # Low
4		-13		- 9						NA
5		-14		- 10						
6		-15		- 11						
7		-16		- 12						
8	11-30-09	0911228-17	30	48 - 1	H3 Sm1	4	3H091124-7	NA	NA	Record, H # Low
9		-18		- 2						NA
10		-19		- 3						
11		-20		- 4						
12		3H091124-7MB		- 5						
13		-7LCS		- 6						
14		-7LCSΔ		- 7						
15		-7CB3		- 8						
16		-8CB1		- 9			3H091124-8			
17		0911229-1		- 10						
18		-2		- 11						
19		-3		- 12						
20		-4		31 - 1						
21		-5		- 2						
22		-6		- 3						
23		-7		- 4						
24		-8		- 5						
25		-9		- 6						
26		-10		- 7						
27		-11		- 8						
28		3H091124-8CB2		- 9						
29		0911229-12		- 10						
30		-13		- 11						

Analyst / Date NA 12-2-09

FORM 762r6.xls (3/7/09)

Note: Each page is copied as completed and included with the workorder/run documentation; reviewed subsequently.

LSC Run Log

Instrument ID: LS6000

379848

ALS Laboratory Group - Fort Collins

	Date	Sample ID	Count Time (min.)	Rack & Position	Test	User #	Batch ID	Position Check	Initials	Comments
1	12-1-09	0911225-18	30	37 - 3	Hb Sm1	4	3H091124-4	MR	MR	NR
2		0911226-2		- 4			3H091124-5			
3		-11		- 5						
4		-12		- 6						
5		-14		- 7						
6		-17		- 8						
7		-18		- 9						
8		0911227-13		- 10			3H091124-6			
9		-14		- 11						
10		-16		- 12						
11		-18		50 - 1						
12		-19		- 2						
13		-20		- 3						
14		0911228-8		- 4			3H091124-7			
15		-12		- 5						
16		-17		- 6						
17		0911229-18		- 7			3H091124-8			
18		-19		- 8						
19		0911229-21		- 9			3H091124-9			
20	12-2-09	Daily RC	10	113 - 113, 112		113		MR	MR	NR
21	12-2-09	3H091124-1001	90	18 - 1	Hb 10ml	8	3H091124-1			
22		0911061-1		- 2						
23		-15		- 3						
24		-3		- 4						
25		0911148-2		- 5						MR 12-2-09
26		0911227-9	30	10 - 1	Hb Sm1	4	3H091124-6	MR	MR	lumex still > 5%
27										
28										
29										
30										MR 12-2-09

Analyst / Date MR 12-2-09

FORM 762r6.xls (3/7/09)

Note: Each page is copied as completed and included with the workorder/run documentation; reviewed subsequently.



Section 6

QUALITY ASSURANCE SUMMARY REPORTS

6



No *NON-CONFORMANCE REPORTS* or *QUALITY ASSURANCE SUMMARY SHEETS* are included in this data package.



Section 7

LABORATORY BENCH SHEETS

7

Radiochemistry Instrument Worksheet

ALS Laboratory Group -- FC

Prep Batch: 3H091124-7

Prep Procedure: H3

Analytical QASS / NCR? Y / N *NR*

Prep Num	LabID	QC Type	Init Alq	Fin Alq	Units	Report Units	Cnt 1 File/Inst	Cnt 1 Rack-Pos	Cnt 1 Pos Chk By	Cnt 2 File/Inst	Cnt 2 Rack-Pos	Cnt 2 Pos Chk By	Cnt 3 File/Inst	Cnt 3 Rack-Pos	Cnt 3 Pos Chk By	Notes
1	0911228-1	SMP	1	1	sample	pCi/sample	LS6000	60-8	<i>NR</i>							<i>X recount, H# Low</i>
1	0911228-2	SMP	1	1	sample	pCi/sample		-9								
1	0911228-3	SMP	1	1	sample	pCi/sample		-10								
1	0911228-4	SMP	1	1	sample	pCi/sample		-11								
1	0911228-5	SMP	1	1	sample	pCi/sample		-12								
1	0911228-6	SMP	1	1	sample	pCi/sample		34-1								
1	0911228-7	SMP	1	1	sample	pCi/sample		2								<i>NR 12-2-09</i>
1	0911228-8	SMP	1	1	sample	pCi/sample		3 X		LS6000	50-4	<i>NR</i>				<i>5 µL nitro added</i>
1	0911228-9	SMP	1	1	sample	pCi/sample		4								
1	0911228-10	SMP	1	1	sample	pCi/sample		5								
1	0911228-11	SMP	1	1	sample	pCi/sample		6								<i>NR 12-2-09</i>
1	0911228-12	SMP	1	1	sample	pCi/sample		8 X		LS6000	50-5	<i>NR</i>				<i>5 µL nitro added</i>
1	0911228-13	SMP	1	1	sample	pCi/sample		9								
1	0911228-14	SMP	1	1	sample	pCi/sample		10								
1	0911228-15	SMP	1	1	sample	pCi/sample		11								
1	0911228-16	SMP	1	1	sample	pCi/sample		12								<i>NR 12-2-09</i>
1	0911228-17	SMP	1	1	sample	pCi/sample		48-1 X		LS6000	50-6	<i>NR</i>				<i>5 µL nitro added</i>
1	0911228-18	SMP	1	1	sample	pCi/sample		2								
1	0911228-19	SMP	1	1	sample	pCi/sample		3								
1	0911228-20	SMP	1	1	sample	pCi/sample		4								<i>NR 12-2-09</i>
1	3H091124-7cb1	MB	1	1	sample	pCi/sample		60-7								<i>10 µL nitro added</i>
1	3H091124-7cb2	MB	1	1	sample	pCi/sample		34-7								
1	3H091124-7cb3	MB	1	1	sample	pCi/sample		48-8								
1	3H091124-7	MB	1	1	sample	pCi/sample		5								
1	3H091124-7	LCS	1	1	sample	pCi/sample		6								
1	3H091124-7	LCSD	1	1	sample	pCi/sample		7								<i>NR 12-2-09</i>

Radiochemistry Instrument Worksheet

ALS Laboratory Group -- FC

Prep Batch: 31091124-7

Prep Procedure: H3

Analytical QASS / NCR? Y (N) NA

Prep Num	LabID	QC Type	Init Alq	Fin Alq	Units	Report Units	Cnt 1 File/Inst	Cnt 1 Rack-Pos	Cnt 1 Pos Chk By	Cnt 2 File/Inst	Cnt 2 Rack-Pos	Cnt 2 Pos Chk By	Cnt 3 File/Inst	Cnt 3 Rack-Pos	Cnt 3 Pos Chk By	Notes	

Spike Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	H-3	648.3610.44	2,523.623	DPM/ml	11/24/09	0.1	ml	RS-013

Radiochemistry Instrument Worksheet

ALS Laboratory Group -- FC

Prep Batch: 3H091124-7

Reporting Units

LabID:	TstGrpName:	RptUnits:
0911228-1	H3_Edgewood_smears_20pCi	pCi/samp
0911228-2	H3_Edgewood_smears_20pCi	pCi/samp
0911228-3	H3_Edgewood_smears_20pCi	pCi/samp
0911228-4	H3_Edgewood_smears_20pCi	pCi/samp
0911228-5	H3_Edgewood_smears_20pCi	pCi/samp
0911228-6	H3_Edgewood_smears_20pCi	pCi/samp
0911228-7	H3_Edgewood_smears_20pCi	pCi/samp
0911228-8	H3_Edgewood_smears_20pCi	pCi/samp
0911228-9	H3_Edgewood_smears_20pCi	pCi/samp
0911228-10	H3_Edgewood_smears_20pCi	pCi/samp
0911228-11	H3_Edgewood_smears_20pCi	pCi/samp
0911228-12	H3_Edgewood_smears_20pCi	pCi/samp
0911228-13	H3_Edgewood_smears_20pCi	pCi/samp
0911228-14	H3_Edgewood_smears_20pCi	pCi/samp
0911228-15	H3_Edgewood_smears_20pCi	pCi/samp
0911228-16	H3_Edgewood_smears_20pCi	pCi/samp
0911228-17	H3_Edgewood_smears_20pCi	pCi/samp
0911228-18	H3_Edgewood_smears_20pCi	pCi/samp
0911228-19	H3_Edgewood_smears_20pCi	pCi/samp
0911228-20	H3_Edgewood_smears_20pCi	pCi/samp








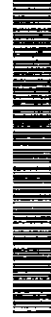




Sample Barcodes

0911228-1 3H091124-7PS1 	0911228-2 3H091124-7PS2 
0911228-3 3H091124-7PS3 	0911228-4 3H091124-7PS4 
0911228-5 3H091124-7PS5 	0911228-6 3H091124-7PS6 
0911228-7 3H091124-7PS7 	0911228-8 3H091124-7PS8 
0911228-9 3H091124-7PS9 	0911228-10 3H091124-7PS10 
0911228-11 3H091124-7PS11 	0911228-12 3H091124-7PS12 
0911228-13 3H091124-7PS13 	0911228-14 3H091124-7PS14 

Radiochemistry Instrument Worksheet

Prep Batch: 3H091124-7

ALS Laboratory Group -- FC

0911228-15 3H091124-7PS15		0911228-16 3H091124-7PS16	
0911228-17 3H091124-7PS17		0911228-18 3H091124-7PS18	
0911228-19 3H091124-7PS19		0911228-20 3H091124-7PS20	
3H091124-7cb1MB 3H091124-7PS21		3H091124-7cb2MB 3H091124-7PS22	
3H091124-7cb3MB 3H091124-7PS23		3H091124-7MB 3H091124-7PS24	
3H091124-7LCS 3H091124-7PS25		3H091124-7LCSD 3H091124-7PS26	

Radiochemistry Prep Worksheet

Prep Batch: 3H091124-7

Prep Procedure: H3

Reviewed By: L.J.F. Review Date: 11/25/2009

Non-Routine Pre-Treatment? Y / N Batch: N/A Re-Prep? Y / N Batch: N/A Prep QASS / NCR? Y / N

Prep SOP: PAI 700 Rev: 10 Prep Analyst: Jay Fielding Balance: Prep Date: 11/24/2009 Prep Dept: RS

Matrix Class: solid Prep SOP: NONE Balance: Cockail: UG-LLT Allquot Pipet: RS-009 Cockail Pipet: T-002

Sampl Prep Num	Labid	QC Dish No.	Int Alq sample	Fin Alq sample	Prep Basis	Analysis Vol.(ml)	Standards	Prep Notes
----------------	-------	-------------	----------------	----------------	------------	-------------------	-----------	------------

1	0911228-1	SMP	N/A	1	1	As Received	N/A	
2	0911228-2	SMP	1	1	As Received	1		
3	0911228-3	SMP	1	1	As Received	1		
4	0911228-4	SMP	1	1	As Received	1		
5	0911228-5	SMP	1	1	As Received	1		
6	0911228-6	SMP	1	1	As Received	1		
7	0911228-7	SMP	1	1	As Received	1		
8	0911228-8	SMP	1	1	As Received	1		
9	0911228-9	SMP	1	1	As Received	1		
10	0911228-10	SMP	1	1	As Received	1		
11	0911228-11	SMP	1	1	As Received	1		
12	0911228-12	SMP	1	1	As Received	1		
13	0911228-13	SMP	1	1	As Received	1		
14	0911228-14	SMP	1	1	As Received	1		
15	0911228-15	SMP	1	1	As Received	1		
16	0911228-16	SMP	1	1	As Received	1		
17	0911228-17	SMP	1	1	As Received	1		
18	0911228-18	SMP	1	1	As Received	1		
19	0911228-19	SMP	1	1	As Received	1		
20	0911228-20	SMP	1	1	As Received	1		
21	3H091124-7cb1	MB	1	1	As Received	1		
22	3H091124-7cb2	MB	1	1	As Received	1		
23	3H091124-7cb3	MB	1	1	As Received	1		
24	3H091124-7	MB	1	1	As Received	1		
25	3H091124-7	LCS	1	1	As Received	1		
26	3H091124-7	LCS	1	1	As Received	1		
		LCS	1	1	As Received	1		

11/25/09

Radiochemistry Prep Worksheet

ALS Laboratory Group -- FC

Prep Batch: 3H0911247

Prep Procedure: H3

Reviewed By: LJF 5 Review Date: 11/25/2009

Non-Routine Pre-Treatment? Y / N Batch: N/A Re-Prep? Y / N Batch: N/A Prep QASS / NCR? Y / N / K

Prep SOP: PAI 700 Rev: 10 Prep Analyst: Jay Fielding Balance: Cocktail: UG-LLT
 Prep SOP: NONE Prep Date: 11/24/2009 Balance: Cocktail Pipet: T-002
 Matrix Class: solid Prep Dept: RS Aliquot Pipet: RS-009

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq sample	Fin Alq sample	Prep Basis	Analysis Vol.(ml)	Standards	Prep Notes

Comments
 Lot # 97-090301. Due to inadequate volume no sample duplicate or matrix spike was performed. A LCS Duplicate was performed instead.

Spiked By: Jay Fielding Date: 11/25/2009
 Witnessed By: Joe D. Dauner Date: 11/25/2009

Spike Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	H-3	848.3610.44	2,523.623	DPM/ml	11/24/09	0.1	ml	RS-013

Radiochemistry Prep Worksheet

Prep Batch: 3H091124-7

Prep Procedure: H3

Prep Batch Not Validated!!!

Reviewed By: Review Date:

Non-Routine Pre-Treatment? Y / N Batch: Re-Prep? Y / N Batch: Prep QASS / NCR? Y / N

Prep SOP: PAI 700 Rev: 10
 Prep SOP: NONE
 Matrix Class: solid

Prep Analyst: Jay Fielding
 Prep Date: 11/24/2009

Balance: Balance: Prep Dept: RS

Cocktail: UG-LLT
 Cocktail Pipet: T-002
 Alliquot Pipet: RS-009

Sample Num	Prep Num	LabID	QC Type	Dish No.	Int Aliq sample	Fin Aliq sample	Prep Basis	Analysis Vol.(ml)	Standards	Prep Notes
------------	----------	-------	---------	----------	-----------------	-----------------	------------	-------------------	-----------	------------

1	1	0911228-1	SMP		1	1	As Received			
2	1	0911228-2	SMP		1	1	As Received			
3	1	0911228-3	SMP		1	1	As Received			
4	1	0911228-4	SMP		1	1	As Received			
5	1	0911228-5	SMP		1	1	As Received			
6	1	0911228-6	SMP		1	1	As Received			
7	1	0911228-7	SMP		1	1	As Received			
8	1	0911228-8	SMP		1	1	As Received			
9	1	0911228-9	SMP		1	1	As Received			
10	1	0911228-10	SMP		1	1	As Received			
11	1	0911228-11	SMP		1	1	As Received			
12	1	0911228-12	SMP		1	1	As Received			
13	1	0911228-13	SMP		1	1	As Received			
14	1	0911228-14	SMP		1	1	As Received			
15	1	0911228-15	SMP		1	1	As Received			
16	1	0911228-16	SMP		1	1	As Received			
17	1	0911228-17	SMP		1	1	As Received			
18	1	0911228-18	SMP		1	1	As Received			
19	1	0911228-19	SMP		1	1	As Received			
20	1	0911228-20	SMP		1	1	As Received			
21	1	3H091124-7cb1 MB	As Received		1	1	As Received			
22	1	3H091124-7cb2 MB	As Received		1	1	As Received			
23	1	3H091124-7cb3 MB	As Received		1	1	As Received			
24	1	3H091124-7 MB	As Received		1	1	As Received			
25	1	3H091124-7 LCS	As Received		1	1	As Received		SI	
26	1	3H091124-7 LCSD	As Received		1	1	As Received		SI	

Supersedes: N/A

Radiochemistry Prep Worksheet

Prep Batch: 3H091124-7

Prep Procedure: H3

Prep Batch Not Validated!!!

Reviewed By:

Review Date:

Non-Routine Pre-Treatment? Y / N Batch: _____ Re-Prep? Y / N Batch: _____

Prep SOP: PAI 700 Rev: 10
 Prep SOP: NONE
 Matrix Class: solid

Prep Analyst: Jay Fielding
 Prep Date: 11/24/2009
 Prep Dept: RS

Cocktail: UG-LT
 Cocktail Pipet: T-002
 Alliquot Pipet: RS-009

Balance: _____
 Balance: _____

Prep QA/SS / NCR? Y / N

Samp Prep Num	LabID	QC Type No.	Init Alq sample	Fin Alq sample	Prep Basis	Analysis Vol.(ml)	Standards	Prep Notes

Comments

Lot # 97-090301. Due to inadequate volume no sample duplicate or matrix spike was performed. A LCS Duplicate was performed instead.

Spiked By: Jay Fielding
 Date: 11/25/2009

Witnessed By: JF
 Date: 11/25/09

Spike Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Alliquot Units	PipetID
S1	H-3	648.3610.44	2,523.623	DPM/ml	11/24/09	0.1 ml	RS-013

SI exp 10/21/10

SAMPLE CONDITION FORM (SOLIDS)

ANALYST: S

ANALYSIS DATE: 11/24/09

METHOD: 3H

WORK ORDER	SAMPLE ID	SAMPLE CONDITION		
		Dry/Wet	TEXTURE	Remarks
0911225	1-20	AS Received	SWIPE	Swipe in LS vial with 5ml.
0911226	1-20	↓	↓	↓
0911227	1-21	↓	↓	↓
0911228	1-20	↓	↓	↓
0911229	1-21	↓	↓	↓
<div style="position: absolute; top: 50%; left: 50%; transform: translate(-50%, -50%); opacity: 0.5;"> <p>S</p> <p>11/24/09</p> </div>				



Section 8

STANDARDS TRACEABILITY DOCUMENTS



Prepare a working dilution of ~5000 dpm/ml of Tritium form 648.2382.75.

bal #

1) Density of DI water

Mass of 100 ml Vol flask	66.4336 g	12
Mass of flask + water	166.1135 g	1
Net Mass	99.6799	
$\rho = 0.9968 \frac{g}{ml}$		

2) Mass of Std Transferred

Mass of Empty 500 ml Glass	260.38g	26
Mass of Glass + Std	266.45g	+
Net Mass Transferred	6.07g	

3) Dilute to Fin. Vol. w/ DI water

Mass of Glass, Std, Diluent	733.7g	26
Mass of Glass	260.38g	1
Net Mass of New Dilution	473.32g	

Final Activity Calc

$$\left(369,580.45 \frac{dpm}{ml} \right) \left(0.9968 \frac{g}{ml} \right) \left(6.07g \right) \left(0.9958 \frac{g}{ml} \right) \left(473.32g \right) = 4,743.7 \frac{dpm}{ml}$$

RG 10/23/09

Std ID: 648.3610.44

RG 10/23/09

Description: 3H

Expiration: 10/21/2010

Activity: 4743.70 dpm/mL

2s Uncertainty: 34.15 dpm/mL

Ref. Date: 9/3/1998

Ref Time: N/A

Prep Date: 9/29/2009 Prep by: JD

Matrix/Comp. DI Water

Half Life (y): 1.23E+01

RG 10/23/09

Reverification Log		
Analysis Date	Initials	Expiration Date

RG 10/23/09

Continued on Page

Read and Understood By


Signed

9/29/09
Date


Signed

10/23/09
Date

Prepare a ¹⁰ dilution ~~working level~~ dilution (of approximately 250 DPM/mL) from standard using RSD # 6483 and diluting with DI water.

1) Determine the density of DI water:

Mass of empty 100 mL class A volumetric flask	67.1522 g	Bal #13
Mass of flask + water	166.7351 g	↓
Net mass of 100 mL H ₂ O	99.5829 g	
	$\rho = 9958 \text{ g/mL}$	

2) Transfer contents of Ampule SRM 4927F to a

40 mL VOA vial - 500 mL glass amber bottle

mass of 40 mL vial w/o lid	255.04 g	Bal #26
mass of open ampule + 50 mL beaker	40.9075 g	Bal #12
mass of empty ampule + 50 mL beaker	36.0148 g	↓
Net mass of Std.	4.8927 g	

3) Dilute Std. with DI water

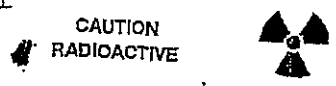
mass of bottle w/o lid	255.04 g	Bal #26
mass of bottle, std, + DI water	757.1 g	↓
Net mass of Std + DI water	502.1 g	

4. Final Activity Calculation

$$\frac{(634.7 \text{ kBq/g})(1000 \text{ Bq/kBq})(60 \text{ DPM/Bq})(4.8927 \text{ g})(.9958 \text{ g/mL})}{502.1 \text{ g}} = 369,530.45 \frac{\text{DPM}}{\text{mL}}$$

U.S. Department of Commerce
National Institute of Standards
and Technology
SRM 4927F
Hydrogen-3
<4 MBq in distilled water

Continued on Page



Read and Understood By

Chad [Signature]
Signed

3/27/03
Date

Bence [Signature]
Signed

3/27/03
Date



National Institute of Standards & Technology

Certificate

PA ID 0648
17-04-02

Standard Reference Material 4927F Hydrogen-3 Radioactivity Standard

This Standard Reference Material (SRM) consists of radioactive hydrogen-3, as water, in 5 mL of distilled water. The solution is contained in a flame-sealed NIST borosilicate-glass ampoule. The SRM is intended for the calibration of beta-particle counting instruments and for the monitoring of radiochemical procedures.

Radiological Hazard

The SRM ampoule contains hydrogen-3 with a total activity of approximately 3.2 MBq. Hydrogen-3 decays by beta-particle emission. None of the beta particles escape from the SRM ampoule. During the decay process no photons are emitted. Approximate unshielded dose rates at several distances (as of the reference time) are given in note [a]*. There is no detectable external radiation. The SRM should be used only by persons qualified to handle radioactive material.

Chemical Hazard

The SRM ampoule contains only distilled water. There is no chemical hazard. If the ampoule is to be opened to transfer the solution, the recommended procedure is given on page 2.

Storage and Handling

The SRM should be stored and used at a temperature between 5 and 65 °C. The solution in an unopened ampoule should remain stable and homogeneous until at least September 2008.

The ampoule (or any subsequent container) should always be clearly marked as containing radioactive material. If the ampoule is transported it should be packed, marked, labeled, and shipped in accordance with the applicable national, international, and carrier regulations. The solution in the ampoule is a dangerous good (hazardous material) because of the radioactivity.

Preparation

This Standard Reference Material was prepared in the Physics Laboratory, Ionizing Radiation Division, Radioactivity Group, L.R. Karam, Group Leader. The overall technical direction and physical measurements leading to certification were provided by L.L. Lucas and M.P. Unterwiesing 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 by J.W.L. Thomas.

Bert M. Coursey, Chief
Ionizing Radiation Division

Gaithersburg, Maryland 20899
June 1999
Half-life and text revised October 2000

Nancy M. Trahey, Chief
Standard Reference Materials Program

Recommended Procedure for Opening the SRM Ampoule

- 1) If the SRM solution is to be diluted, it is recommended that the diluting solution have a composition comparable to that of the SRM solution.
- 2) Wear eye protection, gloves, and protective clothing and work over a tray with absorbent paper in it. Work in a fume hood.
- 3) Shake the ampoule to wet all of the inside surface of the ampoule. Return the ampoule to the upright position.
- 4) Check that all of the liquid has drained out of the neck of the ampoule. If necessary, gently tap the neck to speed the process.
- 5) Holding the ampoule upright, score the narrowest part of the neck with a scribe or diamond pencil.
- 6) Lightly wet the scored line. This reduces the crack propagation velocity and makes for a cleaner break.
- 7) Hold the ampoule upright with a paper towel, a wiper, or a support jig. Position the scored line away from you. Using a paper towel or wiper to avoid contamination, snap off the top of the ampoule by pressing the narrowest part of the neck away from you while pulling the tip of the ampoule towards you.
- 8) Transfer the solution from the ampoule using a pycnometer or a pipet with dispenser handle. NEVER PIPETTE BY MOUTH.
- 9) Seal any unused SRM solution in a flame-sealed glass ampoule, if possible, to minimize the evaporation loss.

See also reference [4]*.

PROPERTIES OF SRM 4927F

Certified values

Solution density	(0.998 ± 0.002) g·mL ⁻¹ at 20.0 °C [b]*
Radionuclide	Hydrogen-3
Reference time	1200 EST, 3 September 1998
Massic activity of the solution [c]	634.7 kBq·g ⁻¹
Relative expanded uncertainty (k=2)	0.72% [d] [e]

Uncertified values

Physical Properties:			
Source description	Liquid in flame-sealed NIST borosilicate-glass ampoule		
Ampoule specifications	Body outside diameter	(16.5 ± 0.5) mm	
	Wall thickness	(0.60 ± 0.04) mm	
	Barium content	Less than 2.5%	
	Lead-oxide content	Less than 0.02%	
	Other heavy elements	Trace quantities	
Solution mass	Approximately 5.0 g		
Chemical Properties:			
Solution composition	Chemical Formula	Concentration (mol·L ⁻¹)	Mass Fraction (g·g ⁻¹)
	H ₂ O 3HHO	55 6 × 10 ⁻⁷	100 1 × 10 ⁻⁶
Radiological Properties:			
Radionuclidic impurities	None detected [f]		
Half lives used	Hydrogen-3: (4500 ± 8) d [g]		
Calibration method and measuring instrument(s)	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 counting systems [h]		

EVALUATION OF THE UNCERTAINTY OF THE MASSIC ACTIVITY [d]*

Input Quantity x_i , the source of uncertainty (and individual uncertainty components where appropriate)	Method Used To Evaluate $u(x_i)$, the standard uncertainty of x_i , (A) denotes evaluation by statistical methods (B) denotes evaluation by other methods	Relative Uncertainty Of Input Quantity, $u(x_i)/x_i$, (%) [i]	Relative Sensitivity Factor, $ \partial y/\partial x_i $ (x_i/y) [j]	Relative Uncertainty Of Output Quantity, $u_i(y)/y$, (%) [k]
Massic count rate of SRM 4927E, corrected for background and decay [h]	Standard deviation of the mean for 23 sets of gas counting measurements (A)	0.18	1.0	0.18
Gram-mole measurements	Estimated (B)	0.20	1.0	0.20
Live-time [p]	Estimated (B)	0.10	1.0	0.10
Extrapolation of count-rate-versus-energy to zero energy	Estimated (B)	0.20	1.0	0.20
Half life of H-3	Standard uncertainty of the half life (A)	0.18 [m]	0.009 [n]	0.002
Liquid-scintillation intercomparison of SRM 4927F and SRM-4927E	Standard deviation of the mean for 7 sets of liquid-scintillation measurements (A)	0.06	1.0	0.06
Radionuclidic impurities	Limit of detection (B) [q]	100	0.0005	0.05
Relative Combined Standard Uncertainty of the Output Quantity, $u_c(y)/y$, (%)				0.36
Coverage Factor, k				$\times 2$
Relative Expanded Uncertainty of the Output Quantity, U/y , (%)				0.72

NOTES

- [a] The Sievert is the SI unit for dose equivalent. See reference [1]. One μSv is equal to 0.1 mrem.
 Distance from Ampoule (cm): 1 30 100
 Approximate Dose Rate ($\mu\text{Sv/h}$): <0.1 (Not detectable)
- [b] The stated uncertainty is two times the standard uncertainty.
- [c] **Massic activity is the preferred name for the quantity activity divided by the total mass of the sample.**
 See reference [1].
- [d] The reported value, y , of massic activity (activity per unit mass) at the reference time was not measured directly but was derived from measurements and calculations of other quantities. This can be expressed as $y = f(x_1, x_2, x_3, \dots, x_n)$, where f is a mathematical function derived from the assumed model of the measurement process.
- The value, x_i , used for each input quantity i has a standard uncertainty, $u(x_i)$, that generates a corresponding uncertainty in y , $u_i(y) = |\partial f / \partial x_i| \cdot u(x_i)$, called a component of combined standard uncertainty of y .
- The combined standard uncertainty of y , $u_c(y)$, is the positive square root of the sum of the squares of the components of combined standard uncertainty.
- The combined standard uncertainty is multiplied by a coverage factor of $k = 2$ to obtain U , the expanded uncertainty of y .
- Since it can be assumed that the possible estimated values of the massic activity are approximately normally distributed with approximate standard deviation $u_c(y)$, the unknown value of the massic activity is believed to lie in the interval $y \pm U$ with a level of confidence of approximately 95 percent.
- For further information on the expression of uncertainties, see references [2] and [3].
- [e] The value of each standard uncertainty component, and hence the value of the expanded uncertainty itself, is a best estimate based upon all available information, but is only approximately known. That is to say, the "uncertainty of the uncertainty" is large and not well known. This is true for uncertainties evaluated by statistical methods (e.g., the relative standard deviation of the standard deviation of the mean for the massic response is approximately 50%) and for uncertainties evaluated by other methods (which could easily be over estimated or under estimated by substantial amounts). The unknown value of the expanded uncertainty is believed to lie in the interval $U/2$ to $2U$ (i.e., within a factor of 2 of the estimated value).
- [f] The estimated limit of detection for radionuclidic impurities is $300 \text{ Bq} \cdot \text{g}^{-1}$.
- [g] The stated uncertainty is the standard uncertainty. See reference [5].
- [h] 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 solution using liquid-scintillation counting.
- [i] Relative standard uncertainty of the input quantity x_i .

- [j] The relative change in the output quantity y divided by the relative change in the input quantity x_i . If $|\partial y/\partial x_i| \cdot (x_i/y) = 1.0$, then a 1% change in x_i results in a 1% change in y . If $|\partial y/\partial x_i| \cdot (x_i/y) = 0.05$, then a 1% change in x_i results in a 0.05% change in y .
- [k] Relative component of combined standard uncertainty of output quantity y , rounded to two significant figures or less. The relative component of combined standard uncertainty of y is given by $u_c(y)/y \approx |\partial y/\partial x_i| \cdot u(x_i)/y = |\partial y/\partial x_i| \cdot (x_i/y) \cdot u(x_i)/x_i$. The numerical values of $u(x_i)/x_i$, $|\partial y/\partial x_i| \cdot (x_i/y)$, and $u_c(y)/y$, all dimensionless quantities, are listed in columns 3, 4, and 5, respectively. Thus, the value in column 5 is equal to the value in column 4 multiplied by the value in column 3. The input quantities are independent, or very nearly so. Hence the covariances are zero or negligible.
- [m] The relative standard uncertainty of $\lambda \cdot t$ is determined by the relative standard uncertainty of λ (i.e., of the half life). The relative standard uncertainty of t is negligible.
- [n] $|\partial y/\partial x_i| \cdot (x_i/y) = |\lambda \cdot t|$
 The live time is determined by counting the pulses from a gated crystal-controlled oscillator.
- [q] The standard uncertainty for each undetected impurity that might reasonably be expected to be present is estimated to be equal to the estimated limit of detection for that impurity, i.e. $u(x_i)/x_i = 100\%$. $|\partial y/\partial x_i| \cdot (x_i/y) = \{(\text{response per Bq of impurity})/(\text{response per Bq of H-3})\} \cdot \{(\text{Bq of impurity})/(\text{Bq of H-3})\}$. Thus $u_c(y)/y$ is the relative change in y if the impurity were present with a massic activity equal to the estimated limit of detection.

REFERENCES

- [1] International Organization for Standardization (ISO), *ISO Standards Handbook - Quantities and Units*, 1993. Available from the American National Standards Institute, 11 West 42nd Street, New York, NY 10036, U.S.A. 1-212-642-4900.
- [2] International Organization for Standardization (ISO), *Guide to the Expression of Uncertainty in Measurement*, 1993. Available from the American National Standards Institute, 11 West 42nd Street, New York, NY 10036, U.S.A. 1-212-642-4900. (Listed under ISO miscellaneous publications as "ISO Guide to the Expression 1993".)
- [3] P. 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.
- [4] National Council on Radiation Protection and Measurements Report No. 58, *A Handbook of Radioactivity Measurements Procedures*, Second Edition, 1985. Available from the National Council on Radiation Protection and Measurements, 7910 Woodmont Avenue, Bethesda, MD 20814 U.S.A.
- [5] L.L. Lucas and M.P. Unterwiesing, *Comprehensive Review and Critical Evaluation of the Half-Life of Tritium*, J. Res. Natl. Inst. Stand. Technol. **105**, 541-549 (2000).



Section 9

ADDITIONAL SUPPORTING DOCUMENTATION



Liquid Scintillation Counter

Instrumentation Calibration

Initial Efficiency Calibration
Standards Traceability

H-3 Swipes "Window 2" Control Limits (LS 6000)

The background count rate is determined from the average of the reagent blanks for the batch.

Window 2 control limits are established using the average count rate from the three reagent blanks associated with each prep batch +/- 3X the estimated poisson uncertainty.

Updated 10/29/09 mh

COUNT DATE	#	Sample ID	Count Duration (min.)	Average count Duration (min.)	Count Rate (CPM)	Batch Average Reagent Blank	Lower Control Limit	Upper Control Limit	PASS/ FAIL
11/28/2009	4	3H091124-4CB1	30		28.70				
11/28/2009	5	3H091124-4CB2	30		29.27				
11/28/2009	6	3H091124-4CB3	30	30	28.10	28.69	25.76	31.62	PASS
11/29/2009	7	3H091124-5CB1	30		27.17				
11/29/2009	8	3H091124-5CB2	30		28.40				
11/29/2009	9	3H091124-5CB3	30	30	28.97	28.18	25.27	31.09	PASS
11/29/2009	10	3H091124-6CB1	30		29.60				
11/29/2009	11	3H091124-6CB2	30		29.00				
11/30/2009	12	3H091124-6CB3	30	30	29.17	29.26	26.29	32.22	PASS
11/30/2009	13	3H091124-7CB1	30		29.53				
11/30/2009	14	3H091124-7CB2	30		28.17				
11/30/2009	15	3H091124-7CB3	30	30	27.47	28.39	25.47	31.31	PASS
11/30/2009	16	3H091124-8CB1	30		29.07				
11/30/2009	17	3H091124-8CB2	30		29.23				
12/1/2009	18	3H091124-8CB3	30	30	27.63	28.64	25.71	31.57	PASS
12/1/2009	19	2H091124-9CB1	30		30.67				
12/1/2009	20	2H091124-9CB2	30		28.87				
12/1/2009	21	2H091124-9CB3	30	30	29.73	29.76	26.77	32.74	PASS

H-3 Swipe Quench Curve Background and Efficiency Determination

LS6000
12/2/2009

Polynomial Coefficient			H # Range	
	Efficiency	Background	Low =	High =
x^0	3.7192E-01	6.0669E+00	113.6	
x^1	-1.1270E-03	6.9704E-03	283.3	

Calib. Date : 10/26/2009

Sample ID	Pos #	H#	Obs.CPM	Corr. BCPM	CPM Corr.Fact.
3H091124-7CB1	60-7	138.8	8.10	7.034	-1.066
3H091124-7CB2	34-7	140.4	7.73	7.046	-0.684
3H091124-7CB3	48-8	136.5	7.30	7.018	-0.282
Average=					-0.677

Sample ID	Pos #	H #	Efficiency	Background	H # Check
0911228-1	60-8	128.8	0.2268	7.642	OK
0911228-2	60-9	132.0	0.2232	7.664	OK
0911228-3	60-10	138.3	0.2161	7.708	OK
0911228-4	60-11	126.8	0.2290	7.628	OK
0911228-5	60-12	117.4	0.2396	7.562	OK
0911228-6	34-1	139.5	0.2147	7.717	OK
0911228-7	34-2	152.3	0.2003	7.806	OK
0911228-8	50-4	122.4	0.2340	7.597	OK
0911228-9	34-4	121.1	0.2354	7.588	OK
0911228-10	34-5	114.3	0.2431	7.541	OK
0911228-11	34-6	149.7	0.2032	7.788	OK
0911228-12	50-5	124.0	0.2322	7.608	OK
0911228-13	34-9	117.8	0.2392	7.565	OK
0911228-14	34-10	117.7	0.2393	7.565	OK
0911228-15	34-11	116.2	0.2410	7.554	OK
0911228-16	34-12	117.3	0.2397	7.562	OK
0911228-17	50-6	124.5	0.2316	7.612	OK
0911228-18	48-2	118.1	0.2388	7.567	OK
0911228-19	48-3	121.5	0.2350	7.591	OK
0911228-20	48-4	130.3	0.2251	7.652	OK
3H091124-7MB	48-5	129.9	0.2255	7.650	OK
3H091124-7LCS	48-6	130.6	0.2247	7.654	OK
3H091124-7LCSD	48-7	125.2	0.2308	7.617	OK

Tritium Swipe (Glass Vial) Quench Curve

10/26/2009

Beckman LS6000

Standard : 699.3020.95

Ref. Date : 9/3/1998

Spike Act. : 160351.040 dpm/mL

Spike Vol. : 0.10000 mL

Bkg. Coefficients

Ax= 6.9704E-03

B= 6.0669E+00

Eff. Coefficients

Bx= -1.1270E-03

C= 3.7192E-01

Window 2

Control limit determination

Non-Spiked/ Background				Spiked / Efficiency						Eff. Coefficients		Control limit determination			
Sample ID	H#	CPM	Calc. Bkg.	Sigma Diff.	Sample ID	H#	CPM	Corr. Bckg.	Corr. CPM	DPM	Efficiency	Calc. Eff.	% Diff.	Sam. ID	CPM
3H090422-2B01	113.5	6.58	6.86	0.84	0916022-1	113.6	1992.88	6.86	1986.02	8556.38	0.2321	0.2439	5.08%	3H090422-2B01	26.75
3H090422-2B02	145.1	7.28	7.08	-0.58	0916022-2	142.4	1885.90	7.06	1878.84	8556.38	0.2196	0.2114	-3.71%	3H090422-2B02	27.73
3H090422-2B03	166.9	7.78	7.23	-1.53	0916022-3	159.4	1731.13	7.18	1723.95	8556.38	0.2015	0.1923	-4.57%	3H090422-2B03	26.78
3H090422-2B04	179.4	7.83	7.32	-1.42	0916022-4	179.9	1499.31	7.32	1491.99	8556.38	0.1744	0.1692	-2.98%	3H090422-2B04	27.63
3H090422-2B05	198.1	7.1	7.45	1.01	0916022-5	197.1	1285.78	7.44	1278.34	8556.38	0.1494	0.1498	0.26%	3H090422-2B05	27.60
3H090422-2B06	214.4	7.12	7.56	1.28	0916022-6	215.7	1071.89	7.57	1064.32	8556.38	0.1244	0.1288	3.56%	3H090422-2B06	27.55
3H090422-2B07	232.7	7.17	7.69	1.50	0916022-7	233.0	894.86	7.69	887.17	8556.38	0.1037	0.1093	5.44%	3H090422-2B07	29.35
3H090422-2B08	248.2	7.17	7.80	1.81	0916022-8	250.4	737.97	7.81	730.16	8556.38	0.0853	0.0897	5.13%	3H090422-2B08	29.17
3H090422-2B09	258.7	8.35	7.87	-1.29	0916022-9	261.4	644.34	7.89	636.45	8556.38	0.0744	0.0773	3.95%	3H090422-2B09	29.07
3H090422-2B10	275.8	7.8	7.99	0.53	0916022-10	278.5	528.08	8.01	520.07	8556.38	0.0608	0.0580	-4.50%	3H090422-2B10	29.12
3H090422-2B11	283.3	8.7	8.04	-1.73	0916022-11	287	459.26	8.07	451.19	8556.38	0.0527	0.0485	-8.09%	3H090422-2B11	27.43
3H090422-2B12*	295.9	8.72	8.13	-1.55	0916022-12*	303.6	393.26	8.18	385.08	8556.38	0.0450	0.0298	-33.88%	3H090422-2B12*	28.15

(BKG CLs = +/- 3 sigma)

Max 1.81

Min -1.73

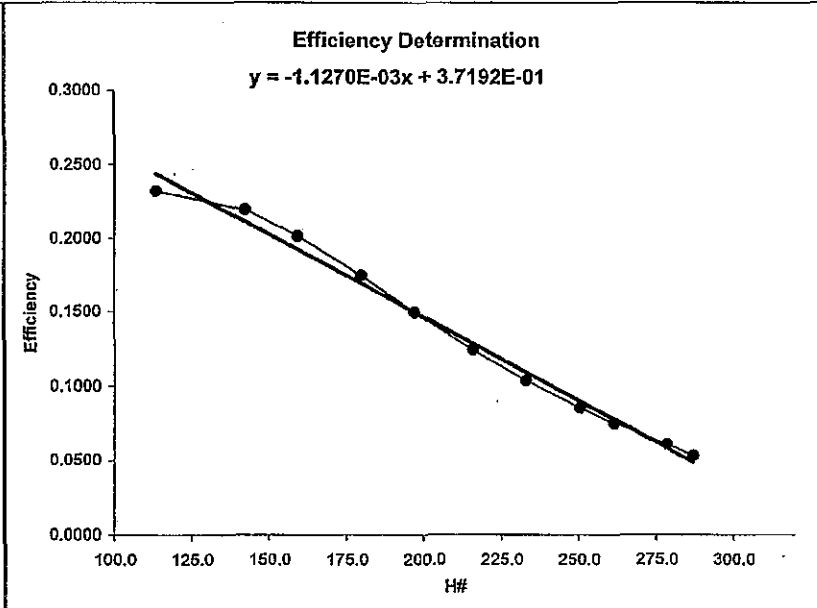
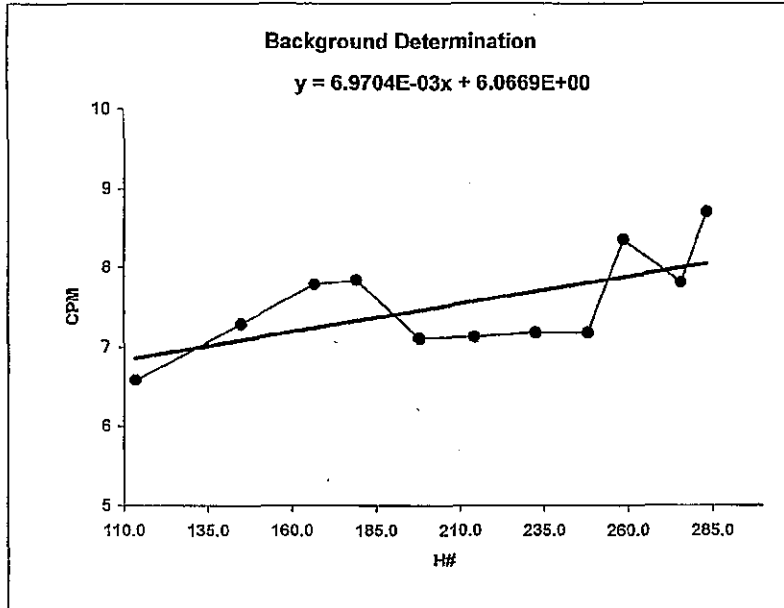
*These data points are not used in the calibration due to poor fit.

(Eff CLs = +/- 10%)

Max 5.44%

Min -33.88%

0916022-1	27.73
0916022-2	27.34
0916022-3	28.48
0916022-4	29.37
0916022-5	26.96
0916022-6	26.07
0916022-7	30.41
0916022-8	30.03
0916022-9	26.80
0916022-10	27.47
0916022-11	25.94
0916022-12*	27.34
Ave. =	27.92
UCL =	31.60
LCL =	24.24



Quench Control Limits	
Upper	283.3
Lower	113.6

Analysis Window Settings	
WIN 1 (50-250)	
WIN 2 (450-900)	

Maria Jeyan 10-29-09
 Instrument Technician Date

[Signature] 10/30/09
 Supervisory Review Date

08

³H Swipe Efficiency Calibration Verification / Method Blank Verification 10/27/09

Calibration Source Check

LS6000
 Analysis Date: 10/27/2009
 Nuclide: ³H
 Half Life: 1.230E+01 yr.

Calibration Check Source:

Spike Standard: 648.3610.05
 Reference Date: 9/31/1998
 Spiked DPM: 5141.07 dpm/mL
 Spike Volume: 0.1 mL
 Spiked into: 1 sample
 Current Spk. Act.: 127.19 pCi/sample

Calibration Check Source Count

Sample ID	Rack	Pos	Prep Date	Cnt. Dur.	Anal. Vol.	GraCPM	BkgCPM	Efficiency	Activity	k (denom.)	Chem. Yield	LC3 Recovery:	Pass/Fail	Units	2s CU	IU	IU=	PU=	2s TPU	PU	PU=
0916023-1	25	2	4/22/2009	180	1	70.06	7.23	0.2216	131.50	0.478	100%	103.4%	PASS	pCi/sample	2.743	14.72765	0.112	0.102	13.41268	20.108	0.102
0916023-2	25	3	4/22/2009	180	1	47.93	7.67	0.1497	124.73	0.323	100%	98.1%	PASS	pCi/sample	3.444	13.96964	0.112	0.102	12.72235	19.206	0.102
0916023-3	25	4	4/22/2009	180	1	25.13	8.21	0.0622	126.09	0.134	100%	99.1%	PASS	pCi/sample	6.415	14.12263	0.112	0.102	12.86166	20.150	0.102

Method Blank Check Count

Sample ID	Rack	Pos	Prep Date	Cnt. Dur.	Anal. Vol.	GraCPM	BkgCPM	Efficiency	Chem. Yield	k (denom.)	activity	MDC	Pass/Fail	Units	2s CU	IU	IU=	PU=	2s TPU	PU	PU=
3H090422-3B01	25	6	4/22/2009	180	1	7.52	7.18	0.2298	100%	0.496	0.6957	1.95	PASS	pCi/sample	1.153	0.07792	0.112	0.102	0.07096	1.158	0.102
3H090422-3B02	25	7	4/22/2009	180	1	7.93	7.68	0.1476	100%	0.318	0.7746	3.11	PASS	pCi/sample	1.850	0.08676	0.112	0.102	0.07901	1.854	0.102
3H090422-3B03	25	8	4/22/2009	180	1	8.12	8.24	0.0574	100%	0.124	-0.9835	3.10	PASS	pCi/sample	4.874	-0.11016	0.112	0.102	-0.10332	4.876	0.102

H-3 Swipe Quench Curve Background and Efficiency Determination

LS6000
10/28/2009

Polynomial Coefficient			H # Range	
	Efficiency	Background	Low =	High =
x^0	3.7192E-01	6.0669E+00	113.6	
x^1	-1.1270E-03	6.9704E-03	283.3	

Calib. Date : 10/26/2009

Sample ID	Pos #	H#	Obs.CPM	Corr. BCPM	CPM Corr.Fact.
3H090422-3CB1	25-1	132.3	7.16	6.989	-0.171
3H090422-3CB2	25-5	129.3	7.38	6.968	-0.412
3H090422-3CB3	25-9	128.8	7.07	6.965	-0.105
Average=					-0.229

Sample ID	Pos #	H #	Efficiency	Background	H # Check
0916023-1	25-2	133.4	0.2216	7.226	OK
0916023-2	25-3	197.2	0.1497	7.671	OK
0916023-3	25-4	274.8	0.0622	8.212	OK
3H090422-3B01	25-6	126.1	0.2298	7.175	OK
3H090422-3B02	25-7	199.0	0.1476	7.683	OK
3H090422-3B03	25-8	279.1	0.0574	8.242	OK

ID: 3H: 5-ML, 10-ML

26 OCT 2009 10:12

USER: 4 COMMENT: LS6000

PRESET TIME : 60.00
 DATA CALC : CPM H# : YES SAMPLE REPEATS: 1 PRINTER : STD
 COUNT BLANK : NO IC# : NO REPLICATES : 1 RS232 : EDIT
 TWO PHASE : NO AGC : NO CYCLE REPEATS : 1
 SCINTILLATOR: LIQUID LUMEX: NO LOW SAMPLE REJ: 0
 LOW LEVEL : YES HALF LIFE CORRECTION DATE: none

CHAN: 50.0 - 250.0 %ERROR: 1.75 FACTOR: 1.000000 BKG. SUB: 0
 CHAN: 450.0 - 900.0 %ERROR: 20.00 FACTOR: 1.000000 BKG. SUB: 0

ALPHA-BETA DISCRIMINATION: NO

SAM NO	POS	TIME MIN	H#	WIND1		WIND2		LUMEX %	ELAPSED TIME
				CPM	%ERROR	CPM	%ERROR		
1	34-1	6.60	113.6	1992.88	1.74	27.73	14.78	0.08	7.20
2	34-2	6.95	142.4	1885.90	1.75	27.34	14.51	0.06	14.85
3	34-3	7.55	159.4	1731.13	1.75	28.48	13.64	0.05	23.07
4	34-4	8.75	179.9	1499.31	1.75	29.37	12.48	0.05	32.52
5	34-5	10.20	197.1	1285.78	1.75	26.96	12.06	0.05	43.43
6	34-6	12.20	215.7	1071.89	1.75	26.07	11.22	0.05	56.36
7	34-7	14.60	233.0	894.86	1.75	30.41	9.49	0.05	71.71
8	34-8	17.75	250.4	737.97	1.75	30.03	8.66	0.06	90.23
9	34-9	20.30	261.4	644.34	1.75	26.80	8.57	0.05	111.34
10	34-10	24.75	278.5	528.08	1.75	27.47	7.67	0.05	136.95
11	34-11	28.45	287.0	459.26	1.75	25.94	7.36	0.05	166.25
12	34-12	33.25	303.6	393.26	1.75	27.34	6.63	0.05	200.41
13	50-1	60.00	113.5	6.58	10.06	26.75	4.99	0.84	261.76
14	50-2	60.00	145.1	7.28	9.57	27.73	4.90	0.63	322.99
15	50-3	60.00	166.9	7.78	9.25	26.78	4.99	0.39	384.17
16	50-4	60.00	179.4	7.83	9.23	27.63	4.91	0.24	445.34
17	50-5	60.00	198.1	7.10	9.69	27.60	4.91	0.22	506.46
18	50-6	60.00	214.4	7.12	9.68	27.55	4.92	0.23	567.60
19	50-7	60.00	232.7	7.17	9.64	29.35	4.77	0.21	628.73
20	50-8	60.00	248.2	7.17	9.64	29.17	4.78	0.24	689.85
21	50-9	60.00	258.7	8.35	8.94	29.07	4.79	0.20	750.98
22	50-10	60.00	275.8	7.80	9.25	29.12	4.79	0.21	812.09
23	50-11	60.00	283.3	8.70	8.75	27.43	4.93	0.19	873.21
24	50-12	60.00	295.9	8.72	8.75	28.15	4.87	0.18	934.33

060-04-102601

WA 10-27-09

B60_04_102601

BSF Version : 3
Instrument Type : LS 6000
Data Capture Date : 26 Oct 2009 09:14:01
User Filename : C:\...\LS WINCONNECTION\DATA\USER04\UN102601.BSF
User Number : 4
User Id : 3H:5-ML,10-ML
User Comments : LS6000
Preset Count Time : 60.00
Calculation Mode : CPM
H# Selected : YES
Sample Repeats : 1
Printer Output Mode : STD
Blank Count : NO
IC# or SCR Selected : NO
Replicates : 1
RS232 Output Mode : EDIT
Two-Phase Selected : NO
AQC Choice : NO
Cycle Repeats : 1
Scintillator Choice : LIQUID
Lumex Selected : NO
Low Sample Reject Count : 0
Low Level Selection : YES
Half Life Correction Date : none
Window Limits Window 1 : 50.00
Preset %Error Iso1 : 1.75
Norm Multiplier Iso1 : 1.00000
Background CPM 1 : 0.00
Window Limits window 2 : 450.00
Preset %Error Iso2 : 20.00
Norm Multiplier Iso2 : 1.00000
Background CPM 2 : 0.00
Alpha/Beta Discrimination : NO

Sam	Rack	Time	H#	CPM Iso1	%Err1	CPM Iso2	%Err2	LumEx	ElTime
1	34-1	6.60	113.6	1992.88	1.74	27.73	14.78	0.08	7.20
2	34-2	6.95	142.4	1885.90	1.75	27.34	14.51	0.06	14.85
3	34-3	7.55	159.4	1731.13	1.75	28.48	13.64	0.05	23.07
4	34-4	8.75	179.9	1499.31	1.75	29.37	12.48	0.05	32.52
5	34-5	10.20	197.1	1285.78	1.75	26.96	12.06	0.05	43.43
6	34-6	12.20	215.7	1071.89	1.75	26.07	11.22	0.05	56.36
7	34-7	14.60	233.0	894.86	1.75	30.41	9.49	0.05	71.71
8	34-8	17.75	250.4	737.97	1.75	30.03	8.66	0.06	90.23
9	34-9	20.30	261.4	644.34	1.75	26.80	8.57	0.05	111.34
10	34-10	24.75	278.5	528.08	1.75	27.47	7.67	0.05	136.95
11	34-11	28.45	287.0	459.26	1.75	25.94	7.36	0.05	166.25
12	34-12	33.25	303.6	393.26	1.75	27.34	6.63	0.05	200.41
13	50-1	60.00	113.5	6.58	10.06	26.75	4.99	0.84	261.76
14	50-2	60.00	145.1	7.28	9.57	27.73	4.90	0.63	322.99
15	50-3	60.00	166.9	7.78	9.25	26.78	4.99	0.39	384.17
16	50-4	60.00	179.4	7.83	9.23	27.63	4.91	0.24	445.34
17	50-5	60.00	198.1	7.10	9.69	27.60	4.91	0.22	506.46
18	50-6	60.00	214.4	7.12	9.68	27.55	4.92	0.23	567.60
19	50-7	60.00	232.7	7.17	9.64	29.35	4.77	0.21	628.73
20	50-8	60.00	248.2	7.17	9.64	29.17	4.78	0.24	689.85
21	50-9	60.00	258.7	8.35	8.94	29.07	4.79	0.20	750.98
22	50-10	60.00	275.8	7.80	9.25	29.12	4.79	0.21	812.09
23	50-11	60.00	283.3	8.70	8.75	27.43	4.93	0.19	873.21
24	50-12	60.00	295.9	8.72	8.75	28.15	4.87	0.18	934.33

UN 10-27-09

ID: 3H: 5-ML, 10-ML

27 OCT 2009 02:41

USER: B COMMENT: LS6000

PRESET TIME : 180.00
 DATA CALC : CPM H# : YES SAMPLE REPEATS: 1 PRINTER : STD
 COUNT BLANK : NO IC# : NO REPLICATES : 1 RS232 : EDIT
 TWO PHASE : NO AQC : NO CYCLE REPEATS : 1
 SCINTILLATOR: LIQUID LUMEX: NO LOW SAMPLE REJ: 0
 LOW LEVEL : YES HALF LIFE CORRECTION DATE: none

CHAN: 50.0 - 250.0 %ERROR: 1.75 FACTOR: 1.000000 BKG. SUB: 0
 CHAN: 450.0 - 900.0 %ERROR: 20.00 FACTOR: 1.000000 BKG. SUB: 0

ALPHA-BETA DISCRIMINATION: NO

SAM NO	POS	TIME MIN	HM	WIND 1		WIND 2		LUMEX %	ELAPSED TIME
				CPM	%ERROR	CPM	%ERROR		
1	25-1	180.00	132.3	7.16	5.57	29.98	2.72	0.36	182.24
2	25-2	180.00	133.4	70.06	1.78	30.97	2.68	0.14	364.55
3	25-3	180.00	197.2	47.93	2.15	28.71	2.78	0.13	546.79
4	25-4	180.00	274.8	25.13	2.97	28.56	2.79	0.14	728.98
5	25-5	180.00	129.3	7.38	5.49	28.89	2.77	0.28	911.24
6	25-6	180.00	126.1	7.52	5.44	30.03	2.72	0.26	1093.50
7	25-7	180.00	199.0	7.93	5.29	30.23	2.71	0.17	1275.71
8	25-8	180.00	279.1	8.12	5.23	29.88	2.73	0.14	1457.83
9	25-9	180.00	128.8	7.07	5.61	30.01	2.72	0.17	1640.02

660-08-101701

10-28-09

B60_08_102701

BSF Version : 3
Instrument Type : LS 6000
Data Capture Date : 27 Oct 2009 02:45:15
User Filename : C:\...\LS WINCONNECTION\DATA\USER08\UN102701.BSF
User Number : 8
User Id : 3H:5-ML,10-ML
User Comments : LS6000
Preset Count Time : 180.00
Calculation Mode : CPM
H# Selected : YES
Sample Repeats : 1
Printer Output Mode : STD
Blank Count : NO
IC# or SCR Selected : NO
Replicates : 1
RS232 Output Mode : EDIT
Two-Phase Selected : NO
AQC Choice : NO
Cycle Repeats : 1
Scintillator Choice : LIQUID
Lumex Selected : NO
Low Sample Reject Count : 0
Low Level Selection : YES
Half Life Correction Date : none
Window Limits Window 1 : 50.00
Preset %Error Iso1 : 1.75
Norm Multiplier Iso1 : 1.00000
Background CPM 1 : 0.00
Window Limits Window 2 : 450.00
Preset %Error Iso2 : 20.00
Norm Multiplier Iso2 : 1.00000
Background CPM 2 : 0.00
Alpha/Beta Discrimination : NO

Sam	Rack	Time	H#	CPM	Iso1	%Err1	CPM	Iso2	%Err2	LumEX	ElTime
1	25-1	180.00	132.3		7.16	5.57	29.98	2.72	0.36	182.24	
2	25-2	180.00	133.4		70.06	1.78	30.97	2.68	0.14	364.55	
3	25-3	180.00	197.2		47.93	2.15	28.71	2.78	0.13	546.79	
4	25-4	180.00	274.8		25.13	2.97	28.56	2.79	0.14	728.98	
5	25-5	180.00	129.3		7.38	5.49	28.89	2.77	0.28	911.24	
6	25-6	180.00	126.1		7.52	5.44	30.03	2.72	0.26	1093.50	
7	25-7	180.00	199.0		7.93	5.29	30.23	2.71	0.17	1275.71	
8	25-8	180.00	279.1		8.12	5.23	29.88	2.73	0.14	1457.83	
9	25-9	180.00	128.8		7.07	5.61	30.01	2.72	0.17	1640.02	

W
10-28-09

LSC Run Log

Instrument ID: LS6000

379825

ALS Laboratory Group - Fort Collins

	Date	Sample ID	Count Time (min.)	Rack & Position	Test	User #	Batch ID	Position Check	Initials	Comments
1	10-21-09	0909050-3	180	3S - 2	FE-SS	12	FE091016-1	MLL	MLL	NA
2		-3D		- 3						
3		-3REP Dup		- 4						
4		-3Rep2 Dup2		- 5						Recount, Lymax > 5%
5	MLL 10-23-09	FE091016-1CB2		- 6						NA
6		0909050-3MS	18.10	- 7						
7		-3REP	180	- 8						
8		-3REP2		- 9						Recount, Lymax > 5%
9		0922005-1		- 10						NA
10		FE091016-1MB		- 11						
11		-1LCS	129.30	- 12						
12		FE091016-1CB3	180	17 - 1						
13	10-23-09	Daily QC	10	1,3 -13,1-2		1,3		MLL	MLL	NA
14	10-23-09	0909050-3Rep2dup2	180	57 - 1	FE-SS	12	FE091016-1			Lymax still > 5%
15		-3Rep2		- 2						NA
16	10-23-09	Daily QC	10	1,3 -13,1-2		1,3		MLL	MLL	NA
17	10-26-09			- 1						
18	10-26-09	0916022-1	6.60	34 - 1	H3	4	34090422-2	MLL	MLL	H3 glass vial swipe Q. Currecalibration
19		-2	6.95	- 2						
20		-3	7.55	- 3						
21		-4	8.75	- 4						
22		-5	10.10	- 5						
23		-6	12.20	- 6						
24		-7	14.60	- 7						
25		-8	17.75	- 8						
26		-9	20.30	- 9						
27		-10	24.75	- 10						
28		-11	28.45	- 11						
29		-12	33.25	- 12						
30		311090422-2mb1	60	50 - 1						

Analyst / Date MLL 10-28-09

FORM 762r6.xls (3/7/09)

Note: Each page is copied as completed and included with the workorder/run documentation; reviewed subsequently.

LSC Run Log

Instrument ID: LS6000

379826

ALS Laboratory Group - Fort Collins

Date	Sample ID	Count/m e (min.)	Rack & Position	Test	User #	Batch ID	Position Check	Initials	Comments	
10-26-09	3H090422-MB2	60	50 - 2	#13	4	3H090422-2	✓	WR	the glass vial B.C swipe calibration	
10-27-09	Daily QC	180	113	-13,1-2	113	---	✓	WR		
										- 3
										- 4
										- 5
										- 6
										- 7
										- 8
										- 9
										- 10
										- 11
										- 12
										10-27-09
- 1										
- 2										
- 3										
- 4										
- 5										
- 6										
- 7										
- 8										
- 9										
- 10										
10-27-09	3H090422-XCB1	180	25	-	8	---	✓	WR		
10-28-09	Daily QC	10	113	-	113	---	✓	WR		
										- 1
										- 2
										- 3
										- 4
										- 5
										- 6
										- 7
										- 8
										- 9
										- 10
										10-28-09
10-28-09	Daily QC	10	113	-	113	---	✓	WR		
										- 1
										- 2
										- 3
										- 4
										- 5
										- 6
										- 7
										- 8
										- 9
										- 10

Analyst / Date WR 10-28-09

Radiochemistry Instrument Worksheet

Prep Batch: 3H090422-2

Prep Procedure: H3 Class Vial Swipe Curve Calibration

Analytical QASS / NCR2 Y / *NA*

Prep Num	LabID	QC Type	Intr Alq	Fin Alq	Units	Report Units	Report	Cnt 1 File/Inst	Cnt 1 Rack-Pos	Cnt 1 Pos	Chk By	Cnt 2 File/Inst	Cnt 2 Rack-Pos	Cnt 2 Pos	Chk By	Cnt 3 File/Inst	Cnt 3 Rack-Pos	Cnt 3 Pos	Chk By	Notes
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1	0916022-1	SMP	1	1	sample	PCII	LS6000	34-1	<i>NA</i>	2		3		4		5		6		
1	0916022-2	SMP	1	1	sample	PCII				2		3		4		5		6		
1	0916022-3	SMP	1	1	sample	PCII				3		4		5		6		7		
1	0916022-4	SMP	1	1	sample	PCII				4		5		6		7		8		
1	0916022-5	SMP	1	1	sample	PCII				5		6		7		8		9		
1	0916022-6	SMP	1	1	sample	PCII				6		7		8		9		10		
1	0916022-7	SMP	1	1	sample	PCII				7		8		9		10		11		
1	0916022-8	SMP	1	1	sample	PCII				8		9		10		11		12		
1	0916022-9	SMP	1	1	sample	PCII				9		10		11		12		13		
1	0916022-10	SMP	1	1	sample	PCII				10		11		12		13		14		
1	0916022-11	SMP	1	1	sample	PCII				11		12		13		14		15		
1	0916022-12	SMP	1	1	sample	PCII				12		13		14		15		16		
1	3H090422-2B01	MB	1	1	sample	PCII				50		1		2		3		4		
1	3H090422-2B02	MB	1	1	sample	PCII				2		3		4		5		6		
1	3H090422-2B03	MB	1	1	sample	PCII				3		4		5		6		7		
1	3H090422-2B04	MB	1	1	sample	PCII				4		5		6		7		8		
1	3H090422-2B05	MB	1	1	sample	PCII				5		6		7		8		9		
1	3H090422-2B06	MB	1	1	sample	PCII				6		7		8		9		10		
1	3H090422-2B07	MB	1	1	sample	PCII				7		8		9		10		11		
1	3H090422-2B08	MB	1	1	sample	PCII				8		9		10		11		12		
1	3H090422-2B09	MB	1	1	sample	PCII				9		10		11		12		13		
1	3H090422-2B10	MB	1	1	sample	PCII				10		11		12		13		14		
1	3H090422-2B11	MB	1	1	sample	PCII				11		12		13		14		15		
1	3H090422-2B12	MB	1	1	sample	PCII				12		13		14		15		16		

Spike Solution Information					
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date
S1	H-3	699.3020.95	88,189.122	DPM/ml	04/22/09
					0.1 ml
					RS-008

NA 10-28-09

Radiochemistry Instrument Worksheet

ALS Laboratory Group -- FC

Prep Batch: 3H090422-2

Reporting Units

LabID:	TstGrpName:	RptUnits:
0916022-1	H3	pCi/l
0916022-2	H3	pCi/l
0916022-3	H3	pCi/l
0916022-4	H3	pCi/l
0916022-5	H3	pCi/l
0916022-6	H3	pCi/l
0916022-7	H3	pCi/l
0916022-8	H3	pCi/l
0916022-9	H3	pCi/l
0916022-10	H3	pCi/l
0916022-11	H3	pCi/l
0916022-12	H3	pCi/l

Sample Barcodes

0916022-1 3H090422-2P51		0916022-2 3H090422-2P52	
0916022-3 3H090422-2P53		0916022-4 3H090422-2P54	
0916022-5 3H090422-2P55		0916022-6 3H090422-2P56	
0916022-7 3H090422-2P57		0916022-8 3H090422-2P58	
0916022-9 3H090422-2P59		0916022-10 3H090422-2P510	
0916022-11 3H090422-2P511		0916022-12 3H090422-2P512	
3H090422-2B01MB 3H090422-2P513		3H090422-2B02MB 3H090422-2P514	
3H090422-2B03MB 3H090422-2P515		3H090422-2B04MB 3H090422-2P516	
3H090422-2B05MB 3H090422-2P517		3H090422-2B06MB 3H090422-2P518	
3H090422-2B07MB 3H090422-2P519		3H090422-2B08MB 3H090422-2P520	
3H090422-2B09MB 3H090422-2P521		3H090422-2B10MB 3H090422-2P522	

Radiochemistry Instrument Worksheet

ALS Laboratory Group -- FC

Prep Batch: 3H090422_2

3H090422-2B11MB
3H090422-2PS23



3H090422-2B12MB
3H090422-2PS24



Radiochemistry Prep Worksheet

ALS Paragon

Prep Batch: 3H090422-2

Prep Procedure: H3

Reviewed By: DBC *DBC*

Review Date: 4/23/2009

Non-Routine Pre-Treatment? Y / Batch: N/A Re-Prep? Y / Batch: N/A Prep QASS / NCR? Y / N/A

Prep SOP: PAI 700 Rev: 10 Prep Analyst: Derek B. Caduff Balance: Cocktail: UG LLT
 Prep SOP: NONE Prep Date: 4/22/2009 Balance: Cocktail Pipet: T-002
 Matrix Class: liquid Prep Dept: RS Aliquot Pipet: RS-015

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Aliq sample	Fin Aliq sample	Prep Basis	Analysis Vol.(ml)	Standards	Prep Notes
1	1	0916022-1	SMP		1	1	As Received		S1	0 UL NITROMETHANE ADDED
2	1	0916022-2	SMP		1	1	As Received		S1	15
3	1	0916022-3	SMP		1	1	As Received		S1	30
4	1	0916022-4	SMP		1	1	As Received		S1	45
5	1	0916022-5	SMP		1	1	As Received		S1	60
6	1	0916022-6	SMP		1	1	As Received		S1	75
7	1	0916022-7	SMP		1	1	As Received		S1	90
8	1	0916022-8	SMP		1	1	As Received		S1	105
9	1	0916022-9	SMP		1	1	As Received		S1	120
10	1	0916022-10	SMP		1	1	As Received		S1	135
11	1	0916022-11	SMP		1	1	As Received		S1	150
12	1	0916022-12	SMP		1	1	As Received		S1	165
13	1	3H090422-2B01	MB		1	1	As Received			0
14	1	3H090422-2B02	MB		1	1	As Received			15
15	1	3H090422-2B03	MB		1	1	As Received			30
16	1	3H090422-2B04	MB		1	1	As Received			45
17	1	3H090422-2B05	MB		1	1	As Received			60
18	1	3H090422-2B06	MB		1	1	As Received			75
19	1	3H090422-2B07	MB		1	1	As Received			90
20	1	3H090422-2B08	MB		1	1	As Received			105
21	1	3H090422-2B09	MB		1	1	As Received			120
22	1	3H090422-2B10	MB		1	1	As Received			135
23	1	3H090422-2B11	MB		1	1	As Received			150
24	1	3H090422-2B12	MB		1	1	As Received			165

Radiochemistry Prep Worksheet

ALS Paragon

Prep Batch: 3H090422-2

Prep Procedure: H3

Reviewed By: DBC *DBC*

Review Date: 4/23/2009

Non-Routine Pre-Treatment? Y / N Batch: N/A Re-Prep? Y / N Batch: N/A Prep QASS / NCR? Y / N

Prep SOP: PAI 700 Rev: 10 Prep Analyst: Derek B. Caduff Balance: Cocktail: UG LLT
 Prep SOP: NONE Prep Date: 4/22/2009 Balance: Cocktail Pipet: T-002
 Matrix Class: liquid Prep Dept: RS Aliquot Pipet: RS-015

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq sample	Fin Alq sample	Prep Basis	Analysis Vol. (ml)	Standards	Prep Notes

Comments
 UG LLT LOT #97-080401

Spiked By: Derek B. Caduff Date: 4/22/2009
 Witnessed By: Jeff Kujawa Date: 4/22/2009

Spill Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	H-3	699.3020.95	88,189.122	DPM/ml	04/22/09	0.1	ml	RS-008

Radiochemistry Prep Worksheet

ALS Paragon

Prep Batch: 3H090422-2

Prep Procedure: H3

Prep Batch Not Validated!!!

Reviewed By: _____

Review Date: _____

Non-Routine Pre-Treatment? Y / N Batch: _____ Re-Prep? Y / N Batch: _____ Prep QASS / NCR? Y / N _____

Prep SOP: PAI 700 Rev: 10 Prep Analyst: Derek B. Caduff *DBC* Balance: _____ Cocktail: _____
 Prep SOP: NONE Prep Date: 4/22/2009 Balance: _____ Cocktail Pipet: _____
 Matrix Class: liquid Prep Dept: RS Aliquot Pipet: _____

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq sample	Fin Alq sample	Prep Basis	Analysis Vol.(ml)	Standards	Prep Notes
1	1	0916022-1	SMP		1	1	As Received		S1	0 UL NITROMETHANE ADDED
2	1	0916022-2	SMP		1	1	As Received		S1	15
3	1	0916022-3	SMP		1	1	As Received		S1	30
4	1	0916022-4	SMP		1	1	As Received		S1	45
5	1	0916022-5	SMP		1	1	As Received		S1	60
6	1	0916022-6	SMP		1	1	As Received		S1	75
7	1	0916022-7	SMP		1	1	As Received		S1	90
8	1	0916022-8	SMP		1	1	As Received		S1	105
9	1	0916022-9	SMP		1	1	As Received		S1	120
10	1	0916022-10	SMP		1	1	As Received		S1	135
11	1	0916022-11	SMP		1	1	As Received		S1	150
12	1	0916022-12	SMP		1	1	As Received		S1	165
13	1	3H090422-2B01	MB		1	1	As Received			0
14	1	3H090422-2B02	MB		1	1	As Received			15
15	1	3H090422-2B03	MB		1	1	As Received			30
16	1	3H090422-2B04	MB		1	1	As Received			45
17	1	3H090422-2B05	MB		1	1	As Received			60
18	1	3H090422-2B06	MB		1	1	As Received			75
19	1	3H090422-2B07	MB		1	1	As Received			90
20	1	3H090422-2B08	MB		1	1	As Received			105
21	1	3H090422-2B09	MB		1	1	As Received			120
22	1	3H090422-2B10	MB		1	1	As Received			135
23	1	3H090422-2B11	MB		1	1	As Received			150
24	1	3H090422-2B12	MB		1	1	As Received			165

Radiochemistry Prep Worksheet

ALS Paragon

Prep Batch: 3H090422-2

Prep Procedure: H3

Prep Batch Not Validated!!!

Reviewed By: _____

Review Date: _____

Non-Routine Pre-Treatment? Y / N Batch: _____ Re-Prep? Y / N Batch: _____ Prep QASS / NCR? Y / N _____

Prep SOP: PAI 700 Rev: 10 Prep Analyst: Derek B. Caduff *DBC* Balance: _____ Cocktail: _____

Prep SOP: NONE Prep Date: 4/22/2009 Balance: _____ Cocktail Pipet: _____

Matrix Class: liquid Prep Dept: RS Aliquot Pipet: _____

Sampl Num	Prep Num	LabID	QC Type	Dish No.	Init Alq sample	Fin Alq sample	Prep Basis	Analysis Vol.(ml)	Standards	Prep Notes

Comments
UG LLT LOT # 97-080901

Spiked By: DBC Date: 4/22/09

Witnessed By: [Signature] Date: 4/22/09

Spike Solution Information								
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	PipetID
S1	H-3	699.3020.95	88,189,122	DPM/ml	04/22/09	0.1	ml	RS-008

*Exp.
4/1/10*

Radiochemistry Instrument Worksheet

Prep Batch: 3H090422-8

Prep Procedure: H3 Glass Vial Swipes / ICBS

Analytical QASS / NCR2 Y / N *MT*

Prep Num	LabID	QC	Unit Type	Units	Report	File/Inst	Cnt 1 Rack-Pos	Cnt 1 Pos	File/Inst	Cnt 2 Rack-Pos	Cnt 2 Pos	File/Inst	Cnt 3 Rack-Pos	Cnt 3 Pos	Notes
1	0916023-1	SMP	1	1	sample	PCIM	LS6000	25-2	W						Added 10uL Nitro
1	0916023-2	SMP	1	1	sample	PCIM		-3							
1	0916023-3	SMP	1	1	sample	PCIM		-4							
1	3H090422-3B01	MB	1	1	sample	PCIM		-6							
1	3H090422-3B02	MB	1	1	sample	PCIM		-7							
1	3H090422-3B03	MB	1	1	sample	PCIM		-8							
1	3H090422-3CB1	MB	1	1	sample	PCIM		-1							
1	3H090422-3CB2	MB	1	1	sample	PCIM		-5							
1	3H090422-3CB3	MB	1	1	sample	PCIM		-9							

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot Units	PipetID
S1	H-3	648.3610.05	2.827.459	DPM/ml	04/22/09	0.1	RS-008

Spike Solution Information

Reporting Units

LabID: 0916023-1 H3
 TstGrpName: RptUnits:
 0916023-2 H3
 0916023-3 H3

Sample Barcodes

0916023-1	3H090422-3PS1	0916023-1	3H090422-3PS2
0916023-3	3H090422-3PS3	0916023-3	3H090422-3PS4
3H090422-3B02MB	3H090422-3PS5	3H090422-3B03MB	3H090422-3PS6
3H090422-3CB1MB	3H090422-3PS7	3H090422-3CB2MB	3H090422-3PS8
3H090422-3CB3MB	3H090422-3PS9		

Radiochemistry Prep Worksheet

Prep Batch: 3H090422-3

Prep Procedure: H3

Reviewed By: DBC
 Review Date: 5/1/2009

Non-Routine Pre-Treatment? Y / N Batch: *MA*

Re-Prep? Y / N Batch: *MA*

Prep QASS / NCR? Y / N *MA*

Prep SOP: PAL 700 Rev: 10

Prep SOP: NONE

Matrix Class: liquid

Prep Analyst: Derek B. Caduff

Prep Date: 4/22/2009

Prep Dept: RS

Balance: Cocktail: UG LLT

Cocktail Pipet: T-002

Alliquot Pipet: RS-015

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Aliq sample	Fin Aliq sample	Prep Basis	Analysis Vol.(ml)	Standards	Prep Notes
1	1	0916023-1	SMP	1	1	1	As Received	1	S1	
2	1	0916023-2	SMP	1	1	1	As Received	1	S1	
3	1	0916023-3	SMP	1	1	1	As Received	1	S1	
4	1	3H090422-3B01	MB	1	1	1	As Received	1	S1	
5	1	3H090422-3B02	MB	1	1	1	As Received	1	S1	
6	1	3H090422-3B03	MB	1	1	1	As Received	1	S1	
7	1	3H090422-3CB1	MB	1	1	1	As Received	1	S1	
8	1	3H090422-3CB2	MB	1	1	1	As Received	1	S1	
9	1	3H090422-3CB3	MB	1	1	1	As Received	1	S1	

Comments

UG LLT LOT #97-080401

Spiked By: Derek B. Caduff Date: 4/22/2009

Witnessed By: Jeff Kujawa Date: 4/22/2009

Spike Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Alliquot	Units	Pipet ID
S1	H-3	648.3610.05	2.827/459	DPM/ml	04/22/09	0.1	ml	RS-008

Radiochemistry Prep Worksheet

ALS Paragon

Prep Batch: 3H090422:3

Prep Procedure: H3 **Prep Batch Not Validated!!!** Reviewed By: _____ Review Date: _____

Non-Routine Pre-Treatment? Y / N Batch: _____ Re-Prep? Y / N Batch: _____ Prep QASS / NCR? Y / N

Prep SOP: PAI 700 Rev: 10 Prep Analyst: Derek B. Caduff *DBC* Balance: _____ Cocktail: UG LLT
 Prep SOP: NONE Prep Date: 4/22/2009 Balance: _____ Cocktail Pipet: T-002
 Matrix Class: liquid Prep Dept: RS Aliquot Pipet: RS-015

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq sample	Fin Alq sample	Prep Basis	Analysis Vol.(ml)	Standards	Prep Notes
1	1	0916023-1	SMP		1	1	As Received		S1	
2	1	0916023-2	SMP		1	1	As Received		S1	
3	1	0916023-3	SMP		1	1	As Received		S1	
4	1	3H090422-3B01	MB		1	1	As Received			
5	1	3H090422-3B02	MB		1	1	As Received			
6	1	3H090422-3B03	LCSD		1	1	As Received			

Comments
 UG LLT LOT# 97-080401

Spiked By: Derek B. Caduff *DBC* Date: 4/22/09
 Witnessed By: *JKS* Date: 4/22/09

Spike Solution Information							
Soln #	Nuclide	Soln ID	Prep Conc	Units	Prep Date	Aliquot Units	Pipet ID
S1	H-3	648.3610.05	2,827.459	DPM/ml	04/22/09	0.1 ml	RS-008

*E-1**
4/31/09

Prepare a working dilution ~ 9900 dpm/ml of 3H from 699.3020.95

1) Determine the density of DI water Bal. #
 Mass of empty 100ml volumetric flask: 66.437g L2
 Mass of flask and 100 ml DI water: 166.065g ↓
 Net mass of DI water: 99.628g
 $\rho = 0.99628 \text{ g/ml}$

2) Transfer standard.
 Mass of empty bottle without lid: 97.1195g L2
 Mass of bottle and standard: 100.5266g ↓
 Net mass of standard: 3.4071g

3) Dilute with DI water.
 Mass of empty bottle without lid: 97.1195g L2
 Mass of bottle, standard, and DI water: 197.7444g ↓
 Net mass of standard and DI water: 100.6249g

4) Final activity calculation:

$$\frac{(4,733,412.57 \text{ dpm/g}) (3.4071 \text{ g}) (0.99628 \text{ g/ml})}{(100.6249 \text{ g}) (0.99628 \text{ g/ml})} = 15,967.757 \text{ dpm/ml}$$
 To correct density correct activity for 699.3020.95: 160351.042 dpm/ml
 MC 7/13/08

Std ID: 699.3020.95

Description: H-3
 Expiration: 2/25/2009
 Activity: 160351.04 dpm/mL
 Uncertainty: 1154.53 dpm/mL
 Ref. Date: 9/3/1998
 Ref Time: N/A
 Prep Date: 2/7/2008 Prep by: DC
 Matrix/Comp. DI WATER
 Half Life (y): 1.23E+01

Reverification Log		
Analysis Date	Initials	Expiration Date
4/1/09	JK	4/1/10

Continued on Page

DC
 Signed

2/7/08
 Date

Read and Understood By
JK
 Signed

7/13/08
 Date

Prepare a 1P dilution of Ampoule 699 by diluting with DI water.

1) Determine the density of DI water

Mass of empty Class A 100 mL volumetric flask	67.7956 g Bal #12
Mass of flask + 100 mL of DI water	167.3755 g
Net mass of DI water	99.5799 g

$$\rho = 0.9958 \text{ g/mL}$$

2) Transfer contents of ampoule 699 into a 40 mL Amber glass VOA vial.

Mass of VOA vial w/o lid	24.3883g Bal #12
Mass of opened ampoule before transfer	40.8432g
Mass of opened ampoule after transfer	36.0281g
Net mass of Std transferred	4.8151g

3) Add DI water to final dilution

Mass of VOA vial ^{w/ lid} from above	24.3883g Bal #12
Mass of VOA vial, Std + DI water	102.9648g
Net mass of Std + DI water	38.5765g

4) Final Activity Calculation

$$(634.7 \text{ KBq/g}) (4.8151 \text{ g}) \left(\frac{60000 \text{ Bq}}{\text{KBq}} \right) \left(\frac{1000 \text{ Bq}}{\text{KBq}} \right) (0.9958 \text{ g/mL})$$

$$38.5765 \text{ g}$$

$$= 1,733,412.57 \frac{\text{Bq}}{\text{mL}}$$

U.S. Department of Commerce
National Institute of Standards
and Technology
SRM 4927F
Hydrogen-3
<4 MBq in distilled water

CAUTION
RADIOACTIVE



Continued on Page

Chad Wajch
Signed

7/28/03
Date

Read and Understood By
[Signature]
Signed

7/31/03
Date



National Institute of Standards & Technology

Certificate

PA.F ID 0699
REC'D 5-09-03

Standard Reference Material 4927F Hydrogen-3 Radioactivity Standard

This Standard Reference Material (SRM) consists of radioactive hydrogen-3, as water, in 5 mL of distilled water. The solution is contained in a flame-sealed NIST borosilicate-glass ampoule. The SRM is intended for the calibration of beta-particle counting instruments and for the monitoring of radiochemical procedures.

Radiological Hazard

The SRM ampoule contains hydrogen-3 with a total activity of approximately 3.2 MBq. Hydrogen-3 decays by beta-particle emission. None of the beta particles escape from the SRM ampoule. During the decay process no photons are emitted. Approximate unshielded dose rates at several distances (as of the reference time) are given in note [a]*. There is no detectable external radiation. The SRM should be used **only** by persons qualified to handle radioactive material.

Chemical Hazard

The SRM ampoule contains only distilled water. There is no chemical hazard. If the ampoule is to be opened to transfer the solution, the recommended procedure is given on page 2.

Storage and Handling

The SRM should be stored and used at a temperature between 5 and 65 °C. The solution in an unopened ampoule should remain stable and homogeneous until at least September 2008.

The ampoule (or any subsequent container) should always be clearly marked as containing radioactive material. If the ampoule is transported it should be packed, marked, labeled, and shipped in accordance with the applicable national, international, and carrier regulations. The solution in the ampoule is a dangerous good (hazardous material) because of the radioactivity.

Preparation

This Standard Reference Material was prepared in the Physics Laboratory, Ionizing Radiation Division, Radioactivity Group, L.R. Karam, Group Leader. The overall technical direction and physical measurements leading to certification were provided by L.L. Lucas and M.P. Unterwieser 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 by J.W.L. Thomas.

Bert M. Coursey, Chief
Ionizing Radiation Division

Nancy M. Trahey, Chief
Standard Reference Materials Program

Gaithersburg, Maryland 20899
June 1999
Half-life and text revised October 2000

Recommended Procedure for Opening the SRM Ampoule

- 1) If the SRM solution is to be diluted, it is recommended that the diluting solution have a composition comparable to that of the SRM solution.
- 2) Wear eye protection, gloves, and protective clothing and work over a tray with absorbent paper in it. Work in a fume hood.
- 3) Shake the ampoule to wet all of the inside surface of the ampoule. Return the ampoule to the upright position.
- 4) Check that all of the liquid has drained out of the neck of the ampoule. If necessary, gently tap the neck to speed the process.
- 5) Holding the ampoule upright, score the narrowest part of the neck with a scribe or diamond pencil.
- 6) Lightly wet the scored line. This reduces the crack propagation velocity and makes for a cleaner break.
- 7) Hold the ampoule upright with a paper towel, a wiper, or a support jig. Position the scored line away from you. Using a paper towel or wiper to avoid contamination, snap off the top of the ampoule by pressing the narrowest part of the neck away from you while pulling the tip of the ampoule towards you.
- 8) Transfer the solution from the ampoule using a pycnometer or a pipet with dispenser handle. NEVER PIPETTE BY MOUTH.
- 9) Seal any unused SRM solution in a flame-sealed glass ampoule, if possible, to minimize the evaporation loss.

See also reference [4]*.

PROPERTIES OF SRM 4927F

Certified values

Solution density	$(0.998 \pm 0.002) \text{ g}\cdot\text{mL}^{-1}$ at 20.0 °C [b]*
Radionuclide	Hydrogen-3
Reference time	1200 EST, 3 September 1998
Massic activity of the solution [c]	634.7 kBq·g ⁻¹
Relative expanded uncertainty ($k=2$)	0.72% [d] [e]

Uncertified values

Physical Properties:			
Source description	Liquid in flame-sealed NIST borosilicate-glass ampoule		
Ampoule specifications	Body outside diameter	$(16.5 \pm 0.5) \text{ mm}$	
	Wall Thickness	$(0.60 \pm 0.04) \text{ mm}$	
	Barium content	Less than 2.5%	
	Lead-oxide content	Less than 0.02%	
	Other heavy elements	Trace quantities	
Solution mass	Approximately 5.0 g		
Chemical Properties:			
Solution composition	Chemical Formula	Concentration (mol·L ⁻¹)	Mass Fraction (g·g ⁻¹)
	H ₂ O ³ H ₂ O	55 6×10^{-7}	1.00 1×10^{-8}
Radiological Properties:			
Radionuclidic impurities	None detected [f]		
Half lives used	Hydrogen-3: $(4500 \pm 8) \text{ d}$ [g]		
Calibration method and measuring instrument(s)	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 counting systems [h]		

EVALUATION OF THE UNCERTAINTY OF THE MASSIC ACTIVITY [d]*

Input Quantity x_i , the source of uncertainty (and individual uncertainty components where appropriate)	Method Used To Evaluate $u(x_i)$, the standard uncertainty of x_i (A) denotes evaluation by statistical methods (B) denotes evaluation by other methods	Relative Uncertainty Of Input Quantity, $u(x_i)/x_i$, (%) [f]	Relative Sensitivity Factor, $ dy/dx_i \cdot$ (x_i/y) [g]	Relative Uncertainty Of Output Quantity, $u_c(y)/y$, (%) [k]
Massic count rate of SRM 4927E, corrected for background and decay [b]	Standard deviation of the mean for 23 sets of gas counting measurements (A)	0.18	1.0	0.18
Gram-mole measurements	Estimated (B)	0.20	1.0	0.20
Live-time [p]	Estimated (B)	0.10	1.0	0.10
Extrapolation of count-rate-versus-energy to zero energy	Estimated (B)	0.20	1.0	0.20
Half life of H-3	Standard uncertainty of the half life (A)	0.18 [m]	0.009 [n]	0.002
Liquid-scintillation intercomparison of SRM 4927E and SRM 4927E	Standard deviation of the mean for 7 sets of liquid-scintillation measurements (A)	0.06	1.0	0.06
Radionuclidic impurities	Limit of detection (B) [q]	100.	0.0005	0.05
Relative Combined Standard Uncertainty of the Output Quantity, $u_c(y)/y$, (%)				0.36
Coverage Factor, k				≈ 2
Relative Expanded Uncertainty of the Output Quantity, $U(y)$, (%)				0.72

NOTES

- [a] The Sievert is the SI unit for dose equivalent. See reference [1]. One μSv is equal to 0.1 mrem.
 Distance from Ampoule (cm): 1 30 100
 Approximate Dose Rate ($\mu\text{Sv/h}$): <0.1 (Not detectable)
- [b] The stated uncertainty is two times the standard uncertainty.
- [c] Massic activity is the preferred name for the quantity activity divided by the total mass of the sample. See reference [1].
- [d] The reported value, y , of massic activity (activity per unit mass) at the reference time was not measured directly but was derived from measurements and calculations of other quantities. This can be expressed as $y = f(x_1, x_2, x_3, \dots, x_n)$, where f is a mathematical function derived from the assumed model of the measurement process.
- The value, x_i , used for each input quantity i has a standard uncertainty, $u(x_i)$, that generates a corresponding uncertainty in y , $u_i(y) = |\partial y / \partial x_i| \cdot u(x_i)$, called a component of combined standard uncertainty of y .
- The combined standard uncertainty of y , $u_c(y)$, is the positive square root of the sum of the squares of the components of combined standard uncertainty.
- The combined standard uncertainty is multiplied by a coverage factor of $k = 2$ to obtain U , the expanded uncertainty of y .
- Since it can be assumed that the possible estimated values of the massic activity are approximately normally distributed with approximate standard deviation $u_c(y)$, the unknown value of the massic activity is believed to lie in the interval $\pm U$ with a level of confidence of approximately 95 percent.
- For further information on the expression of uncertainties, see references [2] and [3].
- [e] The value of each standard uncertainty component, and hence the value of the expanded uncertainty itself, is a best estimate based upon all available information, but is only approximately known. That is to say, the "uncertainty of the uncertainty" is large and not well known. This is true for uncertainties evaluated by statistical methods (e.g., the relative standard deviation of the standard deviation of the mean for the massic response is approximately 50%) and for uncertainties evaluated by other methods (which could easily be over estimated or under estimated by substantial amounts). The unknown value of the expanded uncertainty is believed to lie in the interval $U/2$ to $2U$ (i.e., within a factor of 2 of the estimated value).
- [f] The estimated limit of detection for radionuclidic impurities is $300 \text{ Bq} \cdot \text{g}^{-1}$.
- [g] The stated uncertainty is the standard uncertainty. See reference [5].
- [h] Extensive gas-counting measurements were made on the SRM 4927B solution during 1998 and 1999. The SRM 4927F solution was intercompared with the SRM 4927E solution using liquid-scintillation counting.
- [i] Relative standard uncertainty of the input quantity x_i .

- [l] The relative change in the output quantity divided by the relative change in the input quantity x_i . If $|\partial y/\partial x_i| \cdot (x_i/y) = 1.0$, then a 1% change in x_i results in a 1% change in y . If $|\partial y/\partial x_i| \cdot (x_i/y) = 0.05$, then a 1% change in x_i results in a 0.05% change in y .
- [k] Relative component of combined standard uncertainty of output quantity, rounded to two significant figures or less. The relative component of combined standard uncertainty of y is given by $u_i(y)/y = |\partial y/\partial x_i| \cdot u(x_i)/x_i$. The numerical values of $u(x_i)/x_i$, $|\partial y/\partial x_i| \cdot (x_i/y)$, and $u_i(y)/y$, all dimensionless quantities, are listed in columns 3, 4, and 5, respectively. Thus, the value in column 5 is equal to the value in column 4 multiplied by the value in column 3. The input quantities are independent, or very nearly so. Hence the covariances are zero or negligible.
- [m] The relative standard uncertainty of $\lambda \cdot t$ is determined by the relative standard uncertainty of λ (i.e., of the half life). The relative standard uncertainty of t is negligible.
- [n] $|\partial y/\partial x_i| \cdot (x_i/y) = |\lambda \cdot t|$
- [p] The live time is determined by counting the pulses from a gated crystal-controlled oscillator.
- [q] The standard uncertainty for each undetected impurity that might reasonably be expected to be present is estimated to be equal to the estimated limit of detection for that impurity, i.e. $u(x_i)/x_i = 100\%$. $|\partial y/\partial x_i| \cdot (x_i/y) = \{(\text{response per Bq of impurity})/(\text{response per Bq of Et-3})\} \cdot \{(\text{Bq of impurity})/(\text{Bq of Et-3})\}$. Thus $u_i(y)/y$ is the relative change in y if the impurity were present with a massic activity equal to the estimated limit of detection.

REFERENCES

- [1] International Organization for Standardization (ISO), *ISO Standards Handbook - Quantities and Units*, 1993. Available from the American National Standards Institute, 11 West 42nd Street, New York, NY 10036, U.S.A. 1-212-642-4900.
- [2] International Organization for Standardization (ISO), *Guide to the Expression of Uncertainty in Measurement*, 1993. Available from the American National Standards Institute, 11 West 42nd Street, New York, NY 10036, U.S.A. 1-212-642-4900. (Listed under ISO miscellaneous publications as "ISO Guide to the Expression 1993")
- [3] 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.
- [4] National Council on Radiation Protection and Measurements Report No. 58, *A Handbook of Radioactivity Measurements Procedures*, Second Edition, 1985. Available from the National Council on Radiation Protection and Measurements, 7910 Woodmont Avenue, Bethesda, MD 20814 U.S.A.
- [5] L.L. Lucas and M.P. Unterwiesing, *Comprehensive Review and Critical Evaluation of the Half-Life of Tritium*, J. Res. Natl. Inst. Stand. Technol. 105, 541-549 (2000).

Prepare a working dilution of ~ 4,000 dpm/ml of 3H ,
648.2382.75

1) Determine density of DI water Hall*
 Mass of 100 ml vol. flask 68.2975g 12
 Mass of flask and 100 ml DI H₂O. 168.0291g 1
 Net Mass of water 99.7316g
 $\frac{100}{99.7316} \rho = .9973 \text{ g/ml}$

2) Transfer Std.
 Mass of empty Amber jar (No lid) 257.75g 26
 Mass of Jar + Std transferred 264.58g 1
 * Net Mass of Std. Transferred 6.8506g 12
 ↳ from below. JPO 4/28/08

4) Dilute to Final Vol. w/ DI water
 Mass of Std. $\frac{1}{2}$ O₂ Jar 750.9g 26
 Mass of Jar from above 257.75g
 Net Mass of new dilution 493.15g

* Standard was transferred by difference from a plastic cup
 Mass of Cup and ~ 10g of Standard 23.6533g 12
 Mass of Cup and Std. [Not] Transferred 16.8027g 1

Final Activity Calculation

$$\left(369,530.45 \frac{\text{dpm}}{\text{ml}}\right) \left(6.8506\text{g}\right) \left(.9973 \frac{\text{g}}{\text{ml}}\right) = 5141.07 \frac{\text{dpm}}{\text{ml}}$$

$$\left(.9952 \frac{\text{g}}{\text{ml}}\right) \left(493.15\text{g}\right)$$

JPO 4/28/08
dpm/ml

Std ID: 648.3610.05

Description: H-3

Expiration: 4/30/2009

Activity: 5141.07 dpm/ml

NC 4/13/08

2s Uncertainty: 37.02 dpm/ml

Ref. Date: 9/3/1998

Ref Time: N/A

Prep Date: 4/30/2008 Prep by: JD

Matrix/Comp. DI WATER

Half Life (y): 1.23E+01

Reverification Log		
Analysis Date	Initials	Expiration Date
4/11/09	JK	4/11/10

NC 7/13/08

Signed

4/28/08
Date

NC 7/13/08

Signed

7/13/08
Date

Prepare a ¹⁰ dilution of ~~working level~~ dilution (of approximately 250 ~~ppm~~) from standard using RSO # (cal #) and diluting with DI water.

1) Determine the density of DI water:

Mass of empty 100ml class A volumetric flask	67.1522 g	Bal #13
Mass of flask + water	166.7351 g	↓
Net mass of 100ml H ₂ O	99.5829 g	
	$\rho = .9958 \text{ g/mL}$	

2) Transfer contents of ampule SRM 4927F to a 40ml vial with water. 500 ml glass amber bottle

mass of 40ml vial w/o lid	255.04 g	Bal #26
mass of open ampule + 50ml beaker	40.9075 g	Bal #26
mass of empty ampule + 50ml beaker	36.0182 g	↓
Net mass of SRM	4.8927 g	

3) Dilute Std. with DI water

mass of bottle w/o lid	255.04 g	Bal #26
mass of bottle, std, + DI water	757.1 g	↓
Net mass of Std + DI water	502.1 g	

4. Final Activity Calculation

$$\frac{(634.7 \text{ kBq/g})(1000 \text{ Bq/kBq})(60 \text{ DPM/Bq})(4.8927 \text{ g})(.9958 \text{ g/mL})}{502.1 \text{ g}} = 369,530.45 \frac{\text{DPM}}{\text{mL}}$$

U.S. Department of Commerce
National Institute of Standards
and Technology
SRM 4927F
Hydrogen-3
<4 MBq in distilled water

Continued on Page

CAUTION
RADIOACTIVE



Read and Understood By

Chad Doyle
Signed

3/27/03
Date

Bonnie Maloney
Signed

3/27/03
Date



National Institute of Standards & Technology

Certificate

PA ID 0648
1999-07-02

Standard Reference Material 4927F Hydrogen-3 Radioactivity Standard

This Standard Reference Material (SRM) consists of radioactive hydrogen-3, as water, in 5 mL of distilled water. The solution is contained in a flame-sealed NIST borosilicate-glass ampoule. The SRM is intended for the calibration of beta-particle counting instruments and for the monitoring of radiochemical procedures.

Radiological Hazard

The SRM ampoule contains hydrogen-3 with a total activity of approximately 3.2 MBq. Hydrogen-3 decays by beta-particle emission. None of the beta particles escape from the SRM ampoule. During the decay process no photons are emitted. Approximate unshielded dose rates at several distances (as of the reference time) are given in note [a]*. There is no detectable external radiation. The SRM should be used only by persons qualified to handle radioactive material.

Chemical Hazard

The SRM ampoule contains only distilled water. There is no chemical hazard. If the ampoule is to be opened to transfer the solution, the recommended procedure is given on page 2.

Storage and Handling

The SRM should be stored and used at a temperature between 5 and 65 °C. The solution in an unopened ampoule should remain stable and homogeneous until at least September 2008.

The ampoule (or any subsequent container) should always be clearly marked as containing radioactive material. If the ampoule is transported it should be packed, marked, labeled, and shipped in accordance with the applicable national, international, and carrier regulations. The solution in the ampoule is a dangerous good (hazardous material) because of the radioactivity.

Preparation

This Standard Reference Material was prepared in the Physics Laboratory, Ionizing Radiation Division, Radioactivity Group, L.R. Karam, Group Leader. The overall technical direction and physical measurements leading to certification were provided by L.L. Lucas and M.P. Unterwieser 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 by J.W.L. Thomas.

Bert M. Coursey, Chief
Ionizing Radiation Division

Nancy M. Trahey, Chief
Standard Reference Materials Program

Gaithersburg, Maryland 20899
June 1999
Half-life and text revised October 2000

Recommended Procedure for Opening the SRM Ampoule

- 1) If the SRM solution is to be diluted, it is recommended that the diluting solution have a composition comparable to that of the SRM solution.
- 2) Wear eye protection, gloves, and protective clothing and work over a tray with absorbent paper in it. Work in a fume hood.
- 3) Shake the ampoule to wet all of the inside surface of the ampoule. Return the ampoule to the upright position.
- 4) Check that all of the liquid has drained out of the neck of the ampoule. If necessary, gently tap the neck to speed the process.
- 5) Holding the ampoule upright, score the narrowest part of the neck with a scribe or diamond pencil.
- 6) Lightly wet the scored line. This reduces the crack propagation velocity and makes for a cleaner break.
- 7) Hold the ampoule upright with a paper towel, a wiper, or a support jig. Position the scored line away from you. Using a paper towel or wiper to avoid contamination, snap off the top of the ampoule by pressing the narrowest part of the neck away from you while pulling the tip of the ampoule towards you.
- 8) Transfer the solution from the ampoule using a pycnometer or a pipet with dispenser handle. NEVER PIPETTE BY MOUTH.
- 9) Seal any unused SRM solution in a flame-sealed glass ampoule, if possible, to minimize the evaporation loss.

See also reference [4]*.

PROPERTIES OF SRM 4927F

Certified values:

Solution density	$(0.998 \pm 0.002) \text{ g} \cdot \text{mL}^{-1}$ at 20.0 °C [B]*
Radionuclide	Hydrogen-3
Reference time	1200 EST, 3-September-1998
Massic activity of the solution [C]	$634.7 \text{ kBq} \cdot \text{g}^{-1}$
Relative expanded uncertainty ($k=2$)	0.72% [d] [e]

Uncertified values

Physical Properties:			
Source description	Liquid in flame-sealed NIST borosilicate-glass ampoule		
Ampoule specifications	Body outside diameter	$(16.5 \pm 0.5) \text{ mm}$	
	Wall thickness	$(0.60 \pm 0.04) \text{ mm}$	
	Barium content	Less than 2.5%	
	Lead-oxide content	Less than 0.02%	
	Other heavy elements	Trace quantities	
Solution mass	Approximately 5.0 g		
Chemical Properties:			
Solution composition	Chemical Formula	Concentration (mol·L ⁻¹)	Mass Fraction (g·g ⁻¹)
	H ₂ O 3HHO	55 6×10^{-7}	1800 1×10^{-8}
Radiological Properties:			
Radiomucidic impurities	None detected [f]		
Half lives used	Hydrogen-3: $(4500 \pm 8) \text{ d}$ [g]		
Calibration method and measuring instrument(s)	4πB gas counting of SRM 4927E using the NIST length-compensated internal gas proportional counters and intercomparison of SRMs 4927E/4927F using two 4πB liquid-scintillation counting systems [h]		

EVALUATION OF THE UNCERTAINTY OF THE MASSIC ACTIVITY [d]*

Input Quantity x_i , the source of uncertainty (and individual uncertainty components where appropriate)	Method Used To Evaluate $u(x_i)$, the standard uncertainty of x_i . (A) denotes evaluation by statistical methods, (B) denotes evaluation by other methods	Relative Uncertainty Of Input Quantity, $u(x_i)/x_i$, (%) [I]	Relative Sensitivity Factor, $ dy/dx_i $ (x_i/y) [J]	Relative Uncertainty Of Output Quantity, $u(y)/y$, (%) [K]
Massic count rate of SRM 4927E, corrected for background and decay [H]	Standard deviation of the mean for 23 sets of gas counting measurements (A)	0.18	1.0	0.18
Gram-mole measurements	Estimated (B)	0.20	1.0	0.20
Live-time [p]	Estimated (B)	0.10	1.0	0.10
Extrapolation of count-rate-versus-energy to zero energy [r]	Estimated (B)	0.20	1.0	0.20
Half life of H-3	Standard uncertainty of the half life (A)	0.18 [m]	0.009 [n]	0.002
Liquid-scintillation intercomparison of SRM 4927F and SRM-4927E	Standard deviation of the mean for 7 sets of liquid-scintillation measurements (A)	0.06	1.0	0.06
Radiometric impurities	Limit of detection (B) [q]	100.	0.0005	0.05
Relative Combined Standard Uncertainty of the Output Quantity, $u_c(y)/y$, (%)				0.36
Coverage Factor, k				<u>2</u>
Relative Expanded Uncertainty of the Output Quantity, $U(y)/y$, (%)				0.72

NOTES

- [a] The Sievert is the SI unit for dose equivalent. See reference [1]. One μSv is equal to 0.1 μrem .
 Distance from Ampoule (cm): 30 100
 Approximate Dose Rate ($\mu\text{Sv/h}$): <0.1 (Not detectable)
- [b] The stated uncertainty is two times the standard uncertainty.
- [c] Massic activity is the preferred name for the quantity activity divided by the total mass of the sample. See reference [1].
- [d] The reported value, y , of massic activity (activity per unit mass) at the reference time was not measured directly but was derived from measurements and calculations of other quantities. This can be expressed as $y = f(x_1, x_2, \dots, x_n)$, where f is a mathematical function derived from the assumed model of the measurement process.
- The value, x_i , used for each input quantity i has a standard uncertainty, $u(x_i)$, that generates a corresponding uncertainty in y , $u(y) = |df/dx_i| \cdot u(x_i)$, called a component of combined standard uncertainty of y .
- The combined standard uncertainty of y , $u(y)$, is the positive square root of the sum of the squares of the components of combined standard uncertainty.
- The combined standard uncertainty is multiplied by a coverage factor of $k = 2$ to obtain U , the expanded uncertainty of y .
- Since it can be assumed that the possible estimated values of the massic activity are approximately normally distributed with approximate standard deviation $u(y)$, the unknown value of the massic activity is believed to lie in the interval $y \pm U$ with a level of confidence of approximately 95 percent.
- For further information on the expression of uncertainties, see references [2] and [3].
- [e] The value of each standard uncertainty component and hence the value of the expanded uncertainty itself is a best estimate based upon all available information, but is only approximately known. That is to say, the "uncertainty of the uncertainty" is large and not well known. This is true for uncertainties evaluated by statistical methods (e.g., the relative standard deviation of the standard deviation of the mean for the massic response is approximately 50%) and for uncertainties evaluated by other methods (which could easily be over estimated or under estimated by substantial amounts). The unknown value of the expanded uncertainty is believed to lie in the interval $U/2$ to $2U$ (i.e., within a factor of 2 of the estimated value).
- [f] The estimated limit of detection for radionuclides impurities is $300 \text{ Bq} \cdot \text{g}^{-1}$.
- [g] The stated uncertainty is the standard uncertainty. See reference [5].
- [h] Extensive gas-counting measurements were made on the SRM 4927E solution during 1998 and 1999. The SRM 4927F solution was intercompared with the SRM 4927B solution using liquid-scintillation counting.
- [i] Relative standard uncertainty of the input quantity x_i .

- [j] The relative change in the output quantity y divided by the relative change in the input quantity x_i . If $|\partial y/\partial x_i| \cdot (x_i/y) = 1.0$, then a 1% change in x_i results in a 1% change in y . If $|\partial y/\partial x_i| \cdot (x_i/y) = 0.05$, then a 1% change in x_i results in a 0.05% change in y .
- [k] Relative component of combined standard uncertainty of output quantity, rounded to two significant figures or less. The relative component of combined standard uncertainty of y is given by $u_i(y)/y = |\partial y/\partial x_i| \cdot u(x_i)/y = |\partial y/\partial x_i| \cdot (x_i/y) \cdot u(x_i)/x_i$. The numerical values of $u(x_i)/x_i$, $|\partial y/\partial x_i| \cdot (x_i/y)$, and $u_i(y)/y$, all dimensionless quantities, are listed in columns 3, 4, and 5, respectively. Thus, the value in column 5 is equal to the value in column 4 multiplied by the value in column 3. The input quantities are independent, or very nearly so. Hence the covariances are zero or negligible.
- [m] The relative standard uncertainty of $\lambda \cdot t^{1/2}$ is determined by the relative standard uncertainty of λ (i.e., of the half life). The relative standard uncertainty of t is negligible.
- [n] $|\partial y/\partial x_i| \cdot (x_i/y) = |\lambda \cdot t|$
- [p] The live time is determined by counting the pulses from a gated crystal-controlled oscillator.
- [q] The standard uncertainty for each undetected impurity that might reasonably be expected to be present is estimated to be equal to the estimated limit of detection for that impurity, i.e. $u(x_i)/x_i = 100\%$. $|\partial y/\partial x_i| \cdot (x_i/y) = \{(\text{response per Bq of impurity})/(\text{response per Bq of H-3})\} \cdot \{(\text{Bq of impurity})/(\text{Bq of H-3})\}$. Thus $u_i(y)/y$ is the relative change in y if the impurity were present with a massic activity equal to the estimated limit of detection.

REFERENCES

- [1] International Organization for Standardization (ISO), *ISO Standards Handbook - Quantities and Units*, 1993. Available from the American National Standards Institute, 11 West 42nd Street, New York, NY 10036, U.S.A. 1-212-642-4900.
- [2] International Organization for Standardization (ISO), *Guide to the Expression of Uncertainty in Measurement*, 1993. Available from the American National Standards Institute, 11 West 42nd Street, New York, NY 10036, U.S.A. 1-212-642-4900. (Listed under ISO miscellaneous publications as "ISO Guide to the Expression 1993".)
- [3] 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.
- [4] National Council on Radiation Protection and Measurements Report No. 58, *A Handbook of Radioactivity Measurements Procedures*, Second Edition, 1985. Available from the National Council on Radiation Protection and Measurements, 7910 Woodmont Avenue, Bethesda, MD 20814 U.S.A.
- [5] L.L. Lucas and M.P. Unterwiesing, *Comprehensive Review and Critical Evaluation of the Half-Life of Tritium*, J. Res. Natl. Inst. Stand. Technol. 105, 541-549 (2000).

LS6000 H-3 Swipes Background Determination

Interim control limits are established from the initial calibration for the geometry of interest. Limits are +/- 3 standard deviations from the initial unquenched calibration blank data. Once enough historical data is acquired, new historical limits are set as follows: Control limits for reagent blanks are established from 30 individual historical data points (10 batches). Limits are +/- 3 standard deviations from 30 individual historical data points. Individual reagent blanks and the average of reagent blanks from each batch are in control if the Count Rate (CPM) is within the established control limits.

CURRENTLY UNDER INTERIM LIMITS!

COUNT DATE	#	Sample ID	Count Duration (m)	Count Rate (CPM)	Total Cts.	Mean	Individual Reagent Blanks			Average of Reagent Blanks		
							LCL	UCL	Pass ?	LCL	UCL	Pass ?
10/27/2009	1	3H090422-3CB1	180	7.16	1288.8		3.49	8.24	PASS			
10/27/2009	2	3H090422-3CB2	180	7.38	1328.4		3.49	8.24	PASS			
10/28/2009	3	3H090422-3CB3	180	7.07	1272.6	7.20	3.49	8.24	PASS	3.49	8.24	PASS

H-3 Swipes "Window 2" Control Limits (LS 6000)

The background count rate is determined from the average of the reagent blanks for the batch.

Window 2 control limits are established using the average count rate from the three reagent blanks associated with each prep batch +/- 3X the estimated poisson uncertainty.

Updated 10/29/09 mh

COUNT DATE	#	Sample ID	Count Duration (min.)	Average count Duration (min.)	Count Rate (CPM)	Batch Average Reagent Blank	Lower Control Limit	Upper Control Limit
10/27/2009	1	3H090422-3CB1	180		29.98			
10/27/2009	2	3H090422-3CB2	180		28.89			
10/28/2009	3	3H090422-3CB3	180	180	30.01	29.63	28.41	30.84

DAILY INSTRUMENT PERFORMANCE CHECKS - LS6000 (LL OFF, LUMEX OFF)

Daily IPCs consist of the following standards;

Efficiency Check -

Beckman Tritium Standard

Beckman C-14 Standard

Lot HNZ0202

Lot CNZ3112

101900.00 dpm

98500.0 dpm

2/17/2005 REF

2/17/2005 REF

2/17/2010 EXP

2/17/2010 EXP

INSTRUMENT RE-CALIBRATED FOR ALL TESTS STARTING 04/08/09. mbc

Historical Control Limits

as of 06/12/09 MH

Decay Corrected Tritium

Carbon-14

UCL

70748.54

80439.21

Mean Value

67379.56

76608.77

LCL

64010.58

72778.33

Decay Corrected

Obs	Date	H-3 CPM	H-CPM	PASS?	C-14 CPM	PASS?
122	10/26/2009	51452.50	67035.95	OK	76690.2	OK
123	10/27/2009	51352.20	66915.61	OK	76616.2	OK
124	10/28/2009	51270.40	66819.35	OK	76543.7	OK

DAILY CHECK LL ON ⁹⁹Tc SOURCE- LS6000

⁹⁹ Tc standard		SPIKE	
836.3020.70		KNOWN ACTIVITY	
7/25/2008	REF	58000.38	dpm/g
7/25/2009	EXP	58000.38	dpm

INSTRUMENT RE-CALIBRATED FOR ALL TESTS STARTING 04/08/09. mbc

Historical Control Limits 6/12/2009

	<u>blank</u>	<u>Blank Quench #</u>	<u>spike</u>
UCL	21.36	52.5	11454.01
Mean Value	17.11	50.0	10187.61
LCL	12.85	47.5	8921.21

Obs #	Date	Blank C.R.	Pass ?	Quench #	Pass	Spiked C.R.	Pass ?
122	10/26/2009	16.9	OK	49	OK	10005	OK
123	10/27/2009	18.9	OK	48.4	OK	10076	OK
124	10/28/2009	16.2	OK	50.2	OK	10045.7	OK



Liquid Scintillation Counter

Quality Control Data

Daily Instrument Performance Checks

DAILY INSTRUMENT PERFORMANCE CHECKS - LS6000 (LL OFF, LUMEX OFF)

Daily IPCs consist of the following standards;

Efficiency Check - Beckman Tritium Standard		Beckman C-14 Standard	
Lot HNZ0202		Lot CNZ3112	
101900.00	dpm	98500.0	dpm
2/17/2005	REF	2/17/2005	REF
2/17/2010	EXP	2/17/2010	EXP

INSTRUMENT RE-CALIBRATED FOR ALL TESTS STARTING 04/08/09. mbc

Historical Control Limits	as of 06/12/09 MH	
	<u>Decay Corrected Tritium</u>	<u>Carbon-14</u>
UCL	70748.54	80439.21
Mean Value	67379.56	76608.77
LCL	64010.58	72778.33

Decay Corrected						
<u>Obs</u>	<u>Date</u>	<u>H-3 CPM</u>	<u>H-CPM</u>	<u>PASS?</u>	<u>C-14 CPM</u>	<u>PASS?</u>
144	11/26/2009	51210.50	67041.06	OK	76733.9	OK
145	11/29/2009	51005.30	66803.39	OK	76446.6	OK
146	12/1/2009	51205.20	67085.94	OK	76478.7	OK
147	12/2/2009	51144.30	67016.51	OK	76475.6	OK

DAILY CHECK LL ON ⁹⁹Tc SOURCE- LS6000

⁹⁹ Tc standard		SPIKE	
836.3020.70		KNOWN ACTIVITY	
7/25/2008	REF	58000.38	dpm/g
7/25/2009	EXP	58000.38	dpm

INSTRUMENT RE-CALIBRATED FOR ALL TESTS STARTING 04/08/09. mbc

Historical Control Limits 6/12/2009

	<u>blank</u>	<u>Blank Quench #</u>	<u>spike</u>
UCL	21.36	52.5	11454.01
Mean Value	17.11	50.0	10187.61
LCL	12.85	47.5	8921.21

Obs #	Date	Blank C.R.	Pass ?	Quench #	Pass	Spiked C.R.	Pass ?
144	11/26/2009	14.6	OK	50.3	OK	10189.8	OK
145	11/29/2009	18.2	OK	51	OK	10512	OK
146	12/1/2009	19.2	OK	51.2	OK	10647.8	OK
147	12/2/2009	15.7	OK	51.2	OK	10554.1	OK