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: 09-11-225
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 1-118

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,

ALS Laboratory Group
for Lance Steere
Senior Project Manager

LRS/eh
Enclosure (s): Report

ALS Laboratory Group -- FC

Sample Number(s) Cross-Reference Table

Paragon OrderNum: 0911225
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
SU01-01	0911225-1		WIPE	17-Nov-09	9:00
SU01-01-DUP	0911225-2		WIPE	17-Nov-09	9:05
SU01-02	0911225-3		WIPE	17-Nov-09	9:10
SU01-03	0911225-4		WIPE	17-Nov-09	9:15
SU01-04	0911225-5		WIPE	17-Nov-09	9:20
SU01-05	0911225-6		WIPE	17-Nov-09	9:25
SU01-06	0911225-7		WIPE	17-Nov-09	9:30
SU01-06-DUP	0911225-8		WIPE	17-Nov-09	9:35
SU01-07	0911225-9		WIPE	17-Nov-09	9:40
SU01-08	0911225-10		WIPE	17-Nov-09	9:45
SU01-09	0911225-11		WIPE	17-Nov-09	9:50
SU01-10	0911225-12		WIPE	17-Nov-09	9:55
SU01-11	0911225-13		WIPE	17-Nov-09	10:00
SU01-12	0911225-14		WIPE	17-Nov-09	10:05
SU01-12-DUP	0911225-15		WIPE	17-Nov-09	10:10
SU01-13	0911225-16		WIPE	17-Nov-09	10:15
SU01-14	0911225-17		WIPE	17-Nov-09	10:20
SU01-15	0911225-18		WIPE	17-Nov-09	10:25
SU01-16	0911225-19		WIPE	17-Nov-09	10:30
SU01-17	0911225-20		WIPE	17-Nov-09	10:35

ALS Laboratory Group

225 Commerce Drive Fort Collins, CO 80524
800-443-1511 or (970) 490-1511 (970) 490-1522 Fax

Accession Number (LAB ID) 0911225

Chain-of-Custody

Date 11/20/09 Page 1 of 1 11

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
SU01-01	11/17/09	9:00	1	SM	1	X
SU01-01-DUP	11/17/09	9:05	2	SM	1	X
SU01-02	11/17/09	9:10	6	SM	1	X
SU01-03	11/17/09	9:15	4	SM	1	X
SU01-04	11/17/09	9:20	5	SM	1	X
SU01-05	11/17/09	9:25	6	SM	1	X
SU01-06	11/17/09	9:30	7	SM	1	X
SU01-06-DUP	11/17/09	9:35	8	SM	1	X
SU01-07	11/17/09	9:40	9	SM	1	X
SU01-08	11/17/09	9:45	10	SM	1	X

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

Total number of containers: 10

Form 202r4.xls (1/3/01)

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

* **Time Zone** (circle one): EDT CDT MDT PDT

** **Indicate specific analytes under comments.**

Distribution: white / yellow (Paragon); pink retained by originator.

ALS Laboratory Group

225 Commerce Drive Fort Collins, CO 80524
800-443-1511 or (970) 490-1511 (970) 490-1522 Fax

Accession Number (LAB ID) 0911225

Chain-of-Custody

Date 11/20/09 Page 2 of 11

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
SU01-09	11/17/09	9:50	11	SM	1	X
SU01-10	11/17/09	9:55	12	SM	1	X
SU01-11	11/17/09	10:00	13	SM	1	X
SU01-12	11/17/09	10:05	14	SM	1	X
SU01-12-DUP	11/17/09	10:10	15	SM	1	X
SU01-13	11/17/09	10:15	16	SM	1	X
SU01-14	11/17/09	10:20	17	SM	1	X
SU01-15	11/17/09	10:25	18	SM	1	X
SU01-16	11/17/09	10:30	19	SM	1	X
SU01-17	11/17/09	10:35	20	SM	1	X

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

Total number of containers: 10

Form 202r4.xls (1/3/01)

Relinquished By: (1)	Relinquished By: (2)
Signature [signature]	Signature
Printed Name Michael Barsa	Printed Name
Date 11/20 Time 1400	Date Time
Company Cabrera	Company

Received By: (1)	Received By: (2)
Signature [signature]	Signature
Printed Name Lauren Schmitt	Printed Name
Date 11/23/09 Time 0915	Date Time
Company ALS	Company

* Time Zone (circle one): EDT CDT MDT PDT

** Indicate specific analytes under comments.

Distribution: white / yellow (Paragon); pink retained by originator.

CONDITION OF SAMPLE UPON RECEIPT FORM

Client: CABRERA Workorder No: 0911225

Project Manager: LRS Initials: LAS Date: 11/23/09

1. Does this project require any **special handling** in addition to standard Paragon procedures?		YES	(NO)
2. Are custody **seals** on **shipping containers** intact?	(NONE)	(YES)	NO
3. Are Custody seals on **sample containers** intact?	(NONE)	YES	NO
4. *Is there a* **COC (Chain-of-Custody) present** *or other representative documents?*		(YES)	NO
5. Are the **COC and bottle labels complete and legible**?		(YES)	NO
6. Is the **COC in agreement** with samples received? (IDs, dates, times, no. of samples, no. of containers, matrix, requested analyses, etc.)		(YES)	NO
7. Were **airbills / shipping documents** present and/or removable?	DROP OFF	(YES)	NO
8. Are all aqueous **samples requiring preservation preserved correctly?** (excluding volatiles)	(N/A)	YES	NO
9. Are all aqueous **non-preserved samples pH 4-9**?	(N/A)	YES	NO
10. *Is there* ***sufficient sample*** *for the requested analyses?*		(YES)	NO
11. Were all samples placed in the **proper containers** for the requested analyses?		(YES)	NO
12. Are all samples within **holding times** for the requested analyses?		(YES)	NO
13. Were all sample containers received **intact**? (not broken or leaking, etc.)		(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	(N/A)	YES	NO
15. Do perchlorate LCMS-MS samples **have** headspace? (at least 1/3 of container required)	(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.)	(N/A)	YES	NO
17. Were the samples **shipped on ice**?		YES	(NO)
18. *Were cooler temperatures measured at 0.1-6.0°C?* *IR gun used*:* (#2) #4	RAD ONLY	YES	(NO)

Cooler #: 1

Temperature (°C): Ambient (18.4°)

No. of custody seals on cooler: 2

DOT Survey/ Acceptance Information

External µR/hr reading: 10

Background µR/hr reading: 12

Were external µR/hr readings ≤ two times background and within DOT acceptance criteria? (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 kept cold in-house

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

Project Manager Signature / Date: 11/23/09

*IR Gun #2: Oakton, SN 29922500201-0066 *IR Gun #4: Oakton, SN 2372220101-0002

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

FedEx Express

J09300907312023

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

0911225

Delivery Address Bar Code

SHIP TO: (800) 443-1511 BILL SENDER

Lance Steere
Paragon Analytics
225 Commerce Dr.

Fort Collins, CO 80524

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

1 of 2

MON - 23NOV A2

TRK# 0201 7930 3751 2435

STANDARD OVERNIGHT

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XH FTCA

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2. Fold the printed page along the horizontal line.
3. Place label in shipping pouch and affix it to your shipment so that the barcode portion of the label can be read and scanned.

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ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division
Fort Collins, Colorado

Tritium

Case Narrative

Cabrera Services Inc.

Forest Glen Rad Scoping Survey – 08-3800.04

Work Order Number: 0911225

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 0911225-8, -14, and -18, it was noted that the quench factor (H#) was outside of the current usable calibration range. Thus, an approximate volume of 10 µL of nitro-methane was added to the samples and 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 sample 0911225-16 is greater than the 2 sigma TPU at 2.3 sigma. 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. "Window 2" count rates were observed below the lower threshold, determined from calibration on 11/28/2009 for samples 0911225-10, -13, and -15. 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 Knodel — 12-10-09
Radiochemistry Primary Data Reviewer — Date

Radiochemistry Final Data Reviewer — 12-10-09
Date

Section 1

CHAIN OF CUSTODY

ALS Laboratory Group -- FC

Sample Number(s) Cross-Reference Table

Paragon OrderNum: 0911225
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
SU01-01	0911225-1		WIPE	17-Nov-09	9:00
SU01-01-DUP	0911225-2		WIPE	17-Nov-09	9:05
SU01-02	0911225-3		WIPE	17-Nov-09	9:10
SU01-03	0911225-4		WIPE	17-Nov-09	9:15
SU01-04	0911225-5		WIPE	17-Nov-09	9:20
SU01-05	0911225-6		WIPE	17-Nov-09	9:25
SU01-06	0911225-7		WIPE	17-Nov-09	9:30
SU01-06-DUP	0911225-8		WIPE	17-Nov-09	9:35
SU01-07	0911225-9		WIPE	17-Nov-09	9:40
SU01-08	0911225-10		WIPE	17-Nov-09	9:45
SU01-09	0911225-11		WIPE	17-Nov-09	9:50
SU01-10	0911225-12		WIPE	17-Nov-09	9:55
SU01-11	0911225-13		WIPE	17-Nov-09	10:00
SU01-12	0911225-14		WIPE	17-Nov-09	10:05
SU01-12-DUP	0911225-15		WIPE	17-Nov-09	10:10
SU01-13	0911225-16		WIPE	17-Nov-09	10:15
SU01-14	0911225-17		WIPE	17-Nov-09	10:20
SU01-15	0911225-18		WIPE	17-Nov-09	10:25
SU01-16	0911225-19		WIPE	17-Nov-09	10:30
SU01-17	0911225-20		WIPE	17-Nov-09	10:35

Accession Number (LAB ID) 911225

ALS Laboratory Group

225 Commerce Drive Fort Collins, CO 80524
800-443-1511 or (970) 490-1511 (970) 490-1522 Fax

Chain-of-Custody

Date 11/20/09 Page 1 of 1

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
SU01-01	11/17/09	9:00	1	SM	1	X
SU01-01-DUP	11/17/09	9:05	2	SM	1	X
SU01-02	11/17/09	9:10	3	SM	1	X
SU01-03	11/17/09	9:15	4	SM	1	X
SU01-04	11/17/09	9:20	5	SM	1	X
SU01-05	11/17/09	9:25	6	SM	1	X
SU01-06	11/17/09	9:30	7	SM	1	X
SU01-06-DUP	11/17/09	9:35	8	SM	1	X
SU01-07	11/17/09	9:40	9	SM	1	X
SU01-08	11/17/09	9:45	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)	Relinquished By: (2)
Signature	Signature
Printed Name Michael Barsa	Printed Name
Date 11/20 Time 1400	Date Time
Company Cabrera	Company
Received By: (1)	**Received By: (2)**
Signature	Signature
Printed Name LaurenSchmitz	Printed Name
Date 11/23/09 Time 0915	Date Time
Company ALS	Company

Form 202r4.xls (1/3/01)

* Time Zone (circle one): EDT CDT MDT PDT

** Indicate specific analytes under comments.

Distribution: white / yellow (Paragon); pink retained by originator.

ALS Laboratory Group

225 Commerce Drive Fort Collins, CO 80524
800-443-1511 or (970) 490-1511 (970) 490-1522 Fax

Accession Number (LAB ID) 0911225

Chain-of-Custody

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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
SU01-09	11/17/09	9:50	11	SM	1	X
SU01-10	11/17/09	9:55	12	SM	1	X
SU01-11	11/17/09	10:00	13	SM	1	X
SU01-12	11/17/09	10:05	14	SM	1	X
SU01-12-DUP	11/17/09	10:10	15	SM	1	X
SU01-13	11/17/09	10:15	16	SM	1	X
SU01-14	11/17/09	10:20	17	SM	1	X
SU01-15	11/17/09	10:25	18	SM	1	X
SU01-16	11/17/09	10:30	19	SM	1	X
SU01-17	11/17/09	10:35	20	SM	1	X

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

Total number of containers: 10

Form 202r4.xls (1/3/01)

Relinquished By: (1)	Relinquished By: (2)
Signature [signature]	Signature
Printed Name Michael Barsa	Printed Name
Date 11/20 Time 1400	Date Time
Company Cabrera	Company

Received By: (1)	Received By: (2)
Signature [signature]	Signature
Printed Name Lauren Schmitt	Printed Name
Date 11/23/09 Time 0915	Date Time
Company ALS	Company

* Time Zone (circle one): EDT CDT MDT PDT

** Indicate specific analytes under comments.

Distribution: white / yellow (Paragon); pink retained by originator.

ALS Laboratory Group - Fort Collins

CONDITION OF SAMPLE UPON RECEIPT FORM

Client: CABRERA Workorder No: 911225

Project Manager: LRS Initials: LAS Date: 11/23/09

1. Does this project require any **special handling** in addition to standard Paragon procedures?		YES	(NO)
2. Are custody **seals on shipping containers** intact?	NONE	(YES)	NO
3. Are Custody seals on **sample containers** intact?	(NONE)	YES	NO
4. Is there a **COC (Chain-of-Custody) present** or other representative documents?		(YES)	NO
5. Are the **COC and bottle labels complete and legible**?		(YES)	NO
6. Is the **COC in agreement** with samples received? (IDs, dates, times, no. of samples, no. of containers, matrix, requested analyses, etc.)		(YES)	NO
7 Were **airbills / shipping documents** present and/or removable?	DROP OFF	(YES)	NO
8. Are all aqueous **samples requiring preservation preserved correctly**? (*excluding volatiles*)	(N/A)	YES	NO
9. Are all aqueous **non-preserved samples pH 4-9**?	(N/A)	YES	NO
10. Is there **sufficient sample** for the requested analyses?		(YES)	NO
11. Were *all samples placed* in the **proper containers** for the requested analyses?		(YES)	NO
12. Are all samples within **holding times** for the requested analyses?		(YES)	NO
13. Were all sample containers received **intact**? (not broken or leaking, etc.)		(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	(N/A)	YES	NO
15. *Do perchlorate LCMS-MS samples* **have** headspace? (at least 1/3 of container required)	(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.)	(N/A)	YES	NO
17. Were the samples **shipped on ice?**		YES	(NO)
18. Were cooler temperatures measured at 0.1-6.0°C? **IR gun used*:** (#2) #4	RAD ONLY	YES	(NO)

Cooler #: 1

Temperature (°C): Ambient (18.4°)

No. of custody seals on cooler: 2

DOT Survey/ Acceptance Information

External µR/hr reading: 16

Background µR/hr reading: 12

Were external µR/hr readings ≤ two times background and within DOT acceptance criteria? (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 kept cold in-house

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

Project Manager Signature / Date: _____ 11/23/09

*IR Gun #2: Oakton, SN 29922500201-0066 *IR Gun #4: Oakton, SN 2372220101-0002

Form 201r22.xls (6/1/09)

0911225

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

FedEx Express

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

Delivery Address Bar Code

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

6

SHIP TO: (800) 443-1511 BILL SENDER

Lance Steere
Paragon Analytics
225 Commerce Dr.

Fort Collins, CO 80524

1 of 2

TRK# 0201 7930 3751 2435

MASTER

MON - 23NOV **A2**
STANDARD OVERNIGHT

80524
CO-US
DEN

2

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After printing this label:
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Section 2

SAMPLE RESULTS SUMMARY

Tritium Analysis By Liquid Scintillation Sample Results Summary

Client Name: Cabrera Services Inc.
Client Project Name: Forest Glen Rad Scoping Survey
Client Project Number: 08-3800.04

Laboratory Name: ALS Laboratory Group -- FC
PAI Work Order: 0911225

Reported on: Thursday, December 10, 2009 1:27:23 PM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0911225-1	SU01-01	Sample	H-3	-1.1 +/- 2.6	4.5	pCi/sample	WIPE	3H091124-4	11/28/2009	U
0911225-2	SU01-01-DUP	Sample	H-3	-2.0 +/- 2.6	4.6	pCi/sample	WIPE	3H091124-4	11/28/2009	U
0911225-3	SU01-02	Sample	H-3	-0.4 +/- 2.6	4.5	pCi/sample	WIPE	3H091124-4	11/28/2009	U
0911225-4	SU01-03	Sample	H-3	-0.3 +/- 2.7	4.6	pCi/sample	WIPE	3H091124-4	11/28/2009	U
0911225-5	SU01-04	Sample	H-3	-1.4 +/- 2.6	4.6	pCi/sample	WIPE	3H091124-4	11/28/2009	U
0911225-6	SU01-05	Sample	H-3	-1.8 +/- 2.6	4.5	pCi/sample	WIPE	3H091124-4	11/28/2009	U
0911225-7	SU01-06	Sample	H-3	-1.9 +/- 2.5	4.4	pCi/sample	WIPE	3H091124-4	11/28/2009	U
0911225-8	SU01-06-DUP	Sample	H-3	0.2 +/- 2.9	4.9	pCi/sample	WIPE	3H091124-4	12/1/2009	U
0911225-9	SU01-07	Sample	H-3	-1.4 +/- 2.7	4.7	pCi/sample	WIPE	3H091124-4	11/28/2009	U

Comments:

Data Package ID: *H30911225-1*

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.
Client Project Name: Forest Glen Rad Scoping Survey
Client Project Number: 08-3800.04

Laboratory Name: ALS Laboratory Group -- FC
PAI Work Order: 0911225

Reported on: Thursday, December 10, 2009 1:27:23 PM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0911225-10	SU01-08	Sample	H-3	-0.7 +/- 2.8	4.8	pCi/sample	WIPE	3H091124-4	11/28/2009	U
0911225-11	SU01-09	Sample	H-3	0.3 +/- 2.7	4.6	pCi/sample	WIPE	3H091124-4	11/28/2009	U
0911225-12	SU01-10	Sample	H-3	-1.6 +/- 2.7	4.8	pCi/sample	WIPE	3H091124-4	11/28/2009	U
0911225-13	SU01-11	Sample	H-3	-1.5 +/- 2.6	4.5	pCi/sample	WIPE	3H091124-4	11/28/2009	U
0911225-14	SU01-12	Sample	H-3	0.1 +/- 2.8	4.7	pCi/sample	WIPE	3H091124-4	12/1/2009	U
0911225-15	SU01-12-DUP	Sample	H-3	-1.3 +/- 2.6	4.5	pCi/sample	WIPE	3H091124-4	11/28/2009	U
0911225-16	SU01-13	Sample	H-3	-3.9 +/- 3.4	6.0	pCi/sample	WIPE	3H091124-4	11/28/2009	U
0911225-17	SU01-14	Sample	H-3	-1.0 +/- 2.6	4.5	pCi/sample	WIPE	3H091124-4	11/28/2009	U
0911225-18	SU01-15	Sample	H-3	-0.7 +/- 2.7	4.7	pCi/sample	WIPE	3H091124-4	12/1/2009	U

Comments:

Data Package ID: *H30911225-1*

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.
Client Project Name: Forest Glen Rad Scoping Survey
Client Project Number: 08-3800.04

Laboratory Name: ALS Laboratory Group -- FC
PAI Work Order: 0911225

Reported on: Thursday, December 10, 2009 1:27:23 PM

Lab Sample ID	Client Sample ID	Sample Type	Nuclide	Result +/- 2 s TPU	MDC	Units	Matrix	Prep Batch	Date Analyzed	Flags
0911225-19	SU01-16	Sample	H-3	0 +/- 2.7	4.6	pCi/sample	WIPE	3H091124-4	11/28/2009	U
0911225-20	SU01-17	Sample	H-3	-1.5 +/- 2.6	4.5	pCi/sample	WIPE	3H091124-4	11/28/2009	U

Comments:

Data Package ID: *H30911225-1*

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 3

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9

Method Blank Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911225
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Lab ID: 3H091124-4MB

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 24-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 28-Nov-09

Prep Batch: 3H091124-4
QCBatchID: 3H091124-4-1
Run ID: 3H091124-4A
Count Time: 30 minutes

Final Aliquot: 1.00 sample
Result Units: pCi/sample
File Name: B60_04_112801

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-0.4 +/- 2.9	5.0	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: *H30911225-1*

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9

Laboratory Control Sample(s)

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911225
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Lab ID: 3H091124-4LCS

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 24-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 28-Nov-09

Prep Batch: 3H091124-4
QCBatchID: 3H091124-4-1
Run ID: 3H091124-4A
Count Time: 30 minutes

Final Aliquot: 1.00 sample
Result Units: pCi/sample
File Name: B60_04_112801

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
10028-17-8	H-3	115 +/- 19	5	114	102	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: *H30911225-1*

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9

Laboratory Control Sample(s)

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911225
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Lab ID: 3H091124-4LCSD

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 24-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 28-Nov-09

Prep Batch: 3H091124-4
QCBatchID: 3H091124-4-1
Run ID: 3H091124-4A
Count Time: 30 minutes

Final Aliquot: 1.00 sample
Result Units: pCi/sample
File Name: B60_04_112801

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
10028-17-8	H-3	124 +/- 20	5	114	109	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: *H30911225-1*

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9

Duplicate Sample Results (DER)

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911225
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID:
Lab ID: 3H091124-4LCSD

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 24-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 28-Nov-09

Prep Batch: 3H091124-4
QCBatchID: 3H091124-4-1
Run ID: 3H091124-4A
Count Time: 30 minutes

Final Aliquot: 1.00 sample
Prep Basis: As Received
Moisture(%): NA
Result Units: pCi/sample
File Name: B60_04_112801

CASNO	Analyte	Sample			Duplicate			DER	DER Lim
		Result +/- 2 s TPU	MDC	Flags	Result +/- 2 s TPU	MDC	Flags		
10028-17-8	H-3	115 +/- 19	5	P	124 +/- 20	5	P	0.297	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: *H30911225-1*

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: 0911225
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU01-01
Lab ID: 0911225-1

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 17-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 28-Nov-09

Prep Batch: 3H091124-4
QCBatchID: 3H091124-4-1
Run ID: 3H091124-4A
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_112801

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-1.1 +/- 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: *H30911225-1*

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9

Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911225
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU01-01-DUP
Lab ID: 0911225-2

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 17-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 28-Nov-09

Prep Batch: 3H091124-4
QCBatchID: 3H091124-4-1
Run ID: 3H091124-4A
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_112801

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-2.0 +/- 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: *H30911225-1*

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9

Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911225
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU01-02
Lab ID: 0911225-3

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 17-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 28-Nov-09

Prep Batch: 3H091124-4
QCBatchID: 3H091124-4-1
Run ID: 3H091124-4A
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_112801

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-0.4 +/- 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: *H30911225-1*

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9

Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911225
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU01-03
Lab ID: 0911225-4

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 17-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 28-Nov-09

Prep Batch: 3H091124-4
QCBatchID: 3H091124-4-1
Run ID: 3H091124-4A
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_112801

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-0.3 +/- 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: *H30911225-1*

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9

Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911225
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU01-04
Lab ID: 0911225-5

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 17-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 28-Nov-09

Prep Batch: 3H091124-4
QCBatchID: 3H091124-4-1
Run ID: 3H091124-4A
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_112801

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-1.4 +/- 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: *H30911225-1*

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9

Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911225
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU01-05
Lab ID: 0911225-6

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 17-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 28-Nov-09

Prep Batch: 3H091124-4
QCBatchID: 3H091124-4-1
Run ID: 3H091124-4A
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_112801

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: *H30911225-1*

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9

Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911225
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU01-06
Lab ID: 0911225-7

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 17-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 28-Nov-09

Prep Batch: 3H091124-4
QCBatchID: 3H091124-4-1
Run ID: 3H091124-4A
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_112801

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-1.9 +/- 2.5	4.4	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: *H30911225-1*

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9

Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911225
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU01-06-DUP
Lab ID: 0911225-8

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 17-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 01-Dec-09

Prep Batch: 3H091124-4
QCBatchID: 3H091124-4-1
Run ID: 3H091124-4A
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	0.2 +/- 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: *H30911225-1*

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9

Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911225
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU01-07
Lab ID: 0911225-9

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 17-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 28-Nov-09

Prep Batch: 3H091124-4
QCBatchID: 3H091124-4-1
Run ID: 3H091124-4A
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_112801

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-1.4 +/- 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: *H30911225-1*

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9

Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911225
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU01-08
Lab ID: 0911225-10

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 17-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 28-Nov-09

Prep Batch: 3H091124-4
QCBatchID: 3H091124-4-1
Run ID: 3H091124-4A
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_112801

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-0.7 +/- 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: *H30911225-1*

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9

Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911225
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU01-09
Lab ID: 0911225-11

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 17-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 28-Nov-09

Prep Batch: 3H091124-4
QCBatchID: 3H091124-4-1
Run ID: 3H091124-4A
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_112801

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	0.3 +/- 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: *H30911225-1*

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9

Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911225
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU01-10
Lab ID: 0911225-12

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 17-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 28-Nov-09

Prep Batch: 3H091124-4
QCBatchID: 3H091124-4-1
Run ID: 3H091124-4A
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_112801

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-1.6 +/- 2.7	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: *H30911225-1*

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9

Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911225
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU01-11
Lab ID: 0911225-13

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 17-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 28-Nov-09

Prep Batch: 3H091124-4
QCBatchID: 3H091124-4-1
Run ID: 3H091124-4A
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_112801

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-1.5 +/- 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: *H30911225-1*

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9

Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911225
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU01-12
Lab ID: 0911225-14

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 17-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 01-Dec-09

Prep Batch: 3H091124-4
QCBatchID: 3H091124-4-1
Run ID: 3H091124-4A
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	0.1 +/- 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: *H30911225-1*

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9

Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911225
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU01-12-DUP
Lab ID: 0911225-15

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 17-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 28-Nov-09

Prep Batch: 3H091124-4
QCBatchID: 3H091124-4-1
Run ID: 3H091124-4A
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_112801

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-1.3 +/- 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: *H30911225-1*

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9

Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911225
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU01-13
Lab ID: 0911225-16

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 17-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 28-Nov-09

Prep Batch: 3H091124-4
QCBatchID: 3H091124-4-1
Run ID: 3H091124-4A
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_112801

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-3.9 +/- 3.4	6.0	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: *H30911225-1*

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9

Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911225
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU01-14
Lab ID: 0911225-17

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 17-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 28-Nov-09

Prep Batch: 3H091124-4
QCBatchID: 3H091124-4-1
Run ID: 3H091124-4A
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_112801

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-1.0 +/- 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: *H30911225-1*

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9

Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911225
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU01-15
Lab ID: 0911225-18

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 17-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 01-Dec-09

Prep Batch: 3H091124-4
QCBatchID: 3H091124-4-1
Run ID: 3H091124-4A
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	-0.7 +/- 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: *H30911225-1*

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9

Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911225
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU01-16
Lab ID: 0911225-19

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 17-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 28-Nov-09

Prep Batch: 3H091124-4
QCBatchID: 3H091124-4-1
Run ID: 3H091124-4A
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_112801

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	0 +/- 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: *H30911225-1*

Tritium Analysis By Liquid Scintillation

PAI 704 Rev 9

Sample Results

Lab Name: ALS Laboratory Group -- FC
Work Order Number: 0911225
Client Name: Cabrera Services Inc.
ClientProject ID: Forest Glen Rad Scoping Survey 08-3800.04

Field ID: SU01-17
Lab ID: 0911225-20

Sample Matrix: WIPE
Prep SOP: PAI 700 Rev 10
Date Collected: 17-Nov-09
Date Prepared: 24-Nov-09
Date Analyzed: 28-Nov-09

Prep Batch: 3H091124-4
QCBatchID: 3H091124-4-1
Run ID: 3H091124-4A
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_112801

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	Lab Qualifier
10028-17-8	H-3	-1.5 +/- 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: *H30911225-1*

Section 5

RAW DATA

5

Tritium Analysis By Liquid Scintillation Raw Data Report

Laboratory Name: ALS Laboratory Group -- FC
PAI Work Order: 0911225

Prep SOP: PAI 700
Analytical SOP: PAI 704

Reported on: Wednesday, December 02, 2009 1:01:43 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
0911225-1	H-3	11/17/2009	3H091124-4	NA	115.6	WIPE	1 S	LS6000	3H091124-4A	11/28/2009	6.730	24.16%	30	-1.1	4.5	pCi/sample	NA	
SMP	Trg. Analyte	9:00:00 AM	3H091124-4-1	NA	0.78	NA	1 S	5-2	B60_04_112801	11:33 AM	7.340	NA	NA	2.6	NA	As Received	NA	U
0911225-2	H-3	11/17/2009	3H091124-4	NA	120.6	WIPE	1 S	LS6000	3H091124-4A	11/28/2009	6.330	23.60%	30	-2.0	4.6	pCi/sample	NA	
SMP	Trg. Analyte	9:05:00 AM	3H091124-4-1	NA	0.46	NA	1 S	5-3	B60_04_112801	12:04 PM	7.375	NA	NA	2.6	NA	As Received	NA	U
0911225-3	H-3	11/17/2009	3H091124-4	NA	115.7	WIPE	1 S	LS6000	3H091124-4A	11/28/2009	7.100	24.15%	30	-0.4	4.5	pCi/sample	NA	
SMP	Trg. Analyte	9:10:00 AM	3H091124-4-1	NA	0.38	NA	1 S	5-4	B60_04_112801	12:35 PM	7.340	NA	NA	2.6	NA	As Received	NA	U
0911225-4	H-3	11/17/2009	3H091124-4	NA	121	WIPE	1 S	LS6000	3H091124-4A	11/28/2009	7.200	23.56%	30	-0.3	4.6	pCi/sample	NA	
SMP	Trg. Analyte	9:15:00 AM	3H091124-4-1	NA	0.36	NA	1 S	5-5	B60_04_112801	1:06 PM	7.377	NA	NA	2.7	NA	As Received	NA	U
0911225-5	H-3	11/17/2009	3H091124-4	NA	121.7	WIPE	1 S	LS6000	3H091124-4A	11/28/2009	6.630	23.48%	30	-1.4	4.6	pCi/sample	NA	
SMP	Trg. Analyte	9:20:00 AM	3H091124-4-1	NA	0.38	NA	1 S	5-6	B60_04_112801	1:37 PM	7.382	NA	NA	2.6	NA	As Received	NA	U
0911225-6	H-3	11/17/2009	3H091124-4	NA	117	WIPE	1 S	LS6000	3H091124-4A	11/28/2009	6.400	24.01%	30	-1.8	4.6	pCi/sample	NA	
SMP	Trg. Analyte	9:25:00 AM	3H091124-4-1	NA	0.39	NA	1 S	5-7	B60_04_112801	2:08 PM	7.349	NA	NA	2.6	NA	As Received	NA	U
0911225-7	H-3	11/17/2009	3H091124-4	NA	114.5	WIPE	1 S	LS6000	3H091124-4A	11/28/2009	6.300	24.29%	30	-1.9	4.4	pCi/sample	NA	
SMP	Trg. Analyte	9:30:00 AM	3H091124-4-1	NA	0.35	NA	1 S	5-8	B60_04_112801	2:39 PM	7.332	NA	NA	2.5	NA	As Received	NA	U
0911225-8	H-3	11/17/2009	3H091124-4	NA	131.3	WIPE	1 S	LS6000	3H091124-4A	12/1/2009	7.570	22.39%	30	0.2	4.9	pCi/sample	NA	
SMP	Trg. Analyte	9:35:00 AM	3H091124-4-1	NA	0.77	NA	1 S	37-1	B60_04_120101	4:07 PM	7.449	NA	NA	2.9	NA	As Received	NA	U
0911225-9	H-3	11/17/2009	3H091124-4	NA	124.2	WIPE	1 S	LS6000	3H091124-4A	11/28/2009	6.670	23.19%	30	-1.4	4.7	pCi/sample	NA	
SMP	Trg. Analyte	9:40:00 AM	3H091124-4-1	NA	0.39	NA	1 S	5-10	B60_04_112801	3:40 PM	7.400	NA	NA	2.7	NA	As Received	NA	U
0911225-10	H-3	11/17/2009	3H091124-4	NA	129.1	WIPE	1 S	LS6000	3H091124-4A	11/28/2009	7.070	22.64%	30	-0.7	4.8	pCi/sample	NA	
SMP	Trg. Analyte	9:45:00 AM	3H091124-4-1	NA	0.46	NA	1 S	5-11	B60_04_112801	4:11 PM	7.434	NA	NA	2.8	NA	As Received	NA	U
0911225-11	H-3	11/17/2009	3H091124-4	NA	122.1	WIPE	1 S	LS6000	3H091124-4A	11/28/2009	7.530	23.43%	30	0.3	4.6	pCi/sample	NA	
SMP	Trg. Analyte	9:50:00 AM	3H091124-4-1	NA	0.41	NA	1 S	5-12	B60_04_112801	4:42 PM	7.385	NA	NA	2.7	NA	As Received	NA	U

Comments:

Data Package ID: *H30911225-1*

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: 0911225

Prep SOP: PAI 700
Analytical SOP: PAI 704

Reported on: Wednesday, December 02, 2009 1:01:43 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
0911225-12	H-3	11/17/2009	3H091124-4	NA	127.7	WIPE	1 S	LS6000	3H091124-4A	11/28/2009	6.630	22.80%	30	-1.6	4.8	pCi/sample	NA	
SMP	Trg. Analyte	9:55:00 AM	3H091124-4-1	NA	0.43	NA	1 S	22-2	B60_04_112801	5:44 PM	7.424	NA	NA	2.7	NA	As Received	NA	U
0911225-13	H-3	11/17/2009	3H091124-4	NA	117.4	WIPE	1 S	LS6000	3H091124-4A	11/28/2009	6.570	23.96%	30	-1.5	4.5	pCi/sample	NA	
SMP	Trg. Analyte	10:00:00 AM	3H091124-4-1	NA	0.43	NA	1 S	22-3	B60_04_112801	6:15 PM	7.352	NA	NA	2.6	NA	As Received	NA	U
0911225-14	H-3	11/17/2009	3H091124-4	NA	127.3	WIPE	1 S	LS6000	3H091124-4A	12/1/2009	7.470	22.85%	30	0.1	4.7	pCi/sample	NA	
SMP	Trg. Analyte	10:05:00 AM	3H091124-4-1	NA	0.91	NA	1 S	37-2	B60_04_120101	4:38 PM	7.421	NA	NA	2.8	NA	As Received	NA	U
0911225-15	H-3	11/17/2009	3H091124-4	NA	115.6	WIPE	1 S	LS6000	3H091124-4A	11/28/2009	6.630	24.16%	30	-1.3	4.5	pCi/sample	NA	
SMP	Trg. Analyte	10:10:00 AM	3H091124-4-1	NA	0.58	NA	1 S	22-5	B60_04_112801	7:17 PM	7.340	NA	NA	2.6	NA	As Received	NA	U
0911225-16	H-3	11/17/2009	3H091124-4	NA	166.7	WIPE	1 S	LS6000	3H091124-4A	11/28/2009	6.100	18.40%	30	-3.9	6.0	pCi/sample	NA	
SMP	Trg. Analyte	10:15:00 AM	3H091124-4-1	NA	0.45	NA	1 S	22-6	B60_04_112801	7:48 PM	7.696	NA	NA	3.4	NA	As Received	NA	U
0911225-17	H-3	11/17/2009	3H091124-4	NA	115.8	WIPE	1 S	LS6000	3H091124-4A	11/28/2009	6.800	24.14%	30	-1.0	4.5	pCi/sample	NA	
SMP	Trg. Analyte	10:20:00 AM	3H091124-4-1	NA	0.45	NA	1 S	22-7	B60_04_112801	8:19 PM	7.341	NA	NA	2.6	NA	As Received	NA	U
0911225-18	H-3	11/17/2009	3H091124-4	NA	125	WIPE	1 S	LS6000	3H091124-4A	12/1/2009	7.070	23.10%	30	-0.7	4.7	pCi/sample	NA	
SMP	Trg. Analyte	10:25:00 AM	3H091124-4-1	NA	0.59	NA	1 S	37-3	B60_04_120101	5:09 PM	7.405	NA	NA	2.7	NA	As Received	NA	U
0911225-19	H-3	11/17/2009	3H091124-4	NA	121.8	WIPE	1 S	LS6000	3H091124-4A	11/28/2009	7.400	23.46%	30	0	4.6	pCi/sample	NA	
SMP	Trg. Analyte	10:30:00 AM	3H091124-4-1	NA	0.46	NA	1 S	22-9	B60_04_112801	9:20 PM	7.383	NA	NA	2.7	NA	As Received	NA	U
0911225-20	H-3	11/17/2009	3H091124-4	NA	116.2	WIPE	1 S	LS6000	3H091124-4A	11/28/2009	6.530	24.10%	30	-1.5	4.5	pCi/sample	NA	
SMP	Trg. Analyte	10:35:00 AM	3H091124-4-1	NA	0.47	NA	1 S	22-10	B60_04_112801	9:51 PM	7.344	NA	NA	2.6	NA	As Received	NA	U
3H091124-4	H-3	11/24/2009	3H091124-4	NA	138	WIPE	1 S	LS6000	3H091124-4A	11/28/2009	7.300	21.64%	30	-0.4	5.0	pCi/sample	NA	
MB	Trg. Analyte	11:03:14 AM	3H091124-4-1	NA	0.62	NA	1 S	22-11	B60_04_112801	10:22 PM	7.496	NA	NA	2.9	NA	As Received	NA	U
3H091124-4	H-3	11/24/2009	3H091124-4	NA	134.4	WIPE	1 S	LS6000	3H091124-4A	11/28/2009	63.970	22.04%	30	115	5	pCi/sample	NA	102
LCS	Trg. Analyte	11:03:14 AM	3H091124-4-1	NA	0.31	NA	1 S	22-12	B60_04_112801	10:53 PM	7.471	NA	NA	19	NA	As Received	NA	P

Comments:

Data Package ID: *H30911225-1*

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: 0911225

Prep SOP: PAI 700
Analytical SOP: PAI 704

Reported on: Wednesday, December 02, 2009 1:01:43 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
3H091124-4	H-3	11/24/2009	3H091124-4	NA	135.6	WIPE	1 S	LS6000	3H091124-4A	11/28/2009	67.570	21.91%	30	124	5	pCi/sample	0.30	109
LCSD	Trg. Analyte	11:03:14 AM	3H091124-4-1	NA	0.27	NA	1 S	15-1	B60_04_112801	11:24 PM	7.479	NA	NA	20	NA	As Received	NA	P

Comments:

Data Package ID: *H30911225-1*

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 28 NOV 2009 11:00
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	P#	WIND1 CPM	WIND1 %ERROR	WIND2 CPM	WIND2 %ERROR	LUMEX %	ELAPSED TIME
1	5-1	30.00	135.3	7.47	13.36	28.70	6.82	0.71	30.84
2	5-2	30.00	115.6	6.73	14.07	27.70	6.94	0.78	61.76
3	5-3	30.00	120.6	6.33	14.51	26.17	7.14	0.46	92.67
4	5-4	30.00	115.7	7.10	13.70	29.10	6.77	0.38	123.55
5	5-5	30.00	121.0	7.20	13.61	26.27	7.12	0.36	154.43
6	5-6	30.00	121.7	6.63	14.18	26.40	7.11	0.38	185.31
7	5-7	30.00	117.0	6.40	14.43	27.03	7.02	0.39	216.18
8	5-8	30.00	114.5	6.30	14.55	27.87	6.92	0.35	247.06
9	5-9	30.00	110.9X	7.70	13.16	28.17	6.88	0.37	277.95
10	5-10	30.00	124.2	6.67	14.14	27.07	7.02	0.39	308.85
11	5-11	30.00	129.1	7.07	13.74	25.60*	7.22	0.46	339.75
12	5-12	30.00	122.1	7.53	13.30	26.73	7.06	0.41	370.66
13	22-1	30.00	136.4	7.67	13.19	29.27	6.75	0.58	401.68
14	22-2	30.00	127.7	6.63	14.18	27.70	6.94	0.43	432.55
15	22-3	30.00	117.4	6.57	14.25	24.60*	7.36	0.43	463.44
16	22-4	30.00	105.1X	6.97	13.83	25.87	7.18	0.52	494.33
17	22-5	30.00	115.6	6.63	14.18	25.67*	7.21	0.58	525.23
18	22-6	30.00	166.7	6.10	14.78	26.40	7.11	0.45	556.13
19	22-7	30.00	115.8	6.80	14.00	26.87	7.04	0.45	587.04
20	22-8	30.00	108.7X	6.83	13.97	27.33	6.98	0.49	617.96
21	22-9	30.00	121.8	7.40	13.42	27.63	6.95	0.46	648.85
22	22-10	30.00	116.2	6.53	14.29	27.87	6.92	0.47	679.79
23	22-11	30.00	138.0	7.30	13.51	30.07	6.66	0.62	710.70
24	22-12	30.00	134.4	63.97	4.57	28.30	6.86	0.31	741.66
25	15-1	30.00	135.6	67.57	4.44	29.73	6.70	0.27	772.67
26	15-2	30.00	135.5	7.30	13.51	28.10	6.89	0.58	803.57
27	15-3	30.00	130.5	7.07	13.74	27.17	7.01	0.63	834.48
28	15-4	30.00	140.9	6.83	13.97	27.67	6.94	0.41	865.37
29	15-5	30.00	112.0X	6.53	14.29	26.30	7.12	0.67	896.28
30	15-6	30.00	123.7	6.90	13.90	27.27	6.99	0.45	927.17
31	15-7	30.00	141.6	6.83	13.97	26.00	7.16	0.67	958.08
32	15-8	30.00	132.7	7.50	13.33	27.03	7.02	0.57	989.00
33	15-9	30.00	115.5	6.40	14.43	30.17	6.65	0.50	1019.92
34	15-10	30.00	122.1	5.67	15.34	25.80	7.19	0.50	1050.81
35	15-11	30.00	127.6	6.53	14.29	24.27*	7.41	0.50	1081.73
36	15-12	30.00	118.8	6.43	14.40	27.57	6.95	0.67	1112.67
37	55-1	30.00	141.8	6.90	13.90	27.23	7.00	0.38	1143.68
38	55-2	30.00	107.0X	6.80	14.00	27.17	7.01	0.57	1174.59
39	55-3	30.00	137.2	7.13	13.67	28.40	6.85	0.58	1205.49
40	55-4	30.00	113.3X	6.57	14.25	26.83	7.05	0.43	1236.38
41	55-5	30.00	136.6	7.13	13.67	25.57	7.22	0.29	1267.27
42	55-6	30.00	113.0X	6.93	13.87	24.93*	7.31	0.43	1298.15
43	55-7	30.00	117.5	7.33	13.48	27.80	6.93	0.59	1329.06

B60-04-112801
MA 12-2-09

SAM NO	POS	TIME MIN	H#	WIND1 CPM	WIND1 %ERROR	WIND2 CPM	WIND2 %ERROR	LUMEX %	ELAPSED TIME
44	55-8	30.00	153.8	5.83	15.12	25.87	7.18	0.48	1359.97
45	55-9	30.00	111.5 x	7.27	13.55	27.07	7.02	0.90	1390.92
46	55-10	30.00	109.7 x	8.47	12.55	25.60	7.22	1.16	1421.85
47	55-11	30.00	145.8	5.70	15.29	27.13	7.01	0.57	1452.75
48	55-12	30.00	148.0	7.07	13.74	25.43	7.24	0.92	1483.66

B60-04-112801
[initials] 12-2-09

x Recount, H # Low.

* < LCL of 25.76 & 25.27

B60_04_112801

BSF Version	: 3
Instrument Type	: LS 6000
Data Capture Date	: 28 Nov 2009 11:02:04
User Filename	: C:\...\LS WINCONNECTION\DATA\USER04\UN112801.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	5-1	30.00	135.3	7.47	13.36	28.70	6.82	0.71	30.84
2	5-2	30.00	115.6	6.73	14.07	27.70	6.94	0.78	61.76
3	5-3	30.00	120.6	6.33	14.51	26.17	7.14	0.46	92.67
4	5-4	30.00	115.7	7.10	13.70	29.10	6.77	0.38	123.55
5	5-5	30.00	121.0	7.20	13.61	26.27	7.12	0.36	154.43
6	5-6	30.00	121.7	6.63	14.18	26.40	7.11	0.38	185.31
7	5-7	30.00	117.0	6.40	14.43	27.03	7.02	0.39	216.18
8	5-8	30.00	114.5	6.30	14.55	27.87	6.92	0.35	247.06
9	5-9	30.00	110.9	7.70	13.16	28.17	6.88	0.37	277.95
10	5-10	30.00	124.2	6.67	14.14	27.07	7.02	0.39	308.85
11	5-11	30.00	129.1	7.07	13.74	25.60	7.22	0.46	339.75
12	5-12	30.00	122.1	7.53	13.30	26.73	7.06	0.41	370.66
13	22-1	30.00	136.4	7.67	13.19	29.27	6.75	0.58	401.68
14	22-2	30.00	127.7	6.63	14.18	27.70	6.94	0.43	432.55
15	22-3	30.00	117.4	6.57	14.25	24.60	7.36	0.43	463.44
16	22-4	30.00	105.1	6.97	13.83	25.87	7.18	0.52	494.33
17	22-5	30.00	115.6	6.63	14.18	25.67	7.21	0.58	525.23
18	22-6	30.00	166.7	6.10	14.78	26.40	7.11	0.45	556.13
19	22-7	30.00	115.8	6.80	14.00	26.87	7.04	0.45	587.04
20	22-8	30.00	108.7	6.83	13.97	27.33	6.98	0.49	617.96
21	22-9	30.00	121.8	7.40	13.42	27.63	6.95	0.46	648.85
22	22-10	30.00	116.2	6.53	14.29	27.87	6.92	0.47	679.79
23	22-11	30.00	138.0	7.30	13.51	30.07	6.66	0.62	710.70
24	22-12	30.00	134.4	63.97	4.57	28.30	6.86	0.31	741.66
25	15-1	30.00	135.6	67.57	4.44	29.73	6.70	0.27	772.67
26	15-2	30.00	135.5	7.30	13.51	28.10	6.89	0.58	803.57
27	15-3	30.00	130.5	7.07	13.74	27.17	7.01	0.63	834.48

MJL 12-2-09

B60_04_112801

28	15-4	30.00	140.9	6.83	13.97	27.67	6.94	0.41	865.37
29	15-5	30.00	112.0	6.53	14.29	26.30	7.12	0.67	896.28
30	15-6	30.00	123.7	6.90	13.90	27.27	6.99	0.45	927.17
31	15-7	30.00	141.6	6.83	13.97	26.00	7.16	0.67	958.08
32	15-8	30.00	132.7	7.50	13.33	27.03	7.02	0.57	989.00
33	15-9	30.00	115.5	6.40	14.43	30.17	6.65	0.50	1019.92
34	15-10	30.00	122.1	5.67	15.34	25.80	7.19	0.50	1050.81
35	15-11	30.00	127.6	6.53	14.29	24.27	7.41	0.50	1081.73
36	15-12	30.00	118.8	6.43	14.40	27.57	6.95	0.67	1112.67
37	55-1	30.00	141.8	6.90	13.90	27.23	7.00	0.38	1143.68
38	55-2	30.00	107.0	6.80	14.00	27.17	7.01	0.57	1174.59
39	55-3	30.00	137.2	7.13	13.67	28.40	6.85	0.58	1205.49
40	55-4	30.00	113.3	6.57	14.25	26.83	7.05	0.43	1236.38
41	55-5	30.00	136.6	7.13	13.67	25.57	7.22	0.29	1267.27
42	55-6	30.00	113.0	6.93	13.87	24.93	7.31	0.43	1298.15
43	55-7	30.00	117.5	7.33	13.48	27.80	6.93	0.59	1329.06
44	55-8	30.00	153.8	5.83	15.12	25.87	7.18	0.48	1359.97
45	55-9	30.00	111.5	7.27	13.55	27.07	7.02	0.90	1390.92
46	55-10	30.00	109.7	8.47	12.55	25.60	7.22	1.16	1421.85
47	55-11	30.00	145.8	5.70	15.29	27.13	7.01	0.57	1452.75
48	55-12	30.00	148.0	7.07	13.74	25.43	7.24	0.92	1483.66

WR 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	POS	TIME MIN	H#	WIND1 CPM	WIND1 %ERROR	WIND2 CPM	WIND2 %ERROR	LUMEX %	ELAPSED TIME
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

B60-04-12010

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

12-2-09

LSC Run Log

Instrument ID: LS6000 **379843** ALS Laboratory Group - Fort Collins

	Date	Sample ID	CountTime (min.)	Rack & Position	Test	User #	Batch ID	Position Check	Initials	Comments
1	11-28-09	3H091124-4CB1	30	5 - 1	Hb Sm 1	4	3H091124-4	MA	MA	NA
2		091122S-1		- 2						
3		-2		- 3						
4		-3		- 4						
5		-4		- 5						
6		-5		- 6						
7		-6		- 7						
8		-7		- 8						
9		-8		- 9						Recount, H # Low
10		-9		- 10						NA
11		-10		- 11						
12		-11		- 12						
13		3H091124-4CB2		22 - 1						
14		091122S-12		- 2						
15		-13		- 3						
16		-14		- 4						Recount, H # Low
17		-15		- 5						NA
18		-16		- 6						
19		-17		- 7						
20		-18		- 8						Recount, H # Low
21		-19		- 9						NA
22		-20		- 10						
23		3H091124-4MB		- 11						
24		-4LCS		- 12						
25		-4LCSD		15 - 1						
26		-4CB3		- 2						
27		3H091124-5CB1		- 3			3H091124-5			
28		091122G-1		- 4						
29		-2		- 5						Recount, H # Low
30		-3		- 6						NA

Analyst / Date MA 12-2-09

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

LSC Run Log

Instrument ID: LS6000 **379847** **ALS Laboratory Group - Fort Collins**

	Date	Sample ID	CountTime (min.)	Rack & Position	Test	User #	Batch ID	Position Check	Initials	Comments
1	11-30-09	0911229 - 14	30	31 - 12	HB 5ml	4	3H0911124-8	[illegible]	[illegible]	NA
2		-15		16 - 1						
3		-16		- 2						
4		-17		- 3						
5		-18		- 4						Recount, H # Low
6		-19		- 5						
7		-20		- 6						NA
8		3H0911124-8 MB		- 7						
9		-8LCS		- 8						
10		-8LCSD		- 9						
11		-8CB3		- 10						
12		-9CB1		- 11			3H0911124-9			
13		0911227-21		- 12						
14		0911229-21		29 - 1						Recount, H # Low
15		3H0911124-9MB		- 2						NA
16		-9CB2		- 3						
17		-9LCS		- 4						
18		-9LCSD		- 5						
19		-9CB3		- 6						
20	12-1-09	Daily QC	10	1,3 - 13,12	—	1,3	—	[illegible]	[illegible]	NA
21	12-1-09	3H0911117-1CB1	30	57 - 1	HB 10ml	2	3H0911117-1			Recount all for 180 min.
22		0911116-1		- 2						
23		-1D		- 3						
24		-1MS		- 4						
25		3H0911117-1CB2		- 5						
26		-1MD		- 6						
27		-1LCS		- 7						
28		-1CB3		57 - 8						
29	12-1-09	0911225-8	30	37 - 1	HB. 5ml	4	3H0911124-4	[illegible]	[illegible]	NA
30		-14		- 2						

Analyst / Date [illegible] 12-2-09

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LSC Run Log

Instrument ID: LS6000 379848 **ALS Laboratory Group - Fort Collins**

	Date	Sample ID	CountTime (min.)	Rack & Position	Test	User #	Batch ID	Position Check	Initials	Comments
1	12-1-09	0911225-18	30	37 - 3	Hb 5ml	4	3H091124-4	MC	MC	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 QC	10	1,3 - 1-3, 1-2	—	1,3	—	MC	MC	NR
21	12-2-09	3H091124-1CB1	90	18 - 1	Hb 10ml	8	3H091124-1			
22		0911061-1		- 2						
23		-1B		- 3						
24		-3		- 4						
25		0911148-2		- 5						MC 12-2-09
26		0911227-9	30	10 - 1	Hb 5ml	4	3H091124-6	MC	MC	Lumex still > 5%
27										
28										
29				-						
30				-						MC 12-2-09

Analyst / Date MC 12-2-09

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

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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

Radiochemistry Instrument Worksheet

ALS Laboratory Group -- FC

Prep Batch: 3H091124-4

Prep Procedure: H3 5ml swipes

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
1	0911225-1	SMP	1	1	sample	pCi/sample	LS6000	5-2	MK							* Recount, H # Low
1	0911225-2	SMP	1	1	sample	pCi/sample		-3								
1	0911225-3	SMP	1	1	sample	pCi/sample		-4								
1	0911225-4	SMP	1	1	sample	pCi/sample		-5								
1	0911225-5	SMP	1	1	sample	pCi/sample		-6								
1	0911225-6	SMP	1	1	sample	pCi/sample		-7								
1	0911225-7	SMP	1	1	sample	pCi/sample		-8								MK 12-2-09
1	0911225-8	SMP	1	1	sample	pCi/sample		-9	X	LS6000	37-1	MK				10 µL nitro added
1	0911225-9	SMP	1	1	sample	pCi/sample		-10								
1	0911225-10	SMP	1	1	sample	pCi/sample		-11								
1	0911225-11	SMP	1	1	sample	pCi/sample		-12								
1	0911225-12	SMP	1	1	sample	pCi/sample		22 -2								
1	0911225-13	SMP	1	1	sample	pCi/sample		-3								MK 12-1-09
1	0911225-14	SMP	1	1	sample	pCi/sample		-4	X	LS6000	37-2	MK				10 µL nitro added
1	0911225-15	SMP	1	1	sample	pCi/sample		-5								
1	0911225-16	SMP	1	1	sample	pCi/sample		-6								
1	0911225-17	SMP	1	1	sample	pCi/sample		-7								MK 12-2-09
1	0911225-18	SMP	1	1	sample	pCi/sample		-8	X	LS6000	37-3	MK				10µL nitro added
1	0911225-19	SMP	1	1	sample	pCi/sample		-9								
1	0911225-20	SMP	1	1	sample	pCi/sample		-10								
1	3H091124-4cb1	MB	1	1	sample	pCi/sample		5-1								10µL nitro added
1	3H091124-4cb2	MB	1	1	sample	pCi/sample		22A-1	MK 11-25-09							
1	3H091124-4cb3	MB	1	1	sample	pCi/sample		15-2								
1	*3H091124-4*	*MB*	1	1	*sample*	*pCi/sample*		22-11								
1	3H091124-4	LCS	1	1	sample	pCi/sample		-12								
1	3H091124-4	LCSD	1	1	sample	pCi/sample		15-1								MK 12-1-09

Radiochemistry Instrument Worksheet

ALS Laboratory Group -- FC

Prep Batch: 3H091124-4

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	2,523,626	DPM/ml	11/24/09	0.1	ml	RS-013

Reporting Units

LabID	TstGrpName	RptUnits
0911225-1	H3_Edgewood_smears_20pCi	pCi/samp
0911225-2	H3_Edgewood_smears_20pCi	pCi/samp
0911225-3	H3_Edgewood_smears_20pCi	pCi/samp
0911225-4	H3_Edgewood_smears_20pCi	pCi/samp
0911225-5	H3_Edgewood_smears_20pCi	pCi/samp
0911225-6	H3_Edgewood_smears_20pCi	pCi/samp
0911225-7	H3_Edgewood_smears_20pCi	pCi/samp
0911225-8	H3_Edgewood_smears_20pCi	pCi/samp
0911225-9	H3_Edgewood_smears_20pCi	pCi/samp
0911225-10	H3_Edgewood_smears_20pCi	pCi/samp
0911225-11	H3_Edgewood_smears_20pCi	pCi/samp
0911225-12	H3_Edgewood_smears_20pCi	pCi/samp
0911225-13	H3_Edgewood_smears_20pCi	pCi/samp
0911225-14	H3_Edgewood_smears_20pCi	pCi/samp
0911225-15	H3_Edgewood_smears_20pCi	pCi/samp
0911225-16	H3_Edgewood_smears_20pCi	pCi/samp
0911225-17	H3_Edgewood_smears_20pCi	pCi/samp
0911225-18	H3_Edgewood_smears_20pCi	pCi/samp
0911225-19	H3_Edgewood_smears_20pCi	pCi/samp
0911225-20	H3_Edgewood_smears_20pCi	pCi/samp

Sample Barcodes

0911225-1
3H091124-4PS1

0911225-2
3H091124-4PS2

0911225-3
3H091124-4PS3

0911225-4
3H091124-4PS4

0911225-5
3H091124-4PS5

0911225-6
3H091124-4PS6

0911225-7
3H091124-4PS7

0911225-8
3H091124-4PS8

0911225-9
3H091124-4PS9

0911225-10
3H091124-4PS10

0911225-11
3H091124-4PS11

0911225-12
3H091124-4PS12

0911225-13
3H091124-4PS13

0911225-14
3H091124-4PS14

Radiochemistry Instrument Worksheet

ALS Laboratory Group -- FC

Prep Batch: 3H091124-4

0911225-15 3H091124-4PS15	0911225-16 3H091124-4PS16
0911225-17 3H091124-4PS17	0911225-18 3H091124-4PS18
0911225-19 3H091124-4PS19	0911225-20 3H091124-4PS20
3H091124-4cb1MB 3H091124-4PS21	3H091124-4cb2MB 3H091124-4PS22
3H091124-4cb3MB 3H091124-4PS23	3H091124-4MB 3H091124-4PS24
3H091124-4LCS 3H091124-4PS25	3H091124-4LCSD 3H091124-4PS26

Radiochemistry Prep Worksheet

ALS Laboratory Group -- FC

Prep Batch: 3H091124-4

Prep Procedure: H3

Reviewed By: LJF **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) N/A

11/25 11/25

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

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

Balance:
Balance:

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

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq sample	Fin Alq sample	Prep Basis	Water Added(ml)	Moisture(%)	Analysis Vol.(ml)	Standards	Prep Notes
1	1	0911225-1	SMP	N/A	1	1	As Received	N/A	N/A	N/A	N/A	
2	1	0911225-2	SMP		1	1	As Received					
3	1	0911225-3	SMP		1	1	As Received					
4	1	0911225-4	SMP		1	1	As Received					
5	1	0911225-5	SMP		1	1	As Received					
6	1	0911225-6	SMP		1	1	As Received					
7	1	0911225-7	SMP		1	1	As Received					
8	1	0911225-8	SMP		1	1	As Received					
9	1	0911225-9	SMP		1	1	As Received					
10	1	0911225-10	SMP		1	1	As Received					
11	1	0911225-11	SMP		1	1	As Received					
12	1	0911225-12	SMP		1	1	As Received					
13	1	0911225-13	SMP		1	1	As Received					
14	1	0911225-14	SMP		1	1	As Received					
15	1	0911225-15	SMP		1	1	As Received					
16	1	0911225-16	SMP		1	1	As Received					
17	1	0911225-17	SMP		1	1	As Received					
18	1	0911225-18	SMP		1	1	As Received					
19	1	0911225-19	SMP		1	1	As Received					
20	1	0911225-20	SMP		1	1	As Received					
21	1	3H091124-4cb1	MB		1	1	As Received					
22	1	3H091124-4cb2	MB		1	1	As Received					
23	1	3H091124-4cb3	MB		1	1	As Received					
24	1	3H091124-4	MB		1	1	As Received					
25	1	3H091124-4	LCS		1	1	As Received				S1	
26	1	3H091124-4	LCSD		1	1	As Received				S1	

11/25/09

Radiochemistry Prep Worksheet

ALS Laboratory Group -- FC

Prep Batch: 3H091124-4

Prep Procedure: H3

Reviewed By: LJF **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) N/A

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

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

Balance:
Balance:

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

Samp Num	Prep Num	LabID	QC Type	Dish No.	Init Alq sample	Fin Alq sample	Prep Basis	Water Added(ml)	Moisture(%)	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	648.3610.44	2,523.626	DPM/ml	11/24/09	0.1	ml	RS-013

ALS Laboratory Group -- FC

Radiochemistry Prep Worksheet

Prep Batch: 3H091124-4

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
Prep Dept: RS

Balance:
Balance:

Cocktail: UG-LLT
Cocktail Pipet: T-002
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
1	1	0911225-1	SMP		1	1	As Received			
2	1	0911225-2	SMP		1	1	As Received			
3	1	0911225-3	SMP		1	1	As Received			
4	1	0911225-4	SMP		1	1	As Received			
5	1	0911225-5	SMP		1	1	As Received			
6	1	0911225-6	SMP		1	1	As Received			
7	1	0911225-7	SMP		1	1	As Received			
8	1	0911225-8	SMP		1	1	As Received			
9	1	0911225-9	SMP		1	1	As Received			
10	1	0911225-10	SMP		1	1	As Received			
11	1	0911225-11	SMP		1	1	As Received			
12	1	0911225-12	SMP		1	1	As Received			
13	1	0911225-13	SMP		1	1	As Received			
14	1	0911225-14	SMP		1	1	As Received			
15	1	0911225-15	SMP		1	1	As Received			
16	1	0911225-16	SMP		1	1	As Received			
17	1	0911225-17	SMP		1	1	As Received			
18	1	0911225-18	SMP		1	1	As Received			
19	1	0911225-19	SMP		1	1	As Received			
20	1	0911225-20	SMP		1	1	As Received			
21	1	3H091124-4cb1	MB		1	1	As Received			
22	1	3H091124-4cb2	MB		1	1	As Received			
23	1	3H091124-4cb3	MB		1	1	As Received			
24	1	3H091124-4	MB		1	1	As Received			
25	1	3H091124-4	LCS		1	1	As Received		S1	
26	1	3H091124-4	LCSD		1	1	As Received		S1	

ALS Laboratory Group -- FC

Radiochemistry Prep Worksheet

Prep Batch: 3H091124-4

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
Prep Dept: RS

Balance:
Balance:

Cocktail: UG-LLT
Cocktail Pipet: T-002
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: JDO Date: 11/25/09

Spike Solution Information

Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
S1	H-3	648.3610.44	2,523.626	DPM/ml	11/24/09	0.1	ml	RS-013

S1 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			

S 11/24/09

Section 8

STANDARDS TRACEABILITY DOCUMENTS

8

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

1) Density of DI water
- Mass of 100 ml Vol flask: 66.4336 g
- Mass of flask + water: 166.1135 g
- Net Mass: 99.6799
- ρ = 0.9968 g/ml

2) Mass of Std Transferred
- Mass of Empty 500 ml Glass: 260.38 g
- Mass of Glass + Std: 266.45 g
- Net Mass Transferred: 6.07 g

3) Dilute to Fin. Vol. w/ DI water
- Mass of Glass, Std, Diluent: 733.7 g
- Mass of Glass: 260.38 g
- Net Mass of New Dilution: 473.32 g

Final Activity Calc

$$\left(369{,}530.45\ \frac{dpm}{ml}\right)\left(\frac{0.9968\ g/ml}{0.9958\ g/ml}\right)\left(\frac{6.07\ g}{473.32\ g}\right) = 4{,}743.7\ \frac{dpm}{ml}$$

RG 10/23/09

RG-10/23/09

Stnd 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

Reverification Log		
Analysis Date	Initials	Expiration Date

RG 10/23/09

RG 10/23/09

Continued on Page

Read and Understood By

Signed — 9/29/09 Date — Signed — 10/23/09 Date

~~Prepare a working level dilution (at approximately 2 DPM/mL)~~ 10 dilution tritium standard using RSO #64B 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_2O	99.5829 g	
	ρ = .9958 g/mL	

2) Transfer contents of Ampule SRM 4927F to a ~~40 mL VOA vial~~ 500 mL glass amber bottle CW 3/17/03

mass of ~~40 mL VOA vial~~ glass bottle w/o lid	255.04 g	Bal #26
mass of open ampule + 50mL beaker	40.9075 g	Bal #12
mass of empty ampule + 50mL 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.

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

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

Read and Understood By

Signed: [signature] Date: 3/27/03

Signed: Renee Gallegos Date: 3/27/03

National Institute of Standards & Technology

Certificate

PA IQ 0648
Jeremy 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. Unterweger of the Radioactivity Group.

The support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program 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

*Notes and references are on pages 5 and 6.

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]*.

*Notes and references are on pages 5 and 6.

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_2O	55	1.00
	^3HHO	6×10^{-7}	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]		

*Notes and references are on pages 5 and 6.

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, $\lvert\partial y/\partial x_i\rvert \cdot (x_i/y)$ [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				x 2
Relative Expanded Uncertainty of the Output Quantity, U/y, (%)				0.72

*Notes and references are on pages 5 and 6.

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 (μSv/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 $y = f(x_1, x_2, x_3, \ldots x_n)$, 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, $u_i(y) \equiv |\partial y/\partial x_i| \cdot u(x_i)$, 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 $y \pm U$ 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 $Bq \cdot g^{-1}$.

[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 $u_i(y)/y \equiv |\partial y/\partial x_i| \cdot u(x_i)/y = |\partial y/\partial x_i| \cdot (x_i/y) \cdot u(x_i)/x_i$. 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 $\lambda \cdot t$ 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. $u(x_i)/x_i = 100\%$. $|\partial y/\partial x_i| \cdot (x_i/y)$ = {(response per Bq of impurity)/(response per Bq of H-3)}·{(Bq of impurity)/(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] 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. Unterweger, *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

9

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		
x^0	3.7192E-01	6.0669E+00	Low =	113.6
x^1	-1.1270E-03	6.9704E-03	High =	283.3

Calib. Date : 10/26/2009

Sample ID	Pos #	H#	Obs.CPM	Corr. BCPM	CPM Corr.Fact.
3H091124-4CB1	5-1	135.3	7.47	7.010	-0.460
3H091124-4CB2	22-1	136.4	7.67	7.018	-0.652
3H091124-4CB3	15-2	135.5	7.30	7.011	-0.289
				Average=	-0.467

Sample ID	Pos #	H #	Efficiency	Background	H # Check
0911225-1	5-2	115.6	0.2416	7.340	OK
0911225-2	5-3	120.6	0.2360	7.375	OK
0911225-3	5-4	115.7	0.2415	7.340	OK
0911225-4	5-5	121.0	0.2356	7.377	OK
0911225-5	5-6	121.7	0.2348	7.382	OK
0911225-6	5-7	117.0	0.2401	7.349	OK
0911225-7	5-8	114.5	0.2429	7.332	OK
0911225-8	37-1	131.3	0.2239	7.449	OK
0911225-9	5-10	124.2	0.2319	7.400	OK
0911225-10	5-11	129.1	0.2264	7.434	OK
0911225-11	5-12	122.1	0.2343	7.385	OK
0911225-12	22-2	127.7	0.2280	7.424	OK
0911225-13	22-3	117.4	0.2396	7.352	OK
0911225-14	37-2	127.3	0.2285	7.421	OK
0911225-15	22-5	115.6	0.2416	7.340	OK
0911225-16	22-6	166.7	0.1840	7.696	OK
0911225-17	22-7	115.8	0.2414	7.341	OK
0911225-18	37-3	125.0	0.2310	7.405	OK
0911225-19	22-9	121.8	0.2346	7.383	OK
0911225-20	22-10	116.2	0.2410	7.344	OK
3H091124-4MB	22-11	138.0	0.2164	7.496	OK
3H091124-4LCS	22-12	134.4	0.2204	7.471	OK
3H091124-4LCSD	15-1	135.6	0.2191	7.479	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

Sample ID	H#	CPM	Calc. Bkg.	Sigma Diff.	Sample ID	H#	CPM	Corr. Bckg.	Corr. CPM	DPM	Efficiency	Calc. Eff.	% Diff.
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%
3H090422-2B02	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%
3H090422-2B03	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%
3H090422-2B04	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%
3H090422-2B05	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%
3H090422-2B06	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%
3H090422-2B07	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%
3H090422-2B08	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%
3H090422-2B09	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%
3H090422-2B10	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%
3H090422-2B11	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%
3H090422-2B12*	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%

(BKG CLs = +/- 3 sigma)
Max 1.81
Min -1.73

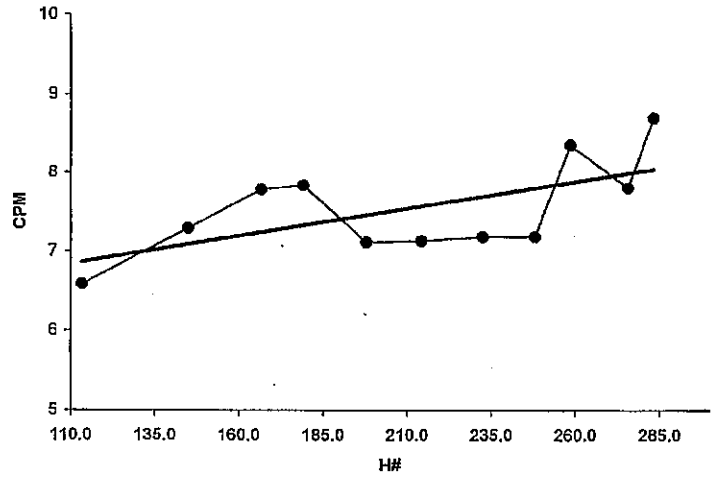
*These data points are not used in the calibration due to poor fit.

(Eff CLs = +/- 10%)
Max 5.44%
Min -33.88%

Sam. ID	CPM
3H090422-2B01	26.75
3H090422-2B02	27.73
3H090422-2B03	26.78
3H090422-2B04	27.63
3H090422-2B05	27.60
3H090422-2B06	27.55
3H090422-2B07	29.35
3H090422-2B08	29.17
3H090422-2B09	29.07
3H090422-2B10	29.12
3H090422-2B11	27.43
3H090422-2B12*	28.15
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

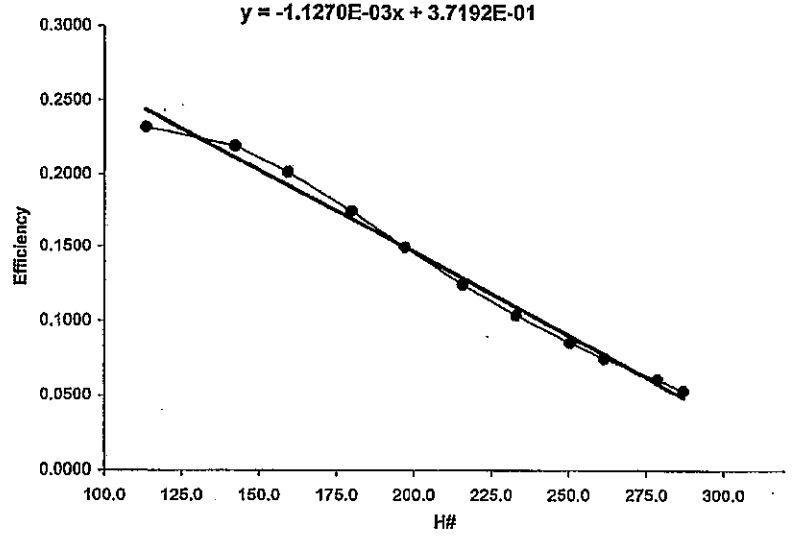
Background Determination

y = 6.9704E-03x + 6.0669E+00



Efficiency Determination

y = -1.1270E-03x + 3.7192E-01



Quench Control Limits	
Upper	283.3
Lower	113.6

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

Instrument Technician — 10-29-09 Date

Supervisory Review — 10/30/09 Date

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r:\inst\lsc\ls6000\Calibrations\Quench Curves\2009\10.26.09_H3_swipes_QCurve (H-3 Quench Curve)

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

Calibration Source Check

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

Calibration Check Source:

Spike Standard: 648.3610.05
Reference Date : 9/3/1998
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

IU= 0.112 *PU= 0.102*

Sample ID	Rack	Pos	Prep Date	Cnt. Dur.	Anal. Vol.	GrsCPM	BkgCPM	Efficiency	Activity	k (denom.)	Chem. Yield	LCS Recovery:	Pass/Fail	Units	2s CU	IU	PU	2s TPU
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	13.41268	20.108
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	12.72235	19.206
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	12.86168	20.150

Method Blank Check Count

IU= 0.112 *PU= 0.102*

Sample ID	Rack	Pos	Prep Date	Cnt. Dur.	Anal. Vol.	GrsCPM	BkgCPM	Efficiency	Chem. Yield	k (denom.)	activity	MDC	Pass/Fail	Units	2s CU	IU	PU	2s TPU
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	0.07096	1.158
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	0.07901	1.854
3H090422-3B03	25	8	4/22/2009	180	1	8.12	8.24	0.0574	100%	0.124	-0.9835	8.10	PASS	pCi/sample	4.874	-0.11016	-0.10032	4.876

H-3 Swipe Quench Curve Background and Efficiency Determination

LS6000
10/28/2009

Polynomial Coefficient				
	Efficiency	Background	H # Range	
x^0	3.7192E-01	6.0669E+00	Low =	113.6
x^1	-1.1270E-03	6.9704E-03	High =	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	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 CPM	WIND1 %ERROR	WIND2 CPM	WIND2 %ERROR	LUMEX %	ELAPSED TIME
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

B60-04-102601

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

10-27-09

ID:3H:5-ML,10-ML 27 OCT 2009 02:41

USER: 8 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	H#	WIND1 CPM	WIND1 %ERROR	WIND2 CPM	WIND2 %ERROR	LUMEX %	ELAPSED TIME
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

B60-08-10170J
MR 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

10-28-09

LSC Run Log

Instrument ID: LS6000

379825

ALS Laboratory Group - Fort Collins

	Date	Sample ID	CountTime (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	MR	MR	NA
2	↓	-3D	↓	- 3	↓	↓	↓	↓	↓	↓
3		-3REP Dup		- 4						
4		-3Rep2Dup2		- 5						Recount, Lumex >5%.
5	MR 10-23-09	FE091016-1CB2		- 6						NA
6		0909050-3MS	128.10	- 7						↓
7		-3REP	180	- 8						
8		-3REP2	↓	- 9						Recount, Lumex >5%.
9		0922005-1		- 10						NA
10		FE091016-1MB		- 11						↓
11		-1LCS	139.30	- 12						
12	↓	FE091016-1CB3	180	17 - 1	↓	↓	↓	↓	↓	↓
13	10-23-09	Daily QC	10	1,3 -1-3, 1-2	—	1,3	—	MR	MR	NA
14	10-23-09	0909050-3Rep2dup2	180	57 - 1	FE-SS	12	FE091016-1			Lumex still >5%.
15	↓	↓ -3Rep2	↓	↓ - 2	↓	↓	↓	↓	↓	NA
16	10-23-09	Daily QC	10	1,3 -1-3, 1-2	—	1,3	—	MR	MR	NA
17	10-26-09	↓	↓	↓ - ↓	—	↓	—	↓	↓	↓
18	10-26-09	0916022-1	6.60	34 - 1	H3	4	3H090422-2	MR	MR	H3 glass vial swipe R. Curve calibration
19	↓	-2	6.95	- 2	↓	↓	↓	↓	↓	↓
20		-3	7.55	- 3						
21		-4	8.75	- 4						
22		-5	10.20	- 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	↓	3H090422-2mb1	60	50 - 1	↓	↓	↓	↓	↓	↓

Analyst / Date MR 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	CountTime (min.)	Rack & Position	Test	User #	Batch ID	Position Check	Initials	Comments
1	10-26-09	3H0904422-2 MB2	60	50 - 2	#3	4	3H0904422-2	MR	MR	#3 glass vial Q.C swipe Calibration
2		-2 MB3		- 3						
3		-2 MB4		- 4						
4		-2 MB5		- 5						
5		-2 MB6		- 6						
6		-2 MB7		- 7						
7		-2 MB8		- 8						
8		-2 MB9		- 9						
9		-2 MB10		- 10						
10		-2 MB11		- 11						
11		-2 MB12		- 12						
12	10-27-09	Daily QC	10	1,3 -13,12	—	1,3	—	MR	MR	NA
13	10-27-09	3H0904422-3CB1	180	25 - 1	#3	8	3H0904422-3			#3 glass vial swipes ICV's/ICB's
14		0916025-1		- 2						
15		-2		- 3						
16		-3		- 4						
17		3H0904421-3CB2		- 5						
18		-3 MB1		- 6						
19		-3 MB2		- 7						
20		-3 MB3		- 8						
21		-3CB3		- 9						
22	10-28-09	Daily QC	10	1,3 -13,10,12	MR 10-28-09 —	1,3	—	MR	MR	NA
23										
24				-						
25				-						
26				-						
27				-						
28				-						
29				-						
30										MR 10-28-09

Analyst / Date MR 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.

Radiochemistry Instrument Worksheet

ALS Laboratory Group -- FC

Prep Batch: 3H090422-2

Prep Procedure: H3 Glass Vial Swipe QCurve Calibration

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
1	0916022-1	SMP	1	1	sample	pCi/l	LS6000	34-1	MR							
1	0916022-2	SMP	1	1	sample	pCi/l		-2								
1	0916022-3	SMP	1	1	sample	pCi/l		-3								
1	0916022-4	SMP	1	1	sample	pCi/l		-4								
1	0916022-5	SMP	1	1	sample	pCi/l		-5								
1	0916022-6	SMP	1	1	sample	pCi/l		-6								
1	0916022-7	SMP	1	1	sample	pCi/l		-7								
1	0916022-8	SMP	1	1	sample	pCi/l		-8								
1	0916022-9	SMP	1	1	sample	pCi/l		-9								
1	0916022-10	SMP	1	1	sample	pCi/l		-10								
1	0916022-11	SMP	1	1	sample	pCi/l		-11								
1	0916022-12	SMP	1	1	sample	pCi/l		-12								
1	3H090422-2B01	MB	1	1	sample	pCi/l		S0 -1								
1	3H090422-2B02	MB	1	1	sample	pCi/l		-2								
1	3H090422-2B03	MB	1	1	sample	pCi/l		-3								
1	3H090422-2B04	MB	1	1	sample	pCi/l		-4								
1	3H090422-2B05	MB	1	1	sample	pCi/l		-5								
1	3H090422-2B06	MB	1	1	sample	pCi/l		-6								
1	3H090422-2B07	MB	1	1	sample	pCi/l		-7								
1	3H090422-2B08	MB	1	1	sample	pCi/l		-8								
1	3H090422-2B09	MB	1	1	sample	pCi/l		-9								
1	3H090422-2B10	MB	1	1	sample	pCi/l		-10								
1	3H090422-2B11	MB	1	1	sample	pCi/l		-11								
1	3H090422-2B12	MB	1	1	sample	pCi/l		-12								

MR 10-28-09

Spike 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 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 3H090422-2PS1	0916022-2 3H090422-2PS2
0916022-3 3H090422-2PS3	0916022-4 3H090422-2PS4
0916022-5 3H090422-2PS5	0916022-6 3H090422-2PS6
0916022-7 3H090422-2PS7	0916022-8 3H090422-2PS8
0916022-9 3H090422-2PS9	0916022-10 3H090422-2PS10
0916022-11 3H090422-2PS11	0916022-12 3H090422-2PS12
3H090422-2B01MB 3H090422-2PS13	3H090422-2B02MB 3H090422-2PS14
3H090422-2B03MB 3H090422-2PS15	3H090422-2B04MB 3H090422-2PS16
3H090422-2B05MB 3H090422-2PS17	3H090422-2B06MB 3H090422-2PS18
3H090422-2B07MB 3H090422-2PS19	3H090422-2B08MB 3H090422-2PS20
3H090422-2B09MB 3H090422-2PS21	3H090422-2B10MB 3H090422-2PS22

ALS Laboratory Group -- FC

Radiochemistry Instrument Worksheet

Prep Batch: 3H090422-2

3H090422-2B11MB 3H090422-2PS23		3H090422-2B12MB 3H090422-2PS24	

ALS Paragon

Radiochemistry Prep Worksheet

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) N/A

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

Prep Analyst: Derek B. Caduff
Prep Date: 4/22/2009
Prep Dept: RS

Balance:
Balance:

Cocktail: UG LLT
Cocktail Pipet: T-002
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	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 DK 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) N/A

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

Prep Analyst: Derek B. Caduff
Prep Date: 4/22/2009
Prep Dept: RS

Balance:
Balance:

Cocktail: UG LLT
Cocktail Pipet: T-002
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

Spike 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

ALS Paragon

Radiochemistry Prep Worksheet

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 SOP: NONE
Matrix Class: liquid

Prep Analyst: Derek B. Caduff DBC
Prep Date: 4/22/2009
Prep Dept: RS

Balance:
Balance:

Cocktail:
Cocktail Pipet:
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

ALS Paragon

Radiochemistry Prep Worksheet

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 SOP: NONE
Matrix Class: liquid

Prep Analyst: Derek B. Caduff DBC
Prep Date: 4/22/2009
Prep Dept: RS

Balance:
Balance:

Cocktail:
Cocktail Pipet:
Aliquot Pipet:

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

Comments
UG LLT LOT # 97-080401

Spiked By: DBC Date: 4/22/09
Witnessed By: JRS Date: 4/22/09

Spike 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

Exp. 4/1/10

Radiochemistry Instrument Worksheet

ALS Laboratory Group -- FC

Prep Batch: 3H090422-3

Prep Procedure: H3 Glass Vial Swipes ICV's/ICB's

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
1	0916023-1	SMP	1	1	sample	pCi/l	LS6000	25-2	MM							Added 10uL Nitto
1	0916023-2	SMP	1	1	sample	pCi/l		-3								60
1	0916023-3	SMP	1	1	sample	pCi/l		-4								140
1	3H090422-3B01	MB	1	1	sample	pCi/l		-6								10
1	3H090422-3B02	MB	1	1	sample	pCi/l		-7								60
1	3H090422-3B03	MB	1	1	sample	pCi/l		-8								140
1	3H090422-3CB1	MB	1	1	sample	pCi/l		-1								10
1	3H090422-3CB2	MB	1	1	sample	pCi/l		-5								10
1	3H090422-3CB3	MB	1	1	sample	pCi/l		-9								10

MM 10-28-09

Spike Solution Information

Soln #	Nuclide	SolnID	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

Reporting Units

LabID:	TstGrpName:	RptUnits:
0916023-1	H3	pCi/l
0916023-2	H3	pCi/l
0916023-3	H3	pCi/l

Sample Barcodes

0916023-1
3H090422-3PS1

0916023-2
3H090422-3PS2

0916023-3
3H090422-3PS3

3H090422-3B01MB
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

ALS Paragon

Prep Batch: 3H090422-3

Prep Procedure: H3

Reviewed By: DBC DBC 5/1/09 Review Date: 5/1/2009

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

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

Prep Analyst: Derek B. Caduff
Prep Date: 4/22/2009
Prep Dept: RS

Balance:
Balance:

Cocktail: UG LLT
Cocktail Pipet: T-002
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	MB		1	1	As Received			
7	1	3H090422-3CB1	MB		1	1	As Received			
8	1	3H090422-3CB2	MB		1	1	As Received			
9	1	3H090422-3CB3	MB		1	1	As Received			

DBC 5/1/09 DBC 5/1/09 DBC 5/1/09

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	Aliquot	Units	Pipet ID
S1	H-3	648.3610.05	2,827.459	DPM/ml	04/22/09	0.1	ml	RS-008

ALS Paragon

Radiochemistry Prep Worksheet

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 SOP: NONE
Matrix Class: liquid

Prep Analyst: Derek B. Caduff DBC
Prep Date: 4/22/2009
Prep Dept: RS

Balance:
Balance:

Cocktail: UG LLT
Cocktail Pipet: T-002
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	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 # 97-0804[illegible]

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

Spike Solution Information

Soln #	Nuclide	SolnID	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

Exp. 4/30/09

Prepare a working dilution ~ 99000 dpm/mL of 3H from 699.2613.18.

1) Determine the density of DI water Cal. #

Mass of empty 100 mL volumetric flask:	66.4397 g	12
Mass of flask and 100 mL DI water:	166.0654 g	↓
Net mass of DI water:	99.6257 g	
ρ =	0.9963 g/mL	

2) Transfer Standard:

Mass of empty bottle without lid:	97.1195 g	12
Mass of bottle and standard:	100.5266 g	↓
Net mass of standard:	3.4071 g	

3) Dilute with DI water.

Mass of empty bottle without lid:	97.1195 g	12
Mass of bottle, standard, and DI water:	197.7444 g	↓
Net mass of standard and DI water:	100.6249 g	

4) Final activity calculation:

$$\frac{(4,733,412.57\ \text{dpm/mL})(3.4071\ \text{g})(0.9963\ \text{g/mL})}{(100.6249\ \text{g})(0.9958\ \text{g/mL})} = 160351.042\ \text{dpm/mL}$$

DC 7/7/08

To reverse density correct activity for 699.2613.18.

MC 7/13/08

Stnd ID: 699.3020.95

Description: H-3
Expiration: 2/25/2009
Activity: 160351.04 dpm/mL
2σ 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

MC 7/13/08

MC 7/13/08

Reverification Log		
Analysis Date	Initials	Expiration Date
4/1/09	[illegible]	4/1/10

MC 7/13/08

Continued on Page

Read and Understood By

[signature] 7/7/08
Signed Date

[signature] 7/13/08
Signed Date

Prepare a 1° 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	

$\rho = 0.9958$ g/mL

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

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

3) Add DI water to final dilution

Mass of VOA vile w/o lid/contents from above	24.3883 g	Bal #12
Mass of VOA vile, std + DI water	62.9648 g	↓
Net mass of Std + DI water	38.5765 g	

4) Final Activity Calculation

$$\frac{(634.7 \text{ KBq/g})(4.8151 \text{ g})(60 \text{ dpm/Bq})(1000 \text{ Bq/KBq})(0.9958 \text{ g/mL})}{38.5765 \text{ g}}$$

(Bq E 7/28/03)

$= 4{,}733{,}412.57$ dpm/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

[signature] 7/29/03 Signed Date

Read and Understood By [signature] 7/31/03 Signed Date

National Institute of Standards & Technology

Certificate

PAF ID 0699
recal 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. Unterweger of the Radioactivity Group.

The support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program 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

*Notes and references are on pages 5 and 6.

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]*.

*Notes and references are on pages 5 and 6.

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 Wall Thickness Barium content Lead-oxide content Other heavy elements	(16.5 ± 0.5) mm (0.60 ± 0.04) mm Less than 2.5% Less than 0.02% Trace quantities	
Solution mass	Approximately 5.0 g		
Chemical Properties:			
Solution composition	Chemical Formula	Concentration (mol·L^{-1})	Mass Fraction (g·g^{-1})
	H_2O ^3HHO	55 6×10^{-7}	1.00 1×10^{-8}
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 4927B using the NIST length-compensated internal gas proportional counters and intercomparison of SRMs 4927E/4927F using two 4πβ liquid-scintillation counting systems [h]		

*Notes and references are on pages 5 and 6.

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, $\lvert \partial y/\partial x_i \rvert \cdot (x_i/y)$ [j]	Relative Uncertainty Of Output Quantity, $u_i(y)/y$, (%) [k]
Massic count rate of SRM 4927E, corrected for backgroumd 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				x 2
Relative Expanded Uncertainty of the Output Quantity, U/y, (%)				0.72

*Notes and references are on pages 5 and 6.

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 (μSv/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 $y = f(x_1, x_2, x_3, \ldots x_n)$, 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 $y \pm U$ 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 Bq$\cdot$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 $u_i(y)/y = |\partial y/\partial x_i| \cdot u(x_i)/y = |\partial y/\partial x_i| \cdot (x_i/y) \cdot u(x_i)/x_i$. 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 $\lambda \cdot t$ 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. $u(x_i)/x_i = 100\%$. $|\partial y/\partial x_i| \cdot (x_i/y) = \{$(response per Bq of impurity)/(response per Bq of H-3)$\} \cdot \{$(Bq of impurity)/(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.

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. Unterweger, *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

Mass of 100 ml vol. flask	68.2975 g	12
Mass of flask and 100 ml DI H_2O	168.0291 g	1
Net Mass of water	99.7316 g	

JDD 4/28/08 ρ = .9973 g/ml

2) Transfer Std.

Mass of empty Amber jar (No lid)	257.75 g	26
Mass of Jar + Std transferred	264.58 g	1
* Net Mass of Std. Transferred	6.8506 g	12

↳ from below JDD 4/28/08

4) Dilute to Final Vol. w/ DI water

Mass of Std. + H_2O + Jar	750.9 g	26
Mass of Jar from above	257.75 g	
Net Mass of new dilution	493.15 g	

* Standard was transferred by difference from a plastic cup

Mass of Cup and ~10 g of Standard	23.6533 g	12
Mass of Cup and Std. [Not] Transferred	16.8027 g	1

Final Activity Calculation

$$\frac{\left(369{,}530.45 \frac{dpm}{ml}\right)(6.8506\,g)(.9973\,g/ml)}{(.9958\,g/ml)(493.15\,g)} = 5141.07 \frac{dpm}{g} \quad \text{JDD } 4/28/08$$

$\frac{dpm}{g} \rightarrow \frac{dpm}{ml}$

Stnd ID: 648.3610.05 MC 7/13/08

Description: H-3
Expiration: 4/30/2009
Activity: 5141.07 dpm/mL
MC 7/13/08
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		4/11/10

MC 7/13/08

Page

JDD 4/28/08 — Signed — 4/28/08 Date

MC 7/13/08 — Signed — 7/13/08 Date

Notebook No. 2382 75

Continued From Page

PROJECT 648.2382.75 3H

Prepare a ~~working level dilution (of approximately 2500 DPM/mL)~~ 10 dilution tritium standard using RSO #648 and diluting with DI water.

1) Determine the density of DI water:

Mass of empty 100mL Class A volumetric flask	67.1522 g	Bal #3
Mass of flask + water	166.7351 g	↓
Net mass of 100mL H_2O	99.5829 g	
	ρ = .9958 g/mL	

2) Transfer contents of Ampule SRM 4927F to a ~~40mL VOA vile~~ 500 mL glass amber bottle CW 3/27/03

mass of ~~40mL VOA vile~~ bottle w/o lid (CW 3/27/03)	255.04 g	Bal #26
mass of open ampule + 50 mL beaker	40.9075 g	Bal #32
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.

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

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

Signed [signature] Date 3/27/03

Read and Understood By

Signed Renee Kellogg Date 3/27/03

National Institute of Standards & Technology

Certificate

PA IQ 0648

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. Unterweger of the Radioactivity Group.

The support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program 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

*Notes and references are on pages 5 and 6.

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]*.

*Notes and references are on pages 5 and 6.

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_2O	55	1
	HHO	6×10^{-7}	1×10^{-8}
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 4927B using the NIST length-compensated internal gas proportional counters and intercomparison of SRMs 4927B/4927F using two 4πβ liquid-scintillation counting systems [h]		

*Notes and references are on pages 5 and 6.

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, $\lvert\partial y/\partial x_i\rvert \cdot (x_i/y)$ [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 [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
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				x 2
Relative Expanded Uncertainty of the Output Quantity, U/y, (%)				0.72

*Notes and references are on pages 5 and 6.

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 (μSv/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 $y = f(x_1, x_2, x_3, \ldots x_n)$, 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 $y \pm U$ 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 $Bq \cdot g^{-1}$.

[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 $u_i(y)/y = |\partial y/\partial x_i| \cdot u(x_i)/y = |\partial y/\partial x_i| \cdot (x_i/y) \cdot u(x_i)/x_i$. 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 $\lambda \cdot t$ 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. Unterweger, *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!

Updated 10/29/09 mh

							Individual Reagent Blanks			Average of Reagent Blanks		
COUNT DATE	#	Sample ID	Count Duration (m)	Count Rate (CPM)	Total Cts.	Mean	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 ^{99}Tc 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

	blank	Blank Quench #	spike
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	
	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?
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 ^{99}Tc 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

	blank	Blank Quench #	spike
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